Chapter 7

Planning for Conservation

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7 PLANNING FOR CONSERVATION

7.1 Introduction

In part, Chapter 7 is an overview of the planning resources that underpin the goals, objectives, and conservation measures in Chapters 8 through 11. It is also a bit of a catchall for other relevant but diverse topics surrounding the MRC planning process. Sub-sections address the MRC management plan and its relationship to the HCP/NCCP; management tools such as our inventory database, landscape model, wildlife tree database, and GIS; feedback on MRC conservation proposals from the wildlife agencies, a science panel, and the general public; conservation prototypes and how they relate to the MRC conservation plan; organizational structures, as well as pacing and funding for HCP/NCCP implementation.

7.2 General Management Plan

MRC produced our first management plan in August 2000 to articulate corporate purpose, policies, plans, and goals. Such a plan was also one of the basic requirements for certification by the Forest Stewardship Council (FSC), a recognition that MRC sought virtually from our inception (section 2.5.3). Included in its 56-pages are specific strategies to restore MRC forests and inventory targets for that restoration. The management plan cites aquatic strategies for large woody debris; stream temperature; canopy and shade; coarse and fine sediment; water flow; nutrients; and barriers to migration. Likewise there are terrestrial strategies for snags; downed logs; mature conifer forest; old growth trees; hardwoods; unique habitats; and habitat connectivity.

While the management plan only summarizes, it does anticipate many of the conservation issues tackled in detail in over 1500 pages of our HCP/NCCP. Still, the management plan does focus on all MRC forest lands, not simply the lands covered by the HCP/NCCP, and concerns itself with business goals as well as forest management. There are provisions in the management plan which are not in the HCP/NCCP; some of these provisions include policies on public access, fire prevention, as well as community and employee relations. Over the course of a decade, many things change. In July 2010, MRC updated our management plan[1] to reflect how we ourselves have changed and grown as a company. Once the wildlife agencies approve our HCP/NCCP, the management plan will make direct reference to it as a core document for long-term MRC operations.

7.3 Planning Tools

Table 7-1 shows planning tools that MRC used to develop our HCP/NCCP or that will play a role in HCP/NCCP implementation. We use the word *tool* in the broadest sense, i.e., something (data, software, process, resource, evaluation) that facilitates the possibility or effectiveness of an action. Some of the individual tools are already integrated into an existing process; for example, data collected from watershed analysis and road inventory become part of our GIS database. Other tools, like focus watersheds, are in the early stages of planning and design themselves and will develop concurrently with HCP/NCCP implementation. Still others, such as additional conservation easements, may or may not be exercised during the 80-year course of our HCP/NCCP. In the subsections that follow, we expand discussion on each of these tools.

[1] Available at http://www.mrc.com/Reports-ManagementPlan.aspx (accessed 02/14/2011)

Table 7-1 Planning and Analysis Tools for the HCP/NCCP

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Application Software			
Forest Inventory Database	• Store data on stands, e.g., acres, vegetation types, unique features, and harvest timing. • Capture information on stand structures that equate to habitat for covered species. • Classify stands by vegetation type, e.g., old growth and pygmy forest. • Provide input data for the landscape model.	• Identify areas which may be below habitat thresholds for covered species.	• Model current northern spotted owl habitat. • Estimate old growth trees, snags, and LWD in the plan area, as well as riparian conditions. • Assess spotted owl habitat by inventory block and by PTHP to ensure compliance with HCP/NCCP objectives.
Landscape Model	• Forecast harvests, tree growth, and wildlife habitat with the growth simulator, CRYPTOS. • Provide data to develop conservation measures for habitat and natural communities in the plan area.	• Identify stands that are near or below target thresholds for spotted owl habitat.	• Assess stands available for harvest based on ▫ Amount of available habitat for covered species. ▫ Amount of timber in stand. ▫ Types of trees available for harvest. ▪ Predict future amount of available habitat for covered species.
California Wildlife Habitat Relationships (CWHR) Database[2]	• Store life history, geographic range, habitat relationships, and management information on 694 species of amphibians, reptiles, birds, and mammals in California. • Provide information from recognized professionals on California's wildlife, including to timber landowners and managers.	• Determine gaps in regional distribution of covered species and areas of low abundance.	• Corroborate information on distribution of covered species.

[2] Available at http://www.dfg.ca.gov/biogeodata/cwhr/ (accessed 02/14/2011)

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Wildlife Tree Database	• Store information on trees important to covered species, especially northern spotted owls and marbled murrelets.	• Detect trends in wildlife and recruitment tree density.	• Ensure PTHPs comply with HCP/NCCP requirements for recruiting and retaining wildlife trees. • Provide compliance reporting data on an annual basis.
Geographic Information System (GIS)	• Create digital maps of the plan area, including locations of harvests, watercourses, roads, habitat areas, and covered species, as well as property boundaries of adjacent landowners.	• Identify ▫ Mass wasting areas. ▫ Habitat fragmentation due to roads. ▫ Occurrences of covered species.	• Ensure PTHPs comply with HCP/NCCP conservation measures for northern spotted owls, marbled murrelets, and Point Arena mountain beaver.
Road Network			
Road Inventory	• Provide information on road ▫ Location. ▫ Mileage. ▫ Condition. ▫ Status (e.g., decommissioned).	• Identify road problems. • Prioritize repairs.	• Re-inventory and reassess road work for volume of sediment targeted and controlled. • Set long-term targets for sediment control in order to prioritize work.
Watershed Analysis Modules			
Watershed Analysis	• Provide information on streams critical to aquatic and amphibian species. • Determine the need for LWD in streams. • Reduce sediment from roads and mass wasting. • Contribute to conservation measures for aquatic, wetland, and riparian habitat, e.g., protections for flood-prone zones, stream-bank stability, and equipment exclusion zones.	• Identify problems related to mass wasting, sediment input, LWD deficiencies, and road conditions.	• Assess and re-assess watershed conditions across the plan area.

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Watershed Analysis—Module 1 Mass Wasting Inventory	• Provide information on mass wasting events and their potential or real impact on aquatic and amphibian species. • Contribute to conservation measures for sediment reduction.	• Identify potential for slope failure and sediment delivery to streams.	• Assess and re-assess mass wasting conditions across the plan area.
Watershed Analysis—Module 2 Surface and Point Source Erosion Inventory	• Provide information on surface source point erosion, as well as its potential or real impact on aquatic and amphibian species. • Improve and protect water quality and aquatic habitat.	• Identify ongoing and potential sediment delivery to streams, including road erosion hazards.	• Assess and re-assess surface point source erosion across the plan area.
Watershed Analysis—Module 3 Hydrology	• Analyze flow regimes to reduce impacts to aquatic species and habitat.	• Identify frequency and magnitude of floods that change flows, cause erosion, and transport sediment.	• Assess and re-assess flood and flow conditions which affect sediment transport and cause erosion across the plan area.
Watershed Analysis—Module 4 Riparian Function	• Assess ▫ Potential of streams to recruit LWD. ▫ Primary characteristics that forest harvest can impact, e.g., canopy, stream temperature, LWD, and sediment filtering.	• Identify deteriorating conditions in riparian areas.	• Assess and re-assess riparian conditions which affect sediment transport and cause erosion.
Watershed Analysis—Module 5 Stream Channel Condition	• Evaluate morphological conditions of stream channels. • Assess aquatic habitat quality.	• Identify stream channels which lack structural features important to salmonid habitat.	• Assess and re-assess stream channel conditions.

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Watershed Analysis—Module 6 Fish Habitat Assessment	• Assess ▫ Major drainages to determine habitat quality for different life stages of salmonids. ▫ Salmonid vulnerability or response to changes in sediment, heat, or wood input.	• Identify changes to quality or structure of aquatic habitat.	• Assess and re-assess fish habitat conditions.
Watershed Analysis—Module 7 Amphibian Distribution	• Determine amphibian species present in Class II streams and other aquatic habitats (wetlands, wet meadows, seeps, springs, and ponds).	• Identify changes in amphibian distribution in response to land management, habitat degradation, or habitat improvement.	• Monitor distribution and abundance of covered amphibians to ▫ Ensure compliance with HCP/NCCP objectives. ▫ Determine effectiveness of HCP/NCCP conservation measures.
Watershed Analysis—Module 8 Synthesis	• Summarize information on sediment inputs, aquatic habitat, and water quality.	• Identify hill-slope hazards to aquatic resources.	• Assess and re-assess sediment inputs, aquatic habitat, and water quality.
Aquatic Habitat			
Long Term Channel Surveys	• Evaluate trends in LWD, shade, and sediment within Class I watercourses throughout the plan area.	• Identify reaches of watercourses which may be changing or unstable due to sediment loads or a lack of LWD.	• Evaluate the effectiveness of AMZ conservation measures and trends in habitat quality.
Stream Temperature Surveys	• Evaluate trends and temperatures annually throughout Class I and Class II watercourses within the plan area.	• Identify streams or reaches of streams where temperatures may threaten aquatic species.	• Evaluate the effectiveness of AMZ conservation measures.

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Focus Watersheds	• Monitor specific watersheds to determine link between conservation measures and habitat or species response.	• Adjust, as needed, conservation measures to improve a negative or off-target response.	• Monitor effectiveness of HCP/NCCP conservation measures in meeting specific objectives. • Determine any need for adaptive management to adjust aquatic conservation measures.
Aquatic Species			
Fish Distribution and Abundance Surveys	• Evaluate distribution and abundance of salmonids throughout Class I streams in the plan area. • Monitor trends and evaluate the status of salmonids.	• Identify changes in fish distribution and abundance in response to land management, habitat degradation, or habitat improvement.	• Monitor distribution and abundance of covered salmonids to ▫ Ensure compliance with HCP/NCCP objectives. ▫ Determine effectiveness of HCP/NCCP conservation measures.
Monitoring and Adaptive Management			
Monitoring Programs	• Evaluate the effectiveness of HCP/NCCP conservation measures. • Adjust conservation measures to improve effectiveness.	• Assess whether HCP/NCCP conservation measures, followed to their full extent, provide the expected outcome. • Implement changes to conservation measures based on assessments. • Identify new and ongoing threats to covered species and their habitat.	• Implement contingency measures or adaptive management, if MRC does not meet HCP/NCCP objectives. • Address ongoing public and agency concerns about the HCP/NCCP conservation measures.
Other Resources			
Conservation Easements[3]	• Protect unique habitat in the plan area, e.g. old growth stands, oak woodlands, and pygmy forest. • Protect potential marbled murrelet habitat.	• Consider creating conservation easements to protect significant habitat in the plan area for aquatic and terrestrial species.	• Negotiate with the wildlife agencies on potential conservation easements.

[3] The Nature Conservancy defines a conservation easement as "a voluntary, legally binding agreement that limits certain types of uses or prevents development from taking place on a piece of property now and in the future, while protecting the property's ecological or open-space values." Refer to http://www.nature.org/ (accessed 12/16/2009). Prior to HCP/NCCP approval, MRC has conveyed the conservation easements of Comptche Hill to the Pacific Forest Trust; the Willow Creek Seed Orchard Tract and the Willow Creek Northern Tract to the Sonoma County Agricultural Preservation and Open Space (SCAPOS) District; as well as a scenic easement along Highway 128 adjacent to the Navarro River Redwoods State Park to Save the Redwoods League. These easements encompass a total of 314 ac preserved as forever wild. The easements are generally older, denser forests which will grow to late seral conditions over the term of the plan. The Navarro River Redwoods easement is connected to the Navarro River Redwoods State Park.

Planning and Analysis Tools for the HCP/NCCP			
Planning Tool	**General Purpose**	**Potential Problems Addressed**	**Use in HCP/NCCP Design or Implementation**
Science Panel Recommendations	• Assist with the identification of habitat protection measures.	• Identify threats to covered species and their habitat.	• Consult with science panel members, as warranted, on ongoing HCP/NCCP issues.
Agency and Public Review of HCP/NCCP	• Provide critical review of HCP/NCCP.	• Identify errors, shortcomings, and unaddressed issues in the HCP/NCCP and suggest alternative solutions.	• Refine and polish the HCP/NCCP based on the reviews of the wildlife agencies and participating residents of Mendocino County.

7.4 Planning at the Landscape Level

MRC is approaching solutions and recommendations for conservation not simply at the project level but at the landscape level. Obtaining solid baseline information about a large forested landscape can be a daunting task. In general, we face this challenge with computer software, including an inventory database, a landscape model, a wildlife tree database, and a geographical information system.

7.4.1 Inventory database

MRC divides the 213,244 ac of the plan area into 9 geographic units called inventory blocks. Inventory blocks are further sub-divided into planning watersheds that are between 3000 to 10,000 ac in size. A watershed analysis unit (WAU) is usually, but not always, contained within a single inventory block and includes one or more planning watersheds. MRC assesses management results at the inventory block, planning watershed, and WAU levels.

No matter what the higher level of assessment, the base unit of forest management is the stand. A stand is the smallest geographic unit in the plan area that is harvested, grown, and reported. Stand sizes range from less than 1 ac to 100 ac or more; generally upslope stands average 20 ac in size while stands in Aquatic Management Zones (AMZ) average 3 ac. Each stand can be harvested as a unit, with its own set of stewardship objectives. Stands must have similar vegetation types throughout. Using aerial photos, MRC assigns each stand a vegetation label. The vegetation label, or strata, is the basis for a sampling system used to acquire vegetation data. Plots are established in a stand and spaced uniformly as a grid (see Appendix U, section U.2, *Sampling Method*). For each plot, we record tree species, size, and age, as well as unique features, such as downed logs, snags, and woodrat nests.

All sampled data is input into a relational database that drives our landscape model, described in sub-section 7.4.2. This database is the source of other management reports, including HCP/NCCP reports. Requests for database information are in the form of *queries* or stylized questions. The flexibility of the *query language* allows MRC to tailor reports to the requests of the wildlife agencies. An agency, for example, might request a report, by planning watershed, on all upslope LWD that is greater than 16 in. dbh or a report, by basin, on all Class I and Class II AMZ acres.

Our inventory database contributes to the conservation of our natural communities and covered species by

- Sharpening our understanding of current conditions and habitat on our land.
- Providing input for computer software to model the impacts of proposed management strategies.

7.4.2 Landscape model

7.4.2.1 Growth simulation

At the core of our landscape planning is computer software to forecast harvests, tree growth, habitat acreage, and other factors important to management decision making. MRC uses a growth simulator based on CRYPTOS, a widely-used growth model in the redwood region. The model *grows* and *harvests* trees in computer simulations. Using information from the inventory database, the model simulates growth and harvest conditions given certain management criteria and constraints, such as management goals; silvicultural methods; harvest frequency; and retention of individual trees with desirable features for wildlife. Modeled growth varies by tree species, site class, tree age, and stand density. MRC has over 250 permanent plots—a subset of all inventory plots—which are used in CRYPTOS growth projections.

7.4.2.2 Projecting wildlife habitat and conserving natural communities

With our landscape model, MRC tracks the current status of our forests and predicts future conditions. Conditions can include not only timber volumes, but wildlife habitat. The landscape model, for example, can track and predict the development of northern spotted owl habitat over time and across MRC forests. It can also track the growth of AMZ stands, including canopy development and LWD recruitment potential, which indirectly impact covered species like the salmonids. All projections of our landscape model are based on structure classes in our inventory database. With a crosswalk that maps the names of different structure classes to the same habitat type, MRC can use other structure classes in our projections, such as the California Wildlife Habitat Relationships (CWHR).

Landscapes, of course, may encompass several different habitats, particularly at the watershed level. This is definitely true of the MRC plan area. For this large land base, MRC depends on the landscape model not only to manage timber production and forecast habitat, but to provide effective conservation of its various natural communities. Since MRC classifies stands by vegetation, we can track old growth stands, pygmy forest, grasslands, and other natural communities within our land.

MRC does not use the landscape model to design the road network; the landscape model works with stands and tree lists, not roads. However, adjustment of stand boundaries for new roads may trigger an adjustment in the net acres that the landscape model uses for its projected yields. Roads reduce the amount of productive ground for growing timber. By the same token, decommissioning roads can increase the amount of productive ground for growing timber. Moreover, many of the decommissioned roads are within sensitive AMZ locations, where forest canopy is essential.

7.4.2.3 Landscape model and the HCP/NCCP

Our landscape model can produce predictions for very long-range forecasts. In fact, it produced an 80-year planning horizon for our HCP/NCCP. Although we can model for extended periods of time, we are always prepared to test a scenario's predictions and re-forecast, particularly based on the results of monitoring or adaptive management. In fact, the landscape model is just one part of a more comprehensive landscape plan. Computer modeling, combined with professional forestry experience, scientific consultation, and research, directs MRC toward our corporate mission, including the goals and objectives of our HCP/NCCP.

The landscape model, however, has been a key part not only of the HCP/NCCP but of the PTEIR/EIS as well. Sections 2.7.1 and 2.7.2 discuss the nature of these documents and the agencies overseeing them. The wildlife agencies in conjunction with Stillwater Sciences prepared the PTEIR/EIS. For their analysis and at their specific direction, MRC modeled landscape conditions, for example, the projected spotted owl habitat in the plan area during Year 40 and Year 75 of HCP/NCCP implementation (Table 10-10). The modeling process itself is time-consuming. As development of the HCP/NCCP stretched out over time, all projections became a moving target. For the PTEIR/EIS, the wildlife agencies agreed to freeze the landscape model data at 2008.

The selection of this date turned out to be auspicious. On the evening of June 20, 2008 and the early hours of June 21, Mendocino County experienced an estimated 129 small lightning fires which, in some cases, combined into larger fires (section 1.18). While the fires burned over about 22,000 ac on MRC land, it was primarily an understory fire. Our inventory analyst re-stratified about 4000 ac with new timber types as a result of the fire. In 2008, we logged 7157 ac (Table 7-

2). Then, along with most companies around the world, MRC went through an economic crisis in 2009. Our work force was temporarily reduced by about 65%. That year, we logged even less—1740 ac. Consequently, the period from 2008 through 2009 had little impact on timber inventory in the plan area.

Nevertheless, in the interest of transparency, we state that in those instances in which we have provided projections about acreage in the plan as of 2010, the projections are based on data from 2008 and growth simulation through 2008 (e.g., Table 3-17). This keeps the projections in the HCP/NCCP and the PTEIR/EIS in synch.

7.4.3 Wildlife tree database

The landscape model does not distinguish structural elements, such as platforms and cavities; however, MRC counts trees that have these characteristics for our wildlife tree database. Although only about 20% of MRC timberland is currently represented in the database, foresters continue to submit information as they mark wildlife trees for PTHP operations.

As part of our wildlife tree strategy, MRC staff will gradually survey our landscape to assess the number of snags, old growth trees, wildlife trees, and recruitment trees (section 9.2.2.1.1). If an area is deficient in wildlife trees, snags, or old growth trees, we will retain additional recruitment trees. On a parallel course, our inventory staff will record similar data as they cruise un-harvested stands and even when they make a second entry into harvested stands. This inventory data will track long-term trends of snags, old growth trees, wildlife trees, and recruitment trees on our landscape. As part of a feedback loop, this data will help us determine if changes need to be made in our forest management. Inventory cruises provide a powerful tool to track rare and important habitat elements on our landscape and inform our overall wildlife strategy.

7.4.4 Geographical information system (GIS)

At one time, timber companies, like everyone else, used paper maps. A GIS is a higher order, digital map that allows us to both map geographic data and analyze features at specific locations. Field data from road inventory, watershed analysis, and biological surveys are all linked to our GIS. This allows MRC to produce maps in our *HCP/NCCP Atlas* with spatially-accurate representations of roads (MAPS 14A-C); watercourses (MAPS 3A-C); cores areas of northern spotted owls (MAPS 15A-M) and coho salmon (MAPS 26A-C); management units for red-legged frogs (MAPS 27A-C); water drafting sites (MAPS 22A-C), and other features.

7.4.4.1 Roads and conservation planning

Roads play an important role not only in timberland management but in conservation planning. MRC could not feasibly manage our timberland if large forested areas were left without roads. The increased cost of helicopter yarding would be prohibitive.[4] However, from a conservation perspective, roads can fragment habitat, disrupt migration corridors, disturb sensitive native species, and create new opportunities for invasive species.

MRC inherited a road network from the previous land owners, who primarily used tractor yarding. Tractor yarding requires more roads near sensitive stream bottoms than cable yarding. MRC is moving more and more to cable yarding. The amount of cable logging will vary by year. In 2007, cable logging accounted for 2974 ac or 58% of our timber volume; in 2008, it was 2654

[4] In small areas, MRC does use helicopter yarding if a road cannot be built or if the cost of helicopter yarding is roughly equivalent to the cost of building a road.

ac or 47% of our timber volume (Table 7-2). In 2009, harvest operations were very limited due to the global economic recession; the total volume harvested was about 13.4 mmbf.

Table 7-2 MRC Harvests for 2007 through 2009

MRC Harvest			
Logging Method	Volume (mmbf)	Acres	Percent
2007			
Tractor	14,391.43	3116	40%
Cable	20,790.72	2974	58%
Helicopter	853.20	184	2%
2008			
Tractor	20,337.82	4503	53%
Cable	18,031.41	2654	47%
Helicopter			0%
2009			
Tractor	6161.17	950	46%
Cable	7241.97	790	54%
Helicopter			0%
2010			
Tractor	20094.76	3726	59%
Cable	19462.44	2585	41%
Helicopter			0%

Through new systematic road design, MRC intends to allow necessary access to our timber stands but with minimal impact on biological resources. We accomplish good, deliberate road design by

- Building new roads along ridge tops to accommodate cable yarding as opposed to tractor yarding.
- Abandoning unnecessary roads, including those along watercourses that increase the risk of sediment delivery.
- Designing, constructing, and maintaining road systems to specific standards spelled out in Appendix E, *Road, Landing, and Skid Trail Standards*.

As of 1st quarter 2011, MRC has completed 90% of our road inventory in the plan area and updated our GIS with road data. We will complete the pending road inventory for the Gualala River (7900 ac) and Alder Creek/Schooner Gulch (13,300 ac) WAUs by end of 2012, as Table 7-3 shows.

Table 7-3 MRC Road Inventory

MRC Road Inventory and GIS Road Updates		
Watershed Analysis Unit	Completion	Scheduled
Albion	1999	
Noyo	2000	
Garcia	1998	
Hollow Tree Creeks	2003	
Navarro River	2002	

MRC Road Inventory and GIS Road Updates		
Watershed Analysis Unit	Completion	Scheduled
Upper Russian River	2003	
Gualala River		2012
Big River	2009	
Cottaneva Creek	2004	
Rockport	2009	
Greenwood Creek	2003	
Elk Creek	2008	
Alder Creek/Schooner Gulch		2012

Since 1998, MRC has decommissioned over 112 miles of roads. Historic roads which are no longer in use account for another 18.1 miles. Decommissioned and historic roads represent about 6% of the MRC road network. We cannot predict the miles of decommissioned roads during the term of our HCP/NCCP. Currently, we are developing a computer program to track the mileage of roads updated to the standards outlined in Appendix E. Under the HCP/NCCP, we will bring all roads in the plan area up to these standards. By decommissioning roads and applying road standards, MRC expects a decrease in road density and an increase in acreage remote from roads.

Re-designing and decommissioning roads and crossings will improve conditions for our covered species and natural communities by

- Reducing sediment delivery.
- Reducing the hydrological connectivity of roads.[5]
- Removing artificial barriers to aquatic migration.
- Reducing habitat fragmentation.
- Controlling disturbance.

Appendix E (*Road, Landing, and Skid Trail Standards*) and Appendix F (*Road Inventory Protocol*) detail our road management prescriptions. Conservation measures in Chapters 8, 10, and 11 limit road construction, use, and alignments.

7.4.4.2 Road updates in GIS

MRC does not use our GIS to plan roads; however, information on new roads or abandoned roads impacts the output from GIS. A Registered Professional Forester (RPF), for example, determines when a new road needs to be built and provides the location in a PTHP. Along with the road location, the RPF includes any additional road attributes, such as culverts and rocked fords. Later our Road Inventory Supervisor or a forester determines the GPS coordinates for the new road and passes these along to our GIS department. Once these coordinates are entered in the GIS database, the new road can appear on updated maps and be part of management analyses.

7.4.5 Watershed analysis

In Chapter 3, *Environment and Habitat*, we introduced the subject of watershed analysis as an important source of information about the baseline condition of the plan area. As we said earlier, one of the outcomes of a watershed analysis is a resource assessment report which is divided into modules (section 3.3.4). In the sub-sections that follow, we describe the intent of these modules,

[5] Hydrological connectivity of roads refers to the transport of water, sediment, and organisms from roads to watercourses.

the nature of our initial watershed analysis, use of the analysis results, and the process for updating the analysis. To see specific methods from completed watershed analyses, refer to Appendix G (G.3.3.1-2 stream canopy; G. 3.4.1-2 stream channel conditions; G.3.5.1-2 fish habitat).

7.4.5.1 Watershed analysis modules

7.4.5.1.1 Mass wasting

The intent of this assessment is to

- Identify the types of mass wasting active in the watershed through a landslide inventory.
- Identify the link between mass wasting and management activities.
- Partition the plan area into zones of relative mass wasting potential (i.e., terrain stability units) based on the likelihood of future mass wasting and sediment delivery to stream channels.
- Quantify sediment input to watercourses from mass wasting.

7.4.5.1.2 Surface and point source erosion

The intent of this assessment is to

- Examine past and present sediment delivery from roads and skid trails in the plan area.
- Provide a hazard assessment of the potential for surface and point source erosion to deliver sediment to watercourses in the future.

MRC assesses road erosion hazards and sediment delivery to develop conservation measures and prioritize restoration that will minimize future sediment inputs from the road network. With our road analysis, MRC also looks at site-specific information generated from the road inventory, such as culvert sizing or diversion potential. Using this information, we prioritize sediment control for individual sites on roads. In the initial watershed analysis, this module may not have input data from the MRC road inventory. However, once a road inventory is complete in a watershed, MRC will update this module to reflect the latest information.

Skid trail evaluation provides context for past, present, and future sediment delivery at watershed scale. MRC will develop information, when needed, on controllable erosion from skid trails and consider this data for our hazard assessment of surface and point source erosion.

7.4.5.1.3 Hydrology

The intent of this assessment is to

- Provide a hydrologic record for the watershed.
- Analyze the frequency of stream flow or precipitation in the watershed.

The hydrology module will show the magnitude of storms and when they occur. Large storms precipitate erosion, sediment transport, or windthrow that impact the habitat conditions for aquatic species.

7.4.5.1.4 Riparian function

The intent of this assessment is to analyze the main riparian processes that forest harvest can affect, namely

- Potential of the riparian stand to recruit large woody debris (LWD) to the stream channel.

- Canopy closure and stream temperature.

In assessing LWD potential, we evaluate short-term LWD recruitment, meaning the next 2-3 decades. An assessment shows current conditions of riparian stands for generating LWD for stream habitat or stream channel stability. It presents field observations of current LWD levels in stream channels and indicates the ability of a riparian stand to recruit LWD in relation to channel sensitivity to LWD. This determines current instream needs for LWD.

An assessment of riparian function also presents canopy closure for perennial streams within a watershed. MRC analyzes all available stream temperatures for a watershed and examines the relationship between stream temperature and canopy closure. We do not explicitly measure other functions of streamside forests, such as nutrient dynamics and climate moderation, although these along with canopy closure and stream temperature are probably highly correlated with LWD recruitment potential.

7.4.5.1.5 Stream channel condition

The intent of this assessment is to

- Determine the existing channel conditions.
- Identify the sensitivity of channels to wood and sediment.

MRC evaluates the morphologic condition of a channel; this evaluation weighs the input of sediment, wood, and water against the ability of a channel to either transport or store these inputs. Stream channel conditions represent the strongest link between forest practices and aquatic habitat. Changes in channel condition typically reflect changes to aquatic habitat. MRC uses this evaluation, therefore, as a bridge between the hillslope processes and the resources affected by those processes. However, due to lag effects, legacy effects, non-timber stressors, lack of controls, and high natural variability, MRC may have difficulty establishing exact relationships between processes and resources.

7.4.5.1.6 Fish habitat assessment

The intent of this assessment is to

- Identify current fish distributions and habitat conditions.
- Present the quality of habitat for anadromous spawning, summer rearing, and over-wintering.

From this information, MRC can evaluate how vulnerable the habitat of anadromous salmonid may be to changes in sediment, heat, or wood input. This assessment also provides the distribution of anadromous species and their life stages, plus compilation of current knowledge on the status of anadromous species in a watershed.

7.4.5.1.7 Amphibian distribution

The intent of this assessment is to

- Improve information on the distribution of covered amphibian species within MRC watersheds.
- Provide a compilation of recent monitoring or studies about covered amphibians within each watershed analysis unit.

7.4.5.1.8 Synthesis[6]

The intent of the synthesis module is to

- Identify interactions between hillslope hazards and aquatic resources.
- Summarize information on sediment inputs, aquatic habitat, and water quality.

MRC synthesizes data from a watershed analysis unit and a CalWater planning watershed. Synthesis on a smaller scale will occur if unique circumstances warrant (e.g., there are odd-shaped property boundaries or unique habitat conditions). If we can hypothesize links between hillslope conditions (road, skid trails, mass wasting, and riparian areas) and aquatic habitat or water quality issues, we will be better prepared to prescribe conservation measures and address unique watershed needs. Up until now, MRC has not completed the synthesis module in the majority of our watershed analyses; however, we will include it in all future analyses.

7.4.5.1.9 Sediment inputs or budget

Within the synthesis, the intent of this assessment is to summarize information on sediment inputs from mass wasting as well as surface and point source erosion.

Our goal is to determine the magnitude or relative concern, both spatially and temporally, of sediment input processes. When the output or storage of sediment is also an issue, a full sediment budget[7] may be warranted.

DEFINITION	A **sediment budget** is a conceptual and quantitative model of sediment transport from origin to exit; it summarizes inputs, changes in sediment storage, and outputs to give an indication of balance or imbalance.

Ratings of aquatic habitat

MRC has developed ratings for aquatic habitat conditions relevant to LWD, shade, and life stages of anadromous salmonids. The synthesis module summarizes and interprets these ratings in relation to each other and within the context of other synthesis components of sediment input and water quality.

7.4.5.1.10 Water quality

A watershed analysis generates water quality information relating to aquatic habitat, including stream temperature; composition of streambed sediment; streambed permeability; and sediment inputs from hillslope processes. Throughout a watershed analysis, MRC uses these parameters to address beneficial uses of water as it relates to aquatic habitat. The synthesis module may summarize additional water quality observations from long-term channel monitoring and focus watershed studies, such as suspended sediment, turbidity, nutrients, pH, conductivity, or dissolved oxygen. In addition, the synthesis module will consider water quality within the context of other synthesis components of aquatic habitat conditions and sediment input.

[6] The synthesis module presented here differs from the protocols in the Washington Watershed Analysis manual (Version 4.0, Washington Forest Practices). The intent is similar; the approach differs.

[7] See Reid and Dunn (1996) for further discussion on sediment budgets.

7.4.5.2 Initial watershed analysis for our HCP/NCCP

As of 1st quarter 2011, MRC has conducted watershed analyses on approximately 90% of our land. We will complete the pending analyses for Cottaneva Creek (10,000 ac) and Alder Creek/Schooner Gulch (13,300 ac) by 2013, as Table 7-4 shows.

Table 7-4 2009 Update on MRC Watershed Analysis

MRC Watershed Analysis			
Watershed Analysis Unit	Includes	Completed	Scheduled
Albion	Big Salmon Creek, Caspar Creek and Little River	1999	
Noyo		2000	
Garcia		1998	
Hollow Tree Creeks	Hollow Tree, Mill Creek, Low Gap, Jack of Heart Creeks	2004	
Navarro River		2003	
Upper Russian River	Ackerman Creek, Jack Smith Creek	2005	
Gualala River		2003	
Big River		2003	
Cottaneva Creek		2004	
Rockport	Juan Creek, Hardy Creek, Howard Creek		2011
Greenwood Creek		2004	
Elk Creek		2009	
Alder Creek/Schooner Gulch	Alder, Mallo Pass, Brush, and Point Arena Creeks, and Schooner Gulch		2013

Our initial watershed analysis focused on conservation of anadromous habitat. Nevertheless, our evaluation of canopy retention, sediment inputs, and disturbance of non-fish-bearing watercourses provided information for informed decisions on covered amphibian species as well. In subsequent watershed analyses, we will focus on both salmonids and amphibians.

Up until now, MRC has performed watershed analyses as *in-house* assessments, with little or no input from the wildlife agencies. For the 2 pending analyses, MRC will follow methods employed in our watershed analysis report for Elk Creek. MRC believes these are currently the best methods; moreover, these methods are consistent with earlier watershed analyses. Within the first year of the initiation of our HCP/NCCP, MRC will meet with the wildlife agencies to evaluate our watershed analysis protocols and focus on plan objectives.

MRC will consider the following conservation measures or restoration actions in initial watershed analysis under our HCP/NCCP:

- Prioritization of road upgrades and controllable erosion repair.
- Placement of LWD for instream needs, including amount, location, and timing of LWD.
- Conservation of unique aquatic habitat features (e.g., channel migration zones).
- Monitoring of unique conditions in a watershed.

7.4.5.3 Watershed analysis updates or re-visits

MRC will re-visit watershed analysis, in its entirety, approximately every 20 years. There will be a total of 4 watershed analyses per watershed analysis unit—1 initial watershed analysis and 3 re-visits over the life of our HCP/NCCP. When proposing new methods, MRC will ensure their comparability with previous watershed analyses.

MRC chose a recurrence interval of 20 years because most of the processes in watershed analysis vary over relatively long time frames. During each re-visit of watershed analysis, we will incorporate information from other monitoring programs with shorter recurrence intervals to allow for a proper assessment of HCP/NCCP goals and objectives. Moreover, we may modify methods and recurrence intervals of watershed analysis and other monitoring programs through adaptive management. Modifications may also arise from recommendations in academic or governmental reports, such as the CDFG Coastal Watershed Assessment Program and the Pacific Northwest Aquatic Monitoring Partnership.[8]

MRC will provide the agencies our module methods, hypotheses to be tested, and our level of sampling. In consultation with the wildlife agencies, MRC may adapt priorities for road repair, determine new restoration actions, and alter monitoring or conservation measures through watershed analysis. Conservation measures revised through monitoring efforts, such as watershed analysis, will provide the same protection as standard HCP conservation measures. This includes conservation measures with limits of allowable change as described in Chapter 13, *Monitoring and Adaptive Management*.

MRC may update watershed analysis components at any time as information on aquatic species, habitat conditions, and the effects of management are identified. We can perform this update through individual modules or through technical reports on specific conservation measures, restoration, or monitoring. MRC will notify the wildlife agencies when an update occurs and give them the opportunity to review methods and objectives. The following situations can affect a watershed analysis update:

- Development of new analytical techniques or research that may improve interpretations of existing information.
- Significant storms (>25-year flood) that trigger significant watershed changes.
- Earthquake activity that triggers large volumes of sediment input from mass wasting.
- Social or regulatory changes requiring updated analysis.

[8] See http://coastalwatersheds.ca.gov/ and http://www.pnamp.org (both accessed 02/14/2011).

7.4.5.4 Future use of watershed analysis

Initial watershed analysis will provide baseline conditions of MRC watersheds and classification of features in those watersheds, including terrain stability, LWD demand, and road inventory. Future watershed analyses will update past information and provide accumulated results within watersheds. MRC will compare past results of watershed analyses and interpret individual monitoring programs within each watershed analysis unit. In consultation with the wildlife agencies, we will develop a Quality Assurance/Quality Control (QA/QC) program to ensure comparable results between watershed analyses. MRC will kick-off discussions with the wildlife agencies about our QA/QC program within 3 years of the issuance of our ITP. With agency concurrence, we will implement the QA/QC program within 5 years of ITP receipt.

7.4.6 Environmental gradients and habitat diversity

The plan area is a working forest, covering a variety of environmental gradients and forest habitats which our HCP/NCCP will protect and maintain. The 7 non-contiguous inventory blocks which make up the plan area (Table 1-5) span a distance of about 70 miles north to south and about 25 miles east to west. They include both coastal and inland areas with elevations ranging from 0-2772 ft. While the coast range generally follows a southeast to northwest trend, the mountainous terrain is broken by many streams and rivers creating slopes with all aspects. For the most part, the large river systems move from east to west, creating north and south aspects. Slopes in the rugged terrain vary from large, flat ridges to shear rock cliffs. Overall, the terrain is relatively gentle on ridgetops and river bottoms, which are usually less than 500 ft wide, but steep everywhere else, resulting in an average slope of about 50%.

The diverse habitat and natural communities of the plan area provide an opportunity for species to re-distribute as environmental dynamics change. Chapter 14 addresses fire, climate change, earthquakes, invasive species, and other environmental changes. The intent of our conservation measures is to prevent or ameliorate the adverse effects of changed circumstances for covered species. MRC will follow guidelines proposed by state or federal agencies, for example, to prevent, quarantine, and treat pathogens and pests. However, if a water-borne pathogen does infect a watershed, MRC will not draft water there or remove logs from Class I and Class II watercourses without the approval of the wildlife agencies (14.9.3.2). Likewise, in the event of an intense and large fire, MRC will restore damaged red-legged frog breeding sites or create new sites in adjacent, unaffected areas within the same planning watershed (14.3.7.2). Following a mass wasting event, MRC will conduct a rare plant survey prior to any operations, protect any rare plants discovered, and replant the affected areas with conifers (14.7.3.1). These are just 3 of dozens of measures, outlined in Chapter 14, to respond to changed circumstances.

7.5 Feedback on MRC Conservation Proposals

7.5.1 Wildlife agencies

MRC would be remiss if we did not acknowledge the role of the wildlife agencies in the entire HCP/NCCP process. Some of the technical team representatives from CDFG, NMFS, and USFWS have remained on the project since 2002, again bringing continuity and team-building to a very long process. Throughout this process of planning and development, MRC has met with agency representatives at the technical and policy levels dozens of times, in the woods and at MRC or agency offices. In addition hundreds of phone calls and emails have passed between us. All this interaction has led to many changes in our original proposals, as we have negotiated issues large and small. Each draft of our HCP/NCCP was subjected to a detailed review by the wildlife agencies. Using a review form, the agencies could pinpoint their comments to subsections of chapters, and even paragraphs, lines, and individual words. MRC responded to these comments in meetings, email, and phone conversations. As a result of this scrutiny, MRC re-thought, re-worded, re-organized, and, in some instances, re-designed our HCP/NCCP.

7.5.2 Science panel

The purpose of a scientific review is to assist the wildlife agencies and MRC in the development of a well-founded HCP/NCCP by recommending (1) management principles and conservation goals; (2) principles of design that address the needs of species, landscapes, ecosystems, and ecological processes; and (3) scientifically sound conservation measures. To achieve this task, MRC convened a science panel very early in our plan development. Facilitated by Greg Giusti of the University of California Cooperative Extension, the panel consisted of

- Reed Noss, PhD (University of Central Florida).
- Lee Benda, PhD (Lee Benda and Associates).
- Tom Hamer (Hamer Environmental).
- Joe McBride, PhD (University of California -Berkeley).
- Terry Roelofs, PhD (Humboldt State University).
- Teresa Sholars, PhD (College of the Redwoods).
- Bob Ziemer, PhD (Humboldt State University).

The science panel held a workshop in Ukiah, CA on May 23-24, 2003. Following the workshop, the science panel toured portions of MRC forests. Later they reviewed the conservation measures and monitoring proposals in the initial draft of our HCP/NCCP. In August 2003, the science panel responded in a written report to questions prepared by MRC and the wildlife agencies. Because our HCP/NCCP has subsequently undergone considerable revisions based on agency reviews, the science panel comments are not always germane to the current draft of our HCP/NCCP. In Appendix V, however, we have provided a summary of the science panel's recommendations and an indication of how MRC has used these early critiques and recommendations in re-thinking and revising our proposed conservation measures. Some of the panel's comments suggested

- Employing a consultant botanist.
- Developing a comprehensive list of covered plant species based on actual surveys of the plan area.
- Revising and clarifying our old-growth definitions.
- Bolstering conservation measures for seeps, springs, wet areas, and wetlands.
- Adding conservation measures to address soil pipes.

7.5.3 General public

In June 2002, the wildlife agencies conducted 3 public scoping meetings in Santa Rosa, Ukiah, and Fort Bragg to discuss our HCP/NCCP process and solicit public comments and concerns for PTEIR/EIS consideration. Based on questions at the meetings and comments submitted in writing, MRC held several stakeholder outreach workshops the following September to discuss key identified topics in depth. Those topics were (1) HCP/NCCP Development and Approval Process (September 24); (2) HCP/NCCP Implementation and Monitoring (September 25); (3) Understanding the MRC Landscape Model (September 27); and (4) Existing Biological and Hydrological Conditions of MRC Lands (September 30). Additional outreach meetings will occur with the release in 2011 of the public draft of our HCP/NCCP. MRC will provide an overview of the plan area, the organization of our HCP/NCCP, and key elements of the plan strategy, such as stratified conservation measures and monitoring, to assist the public in their evaluation.

In the final version of the PTEIR/EIS, the wildlife agencies will provide written responses to issues raised by the public during a 90-day comment period. In addition, MRC may revise our HCP/NCCP based on these public comments and agency responses.

7.6 Prototypical Conservation Strategies in Relation to MRC Plan

7.6.1 Strategic conservation prototypes

Achieving conservation goals may require several different strategies, applied either separately or in conjunction with one another.

- *Fine filter strategy*

  At one extreme is the "fine filter" strategy that focuses on habitat needs of particular species. Such a selective focus may not adequately conserve the biodiversity in a plan area.

- *Coarse filter strategy*

  At the opposite extreme is the "coarse filter" strategy that primarily provides for ecological preserves. Unfortunately, some species may still fall through the "holes," especially if the preserves do not encompass all the habitats within a plan area or if the preserves are unduly small. Moreover, because the goal of the *coarse filter strategy* is to manage areas for biodiversity, its application may be inimical to other land uses.

- *Mesofilter strategy*

  As a mediatory approach, Malcolm L. Hunter suggests a "mesofilter" strategy:

  > The key idea of mesofilter conservation is that most ecosystems contain certain features that are central to the welfare of many species; thus, conserving those features can have a positive effect on a large suite of species (Hunter 2005, p. 1026).

According to Hunter, examples of mesofilter conservation are conserving deadwood in a managed forest; conserving springs, pools, and other small wetlands; and maintaining critical processes in ecosystems, such as low intensity ground fires and periodic flooding. Mesofilter conservation benefits species that may be overlooked in fine filter strategies, like invertebrates, fungi, and non-vascular plants.

In proposing a *mesofilter strategy*, plan proponents must decide which habitat features and processes are significant to a conservation goal. The basis for such a decision might be known habitat needs of certain species or conditions and ranges of natural variability (Landres et al. 1999). The underlying premise for this strategy is that by approximating past conditions, the plan proponents can predict and reduce impacts to current ecosystems and species. If the proposed land management approximates the conditions under which a biological community evolved, the risk to the component species is minimal.

7.6.2 MRC conservation strategy

MRC is proposing a combination of the *fine*, *coarse*, and *mesofilter* strategies. Our *fine filter strategy* focuses on target species, i.e., the covered species listed in Chapter 1, *Purpose and Scope of the Plan*. In a very limited application of a *coarse filter strategy*, MRC is setting aside Type I old growth stands. In addition, our designation of LACMA, AMZs, and stable core areas for northern spotted owls mimic *preserves.* Finally, in conserving biodiversity through conservation standards for snags, downed wood, wildlife trees, old-growth trees, hardwoods, and other natural communities, MRC comes close to a *mesofilter strategy*. Admittedly, though, the natural ranges of variability for many of the habitat elements and stages in the plan area are scientifically unclear.

Most NCCPs establish permanent habitat preserves to offset development in other areas of an owner's property. Our plan area is a working forest. MRC will manage the majority of the plan area with uneven-aged management, as discussed in our Timber Management Plan. This technique will result in forest-type conditions more conducive to native flora and fauna during the 80-year term of our HCP/NCCP. Likewise, our conservation measures impact every acre of our landscape. Separate preserves, on the other hand, will only play a minor role in our HCP/NCCP and our forest management.

7.7 Setting Goals and Objectives for our HCP/NCCP

7.7.1 Overview

Goals are guiding principles; objectives are measurable targets to achieve goals. MRC goals and objectives are the performance criteria for the conservation measures detailed in Chapters 8 through 11. With these objectives, MRC can evaluate the effectiveness of our conservation measures. In comparing results against targets, we will distinguish, wherever possible, management impacts from background variation[9] or land use not related to our HCP/NCCP.

MRC based the goals and objectives of our HCP/NCCP on our current information about environmental conditions on our land and our current knowledge of what is optimal for each covered species. These goals and objectives also comply with requirements for the HCP and NCCP programs as well as for beneficial uses of water (Table 2-4). MRC consulted frequently with the wildlife agencies and with both the North Coast Regional Water Quality Control Board and California Geological Survey. Beginning in 2002, we drafted proposals that the agencies reviewed and discussed with us in meetings both at agency and MRC offices. Our overall intent was to provide mitigation and conservation of the covered species, habitat, and natural communities. The bases for our proposals were scientific research as well as results from long-term monitoring of our forestlands. We have, for example, 18 years of data on northern spotted owls on our land; with this information, we propose to increase their current population by increasing nesting/roosting habitat. The California Geologic Survey and CAL FIRE also participated in review of our HCP/NCCP drafts.

The majority of our objectives propose measurement at the source of an environmental condition. Separating management impacts under our HCP/NCCP from past effects, non-management factors, or other background variation is often difficult. For example, you can more conclusively determine that sediment is from a road if you actually observe it entering a watercourse from a road. On the other hand, cumulative effects—i.e., the collective response from multiple environmental stressors—are best measured at a landscape scale or, in the case of aquatic habitat, downstream from the source of stress. MRC recognizes, however, the limitations of taking observations at a distance from a source; these cases require careful interpretation.

7.7.2 Objectives of the RWQCB

As we stated in section 2.6.4, the Water Quality Control Plan for the North Coast Region, also known as the *Basin Plan*, identifies beneficial uses of water in the North Coast Region and describes problems with surface and ground water. The *Basin Plan* further defines water quality

[9] Background variation is change in environmental conditions not including variation due to management activities.

objectives to protect beneficial uses of water. In the *Basin Plan* are various pollution categories. The most relevant categories for the plan area are sediment and temperature pollution. Table 7-5 shows the *Basin Plan* objectives for sediment and temperature, along with the parameters that MRC will monitor to demonstrate that we are meeting these objectives.

Table 7-5 Basin Plan Objectives and Monitoring Parameters

Basin Plan Objective	Description	HCP/NCCP Monitoring Parameters
suspended material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.	Turbidity and suspended sediment rating curves within focus watersheds
settleable material	Waters shall not contain substances in concentrations that result in deposition that causes nuisance or adversely affects beneficial uses.	Permeability observations, bulk gravel samples, V-star
sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.	Suspended sediment loads within focus watersheds
turbidity	Turbidity shall not be increased more than 20% above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.	Turbidity rating curves within focus watersheds and grab samples across the plan area
temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water board that such alteration in temperature does not adversely affect beneficial uses.	Target temperature values by species

7.7.3 Objectives for instream habitat

Past habitat conditions, time lags in sediment transport, sediment storage, and stochastic hydrologic events all create a dynamic environment. MRC can reasonably hypothesize, however, that instream habitat conditions will improve with our increased focus on conservation and management. Quantifying and sequencing that improvement is problematic and can actually lead to inaccurate projections. Nonetheless, MRC has provided objectives that measure stream habitat and water quality conditions; these measurements should be interpreted with caution. Where specific numerical targets are provided, MRC expects a range of values approaching targets to indicate success for our conservation approach.

7.7.4 Objectives for instream sediment

Some important indications of stream habitat and water quality are residual pool volumes, permeability of stream gravels, percent of particles <0.85 mm and <6.4 mm, V-star, suspended sediment, and turbidity. Of these measurements, MRC only has quantified targets for stream gravel permeability, percent of particles <0.85 mm and <6.4 mm, and V-star. With decreased sediment inputs, MRC expects residual pool depths to increase, as well as the depth variability of longitudinal profiles. This increase will be in conjunction with increased LWD. Fewer pools will be subject to aggradation or filling, and LWD will create greater scour. The rating curve between suspended sediments and stream flow will decrease, as will the curve between turbidity and streamflow. The rate and magnitude of these changes, though, is uncertain. Interpreting instream sediment conditions requires an understanding of instream LWD levels and upslope conditions influencing sediment inputs. Evaluations of sediment budgets and LWD loading within focus watersheds will help MRC interpret instream sediment conditions.

7.7.5 Objectives for riparian areas

MRC has quantified instream riparian objectives by providing ideal trajectories of long-term trends. We expect lower temperatures of stream water due to our riparian conservation measures. As a result, we quantify a temperature threshold that we think the stream will trend toward. However, we do not quantify the amount of temperature change in the stream water or the timing of that change. In interpreting stream temperature, one must investigate instream conditions as well as shade, air temperature, proximity to ocean, location in the stream network, and other factors that might affect change. In some circumstances, it may be physically impossible for a stream to reach a temperature target. For example, the riparian area of Ackerman Creek, near Ukiah, is dominated by oak woodlands. Typically summer air temperatures are greater than 100^{o} F in this area. Achieving an established target without considering Ackerman Creek's inherent limitations is unlikely.

7.7.6 Objectives for aquatic species

MRC designed our objectives for aquatic species to

- Protect locations where covered species currently exist, e.g., by treating watercourses where coastal tailed frogs are present as Large Class II watercourses; by protecting documented breeding sites for red-legged frogs; and by implementing AMZ measures whenever covered salmonids are present.
- Provide for a net increase in the amount and enhancement of existing habitat, e.g., by implementing measures for potential breeding sites of red-legged frogs and by implementing AMZ measures for all watercourses and aquatic features regardless of species presence.

We have concluded that these measures will protect covered species where they now occur and protect all aquatic habitat throughout the plan area to which these species might expand.

7.7.7 Objectives for terrestrial habitat

Throughout the term of our HCP/NCCP, MRC will maintain the current acreages of Type I old-growth forest and rocky outcrops. The basis of our acreage estimates is field reconnaissance and forester mapping for Type I old-growth forest and aerial photos for rocky outcrops.

For hardwood species, there will be specific retention requirements in all harvest areas. Moreover, MRC has identified stands that likely will remain as hardwood-dominated stands, regardless of any management actions. MRC will not convert these to timber production.
In managed stands, MRC will maintain a minimum density of snags, wildlife trees, and downed logs per acre to balance conservation goals with sustainable harvest. All of these objectives provide for the protection of both rare habitat elements and important habitat types. MRC biologists believe this strategy will allow habitat components to persist on the landscape in various stages—similar to natural processes.

7.7.8 Objectives for terrestrial wildlife species

MRC designed our objectives for terrestrial species to

- Protect locations where covered species currently exist, e.g., cores areas of northern spotted owls and the Lower Alder Creek Management Area (LACMA).
- Provide for a net increase in the amount and enhancement of existing habitat, e.g., increase nesting/roosting habitat for northern spotted owls (O§10.3.1.2-5 and O§10.3.1.2-6), accelerate growth of murrelet habitat within LACMA, and increase habitat for Point Arena mountain beaver (O§10.3.3.2-1 and O§10.3.3.2-2).
- Provide, if possible, for an increase in the population of the covered species on our forestlands, e.g., increase the population of northern spotted owls according to the proposed population objectives (O§10.3.1.2-1 and O§10.3.1.2-2).
- Protect existing habitat for covered terrestrial species.

These measures will protect covered species on our forestlands and, in some cases, increase their numbers. Although we may grow habitat, we recognize that other factors may limit population growth of the covered species. For example, a sparse ocean food base may limit the population of marbled murrelets. Nevertheless, we will continue to grow requisite habitat.

7.7.9 Objectives for rare plants

MRC designed our rare plant objectives to

- Conserve natural communities, habitats, and covered plants in the plan area.
- Contribute to the recovery of listed plants in the plan area.
- Manage and conserve covered plants.

These objectives are implemented through management categories which rank plants according to their statewide rarity and threat status.

7.7.10 Objectives for natural communities

Our goal is to maintain, conserve, restore, and enhance our natural communities while conducting sustainable forest management. This goal applies to all our natural communities, with one exception—the upland broadleaved community. MRC believes that the upland broadleaved community is currently much larger now than in the past. Historic clearcuts of coniferous forest have allowed the broadleaved community to thrive and spread. Through sustainable forestry, MRC proposes to restore the broadleaved community to a distribution and density that we believe is more reflective of its *natural* distribution and density within the North Coast coniferous community.

7.7.11 Objectives for biodiversity

Although MRC has not proposed objectives or conservation measures specifically for biodiversity, the sum of all our conservation measures and objectives will promote biodiversity. Improving cold water habitat for salmonids, for example, will benefit other species that depend on it. Conserving rare plants adds to species diversity across our landscape. MRC policies for wildlife trees, hardwoods, and old growth retention will benefit species other than those covered in our HCP/NCCP.

7.7.12 Summary of goals and objectives

Table 7-6 provides a summary of all the goals and objectives that MRC is proposing in our HCP/NCCP. Each goal and objective has a unique number. Goals are preceded by the letter G and objectives by O. Following this designation is the section number in which the item appears as well as a sequential number indicating its location. For example, in the number O§10.3.2-1, O indicates this is an objective, 10.3.2 indicates the section within our HCP/NCCP where the objective is located, and 1 indicates it is the first objective in that section. For explanatory notes, footnotes, and cross-references attached to a goal or objective, refer to its relevant section number in Chapters 8-11.

Table 7-6 Summary of MRC Goals and Objectives

Summary of MRC Goals and Objectives	
AQUATIC HABITAT	
Riparian Function	
G§8.2.2-1	Conserve and develop streamside stands with large, dense conifer species to (1) increase riparian function; (2) create and enhance habitat for covered anadromous salmonid and amphibian species; and (3) protect beneficial uses of water.
Riparian Stands	
O§8.2.2-1	Develop and maintain Class I and Large Class II AMZs based on targets for basal area and size distribution (see Table 8-5 through Table 8-7 and Appendix U, *Inventory Strategy*).
O§8.2.2-2	Achieve, per planning watershed, at least 70% canopy averaged across the entire Class I and Large Class II AMZ. ▪ More than 75% of the stands sampled during timber inventories will meet this canopy requirement within 30 years of HCP/NCCP initiation. ▪ More than 90% of the stands sampled during timber inventories will meet this canopy requirement within 70 years of HCP/NCCP initiation (Table 8-3).
O§8.2.2-3	Manage for a mix of tree species in the AMZs that closely resembles the following conditions: ▪ More than 45% of vegetation strata in riparian stands will be conifer/hardwood or conifer-dominated 40 years after HCP/NCCP initiation. ▪ More than 90% of vegetation strata in riparian stands will be conifer/hardwood or conifer-dominated 70 years after HCP/NCCP initiation.
Instream Conditions	
O§8.2.2-4	Increase the amount of instream LWD to improve the quality of aquatic habitat in Class I and Class II watercourses (see Appendix S, *Targets for LWD and Effective Shade*).
O§8.2.2-5	Increase pool frequency, residual pool depth, or residual pool volumes as measured at the stream reach scale through LWD recruitment (see Appendix S, *Targets for LWD and Effective Shade*).
O§8.2.2-6	Decrease summer water temperatures, where possible, to manage for temperatures at or below MWMT targets for covered species (see the *Water Quality Control Plan for the North Coast Region*, i.e., the Basin Plan).
O§8.2.2-7	Achieve *on-target* ratings for both stream shade and LWD at the planning watershed scale (see Appendix S, *Targets for LWD and Effective Shade*).
Sediment Input	

Summary of MRC Goals and Objectives

G§8.3.2-1	Reduce sediment delivery from forest management to (1) promote high quality habitat for covered anadromous salmonid and amphibian species and (2) protect other beneficial uses of water.
Mass Wasting Unrelated to Roads	
O§8.3.2-1	Reduce, by year 40 of the HCP/NCCP, sediment delivery from mass wasting unrelated to roads by at least 10% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
O§8.3.2-2	Reduce, within the 80-year timeframe of the HCP/NCCP, sediment delivery from mass wasting unrelated to roads by at least 20% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
Road, Skid Trail, and Landing	
O§8.3.2-3	Reduce, by year 40 of the HCP/NCCP, sediment delivery from mass wasting related to roads by at least 30% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
O§8.3.2-4	Reduce, within the 80-year timeframe of the HCP/NCCP, sediment delivery from mass wasting related to roads by at least 60% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
O§8.3.2-5	Upgrade, within the first 30 years of the HCP/NCCP, the road network in the plan area to the standards specified in Appendix E, *Roads, Landings, and Skid Trails;* complete upgrades to the road network in coho "core" areas within the first 20 of those 30 years.
O§8.3.2-6	Control 1,302,000 yd^3 of controllable erosion within the first 30 years of the HCP/NCCP. **NOTE** The total amount of controllable erosion may change due to road inventory updates and weather.
O§8.3.2-7	Reduce point source erosion from roads, skid trails, or landings and sediment delivery associated with surface erosion by 50% within the first 30 years of the HCP/NCCP (i.e., from 4000 to 2000 yd^3 per mi^2 per year) and 70% within the initial 70 years of the HCP/NCCP (i.e., from 4000 to 1200 yd^3 per mi^2 per year).
Instream Sediment	

Summary of MRC Goals and Objectives

O§8.3.2-8	Demonstrate an improving trend in the following parameters over the life of the HCP/NCCP based on MRC conducting (a) watershed analyses at least every 20 years, (b) long-term channel monitoring every 10 years, and (c) focus watershed studies every 3-5 years: ▪ Quality of stream gravel as measured by increased permeability and percent of fine particles < 0.85 mm. ▪ Stream-reach complexity as measured by residual pool depths and standard deviation of residual pool depths within long-term stream monitoring reaches. ▪ Proportion of fine sediment in pools (V-star). ▪ Decreased sediment inputs to the sediment budget for focus watersheds. **NOTE** 1. MRC has not set benchmarks for instream sediment objectives since rarely do management activities unambiguously or expressly impact instream habitat conditions. 2. Stream gravel permeability will approximate, on average, 10,000 cm/hr across stream reaches. 3. The percent of fine material < 0.85 mm, recovered from dry sieve techniques, will approximate, on average, < 7% across stream reaches. 4. The fraction of pool volume filled with fine sediment should average ≤ 0.21 across stream reaches.
O§8.3.2-9	Demonstrate an improving trend in the turbidity and suspended sediment.
Hydrologic Change	
G§8.4.1-1	Limit the adverse impact of hydrologic change on covered anadromous salmonid and amphibian species or on beneficial uses of water.
O§8.4.1-1	Reduce hydrologic change by maintaining at least 50% canopy cover, averaged across CalWater planning watersheds in the plan area.
O§8.4.1-2	Minimize hydrologic connectivity of road systems to watercourses as outlined in Appendix E, *Roads, Landings, and Skid Trails* by upgrading, within the first 30 years of the HCP/NCCP, the MRC road network to these standards.
O§8.4.1-3	Maintain, during water drafting, equivalent temperatures downstream and upstream and limit the reduction of the wetted width of the 1st downstream riffle as well as pool volume.
TERRESTRIAL HABITAT	
Snags, Downed Wood, and Wildlife Trees	
G§9.2.2-1	Retain and recruit snags in managed stands and downed wood on the forest floor.
G§9.2.2-2	Retain all wildlife trees.
G§9.2.2-3	Manage wildlife trees and downed wood so that they ▪ Are well distributed across the forest—in both riparian and upslope areas, in groups and singly. ▪ Exist in sufficient quantity and quality across the forest.

Summary of MRC Goals and Objectives

O§9.2.2-1	Retain in Class I and Large Class II AMZ at least ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥16 in. dbh and ≥ 30 ft tall. ▪ 2 hard snags or recruitment trees o*n average per acre* that are ≥24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 6 hard logs *on average* per acre that are (a) ≥16 in. average diameter, (b) ≥6 ft long, and (c) derived from at least 3 trees.
O§9.2.2-2	Retain in general forested areas at least ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥16 in. dbh and ≥ 30 ft tall. ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 5 hard logs *on average per acre* that are (a) ≥16 in. average diameter, (b)≥ 6 ft long, and (c) derived from at least 3 trees.
Hardwoods	
G§9.3.2-1	Restore stands that historically were dominated by conifers.
G§9.3.2-2	Exclude harvests from Class I hardwood stands.
G§9.3.2-3	Maintain patches dominated by early seral hardwoods in variable retention units.
G§9.3.2-4	Provide representative samples of early seral hardwood stands throughout the plan area.
O§9.3.2-1	Retain, after harvest**,** 15 ft^2/ac of hardwoods > 6 in. dbh, if such hardwoods comprised at least 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-2	Prohibit treatment of hardwoods > 6 in. dbh if such hardwoods comprise less than 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-3	Maintain true oak stands.
O§9.3.2-4	Retain hardwood components of riparian stands (AMZs) unless the riparian stand has been identified for conversion to conifer.
O§9.3.2-5	Retain hardwood areas within variable retention units.
O§9.3.2-6	Harvest in representative sample areas only to maintain the relative proportion of hardwoods to conifers.
O§9.3.2-7	Designate 1487 ac as representative sample areas for early seral hardwood stands (Appendix B, *HCP/NCCP Atlas*, MAPS 4A-C).
Old Growth	

Summary of MRC Goals and Objectives

G§9.4.2-1	Preserve and enhance the character and function of old growth and late-successional forests in the plan area.
G§9.4.2-2	Promote the development of mature and late-successional forest.
G§9.4.2-3	Protect the remaining old-growth trees and forest in the plan area.
O§9.4.2-1	Maintain 101 ac of Type I old growth currently identified in the plan area, as well as any new Type-I old-growth stands later discovered in the plan area, in order to retain their stand acreage and enhance stand function.
O§9.4.2-2	Maintain 520 ac of Type II stands currently identified in the plan area, as well as any new Type II stands later discovered in the plan area in order to retain their stand acreage and enhance stand function.
O§9.4.2-3	Increase acreage of mature and late successional forest within AMZ and LACMA (see M§13.9.2.2-1, M§13.5.1.2-2, M§13.5.1.1-1, M§13.5.1.1-2).
Rocky Outcrops	
G§9.5.2-1	Retain and preserve known rocky outcrops in the plan area.
G§9.5.2-2	Minimize disturbance of rocky outcrops.
G§9.5.2-3	Avoid adverse impacts to sensitive species that may inhabit or use rocky outcrops for reproduction, cover, or foraging, particularly the peregrine falcon.
O§9.5.2-1	Preserve and maintain 3 rocky outcrops comprising 63 ac (20 ha) across 3 planning watersheds.
Common Natural Communities	
G§9.6.1.2-1	Maintain existing natural communities.
O§9.6.1.2-1	Regenerate harvested conifer forest with a mix of conifer species similar to the harvested stand.
O§9.6.1.2-2	Maintain various successional stages of coastal forest, including Type I and Type II old-growth stands as well as representative hardwood forests.
O§9.6.1.2-3	Maintain existing stand dominance of native conifers other than redwood and Douglas fir where this occurs.
Uncommon Natural Communities	
G§9.6.2.2-1	Maintain existing natural communities.
O§9.6.2.2-1	Reintroduce and manage ecological processes or surrogates after obtaining approval of the wildlife agencies.
O§9.6.2.2-2	Conserve 3274 ac of uncommon natural communities by limiting MRC activities within them: • 135 ac of pygmy forest. • 319 ac of Bishop pine. • 1084 ac of oak woodlands. • 1669 ac of grasslands. • 67 ac of salt marsh.

Summary of MRC Goals and Objectives

O§9.6.2.2-3	Control any species which the wildlife agencies and MRC designate as an exotic invasive.

Invasive Species

G§9.7.2-1	Reduce the adverse ecological effects of invasive species in the plan area in order to enhance natural communities and protect covered species.
O§9.7.2-1	Eradicate or reduce the cover, biomass, and distribution of target, non-native invasive plants, such as jubata grass, broom, and eucalyptus, in the plan area through an Invasive Plant Control Program (IPCP).
O§9.7.2-2	Reduce the number and distribution of non-native, invasive animals, such as bullfrogs, if they threaten the ecological balance in natural communities or the populations of covered species.
O§9.7.2-3	Implement, with external or MRC funding and with the cooperation of the wildlife agencies as well as other land agencies, control programs for existing and newly discovered invasive species which benefit the region.

Fish and Wildlife

Coho Salmon

G§10.2.1.2-1	Maintain and improve anadromous salmonid distribution throughout the plan area.
G§10.2.1.2-2	Maintain and improve aquatic habitat.

Major Drainage Basins

O§10.2.1.2-1 Maintain presence of

- Steelhead in 100% of the ASMB where baseline data and new information indicate their presence.
- Coho salmon in 100% of ASMB, where baseline data and new information indicate their presence.

Note
MRC considers anadromous salmonid species *present* if we detect them once during 3 annual consecutive surveys in a basin. We will consider that basin able to *support* the new species only if we detect them on 2 or more occasions in a continuous 6-year time period.

Distribution

O§10.2.1.2-2	Maintain steelhead in 90% of sampling sites throughout the plan area, where baseline data and new information indicates their presence.
O§10.2.1.2-3	Maintain coho salmon in 85% of sampling sites throughout the plan area, where baseline data and new information indicates their presence.

Note
MRC set objectives for coho salmon and steelhead distribution at less than 100% to account for natural variations in flow and temporary barriers, such as log jams, which may impede accessibility. When we detect new fish species in a sampling site, we will consider that sampling site able to support the new species only if we detect them on 2 or more occasions in a continuous 6-year time period.

Chinook Salmon Monitoring Reaches

Summary of MRC Goals and Objectives

OS10.2.1.2-4	Maintain Chinook salmon in the Chinook Salmon Monitoring Reaches (CSMR) currently identified for annual monitoring: Hollow Tree Creek and North Fork Noyo River (see *HCP/NCCP Atlas*, MAPS 3A-3C).

Red-legged Frogs

G§10.2.2.2-1	Manage for well distributed meta-populations (i.e., partially isolated sub-populations) of red-legged frogs.
G§10.2.2.2-2	Maintain and manage red-legged frog habitats for native species.

Distribution

O§10.2.2.2-1	Establish the baseline distribution of both potential and documented red-legged frog breeding sites by Year 2 of HCP/NCCP implementation.

Occupancy

O§10.2.2.2-2 Maintain red-legged frogs in 100% of the red-legged frog management units (RLFMU), where baseline surveys and new surveys indicate their presence.

> **NOTE**
> MRC considers red-legged frogs *present* if we detect them once during 3 annual consecutive surveys. Since red-legged frogs live approximately 6 years, this survey period covers about half their life expectancy.

Habitat

O§10.2.2.2-3 Maintain habitat quality (e.g., maximum depth and surface area) at 90% of potential breeding sites identified during distribution surveys, including water drafting sites.

> **NOTE**
> MRC set habitat objectives at less than 100% to account for the temporary nature of some sites; for example, pools upstream of log jams may dissipate after the log jam shifts.

O§10.2.2.2-4 Create amphibian habitat when constructing new water drafting ponds in the course of covered activities.

Coastal Tailed Frogs

G§10.2.3.2-1	Maintain or enhance baseline distribution of larval coastal tailed frogs.

Distribution

O§10.2.3.2-1 Establish a baseline distribution of larval coastal tailed frogs by Year 2 of HCP/NCCP implementation.

O§10.2.3.2-2 Maintain larval coastal tailed frogs in 95% of sites where either the baseline distribution survey, incidental observation, or a new survey indicates their presence.

> **NOTE**
> MRC set the distribution objective at less than 100% to account for sampling error.

Northern Spotted Owls

G§10.3.1.2-1	Contribute to overall population increases and species recovery in northern California.
G§10.3.1.2-2	Maintain well-distributed and productive owl populations in the plan area.

Summary of MRC Goals and Objectives

G§10.3.1.2-3	Increase the owl nesting/roosting habitat by allowing a larger proportion of stands to progress and persist to a point where they have characteristics suitable for owl nesting and roosting.
Population Objective 1	
O§10.3.1.2-1	Maintain at least 28 Level-1 territories and 67 Level-2 territories during the first 60 years of the HCP/NCCP.
Population Objective 2	
O§10.3.1.2-2	Increase to 34 Level-1 territories and 80 Level-2 territories by Year 75 of the HCP/NCCP.
Distribution Objective 1	
O§10.3.1.2-3	Achieve by Year 40 of the HCP/NCCP a distribution of spotted owl territories in each inventory block that is proportionate to its potential nesting/roosting habitat, i.e., an inventory block with 10% of the total potential nesting/roosting habitat in the plan area should have at least 10% of the Level-1 and Level-2 territories specified in the population objectives (see Table 10-7).
Distribution Objective 2	
O§10.3.1.2-4	Achieve by Year 75 of the HCP/NCCP a distribution of spotted owl territories in each inventory block that exceeds *Distribution Objective 1* by 20% (see Table 10-7).
Habitat Objective 1	
O§10.3.1.2-5	Achieve by Year 40 of the HCP/NCCP a landscape configuration in which 23% of all potential habitat is nesting/roosting habitat, while still maintaining separate objectives for each inventory block (Table 10-10).
Habitat Objective 2	
O§10.3.1.2-6	Achieve by Year 75 of the HCP/NCCP a landscape configuration in which 25% of all potential habitat and 25% of each inventory block are nesting/roosting habitat (Table 10-10).
Marbled Murrelets	
G§10.3.2.2-1	Protect the murrelet population and its habitat in Lower Alder Creek.
G§10.3.2.2-2	Protect and increase potential murrelet habitat across the plan area.
O§10.3.2.2-1	Retain permanently all trees defined as primary murrelet habitat trees.
O§10.3.2.2-2	Retain permanently all sites occupied by marbled murrelets.
O§10.3.2.2-3	Maintain murrelet presence in the Navarro River watershed and in drainages in which, in the future, MRC biologists detect murrelets.
O§10.3.2.2-4	Provide opportunities for the wildlife agencies to analyze or purchase conservation easements in 6 MRC areas compatible for development of murrelet habitat and for murrelet colonization.
O§10.3.2.2-5	Maintain a stable or increasing (i.e. non-declining) number of murrelet radar detections at LACMA.
Point Arena Mountain Beaver	

Summary of MRC Goals and Objectives

G§10.3.3.2-1	Maintain or increase the population of Point Arena mountain beaver by increasing the amount and quality of their current habitat in the plan area.
O§10.3.3.2-1	Maintain or enhance at least 85% of the known burrow systems of Point Arena mountain beaver in the plan area (i.e., 12 of 14).
O§10.3.3.2-2	Create at least 1 site of potential habitat for each active burrow system when harvest occurs within the assessment area for Point Arena Mountain Beaver.
COVERED RARE PLANTS	
G§11.2-1	Conserve the natural communities, habitats, and occurrences of covered rare plant species found in the plan area.
G§11.2-2	Contribute to the recovery of covered rare plant species in the plan area that are listed as *threatened* or *endangered* by CDFG or USFWS.
G§11.2-3	Manage and conserve rare plant species that are not listed as *threatened* or *endangered* so that listing remains unnecessary.
Management Category 1 (MC1)	
O§11.2-1	Maintain all covered rare plant occurrences in the plan area at stable-to-increasing levels of abundance and distribution (i.e., occurrence trend is stable-to-increasing).
O§11.2-2	Avoid or minimize mortality of individual plants.
O§11.2-3	Minimize direct and indirect adverse impacts to occurrences, such as ground disturbances, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-4	Retain existing site conditions of importance to covered rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil structure, soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 2 (MC2)	
O§11.2-5	Maintain a stable-to-increasing number of occurrences in each inventory block where the covered species is known (i.e., species trend is stable-to-increasing).
O§11.2-6	Maintain, on average, stable-to-increasing levels of abundance and distribution for the covered species throughout its range in the plan area (i.e., species trend is stable-to-increasing).
O§11.2-7	Minimize mortality of individual plants
O§11.2-8	Reduce direct and indirect adverse impacts, such as ground disturbances, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-9	Minimize changes in site conditions of importance to rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil structure, soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 3 (MC3)	

Summary of MRC Goals and Objectives

O§11.2-10	Maintain stable-to-increasing levels of abundance and distribution within all inventory blocks where the covered species is found (i.e., species trend is stable-to-increasing).
O§11.2-11	Reduce mortality of individual rare plants, as feasible.
O§11.2-12	Reduce, as feasible, direct and indirect adverse impacts, such as ground disturbance, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-13	Minimize, as feasible, changes in site conditions of importance to rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 4 (MC4)	
O§11.2-14	Maintain number and size of occurrences in the plan area so that the species continues to qualify for its current S rank or an S rank that denotes greater abundance (see section 11.5.1).
O§11.2-15	Reduce mortality of individual rare plants, as feasible.
O§11.2-16	Maintain stable-to-increasing occurrences in the plan area, mainly through community-based conservation measures.

7.8 Proposing Conservation Measures to Meet Goals and Objectives

In Chapters 8 through 11, we propose conservation measures for aquatic habitat, terrestrial habitat, and covered species. In a few cases, we also provide *alternatives* to proposed conservation measures.

DEFINITION

A **conservation measure** is one or more proposed prescriptions to avoid, minimize, or otherwise mitigate adverse impacts to covered species or to protect, restore, or enhance habitat for these species.

An **alternative conservation measure** is an equivalent measure for a specified context that (a) meets or exceeds the protections of a conservation measure that would normally be implemented; and (b) has the approval of the wildlife agencies.

MRC is proposing very little direct management of covered species, such as translocation. Instead, we will cooperate with the wildlife agencies on management efforts to enhance the habitat and status of covered species in the plan area and in the region. Throughout the drafting of our HCP/NCCP, MRC has reached agreement with the wildlife agencies on each conservation measure, as well as any limits of deviation that should apply (e.g., C§8.3.3.1.2-9 through C§8.3.3.1.2-11). *Appendix W* contains a summary of all the proposed conservation measures.

7.9 Organizational Structure for HCP/NCCP Implementation

MRC will implement our HCP/NCCP through the covered activities described in section 1.14. While these covered activities will usually occur during harvest operations within PTHPs, some, such as habitat improvement and covered species monitoring, will occur outside PTHPs.

7.9.1 Operations and monitoring coordinators

MRC will ensure that all our employees and contractors learn the applicable conservation measures for their job duties. In carrying out this responsibility, we will assign 2 persons to oversee implementation of our HCP/NCCP.

- An HCP/NCCP operations coordinator will review PTHPs for conformance to the plan and consult with the wildlife agencies on operational issues. In the first 3 years of HCP/NCCP implementation, the operations coordinator will review up to 25 PTHPs, starting with all PTHPs with active operations in the initial year of our HCP/NCCP (if 25 or less). The operations coordinator will continue to review PTHPs until 25 have been reviewed, or 3 years have elapsed, whichever comes first.

- An HCP/NCCP monitoring coordinator will oversee requisite monitoring, ensure its completion, distribute reports to the wildlife agencies, and consult with them on monitoring issues.

Both the operations and monitoring coordinators will prepare an annual report that summarizes post-harvest compliance and identifies those issues which MRC will address with additional effort and training.

7.9.2 Foresters

MRC foresters will be the primary implementers of our HCP/NCCP. They will prepare PTHPs in accordance with our HCP/NCCP, the PTEIR, and the Forest Practice Rules. In addition, they will supervise PTHP operations as well as other management activities on our land, such as road maintenance and vegetation management. When necessary, MRC will contract with a professional geologist to review proposed operations or to complete a geological review for watershed analysis.

7.9.3 Forest science staff

Even prior to HCP/NCCP implementation, biologists in our Forest Science Department have performed some tasks which our HCP/NCCP monitoring programs will require. These tasks include monitoring of northern spotted owls, LACMA, and stream channel conditions, as well as surveying for Point Arena mountain beaver. Since 2006, MRC has posted our monitoring results on the MRC website.[10]

7.9.4 Road, inventory, and GIS staff

MRC has a dedicated crew to do road inventory, along with analysts for our timber inventory database, landscape model, and GIS. Each of these organizational areas will provide essential data for HCP/NCCP implementation.

[10] http://www.mrc.com/Monitoring-Overview.aspx (accessed 02/14/2011)

7.10 Implementation Pacing and Funding

7.10.1 Concurrency of conservation, mitigation, and routine operations

Conservation and mitigation under our HCP/NCCP will proceed concurrently with routine MRC operations and timber harvests. Foresters, for example, will incorporate appropriate conservation measures into their PTHPs and conduct operations in accordance with HCP/NCCP time frames established in Chapters 8–11 and Appendix E, *Road, Landing, and Skid Trail Standards*. Those time frames ensure that MRC implements key conservation measures in proportion to impacts to covered species from covered activities.

As the impacts from covered activities increase, the conservation effort intensifies. In other words, as timber harvest and other covered activities increase on a per acre basis, the implementation of conservation measures will increase in direct proportion, on an acre-per-acre basis. In years of reduced harvest, implementation of the conservation measures will outpace the impacts of covered activities. In this sense, there will be “rough proportionality” between conservation efforts and level of impacts. This will ensure that conservation and mitigation are not “catch up” efforts as the term of the plan draws to a close.

The number of acres on which MRC implements conservation and mitigation each year will meet or exceed the number of acres on which we conduct timber harvest and other covered activities. MRC will include in each annual report the number of acres on which timber harvest occurs and the number of acres on which we implemented conservation measures, as well as other conservation efforts. Data for the new report (see section D.9) will include

- Levels of impact.
  - Volume harvested.
  - Acres harvested.
  - Miles of new road construction.
  - Number of new stream crossing by stream class.
- Measurable conservation efforts.
  - Annual growth of trees (comparable to volume harvested).
  - Acres retained in core areas of northern spotted owls.
  - Acres retained in uncommon natural communities, e.g., pygmy forest.
  - Number of old growth trees retained.
  - Number of wildlife trees retained.
  - AMZ acres retained.
  - Volume of controlled sediment.
  - Dollars spent on controlling sediment.
  - Number of trees planted.
  - Acres preserved in Lower Alder Creek Management Area (LACMA).
  - Acres maintained in Murrelet Habitat Recruitment Stands (MHRS).
  - LWD added to streams.
  - Miles of road decommissioned or abandoned.
  - Miles of road upgraded to HCP standards.
  - Number of fish passage barriers removed and miles of stream opened.

7.10.2 Sample annual budget for HCP/NCCP implementation

Before January 30th of each year, MRC will submit to the wildlife agencies an annual budget approved by our Board of Directors. This budget will authorize sufficient expenditure funds for the current year to carry out MRC commitments under federal and state permits and under our HCP/NCCP. In addition, the president of MRC will deliver to the wildlife agencies a letter verifying that MRC has established an accounting reserve or maintained an adequate amount to implement measures included in the operating program. HCP/NCCP implementation will impose costs beyond normal MRC operating costs for that year. MRC will also provide a report from an independent auditor confirming that MRC has established or maintained such reserve. The amount of the accounting reserve will reflect the amount shown in the annual budget, but in no event will the amount be less than $2,000,000. Details about the accounting reserve are in Appendix A (*Implementating Agreement*, section A.8.1, "Primary Funding and Demonstration of Availability"). MRC will adjust the amount of the accounting reserve each year based on the Consumer Price Index published by the Bureau of Labor Statistics of the United States Department of Labor (San Francisco-Oakland-San Jose, CA). The amount will be increased or decreased in proportion to the extent of lands added or deleted in accordance with section 1.12 of our HCP/NCCP.

Table 7-7 shows a sample MRC budget for the initial year of HCP/NCCP implementation. We estimated the budget numbers based on existing budgets for MRC departments, plus additional costs for monitoring and implementation in the plan area. Our estimate excludes annual capital and logging costs. As part of our ongoing forest management, we have already implemented over half of the requirements of our HCP/NCCP. Consequently, we calculated that HCP/NCCP implementation will exceed our current costs by 40%. The sample budget below reflects this increase. The actual amount allocated to each program cited will depend on economic conditions within MRC and the timber industry at the time of HCP/NCCP commencement. The global financial crisis that began in 2008 and may persist for several years has made budget projections much less predictable for the entire business community.

Table 7-7 Sample Budget for Initial Year of HCP/NCCP Implementation

Program	US$
Terrestrial Wildlife	**$170,000**
Aquatic Wildlife	**$95,000**
Sediment Control/Road work	**$260,000**
Forestry	**$370,000**
Administration	**$840,000**
Inventory	**$75,000**
GIS	**$30,000**
Total	**$1,840,000**

Chapter 8

Conservation Measures for Aquatic Habitat

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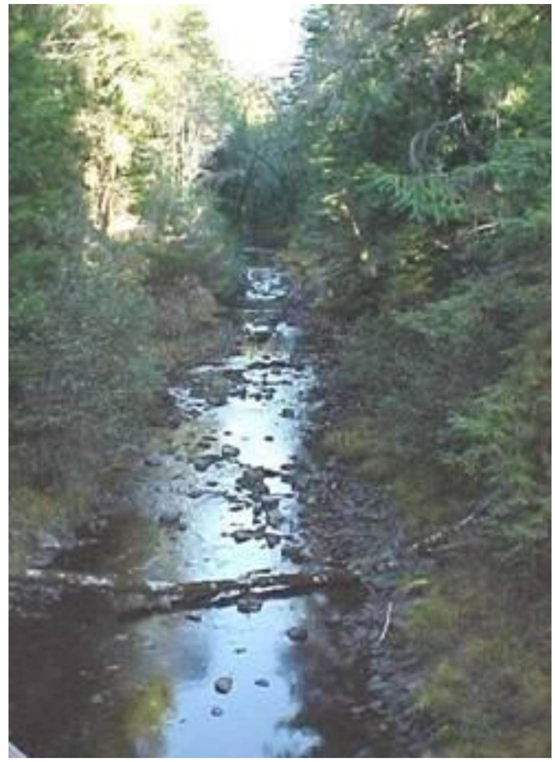
8 CONSERVATION MEASURES FOR AQUATIC HABITAT

8.1 Introduction



Chapter 8 addresses the conservation measures for aquatic habitat under the topics of riparian and wetland areas, sediment inputs, and hydrologic change. Each of these sub-sections includes overviews, goals and objectives, conservation measures, and rationales. Later, Chapter 10 provides conservation measures for covered fish and amphibian species within this aquatic habitat.

Quite simply, aquatic habitat is where aquatic species live, breed, and rear offspring. Natural habitat for anadromous salmonid species is within streams and rivers; for amphibian species, it is in streams, rivers, ponds, and wetlands—and partly in riparian and upland areas where amphibians sometimes forage. Through our HCP/NCCP, MRC will maintain and enhance aquatic habitat while protecting beneficial uses of water. Unquestionably, this is a challenge, because aquatic habitat is influenced by many environmental factors, such as rising or falling temperatures and sediment in streams.

In Chapter 3, we acknowledged that watershed analyses indicate that we need to improve environmental conditions on our land. Our most critical issues are managing riparian stands to recruit LWD for streams and reducing sediment input to streams from roads. In addition, we must increase stream shade in riparian areas and decrease sediment inputs from mass wasting and skid trails. Research on the effects of forest harvest on hydrologic change has also prompted us to consider new ways to minimize hydrologic change and its impacts to aquatic species. All of the conservation measures proposed in this chapter, therefore, reflect a good deal of corporate introspection.

8.2 Riparian and Wetland Areas

8.2.1 Overview

Riparian areas are zones of vegetation adjacent to a stream, river, lake, or wetland. They influence the adjacent water and are, in turn, influenced by it. Riparian areas form the link between terrestrial and aquatic environments, exerting a strong impact on the biological and physical processes that create and maintain aquatic habitat.

Riparian function is a measure of how well streamside vegetation can

- Recruit streamside trees for large woody debris (LWD).
- Shade streams with canopy.
- Moderate summer water temperatures.
- Sustain a cool micro-climate.
- Stabilize stream banks.

- Maintain channel form.
- Filter sediment adjacent to streams.
- Provide nutrient cycling, organic material, and hydraulic roughness for floodplains.
- Produce habitat for riparian obligate plants and animals.

Forest management can affect aquatic habitat by altering riparian function. Adverse conditions attributed to forest management include mass wasting, road erosion, and changes to watershed hydrology. In some cases, conservation measures that address riparian function also provide protection to aquatic habitat by reducing sediment and mitigating hydrologic change.

8.2.1.1 Defining basic terms and concepts

In this subsection, we provide definitions and illustrations of key terms that occur frequently in the conservation measures and rationale for riparian and wetland areas.

8.2.1.1.1 DBH and basal area

DEFINITION

DBH is the diameter of a tree at breast height or 4.5 ft above the ground; diameter is calculated from the circumference of a tree trunk.

Basal area (BA) is the circular area of a tree cross-section at dbh, i.e., $A = \pi r^2$ or $A = \pi(\text{dbh}/2)^2$.

Basal area per acre is the summation of the individual basal areas for all the trees within an acre.

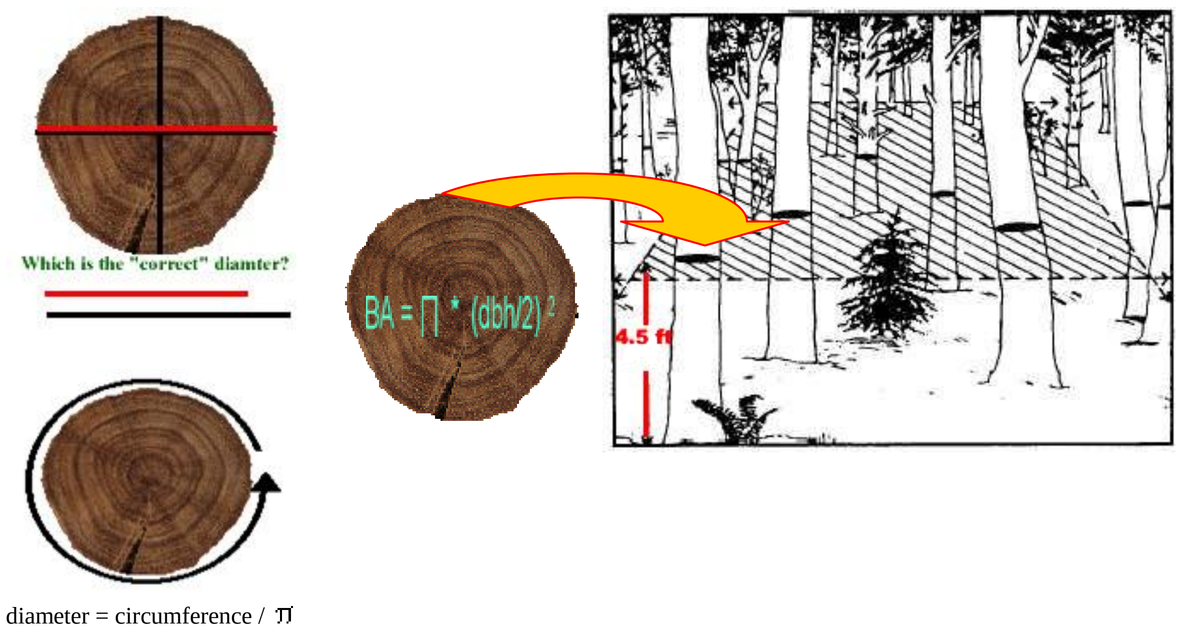


Figure 8-1 DBH and Basal Area[1]

[1] This figure was developed from illustrations of basal area in *Stewardship Notes*, Indiana Division of Forestry and of cross-sectional diameters from *The School of Resources, Environment, and Society*, Australian National University.

8.2.1.1.2 Watercourse classifications and AMZ

DEFINITION

Aquatic Management Zone (AMZ) is the strip along Class I, Class II, and Class III watercourses where MRC will manage riparian function.[2]

MRC classifies watercourses based on available information about presence of aquatic species and habitat characteristics. The categories shown in Table 8-1 are Class I, Class II, and Class III. Unlike the categories for Class I and Class III, MRC sub-divides Class II into large and small watercourses. In doing so, we hypothesize that drainage areas of at least 100 ac (i.e., Large Class II watercourses) support perennial surface water, whereas drainage areas less than 100 ac (i.e., Small Class II watercourses) do not. Moreover, we consider watersheds with perennial surface water to be important both for cold water inputs to larger watercourses and for habitat for cold water amphibians which require perennial water for larval development.

Table 8-1 Watercourse Definitions

Watercourse Classification	Definition
Class I	Fish always or seasonally present on-site. Includes habitat to sustain fish migration and spawning, as well as man-made lakes or ponds inhabited by stocked native fish. Also includes Class II streams that could be restored for fish habitat. Excludes man-made lakes or ponds inhabited only with non-native fish (modified from CCR 916.5 Table I, 2002[3]).
Large Class II	Watercourses with aquatic habitat for non-fish aquatic species (modified from CCR 916.5 Table I, 2002). Drainage area is at least 100 ac or surface flow is perennial during normal annual rainfall. MRC may adjust threshold acreage through adaptive management. MRC will treat watersheds with breeding coastal tailed frogs present as Large Class II regardless of the size of the watershed area.
Small Class II	Watercourses with aquatic habitat for non-fish aquatic species (modified from CCR 916.5 Table I, 2002). Drainage area is less than 100 ac; MRC may adjust this acreage through adaptive management (see Chapter 13, M§13.5.1.2-3).
Class III[4]	Watercourses with no aquatic habitat present. Shows capability of transporting sediment downstream to Class I and Class II waters under normal high water conditions and after timber operations (CCR 916.5 Table I, 2002).

[2] The Forest Practice Rules use the term Watercourse and Lake Protection Zone (WLPZ) to describe the riparian protection area.

[3] Modifications to these classifications are as follows: (a) Class I does not include domestic water sources, although MRC will protect domestic water sources per CCR 916.5; and (b) Class II watercourses include Small and Large Class II watercourses. The MRC distinction between Small and Large Class II watercourses is different from the classification in the Anadromous Salmonid Protection Rules adopted by the Board of Forestry in 2009.

[4] The Science Panel advised that MRC include soil pipes that can contribute sediment to a Class I or Class II watercourse in the definition of a Class III watercourse. Instead, MRC has developed conservation measures specific to soil pipes (C§8.2.3.2.6-1 through C§8.2.3.2.6-5).

Figure 8-2 depicts major stream classes in a watershed as well as other terms in this chapter, such as evapotranspiration, infiltration, and groundwater aquifer.

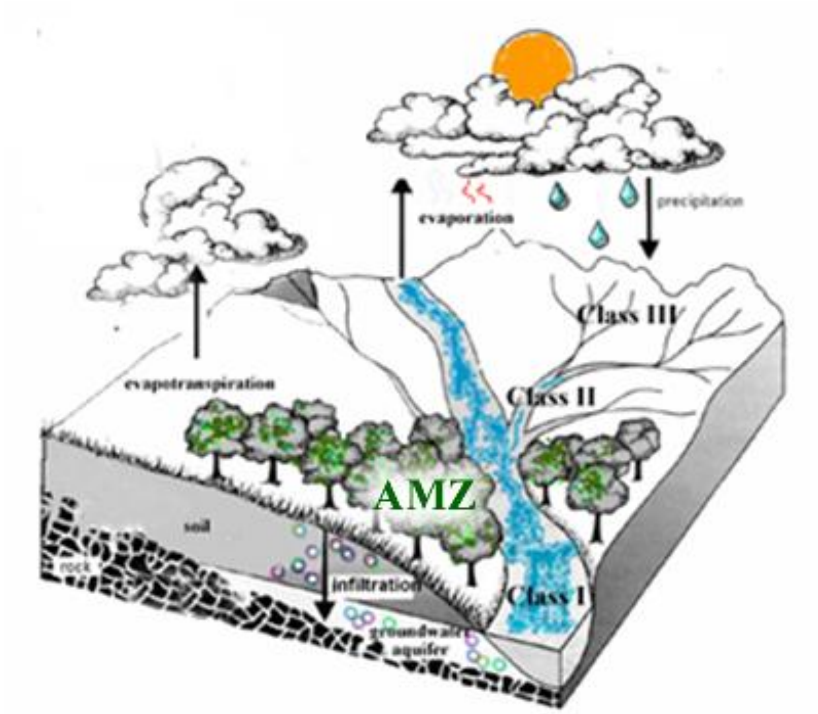


Figure 8-2 Stream Classes and Hydrologic Processes

8.2.1.1.3 AMZ bands

MRC will counteract disturbance within the AMZ with three bands: inner, middle, and outer (Figure 8-3). Disturbance will vary across these bands, with the least disturbance in the inner band.

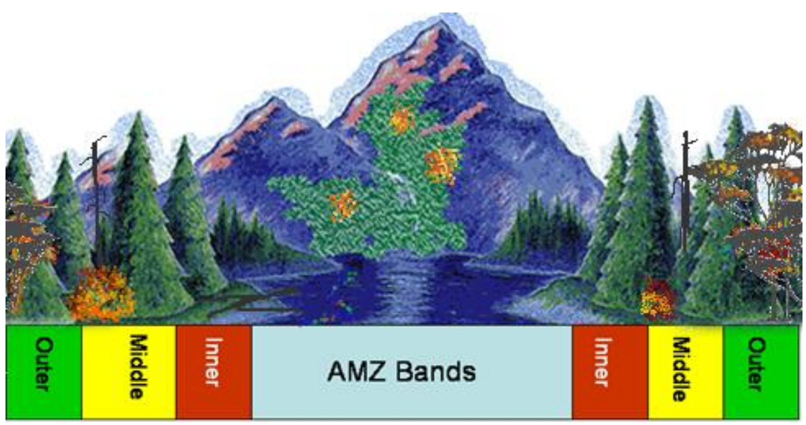


Figure 8-3 AMZ Bands for Class I and Large Class II Streams and Rivers

MRC will delineate AMZ bands on the largest streams or rivers—Class I and Large Class II—where fish and amphibian species, covered by our HCP/NCCP, are present. For smaller streams—Small Class II and Class III— where covered fish are never present and amphibians are seldom present year round, there will be one continuous band. Table 8-2 outlines the riparian functions for each of the AMZ bands.

Table 8-2 Riparian Function within Bands of the AMZ

Bands	Riparian Function
Inner[5]	• Recruit LWD. • Promote stream shade with canopy and cool streamside microclimate. • Promote nutrient cycling within the floodplain. • Provide coarse and fine organic inputs. • Provide hydraulic roughness on the floodplain. • Promote streambank stability. • Provide sediment filtration.
Middle	• Recruit LWD. • Promote stream shade with canopy and cool streamside microclimate. • Provide coarse and fine organic inputs. • Provide sediment filtration.
Outer	• Buffer inner and middle band processes from upslope management. • Retain canopy to moderate microclimate within inner and middle bands. • Recruit LWD from trees toppling into inner or middle band.

8.2.2 Goal and objectives

Goal and Objectives for Riparian Function	
Goal	
G§8.2.2-1	Conserve and develop streamside stands with large, dense conifer species to (1) increase riparian function; (2) create and enhance habitat for covered anadromous salmonid and amphibian species; and (3) protect beneficial uses of water.
Objectives	
Riparian Stands	
O§8.2.2-1	Develop and maintain Class I and Large Class II AMZs based on targets for basal area and size distribution (see Table 8-5 through Table 8-7 and Appendix U, *Inventory Strategy*).
O§8.2.2-2	Achieve, per planning watershed, at least 70% canopy averaged across the entire Class I and Large Class II AMZ.[6] ▪ More than 75% of the stands sampled during timber inventories will meet this canopy requirement within 30 years of HCP/NCCP initiation. ▪ More than 90% of the stands sampled during timber inventories will meet this canopy requirement within 70 years of HCP/NCCP initiation (Table 8-3).

[5] These functions apply to the entire AMZ of Small Class II and Class III watercourses with one exception. The requirement to promote stream shading to moderate summer water temperatures does not apply to Small Class II and Class III watercourses.

[6] This objective arises from the AMZ conservation measure (C§8.2.3.1.2-1) to close up riparian canopy in Class I and Large Class II AMZs so that inner bands, middle bands, and outer bands have at least 85%, 70%, and 50% canopy, respectively.

Goal and Objectives for Riparian Function	
O§8.2.2-3	Manage for a mix of tree species in the AMZs that closely resembles the following conditions: ▪ More than 45% of vegetation strata[7] in riparian stands will be conifer/hardwood or conifer-dominated 40 years after HCP/NCCP initiation. ▪ More than 90% of vegetation strata in riparian stands will be conifer/hardwood or conifer-dominated 70 years after HCP/NCCP initiation.
Instream Conditions	
O§8.2.2-4	Increase the amount of instream LWD to improve the quality of aquatic habitat in Class I and Class II watercourses (see Appendix S, *Targets for LWD and Effective Shade*).
O§8.2.2-5	Increase pool frequency, residual pool depth, or residual pool volumes as measured at the stream reach scale through LWD recruitment (see Appendix S, *Targets for LWD and Effective Shade*).
O§8.2.2-6	Decrease summer water temperatures, where possible, to manage for temperatures at or below MWMT targets for covered species (see the *Water Quality Control Plan for the North Coast Region*, i.e., the Basin Plan).
O§8.2.2-7	Achieve *on-target* ratings for both stream shade and LWD at the planning watershed scale (see Appendix S, *Targets for LWD and Effective Shade*).

8.2.2.1 80-year projections for timber stands

The histograms in Figures 8-4 and 8-5 show (a) average conditions for a subset of Class I and Class II AMZs at Year 50 of HCP/NCCP implementation and (b) projected average basal area and tree density for these same stands under pre-harvest conditions at Year 70 and post-harvest conditions at Year 75. The subset comprises 128 stands from 8 different planning watersheds across all the MRC inventory blocks within the plan area. Years 70 and 75 represent stands that are in regulated states of growth and harvest, i.e., the stands have the required basal areas to meet the retention levels for each size class. Our landscape model simulates growth in 5-year increments. As a result, our post-harvest conditions include in-growth (new seedlings in the 0-8 in. dbh class) as well as growth (residual trees retained) across all diameter classes. Figures 8-4 and 8-5 show that AMZ stands will have a more even distribution of size classes post-harvest, but trees in the larger size classes will still dominate the stands. On the other hand, Figure 8-6 and Tables 8-3 through 8-8 incorporate data for all Class I and Large Class II AMZ stands. They demonstrate that tree density will decrease in AMZ stands while trees in the larger diameter classes will increase across the plan area.

Table 8-3 projects AMZ canopy cover by planning watershed. These values represent canopy cover averaged across the Class I and Large Class II AMZs. At this time, our inventory is not robust enough within the AMZs to give accurate data at the planning watershed level. Currently AMZ stands are not distinguishable from upslope stands. The data within Table 8-3 comes from a computer program which uses structure classes to model canopy. However, our timber inventory monitoring program will include actual AMZ canopy measurements. Data captured by foresters cruising stands in the field will provide a more accurate picture of AMZ conditions for

[7] MRC assigns a vegetation label, or strata, to a stand using aerial photos. This photo interpretation is the basis for a stratified sampling system to acquire vegetation data (see Appendix U, U.2.1, *Stratified sampling*).

subsequent reporting. In Table 8-3, we have designated Year 30 and Year 70 of HCP/NCCP implementation as benchmark years. Table 8-4, on the other hand, provides the anticipated AMZ harvest across the plan area throughout the term of our HCP/NCCP and beyond.

Objective O§8.2.2-3 describes MRC targets for managing a mix of tree species within AMZs. In an effort to re-construct earlier forest conditions, MRC researched aerial photos stored in our vault, published photos, Bureau of Land Management records, and anecdotes from individuals alive in the early 20th century. We also examined pre-European evidence, such as stumps and old trails. Visits to nearby preserves, like Hendy Woods, Montgomery Woods, Armstrong Woods, and Mailliard Reserve, reinforced our photographic and written evidence. From all this data, we concluded that currently there is a greater hardwood-to-conifer ratio in our plan area than existed before European intervention. Tanoak, in particular, has proliferated. We cannot determine the exact composition of these early forests since slight variations in site conditions can favor one species over another. Consequently, we have built into our conservation measures safeguards to ensure that hardwoods will remain as a valued species across the plan area.

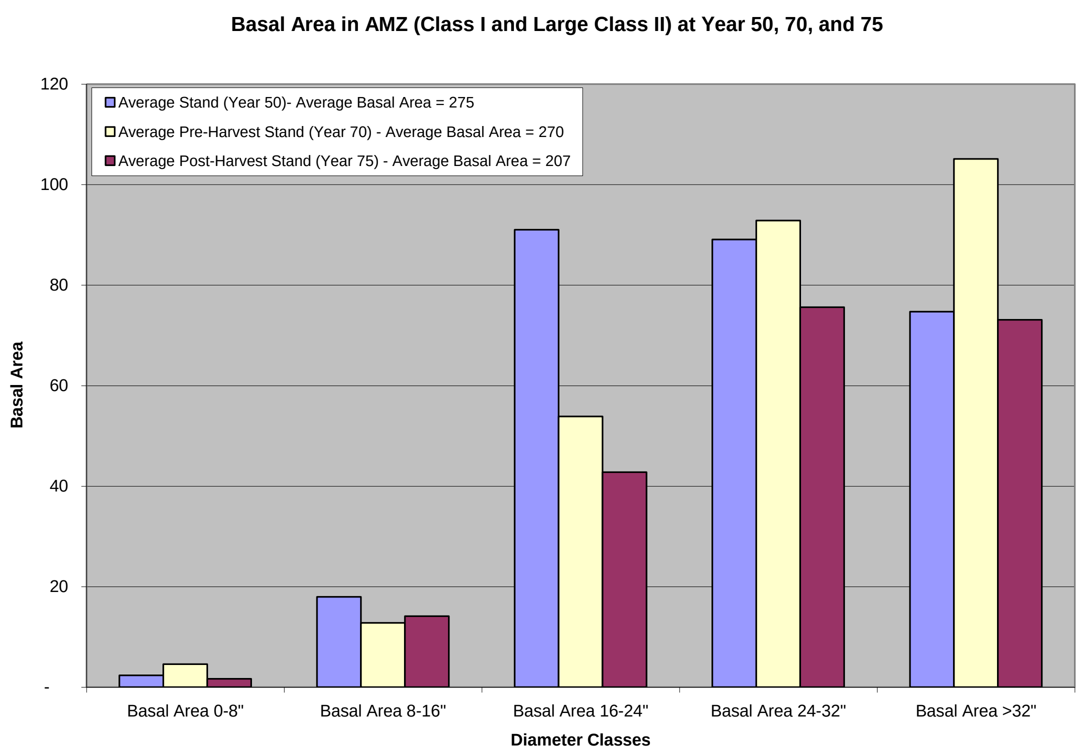


Figure 8-4 Basal Area in Class I and Large Class II AMZ

Figure 8-5 Tree Density in Class I and Large Class II AMZ

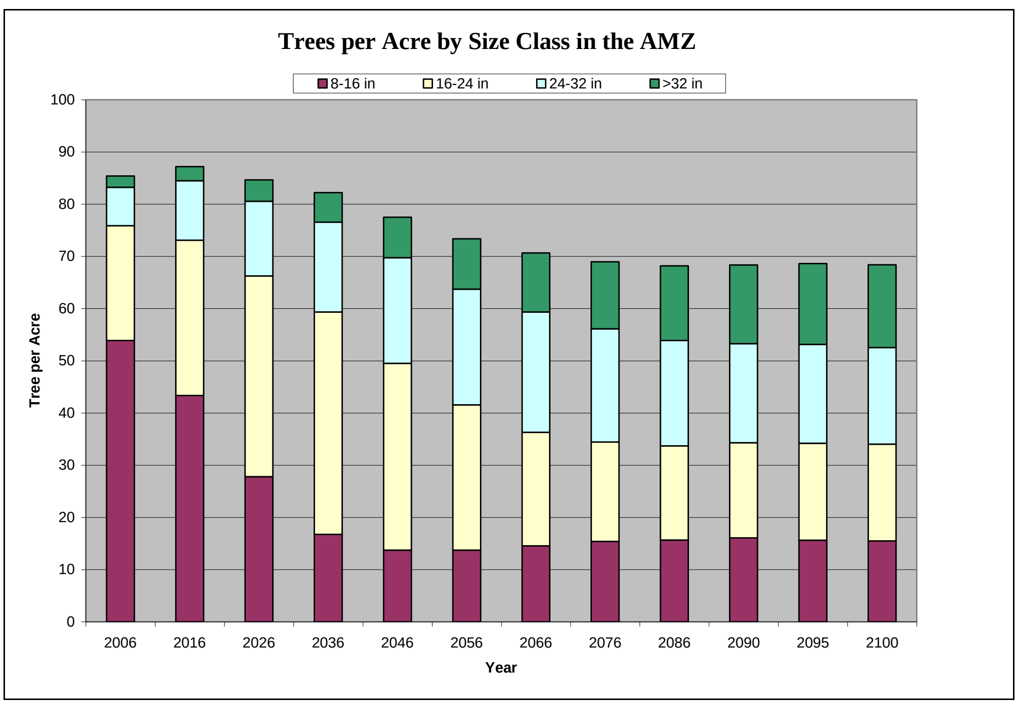


Figure 8-6 Trees per Acre in Inner and Middle Bands of Class I and Large Class II AMZ

Table 8-3 Current and Estimated Average AMZ Canopy Cover in Planning Watersheds

Current and Estimated Average AMZ Canopy Cover			
		Benchmark Years	
Planning Watershed	Current Canopy	Canopy Year 30	Canopy Year 70
	% Coverage		
Cottaneva Creek	83	84	89
Dutch Henry Creek	77	85	89
East Branch N.F. Big River	80	84	89
Flynn Creek	83	85	93
Hardy Creek	66	82	87
Hayworth Creek	72	84	86
Hendy Woods	84	85	88
Howard Creek	76	85	89
John Smith Creek	82	85	88
Juan Creek	68	84	88
Little North Fork Navarro River	69	82	86
Little River	85	85	89
Lower Albion River	83	86	93
Lower Alder Creek	74	85	90
Lower Elk Creek	73	84	87
Lower Greenwood Creek	83	85	86
Lower Hollow Tree Creek	67	85	88
Lower Navarro River	82	85	90
Lower North Fork Big River	82	85	89
Lower South Branch Navarro River	78	85	88
Mallo Pass Creek	68	84	89
Martin Creek	81	85	90
McMullen Creek	78	85	86
Mettick Creek	69	84	89
Middle Albion River	82	84	91
Middle Fork Noyo River	69	84	85
Middle Hollow Tree Creek	77	85	92
Middle Navarro River	78	85	91
Middle South Branch Navarro River	64	84	88
Mill Creek	82	83	87
North Fork Garcia River	72	81	89
North Fork Indian Creek	67	81	88
North Fork Navarro River	85	87	90
North Fork Noyo River	64	83	88
Olds Creek	76	82	85
Point Arena Creek	84	85	89
Ray Gulch	78	88	92
Redwood Creek	40	84	87
Rolling Brook	82	85	87
Russell Brook	83	85	90
Russian Gulch	85	85	86

Current and Estimated Average AMZ Canopy Cover			
		Benchmark Years	
Planning Watershed	Current Canopy	Canopy Year 30	Canopy Year 70
	% Coverage		
South Daugherty Creek	62	85	89
South Fork Albion River	77	85	92
South Fork Garcia River	71	85	87
Two Log Creek	73	85	89
Upper Ackerman	76	81	85
Upper Albion River	83	86	91
Upper Elk Creek	81	85	89
Upper Greenwood Creek	82	85	89
Upper Hollow Tree Creek	65	84	88
Upper Navarro River	74	85	88
Upper Noyo River	84	85	89
Upper South Branch Navarro River	66	85	88

Table 8-4 Projected Harvest in Inner and Middle Bands of Class I and Large Class II AMZ

Major River	**AMZ Gross Acres**	***Projection Periods in the Plan Area**				
		HCP/NCCP Time Period				Beyond
		Years 0-20 (ac)	Years 20-40 (ac)	Years 40-60 (ac)	Years 60-80 (ac)	Years 80-100 (ac)
Albion	1508	83	381	999	1188	1176
Big River	3415	10	720	1376	2724	2917
Garcia River	1377	92	432	811	983	1136
Navarro	5212	180	1232	2829	3923	4103
Hollow Tree (SF Eel)	2011	0	354	1606	1853	1861
Noyo	1677	31	347	887	1425	1443
Cottaneva, Howard, Hardy, Juan	1519	0	112	792	1216	1204
Alder, Elk, Greenwood, Mallo Pass	3487	19	1442	2544	2745	2907
Russian	240	0	5	5	19	81
Albion	1508	83	381	999	1188	1176
Totals for Plan Area	20,446	**416**	**5,025**	**11,849**	**16,077**	**16,828**
Percentage of Total AMZ		**2.0%**	**24.6%**	**58.0%**	**78.6%**	**82.3%**

TABLE NOTE

*The MRC landscape model simulates harvest of stands in 20-year increments.

In Tables 8-5 through 8-8, we have provided projections, based on our landscape model, of tree sizes and distribution during the 80-year term of our HCP/NCCP. The data in these tables is for forested stands only and does not include pygmy forest, oak woodland, grasslands, brush, or

rocky outcrops. In the tables, we have averaged the projected targets for tree size and distribution across our land; individual stand conditions will vary.
Table 8-5 through Table 8-7 shows tree size and distribution by site class. Site class is a relative measure of forest productivity. There are 5 site classes. The California Public Resources Code (PRC) 4528(d) divides the 5 site classes into 3 categories. Site Class I denotes lands of the highest productivity, i.e., those in the flood plain or channel migration zones. Site Classes II and III denote lands of intermediate productivity, and Site Classes IV and V denote lands of the lowest productivity. MRC maintains the same delineation for site classes as the PRC as these are the stocking standards, per site class, that we must abide by after implementation of our HCP/NCCP. Therefore, for management consistency, MRC lumps Site Class II with Site Class III, and Site Class IV with Site Class V. As a whole, MRC forests are primarily in Site Class III. The majority of AMZ stands in the plan area are either Site Class II or III.

The dates 2047 and 2082, represented by shaded rows in Tables 8-5 through 8-8, signal benchmarks when MRC and the wildlife agencies will review timber inventory objectives to determine whether MRC is meeting those objectives and to negotiate any necessary adjustments in the objectives. These dates are equivalent to Year 35 and Year 70, respectively, of HCP/NCCP implementation, assuming that our HCP/NCCP commences in 2012.

Table 8-5 Trees per Acre by DBH in Site Class II and III

Inner and Middle Bands of Large Class I and Large Class II AMZ Trees in Site Class II and Site Class III					
Dates during HCP/NCCP Term	DBH (in.)				Average Basal Area of Stands (sq ft/ac)
	8-16	16-24	24-32	>32	
	Trees Per Acre				
2012	47	18	6	2	117
2017	46	21	7	2	127
2022	43	24	8	2	139
2027	40	28	9	3	151
2031	35	31	10	3	163
2037	31	33	12	4	173
2042	26	33	13	4	182
2047	22	33	15	5	191
2052	19	33	16	6	199
2057	16	31	17	7	207
2062	14	29	19	8	212
2067	13	27	19	9	215
2072	13	25	19	9	215
2077	14	22	19	10	218
2082	15	21	19	11	221
2087	14	20	21	11	225
2092	14	20	21	12	227

Table 8-6 Trees per Acre by DBH in Site Class I

Inner and Middle Bands of Large Class I and Large Class II AMZ Trees in Flood Plain or Channel Migration Zones (CMZ)					
Dates during HCP/NCCP Term	DBH (in.)				Average Basal Area of Stands (sq ft/ac)
	8-16	16-24	24-32	>32	
	Trees Per Acre				
2012	37	18	11	7	168
2017	37	20	12	8	178
2022	34	22	12	8	189
2027	31	25	13	9	201
2031	28	27	14	10	212
2037	25	28	14	11	222
2042	23	28	15	12	232
2047	20	29	16	13	241
2052	18	28	17	13	245
2057	17	28	17	14	252
2062	16	26	19	14	254
2067	16	25	20	14	256
2072	17	24	20	14	259
2077	17	23	20	15	263
2082	19	22	21	15	264
2087	18	21	21	15	266
2092	18	21	22	16	269

Table 8-7 Site Class IV and V Trees per Acre by DBH

Inner and Middle Bands of Large Class I and Large Class II AMZ Trees in Site Class IV and Site Class V					
Dates during HCP/NCCP Term	DBH (in.)				Average Basal Area of Stands (sq ft/ac)
	8-16	16-24	24-32	>32	
	Trees Per Acre				
2012	32	11	4	1	74
2017	31	13	5	1	81
2022	28	16	5	1	89
2027	25	18	6	2	97
2031	20	21	7	2	106
2037	15	24	8	3	117
2042	12	24	9	3	127
2047	10	23	11	4	134
2052	8	22	13	5	147
2057	6	21	14	6	153
2062	5	18	16	7	159
2067	5	15	16	8	164
2072	5	12	16	10	168
2077	5	10	15	11	168
2082	5	9	14	11	170
2087	5	8	15	11	173
2092	5	7	15	12	175

Table 8-8 Number of Trees and Average Tree Height

Inner and Middle Bands of Class I and Large Class II AMZ					
Dates during HCP/NCCP Term	DBH (in.) 24-32		>32		Average Tree Height (>24 in.)
	Average Height	Trees per Acre	Average Height	Trees per Acre	
2012	115	8	117	3	116
2017	119	9	121	3	119
2022	122	10	131	3	124
2027	123	11	139	4	127
2031	128	12	145	4	133
2037	130	13	148	5	135
2042	133	15	153	6	138
2047	134	17	155	6	140
2052	135	18	158	7	141
2057	136	20	160	8	143
2062	138	20	163	9	145
2067	139	21	164	10	147
2072	141	21	168	10	150
2077	142	21	169	11	151
2082	144	20	170	12	153
2087	146	21	173	12	156
2092	149	22	176	12	159

In conjunction with Tables 8-5 through 8-8, Tables 8-9 and 8-10 give the range of basal area and trees per acre of Class I and Large Class II AMZ stands.

Table 8-9 Range of Basal Area for Class I and Large Class II AMZ Stands

		Diameter Classes				
		0-8"	8-16"	16-24"	24-32"	>32"
Year 2050	min	2	5	71	71	34
	max	3	50	114	113	111
Year 2070	min	2	8	37	65	78
	max	19	15	82	111	135
Year 2075	min	1	10	20	63	62
	max	2	18	61	85	86

Table 8-10 Range of Trees per Acre for Class I and Large Class II AMZ Stands

		Diameter Classes				
		0-8"	8-16"	16-24"	24-32"	>32"
Year 2050	min	12	20	33	19	5
	max	40	79	53	26	14
Year 2070	min	14	16	17	15	9
	max	42	41	31	29	18
Year 2075	min	32	16	10	15	8
	max	59	35	27	22	11

8.2.3 Conservation measures

8.2.3.1 Class I and Large Class II AMZ

The AMZ will incorporate conservation measures that affect different riparian processes. A management action within a Class I or Large Class II AMZ must meet a combination of restrictions. The conservation measures for such areas are organized by these restrictions:

- AMZ band widths.
- Canopy retention.
- Basal area retention.
- Largest tree retention.
- Silviculture.
- Flood-prone zones.
- Streambank stability.
- Heavy equipment limitations.
- Soil pipes.
- Bare soil.
- Cable corridors.

In order to promote and maintain riparian function, MRC will retain large trees and overstory canopy within AMZs and limit equipment disturbances at sufficient widths from a stream channel. We will exclude equipment from AMZs unless use of such equipment is for restoration purposes or actually reduces environmental impacts, e.g., traveling over roads in the AMZ to repair a damaged culvert. There will be a *no harvest zone* for all non-sprouting species within 10 ft of all Class I, Class II, and Class III watercourses; however, we will allow limited harvest within redwood clumps. MRC has mapped flood-prone areas or channel migration zones along Class I watercourses; these will receive greater basal-area standards and increased AMZ width, where needed, for maintenance of floodplain and riparian interactions.

In some cases, due to past management, an AMZ does not provide a desired level of riparian function. Areas with unnaturally high levels of hardwood, overstocked stands of young even-aged conifers, or stands with poor-growing conifer trees can provide greater riparian function in the long-term with some restorative vegetation management. We will limit the amount and extent of these restoration treatments and regulate them through monitoring and adaptive management. This will ensure that such treatments do not adversely affect the covered aquatic species. In addition to the AMZ, MRC will create buffer areas to retain canopy, exclude equipment disturbances, and maintain habitat features in wetlands or wet meadows, seeps, springs, and wet areas.

8.2.3.1.1 AMZ band widths

	Conservation Measures for Band Widths Class I and Large Class II AMZ
C§8.2.3.1.1-1	Establish AMZ widths by watercourse class and slope class.

Watercourse	Slope Class (%)	AMZ Band Widths***		
		Inner	Middle*	Outer
Class I	0-30	0-50	50-100	100-130
	30-50	0-50	50-130	130-150
	>50	0-50	50-150**	150**-190
Large Class II	0-30	0-25	25-50	50-100
	30-50	0-25	25-75	75-130
	>50	0-25	25-100**	100**-150

TABLE NOTES

* Flood-prone and channel migration zones on Class I watercourses can adjust these dimensions. The middle band starts on the outer edge of the flood prone or channel migration zones.

** Adjust 20-25 ft for cable and helicopter yarding operations adjacent to Class I and Class II AMZ, respectively. In effect, as the outer edge of the middle band “shrinks”, the inner edge of the outer band “expands” (see Figure 8-7).

***Measured along the slope distance from the bankfull channel or channel migration zone boundary.

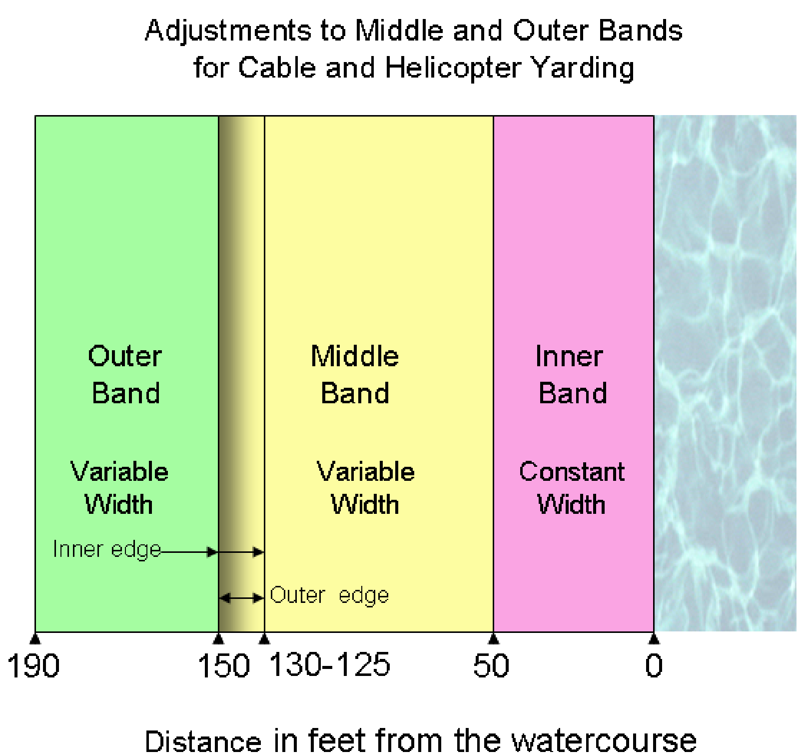


Figure 8-7 Adjusting Middle and Outer Bands

8.2.3.1.2 ***Canopy***

DEFINITION	Canopy is the amount of vegetation or topography that blocks out the vertical projection of the sky; sun angle does not affect canopy

When selecting trees for harvest, an MRC forester will use professional judgment and ocular estimation to determine the percentage of canopy retention. If there is a disagreement about the canopy retention before, during, or after harvest, the forester will meet with the disputant to agree upon a sampling intensity and to make further observations using a sight tube per CAL FIRE protocol (Anon. 1999).

	Conservation Measures for Canopy Retention **Class I and Large Class II AMZ**
C§8.2.3.1.2-1	Develop or retain canopy in the inner, middle, and outer band of the AMZ. ▪ Inner band: 85% canopy. ▪ Middle band: 70% canopy. ▪ Outer band: 50% canopy. **NOTE** MRC will use these AMZ canopy targets during PTHP compliance monitoring to assess canopy cover after harvesting. Timber inventory monitoring, however, will assess canopy cover by planning watershed and will set a target of 70% canopy across all 3 bands rather than stratifying the target by AMZ band. The un-weighted average of the 3 bands is approximately 70%. See Appendix U, *Inventory Strategy*.

8.2.3.1.3 Basal area retention

The inner and middle bands of Class I and Large Class II AMZ will have basal area retention based on the site class of the AMZ. AMZ basal area is the average basal area across the width of each inner and middle band for a linear distance of 330 ft (≈100 m). The average of the summed widths of the inner and middle bands multiplied by a distance of 330 ft is approximately 1 ac.

	Conservation Measures for Basal Area Retention **Inner and Middle Bands** **Class I and Large Class II AMZ**
Pre-harvest condition for Site Class I: ≥ 300 ft^2/ac of conifer basal area	
C§8.2.3.1.3-1	Retain in Site Class I, **post harvest**, 240 ft^2/ac or 75% of the pre-harvest basal area, whichever is greater.
Pre-harvest condition for Site Class II or III: ≥ 260 ft^2/ac of conifer basal area	
C§8.2.3.1.3-2	Retain in Site Class II or III, **post harvest**, 200 ft^2/ac or 75% of the pre-harvest basal area, whichever is greater.
Pre-harvest condition for Site Class IV or V: ≥ 220 ft^2/ac of conifer basal area	
C§8.2.3.1.3-3	Retain in Site Class IV and V, **post harvest**, 160 ft^2/ac or 75% of the pre-harvest basal area, whichever is greater. **NOTE** If a pre-harvest condition does not apply, MRC will not harvest in the bands of the AMZ. In addition, these conservation measures only apply to the inner and middle bands of the AMZ; the outer band does not have basal area targets. In most cases, when pre-harvest conditions are met or exceeded, harvest will occur in the middle band rather than the inner band.

8.2.3.1.4 Largest tree retention

	Conservation Measures for Largest Tree Retention **Class I and Large Class II AMZ**
Large Tree Retention	
C§8.2.3.1.4-1	Retain a percentage of the largest trees based on channel sensitivity to LWD. ▪ High sensitivity: retain 30% in inner band, 15% in middle band. ▪ Moderate sensitivity: retain 20% in inner band, 10% in middle band. ▪ Low sensitivity: retain 10% in inner band, 5% in middle band. **NOTE** ▫ MRC identifies the sensitivity of stream channels within watershed analysis. For areas in which we have not conducted a watershed analysis, we will identify sensitivity on a site-by-site basis with the assistance of staff hydrologists, geomorphologists, or aquatic biologists. ▫ MRC will calculate, prior to each entry into an AMZ stand, the percentage of large conifer trees for retention. The percentage applies to trees with at least a 12 in. dbh. Selection of the largest trees will progress systematically through size classes demarcated at 4 in. (dbh) intervals, beginning with the largest size class. For example, if the largest tree retention standard is 20% and 100 trees are ≥ 12 in. dbh within the band, then MRC will retain the 20 largest trees in addition to all other AMZ requirements. In determining the largest trees retained, MRC will start with the largest size class and work backward to the next largest size class and so forth. In addition, MRC will retain all trees leaning across the plane of the channel zone, even if they are not one of the largest trees. In effect, this means that the stem of the tree (from the point where it reaches 6 in. in diameter and above) crosses the plane of the bankfull channel.
Exchanging Retention Trees	
C§8.2.3.1.4-2	Apply the following rules if 2 or more potential retention trees are within the same redwood clonal group: 1. Designate the largest tree within the redwood clonal group as the retention tree, if operationally feasible; otherwise 2. Substitute another tree outside this redwood clonal group which is the same size class or next available size class as that designated largest tree. **NOTE** The purpose of this conservation measure is to replace any large tree which is harvested and to space out the large retention trees throughout the AMZ.

	Conservation Measures for Largest Tree Retention Class I and Large Class II AMZ
C§8.2.3.1.4-3	Substitute a tree for a large retention tree even though it does not meet the standards for large tree retention if (a) the HCP/NCCP or a report from a professional geologist dictates its retention to provide erosion control or mass wasting stability and (b) it meets the eligibility requirements in C§8.2.3.1.4-5. **NOTE** Apart from the prescriptions in C§8.2.3.1.4-2, MRC may only trade a large retention tree with another tree for operational purposes, such as cable line restrictions (C§8.2.3.1.10-2) or felling and skidding limitations. The limitations on trade trees are (a) 10% of large trees within an AMZ per PTHP during the first 10 years of the HCP/NCCP and (b) 15% of large trees within an AMZ per PTHP from Years 11-20 of HCP/NCCP implementation. After Year 20, MRC may trade up to 20% of large trees per PTHP within an AMZ. Harvesting of a trade tree within an AMZ can only occur if the 1. AMZ meets its requirements for canopy and basal area. 2. Tree is not one of the largest retention trees or within 10 ft of the bankfull channel. 3. AMZ streams, in locations where harvests are occurring, meet their LWD targets. 4. Cumulative number of trade trees during the term of the HCP/NCCP account for no more than 40% of the large trees within an AMZ stand.
C§8.2.3.1.4-4	Mark a smaller tree that becomes a retention tree as part of a trade to ensure it will be retained and is no longer eligible as a trade tree during subsequent harvest entries.
Qualifying as a Trade Tree	
C§8.2.3.1.4-5	Follow the rule that a tree is eligible for trade with a retention tree ▪ If it is the next largest individual tree in sequence after the full complement of trees has been retained. ▪ If it leans out toward the active channel, is likely to recruit in the near future, and is in the top 50 percentile of tree size for that AMZ band.

Table 8-11 provides examples of how many trees MRC would potentially retain based on stocking levels of stands, channel sensitivity, standards for basal area retention (C§8.2.3.1.3-1 to C§8.2.3.1.3-3), and AMZ band. Stocking levels show the amount of trees retained at different stocking densities.

Characteristics of AMZ stands vary across the plan area. Some AMZ stands are dominated by small trees, some by large trees, while others have a mix of both. The designations for stand stocking in Table 8-11 (namely, *poor*, *moderate*, and *well*) are for hypothetical stands; the stands represent a range of conditions across the plan area. Likewise, Table 8-11 shows a hypothetical result for an allowable harvest given the conservation measures for large tree and basal area retention. In practice, the retention would likely be greater because of additional conservation measures cited in this chapter. The guidelines for canopy retention, for example, might limit the potential harvest more than measures for large tree and basal area retention.

Table 8-11 Large Tree and Basal Area Retention

Class I and Large Class II AMZ (Inner and Middle Bands)																				
Stand Stocking	**Channel Sensitivity/Band**	**Pre Harvest # of Trees dbh (in.)**							**Total Trees > 4 in.**	**Pre Harvest Basal Area (sq. ft)**	**Post Harvest # of Trees dbh (in.)**							**Total Trees < 4 in.**	**Post Harvest Basal Area (sq. ft)**	**Minimum Number of Largest Trees Retained**
		4-11	**12-16**	**17-20**	**21-24**	**25-28**	**29-32**	**>32**			**4-11**	**12-16**	**17-20**	**21-24**	**25-28**	**29-32**	**>32**			
Poor	High/Inner	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Poor	High/Middle	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Poor	Moderate/Inner	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Poor	Moderate/Middle	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Poor	Low/Inner	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Poor	Low/Middle	12	17	15	10	6	5	1	66	127	12	17	15	10	6	5	1	66	127	**ALL**
Moderate	High/Inner	12	16	16	14	15	10	14	97	288	9	16	13	10	5	10	14	77	219	**29**
Moderate	High/Middle	12	16	16	14	15	10	14	97	288	9	16	14	12	3	10	14	78	218	**15**
Moderate	Moderate/Inner	12	16	16	14	15	10	14	97	288	9	16	16	12	9	5	14	81	220	**19**
Moderate	Moderate/Middle	12	16	16	14	15	10	14	97	288	9	16	16	12	10	8	10	81	216	**10**
Moderate	Low/Inner	12	16	16	14	15	10	14	97	288	9	16	16	12	10	8	10	81	216	**10**
Moderate	Low/Middle	12	16	16	14	15	10	14	97	288	9	16	16	14	15	9	5	84	218	**5**
Well	High/Inner	8	12	13	17	20	14	18	102	352	6	12	10	10	10	13	18	79	265	**31**
Well	High/Middle	8	12	13	17	20	14	18	102	352	6	12	13	17	17	12	10	87	267	**10**
Well	Moderate/Inner	8	12	13	17	20	14	18	102	352	6	12	13	17	18	2	18	86	265	**20**
Well	Moderate/Middle	8	12	13	17	20	14	18	102	352	6	12	13	17	18	11	10	87	266	**10**
Well	Low/Inner	8	12	13	17	20	14	18	102	352	6	12	13	16	14	14	10	85	263	**10**
Well	Low/Middle	8	12	13	17	20	14	18	102	352	6	12	13	17	20	14	6	88	266	**5**

8.2.3.1.5 *Silviculture*

The conservation measures that follow do not apply to rehabilitation sites.

	Conservation Measures for Silviculture Class I and Large Class II AMZ
Inner Band	
C§8.2.3.1.5-1	Apply silvicultural treatments to develop or maintain late seral forest conditions, such as thinning from below or individual tree selection.
C§8.2.3.1.5-2	Use high retention selection that meets basal area and canopy requirements.
C§8.2.3.1.5-3	Maintain or increase conifer dominance—if necessary, by controlling hardwoods.
C§8.2.3.1.5-4	Ensure that redwood clonal groups or “clumps” have no more than 50% of their stems greater than 8 in. dbh removed per entry.
C§8.2.3.1.5-5	Do not harvest trees from the inner band if shelterwood or seed tree removal occurs in the outer band for that rotation.
C§8.2.3.1.5-6	Do not sanitize or salvage LWD that is within the bankfull channel; retain all downed LWD in the AMZ unless the AMZ meets its LWD targets.
C§8.2.3.1.5-7	Harvest snags in the AMZ only with the approval of the wildlife agencies.
C§8.2.3.1.5-8	Leave, as a first priority, LWD previously designated as a large retention tree or wildlife tree.
C§8.2.3.1.5-9	Do not initiate prescribed burning in Small Class II AMZ.
C§8.2.3.1.5-10	Permit fire control lines for controlled burning in Small Class II AMZs only with concurrence of the wildlife agencies.
C§8.2.3.1.5-11	Allow salvage harvest in an AMZ only with concurrence of the wildlife agencies.
C§8.2.3.1.5-12	Allow harvest of a minimum merchantable length log from any LWD that obstructs a road.
C§8.2.3.1.5-13	Avoid damage or destruction to non-commercial vegetation beyond the minimum disturbance required for covered activities.
C§8.2.3.1.5-14	Retain all old-growth trees. **NOTE** If the RPF determines that the inner zone is over-stocked with trees <16 in. dbh and that this is limiting future growth, MRC may request the wildlife agencies to advise the RPF which trees to harvest in order to more quickly reach the objectives of the HCP/NCCP.
Middle Band	
C§8.2.3.1.5-15	Apply silvicultural treatments to develop or maintain late seral forest conditions, such as thinning from below or individual tree selection.
C§8.2.3.1.5-16	Use high retention selection that meets basal area and canopy requirements.

	Conservation Measures for Silviculture Class I and Large Class II AMZ
C§8.2.3.1.5-17	Maintain or increase conifer dominance—if necessary, by controlling hardwoods.
C§8.2.3.1.5-18	Do not harvest trees from the middle band if shelterwood or seed tree removal occurs in the outer band for that rotation, unless this is an AMZ restoration harvest.
C§8.2.3.1.5-19	Do not sanitize or salvage LWD that is within the bankfull channel; retain all downed LWD in the AMZ unless the AMZ meets its LWD targets.
C§8.2.3.1.5-20	Leave, as a first priority, LWD previously designated as a large retention tree or wildlife tree.
C§8.2.3.1.5-21	Allow salvage harvest in an AMZ only with concurrence of the wildlife agencies.
C§8.2.3.1.5-22	Allow harvest of a minimum merchantable length log from any LWD that obstructs a road.
C§8.2.3.1.5-23	Avoid damage or destruction to non-commercial vegetation beyond the minimum disturbance required for covered activities.
C§8.2.3.1.5-24	Retain all old-growth trees.
Outer Band	
C§8.2.3.1.5-25	Maintain or increase conifer dominance—if necessary, by controlling hardwoods.
C§8.2.3.1.5-26	Maintain, on average, 50% canopy within 330 ft (100 m) sections.
C§8.2.3.1.5-27	Limit harvest openings to ¼ ac in size.
C§8.2.3.1.5-28	Do not sanitize or salvage LWD that is within the bankfull channel; retain all downed LWD in the AMZ unless the AMZ meets its LWD targets.
C§8.2.3.1.5-29	Leave, as a first priority, LWD previously designated as a large retention tree or wildlife tree.
C§8.2.3.1.5-30	Allow salvage harvest in an AMZ where an adjacent upslope stand is “no harvest” only with concurrence of CDFG.
C§8.2.3.1.5-31	Allow harvest of a minimum merchantable length log from any LWD that obstructs a road.
C§8.2.3.1.5-32	Retain all old-growth trees.

8.2.3.1.6 Flood-prone zones

The majority of Class I stream channels within the plan area are topographically confined, with little capacity for channel migration or floodplain development. Some flood-prone or channel migration zones occur along the Navarro River, the lower portion of North Fork Navarro River, Albion River, South Fork Albion River, Cottaneva Creek, Juan Creek, and Garcia River (see *HCP/NCCP Atlas*, MAPS 3A-3C).

	Conservation Measures for Flood-prone Zones Class I AMZ
C§8.2.3.1.6-1	Retain 300 ft^2/ac of the conifer basal area or retain 75% of the pre-harvest basal area, whichever is greater.
C§8.2.3.1.6-2	Avoid damage or destruction to non-commercial vegetation in the flood-prone or channel migration zone beyond the minimum disturbance required for covered activities.
C§8.2.3.1.6-3	Extend the width of the middle band out to the base of a hillslope, if it does not already extend to or beyond that point.
C§8.2.3.1.6-4	Exclude all equipment, unless on existing roads or for use in road decommissioning.

8.2.3.1.7 Streambank stability

	Conservation Measures for Streambank Stability Class I and Large Class II AMZ
C§8.2.3.1.7-1	Retain all trees whose trunks (a) are within 10 ft of the bankfull channel or within 10 ft of a watercourse or lake transition zone where there is no delineated bankfull channel; or (b) have roots visible in the bank; or (c) provide anchor to an over-hanging bank, unless it is necessary to remove trees to create a cable corridor. **NOTE** Thinning of a redwood clonal group within 10 ft of a bankfull channel or within 10 ft of a watercourse or lake transition zone may also occur as long as MRC adheres to the guidelines for large tree retention.
C§8.2.3.1.7-2	Start the 10-ft retention zone at the landward edge of an undercut bank, using visual determination. **EXAMPLE** A bank is undercut by 5 ft. The retention zone will measure 10 ft from the depth of the undercut, i.e., 15 ft from the edge of the bank.
C§8.2.3.1.7-3	Ensure that redwood clonal groups or “clumps” have no more than 50% of their stems greater than 8 in. dbh removed per entry.
C§8.2.3.1.7-4	Follow 1 of these practices when trees, within the first 10 ft of the watercourse channel, are removed for cable corridors: ▪ Leave the trees in the AMZ for LWD. ▪ Place trees in the active channel as per the instream LWD enhancement guidelines, if feasible.

8.2.3.1.8 Equipment exclusion

<table>
<tr><th></th><th>Conservation Measures for Equipment Exclusion
Class I and Large Class II AMZ</th></tr>
<tr><td>C§8.2.3.1.8-1</td><td>
Exclude all equipment in Class I and Large Class II AMZs unless there is an allowable use.
ALLOWABLE USE

Erosion control or restoration
MRC may use a skid trail or landing one-time-only to control erosion or conduct restoration. Upon completing operations, we will decommission the skid trail or landing.
Existing skid trails, landings, or skid trail crossings
MRC may use—only rarely (perhaps 4 times a year)—an existing skid trail, landing, or designated skid trail crossing that does not require any reconstruction, if

Alternatives would create a greater risk and magnitude of sediment delivery.
Perched material is pulled back from landings and the landings shaped to prevent rill erosion by draining them into a rocked face outlet.
Surface areas >25 ft^2 are mulched, rocked, or covered in slash compacted by a tractor.

New skid trails, landings, or skid trail crossings
MRC may construct —only rarely (perhaps once every 3 years, lessening over time) and after obtaining approval of the wildlife agencies—a new skid trail, landing, or designated skid trail crossing if

Alternatives would create a greater risk and magnitude of sediment delivery.
All mitigations, approved by the wildlife agencies, are fully implemented.
All trees felled for construction of these new facilities in an AMZ within the inner and middle bands have the “key piece size” logs set aside for LWD placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD.

Existing Roads
MRC may use and maintain existing roads in AMZs.
New Roads
MRC may construct— only rarely (perhaps once every 3 years, lessening over time)—new roads to watercourse approaches within an AMZ if

The road does not parallel a watercourse.
Each approach on either side of a watercourse does not exceed 200 ft.
All trees felled for construction of these new facilities in an AMZ within the inner and middle bands have the “key piece size” logs set aside for LWD placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD.

MRC may construct— only rarely (perhaps once every 3 years, lessening over time) and after obtaining approval of the wildlife agencies —a road segment not associated with a crossing or an approach to a crossing if

Alternatives would create a greater risk and magnitude of sediment delivery.
All mitigations, approved by the wildlife agencies, are fully implemented.
All trees felled in an AMZ for construction of these new facilities have the “key piece size” logs set aside for LWD

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	Conservation Measures for Equipment Exclusion **Class I and Large Class II AMZ**
	placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD. ▪ *Watercourse crossing construction* MRC may use equipment to construct watercourse crossings.

8.2.3.1.9 Bare soil

	Conservation Measures for Bare Soil **Class I and Large Class II AMZ**
C§8.2.3.1.9-1	Treat, for erosion control, areas of exposed mineral soil which are (a) at least 100 ft^2 in size and (b) not on a running surface, with mulch, grass seed, slash, or other appropriate material; for running surfaces, see Appendix E, *Roads, Landings, and Skid Trails*.
C§8.2.3.1.9-2	Do not initiate prescribed or broadcast burning in the AMZ.

8.2.3.1.10 Cable corridors

	Conservation Measures for Cable Corridors **Class I and Large Class II AMZ**
C§8.2.3.1.10-1	Allow felled trees to remain in the AMZ for LWD or place the trees in the active channel as per instream LWD enhancement guidelines.
C§8.2.3.1.10-2	Harvest trees in a cable corridor only if the ▪ AMZ meets requirements for canopy and basal area. ▪ Tree is not one of the largest retention trees or within 10 ft of the bankfull channel. ▪ Streams meet LWD targets.

8.2.3.2 Small Class II AMZ

Management operations within a Small Class II AMZ must meet a combination of restrictions. The conservation measures for such areas are organized by these restrictions:

- AMZ band width.
- Canopy.
- Silviculture.
- Streambank stability.
- Equipment exclusion.
- Soil pipes.
- Bare soil.

8.2.3.2.1 AMZ band width

	Conservation Measures for Small Class II AMZ Widths
C§8.2.3.2.1-1	Establish AMZ widths. ▪ 0-30% slope = 50 ft ▪ 30-50% slope = 75 ft ▪ > 50% slope = 100 ft **NOTE** For slopes > 50%, MRC may subtract 25 ft from the AMZ width for cable and helicopter yarding.

8.2.3.2.2 Canopy

	Conservation Measures for Canopy Small Class II AMZ
C§8.2.3.2.2-1	Maintain, on average, 50% canopy over the width of the AMZ within 330 ft (100 m) segments.

8.2.3.2.3 Silviculture

	Conservation Measures for Silviculture Small Class II AMZ
C§8.2.3.2.3-1	Maintain or enhance uneven-aged conditions.
C§8.2.3.2.3-2	Harvest so that trees are dispersed in a relatively uniform manner.
C§8.2.3.2.3-3	Maintain or increase conifer dominance—if necessary, by controlling hardwoods.
C§8.2.3.2.3-4	Do not sanitize or salvage LWD that is within the bankfull channel; retain all downed LWD in the AMZ unless the AMZ meets its LWD targets.
C§8.2.3.2.3-5	Leave, as a first priority, LWD previously designated as a large retention tree or wildlife tree.
C§8.2.3.2.3-6	Do not initiate prescribed burning in Small Class II AMZ.
C§8.2.3.2.3-7	Permit fire control lines in Small Class II AMZs only with concurrence of the wildlife agencies.
C§8.2.3.2.3-8	Allow salvage harvest in an AMZ only with concurrence of the wildlife agencies.
C§8.2.3.2.3-9	Allow harvest of a minimum merchantable length log from any LWD that obstructs a road.
C§8.2.3.2.3-10	Avoid damage or destruction to non-commercial vegetation beyond the minimum disturbance required for covered activities.
C§8.2.3.2.3-11	Retain all old-growth trees.

8.2.3.2.4 Streambank stability

	Conservation Measures for Streambank Stability Small Class II AMZ
C§8.2.3.2.4-1	Retain all trees whose trunks (a) are within 10 ft of the bankfull channel or within 10 ft of a watercourse or lake transition zone where there is no delineated bankfull channel; or (b) have roots visible in the bank; or (c) provide anchor to an over-hanging bank, unless it is necessary to remove trees to create a cable corridor. **NOTE** MRC may also thin a redwood clonal group within 10 ft of the bankfull channel or within 10 ft of a watercourse or lake transition zone if they follow the large tree retention guidelines.
C§8.2.3.2.4-2	Start the 10-ft retention zone at the landward edge of an undercut bank, using visual determination. **EXAMPLE** A bank is undercut by 5 ft. The retention zone will measure 10 ft from the depth of the undercut, i.e., 15 ft from the edge of the bank.
C§8.2.3.2.4-3	Ensure that redwood clonal groups or "clumps" have no more than 50% of their stems greater than 8 in. dbh removed per entry.
C§8.2.3.2.4-4	Follow 1 of these practices when trees, within the first 10 ft of the watercourse channel, are removed for cable corridors: ▪ Leave the trees in the AMZ for LWD. ▪ Place trees in the active channel as per the instream LWD enhancement guidelines, if feasible.

8.2.3.2.5 Equipment exclusion

	Conservation Measures for Equipment Exclusion Small Class II AMZ
C§8.2.3.2.5-1	Exclude all equipment unless there is an allowable use. **ALLOWABLE USE** ▪ *Erosion control or restoration* MRC may use a skid trail or landing one-time-only to control erosion or conduct restoration. Upon completing operations, we will decommission the skid trail or landing. ▪ *Existing skid trails, landings, or skid trail crossings* MRC may use—only rarely (perhaps 4 times a year)—an existing skid trail, landing, or designated skid trail crossing that does not require any reconstruction, if - Alternatives would create a greater risk and magnitude of sediment delivery. - Perched material is pulled back from landings and the landings shaped to prevent rill erosion by draining them into a rocked face outlet. - Surface areas >25 ft^2 are mulched, rocked, or covered in slash compacted by a tractor. ▪ *New skid trails, landings, or skid trail crossings* MRC may construct —only rarely (perhaps once every 3 years, lessening over time) and after obtaining approval of the wildlife agencies—a new skid trail, landing, or designated skid trail crossing if - Alternatives would create a greater risk and magnitude of sediment delivery.

	Conservation Measures for Equipment Exclusion Small Class II AMZ
	- All mitigations, approved by the wildlife agencies, are fully implemented. - All trees felled for construction of these new facilities within the inner and middle bands of an AMZ have the "key piece size" logs set aside for LWD placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD. ▪ *Existing Roads* MRC may use and maintain existing roads in AMZs. ▪ *New Roads* MRC may construct new roads to watercourse approaches within an AMZ if - The road does not parallel a watercourse. - Each approach on either side of a watercourse does not exceed 200 ft. - All trees felled for construction of these new facilities in an AMZ within the inner and middle bands have the "key piece size" logs set aside for LWD placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD. MRC may construct— only rarely (perhaps once every 3 years, lessening over time) and after obtaining approval of the wildlife agencies—a road segment not associated with a crossing or an approach to a crossing if - Alternatives would create a greater risk and magnitude of sediment delivery. - All mitigations, approved by the wildlife agencies, are fully implemented. - All trees felled in an AMZ for construction of these new facilities have the "key piece size" logs set aside for LWD placement, either in the vicinity of the new facilities or near watercourse sections deficient in LWD. ▪ *Construction of watercourse crossings* MRC may use equipment to construct watercourse crossings.

8.2.3.2.6 Soil pipes[8]

	Conservation Measures for Soil Pipes Small Class II AMZ
C§8.2.3.2.6-1	Exclude equipment from the area between a Class II watercourse and a swale when there is evidence of exposed soil pipes or soil pipes transitioning into stream channels, e.g., when areas of soil over a pipe collapse or when "holes" in the floor of the swale reveal flowing sub-surface water. **NOTE** The protection should extend up the swale until there is no more evidence of soil pipe collapse.
C§8.2.3.2.6-2	Use only existing skid trails or roads.
C§8.2.3.2.6-3	Disconnect roads or skid trails hydrologically from the swale, where topographical features allow.[9]

[8] For definitions of soil pipe and swale, please refer to Chapter 16, *Glossary*.

	Conservation Measures for Soil Pipes Small Class II AMZ
C§8.2.3.2.6-4	Disperse drainage from roads or skid trails throughout the swale, if disconnecting roads or skids trails is not feasible.

8.2.3.2.7 Bare soil

	Conservation Measures for Bare Soil Small Class II AMZ
C§8.2.3.2.7-1	Treat, for erosion control, areas of exposed mineral soil which are (a) at least 100 ft^2 in size and (b) not on a running surface, with mulch, grass seed, slash, or other appropriate material; for running surfaces, see Appendix E, *Roads, Landings, and Skid Trails*.
C§8.2.3.2.7-2	Do not initiate prescribed or broadcast burning in the AMZ.

8.2.3.3 Class III AMZ

Management operations within a Class III AMZ must meet a combination of restrictions. The conservation measures for such areas are organized by these restrictions:

- AMZ band width.
- Canopy.
- Silviculture.
- Streambank stability.
- Equipment exclusion.
- Bare soil.

8.2.3.3.1 AMZ band width

	Conservation Measures for Band Widths Class III AMZ
C§8.2.3.3.1-1	Establish AMZ widths. ▪ 0-30% slope = 25 ft ▪ > 30% slope = 50 ft

8.2.3.3.2 Canopy

	Conservation Measures for Canopy Class III AMZ
C§8.2.3.3.2-1	Maintain, on average, 50% canopy over the width of the AMZ in 330 ft (100 m) sections.

[9] When water can flow continuously from a road or an adjacent ditch into a stream, the road is considered “hydrologically connected” to the stream. This connection allows run-off, sediment, and spills to drain directly into the stream. To "disconnect" a road requires diverting the water flow with either water bars or ditch relief culverts. Water bars are humps or mounds of earth or rock constructed diagonally across a road to divert the water from flowing directly into a stream. Ditch relief culverts intercept water inside a ditch and divert it across a road. While diverted water from water bars and ditch relief culverts eventually enters the stream, that water has filtered through the ground and vegetation, which removes some of the sediment along the way.

8.2.3.3.3 Silviculture

	Conservation Measures for Silviculture Class III AMZ
C§8.2.3.3.3-1	Maintain or enhance uneven-aged conditions.
C§8.2.3.3.3-2	Harvest so that trees are dispersed in a relatively uniform manner.
C§8.2.3.3.3-3	Maintain or increase conifer dominance—if necessary, by controlling hardwoods.
C§8.2.3.3.3-4	Do not sanitize or salvage LWD that is within the bankfull channel; retain all downed LWD in the AMZ unless the AMZ meets its LWD targets.
C§8.2.3.3.3-5	Leave, as a first priority, LWD previously designated as a large retention tree or wildlife tree.
C§8.2.3.3.3-6	Do not initiate prescribed burning in Class III AMZ.
C§8.2.3.3.3-7	Permit fire control lines in Class III AMZs only with concurrence of the wildlife agencies.
C§8.2.3.3.3-8	Allow salvage harvest in an AMZ only with concurrence of the wildlife agencies.
C§8.2.3.3.3-9	Allow harvest of a minimum merchantable length log from any LWD that obstructs a road.
C§8.2.3.3.3-10	Avoid damage or destruction to non-commercial vegetation beyond the minimum disturbance required for covered activities.
C§8.2.3.3.3-11	Retain all old-growth trees.

8.2.3.3.4 Streambank stability

	Conservation Measures for Streambank Stability Class III AMZ
C§8.2.3.3.4-1	Retain all trees whose trunks (a) are within 10 ft of the bankfull channel, or (b) have roots visible in the bank, or (c) provide anchor to an over-hanging bank, unless it is necessary to remove trees to create a cable corridor or thin a redwood clonal group.
C§8.2.3.3.4-2	Start the 10-ft retention zone at the landward edge of an undercut bank. **EXAMPLE** A bank is undercut by 5 ft. The retention zone will measure 10 ft from the depth of the undercut—15 ft from the edge of the bank.
C§8.2.3.3.4-3	Ensure that redwood clonal groups or "clumps" have no more than 50% of their stems > 8 in. dbh removed per entry.

8.2.3.3.5 Equipment limitation

	Conservation Measures for Equipment Limitation Class III AMZ
C§8.2.3.3.5-1	Adhere to the standards in Appendix E, *Roads, Landings, and Skid Trails*, and Appendix T, *Master Agreement for Timber Operations*.
C§8.2.3.3.5-2	Limit all heavy equipment unless there is an allowable use. **ALLOWABLE USE** ▪ *Existing skid trails and landings* MRC may use stable, existing skid trails and landings. We will mulch or slash skid trails and landings upon completion of operations or before the winter period, whichever comes first. ▪ *Existing roads* MRC may use and maintain existing roads. ▪ *New roads* MRC may construct new roads that do not parallel an AMZ. ▪ *New landings* MRC may construct—only rarely (perhaps once a year)—a new landing within an AMZ if - Alternatives would create a greater risk and magnitude of sediment delivery. - All mitigations, approved by the wildlife agencies, are fully implemented. - All trees felled in an AMZ for construction of these new facilities have the "key piece size" logs set aside for LWD placement, either in the vicinity of the new facilities or in the nearest Class I or Class II watercourse deficient in LWD. ▪ *New truck road crossings and skid trail crossings* MRC may construct new truck road and skid trail crossings if - Alternatives would create a greater risk and magnitude of sediment delivery. - All trees felled in an AMZ for construction of these new facilities have the "key piece size" logs set aside for LWD placement, either in the vicinity of the new facilities or in the nearest Class I or Class II watercourse deficient in LWD.

8.2.3.3.6 Bare soil

	Conservation Measures for Bare Soil Class III AMZ
C§8.2.3.3.6-1	Treat, for erosion control, areas of exposed mineral soil which are (a) at least 100 ft^2 in size and (b) not on a running surface, with mulch, grass seed, slash, or other appropriate material; for running surfaces, see Appendix E, *Roads, Landings, and Skid Trails*.
C§8.2.3.3.6-2	Do not initiate prescribed or broadcast burning in the AMZ.
C§8.2.3.3.6-3	Treat the running surfaces of a truck road per Appendix E, *Roads, Landings, and Skid Trails*, section E.2.5.

8.2.3.3.7 Soil pipes

	Conservation Measures for Soil Pipes **Class III AMZ**
C§8.2.3.3.7-1	Apply conservation measures C§8.2.3.3.7-1 through C§8.2.3.3.7-8 only when there is evidence of exposed soil pipes or soil pipes transitioning into stream channels, e.g., when areas of soil over a pipe collapse or when "holes" in the floor of the swale reveal flowing sub-surface water. **NOTE** The protection should extend up the swale until there is no more evidence of soil pipe collapse.
C§8.2.3.3.7-2	Fell trees so that they do not collapse a soil pipe, thereby prohibiting ground yarding across the collapsed soil pipe.
C§8.2.3.3.7-3	Use only existing skid trails or roads.
C§8.2.3.3.7-4	Avoid soil pipes when operating heavy equipment.
C§8.2.3.3.7-5	Cross soil pipes only at existing crossings when operating equipment.
C§8.2.3.3.7-6	Disconnect roads or skid trails hydrologically from the swale, where topographical features allow.[10]
C§8.2.3.3.7-7	Disperse drainage from roads or skid trails throughout the swale, if disconnecting roads or skids trails is not feasible.
C§8.2.3.3.7-8	Remove all transported fill upon completion of the operation.
C§8.2.3.3.7-9	Avoid equipment use in the floor of the swale, with the exception of crossing locations, even if there is no evidence of soil pipes.

8.2.3.4 AMZ restoration treatments

In some cases, a passive conservation approach will not achieve the desired level of riparian function in AMZs. To improve riparian function, MRC will use limited restoration treatments in the AMZ to (a) restore stands that are currently hardwood dominated to conifer dominance and (b) treat conifer stands that are over-stocked and stagnating. A restoration harvest, in this context, generally allows for less than 50% canopy over the AMZ. The "Alternative Conservation Measures for Restoration Treatments" indicate the exceptions (AC§8.2.3.4-1 through AC§8.2.3.4-22). The objective of the restoration treatment is to accelerate the AMZ toward improved riparian function in areas where the seral stage of climax vegetation is conifer-dominated.

Restoration treatments, as alternatives to the conservation measures for the AMZ, carry restrictions. Although this alternative treatment appears to differ from the definition of an alternative conservation measure in Chapter 7, *Planning for Conservation*, the intent of the restoration treatment is to provide more AMZ function over time than the conservation measures provide. MRC will use restoration treatments in select AMZs where hardwood dominance has superseded conifer dominance.

[10] For an explanation of hydrologically disconnecting a road, refer to the footnote for C§8.2.3.2.6-3.

Moreover, MRC plans to conduct pre- and post-treatment monitoring programs for select pilot projects in these restoration areas to assess stream temperature impacts to aquatic species (*HCP/NCCP Atlas*, MAPS 3A-3C). We will assess stream temperature regimes through our stream temperature monitoring. Using the closest monitoring location to the restoration site, we will determine in which threshold range the site falls.

ALTERNATIVE Conservation Measures for Restoration Treatments Class I, Large Class II, Small Class II, and Class III AMZ	
AMZ Restoration	
AC§8.2.3.4-1	Ensure that conservation measures for bank stability applicable within 10 ft of a bankfull channel remain in effect during a restoration treatment.
AC§8.2.3.4-2	Allow restoration treatments in coho salmon streams where temperatures are at or above the threshold and water flows July through September, with concurrence of the wildlife agencies.
AC§8.2.3.4-3	Do not use restoration treatment on inner gorge topography or within 25 ft of an inner gorge break in slope.
AC§8.2.3.4-4	Do not use restoration treatment on historically active mass wasting hazards unless operations are approved by a California Registered Geologist and meet canopy standards of 70%.
AC§8.2.3.4-5	Retain at least 50% canopy in a restoration treatment on steep streamside slopes or steep dissected topography (i.e., within TSU1, TSU2, or TSU3), unless operations are approved by a California Registered Geologist.
AC§8.2.3.4-6	Apply equipment exclusion zone (EEZ) provisions during restoration treatments except for brush crushing operations.
AC§8.2.3.4-7	Retain at least 70% canopy within the inner bands of Class I and Large Class II AMZs.
AC§8.2.3.4-8	Retain all conifers > 12 in. dbh.
AC§8.2.3.4-9	Limit the percentage of stream length that can be restored (per rolling 10-year period and per CalWater planning watershed) by the range of stream temperature thresholds for the cold-water species present in the stream length proposed for restoration or downstream of the restoration for up to ¼ mile (see Table 8-12 and Table 8-13).
AC§8.2.3.4-10	Determine stream temperature values within ¼ mile downstream of the proposed treatment site.
AC§8.2.3.4-11	Limit AMZ restoration harvests through monitoring and adaptive management. **EXAMPLE** If stream temperatures rise above the current range for target species (see Table 8-12 and M§13.5.1.1-5), MRC will adjust the amount of AMZ restoration harvest.

	ALTERNATIVE Conservation Measures for Restoration Treatments Class I, Large Class II, Small Class II, and Class III AMZ
AC§8.2.3.4-12	Phase in AMZ restoration harvests slowly with more intense monitoring in the first 5-10 years of the HCP/NCCP. **NOTE** During this initial period of intense monitoring, MRC will not conduct AMZ restoration harvests within watersheds on the 303(d) list, i.e., Navarro River, Big River, Garcia River, and South Fork Eel River.
Brush Crushing[11]	
AC§8.2.3.4-13	Perform brush crushing only on slopes < 30%.
AC§8.2.3.4-14	Raise tractor blades when brush crushing.
AC§8.2.3.4-15	Retain at least 95% of ground cover (downed brush, mulch, tree lopping, etc.).
AC§8.2.3.4-16	Do not conduct brush crushing operations within 25 ft of the bankfull channel of a Class I or Class II watercourse or within 10 ft of the bankfull channel of a Class III watercourse.
AC§8.2.3.4-17	Plant brush-crushed areas with redwood and Douglas fir, interspersed no more than 12 ft apart.
AC§8.2.3.4-18	Do not remove any overstory tree within an inner zone of the AMZ, including hardwoods, during brush-crushing operation.
AC§8.2.3.4-19	Retain conifer trees ≥ 6 in. dbh in order to create a spacing of 20 ft between trees.
AC§8.2.3.4-20	Retain conifer trees < 6 in. order to create a spacing of 15-20 ft between trees, unless their removal is required for covered activities.
AC§8.2.3.4-21	Limit brush-crushing operations to 5% of stream length per decade per CalWater planning watershed (see Table 8-13).
AC§8.2.3.4-22	Allow brush-crushing operations only within the first 40 years of the HCP/NCCP.

Table 8-12 MWMT Temperature Thresholds for Coho, Steelhead, and Coastal Tailed Frogs

Stream Temperature Thresholds for AMZ Restoration Treatments in the Plan Area			
Species	**Upper Temperature Range (C^0)**	**Middle Temperature Range (C^0)**	**Lower Temperature Range (C^0)**
coho salmon	>18	16-18	<16
steelhead	>21	17-21	<17
coastal tailed frog	>15	13-15	<13

[11] MRC proposes to use ground equipment, in special cases, to crush brush within the AMZ in order to increase conifer stocking in these zones. These areas are generally associated with hardwood-dominated or mixed conifer/hardwood stands located adjacent to a watercourse. The stands have low conifer basal areas (< 60 ft^2 per ac) and have low-to-moderate canopy levels (< 50%). MRC will not use brush crushing to convert stand types.

Table 8-13 Stream Length for AMZ Restoration Treatment in the Plan Area

Watercourse		Stream Length Limit by Stream Temperature Threshold Per 10-year Rolling Period and Per CalWater Planning Watershed		
		Upper Temperature Range	**Middle Temperature Range**	**Lower Temperature Range**
Class I	Inner Band	No treatment allowed	5%	10%
	Middle Band	5%	10%	10%
	Outer Band	10%	15%	15%
Large Class II	Inner Band	No treatment allowed	5%	10%
	Middle Band	5%	10%	10%
	Outer Band	10%	15%	15%
Small Class II		15%	10%	15%
Class III		15%	15%	15%

8.2.3.5 Wetlands, wet meadows, wet areas, seeps, and springs

8.2.3.5.1 Wetlands, wet meadows, and wet areas

DEFINITION

Wetlands, wet meadows, and wet areas are natural areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to develop hydric soils and to support, with adequate sun light, a prevalence of hydrophytic vegetation.

Wetlands generally include swamps, marshes, bogs, and similar areas. Wetland areas include tidal or estuarine wetlands which may be highly saline. The presence of hydric soils, aquatic animals, or hydrophilic plants may also assist in defining wetland areas.

	Conservation Measures for Wetlands, Wet Areas, and Wet Meadows
C§8.2.3.5.1-1	Maintain a 25-ft EEZ (excluding existing roads) around wetlands, wet meadows, and wet areas whose surface area is > 10 ft^2 and < 50 ft^2.
C§8.2.3.5.1-2	Maintain a 50-ft EEZ (excluding existing roads) around wetlands, wet meadows, and wet areas that are more than 50 ft^2 in surface area. **NOTE** MRC must obtain approval of our aquatic biologist before equipment can enter the EEZ of a wet area, wetland, or a wet meadow, making them a potential equipment limitation zone (ELZ). C§10.2.2.3-2, C§10.2.2.3-3, C§10.2.2.3-8, C§10.2.3.3-1, and C§10.2.3.3-2 describe the survey methods and criteria for entering the EEZ.
C§8.2.3.5.1-3	Avoid artificial wetlands, wet areas, and wet meadows created by forest management, except for the use of existing roads or where alternate routes would result in more habitat degradation.
C§8.2.3.5.1-4	Retain within the EEZ at least 75 ft^2 of basal area or at least 50% of the pre-harvest basal area, whichever is greater.
C§8.2.3.5.1-5	Fell trees away from the area, unless this creates a safety hazard.
C§8.2.3.5.1-6	Leave trees in place that were felled to remediate safety concerns.

	Conservation Measures for Wetlands, Wet Areas, and Wet Meadows
C§8.2.3.5.1-7	Retain old growth trees.
C§8.2.3.5.1-8	Do not sanitize or salvage harvest.
C§8.2.3.5.1-9	Retain LWD.
C§8.2.3.5.1-10	Survey a water drafting site for covered species prior to its development and apply the conservation measures for the covered species present.
C§8.2.3.5.1-11	Follow water drafting guidelines specified in C§10.2.2.3-4 and Appendix E (section E.7, *Standards for Water Drafting).*
C§8.2.3.5.1-12	Protect covered wetland plants (see Chapter 11, *Conservation Measures for Rare Plants).*

8.2.3.5.2 Seeps and springs

DEFINITION Seeps and springs are groundwater discharge that slowly oozes to the surface of the ground or is visibly flowing from the ground.

Springs are locations where water emerges from the ground and flow is evident. Generally seeps are non-flowing water emerging from the ground. Seeps and springs often have hydrophytes (plants adapted for life in water), wet soil, and standing water throughout most of the year.

MRC will use similar management measures for both seeps and springs, due to the variability of delineation. A seep one portion of the year, for example, may be a spring at another time.

	Conservation Measures for Seeps and Springs
C§8.2.3.5.2-1	Protect seeps or springs within Class I or Class II watercourses of AMZs.
C§8.2.3.5.2-2	Extend the AMZ boundary 50 ft beyond a seep or spring, if the seep or spring is on, near, or draining into the AMZ boundary.
C§8.2.3.5.2-3	Apply a 50-ft EEZ (excluding existing roads) and a 50% canopy retention requirement to seeps or springs that do not drain into a defined watercourse and are unable to deliver sediment to higher order streams. **NOTE** MRC will require a biological consultation with an MRC biologist before equipment can enter the EEZ of a seep or spring, making them a potential ELZ. C§10.2.2.3-2, C§10.2.2.3-3, C§10.2.2.3-8, C§10.2.3.3-1, and C§10.2.3.3-2 describe the survey methods and criteria for entering the EEZ.
C§8.2.3.5.2-4	Avoid artificial wetlands, wet areas, and wet meadows created by forest management, except for the use of existing roads or where alternate routes would result in more habitat degradation.
C§8.2.3.5.2-5	Fell trees away from seeps or springs, unless this creates a safety hazard.

	Conservation Measures for Seeps and Springs
C§8.2.3.5.2-6	Leave felled trees in place that were cut to remediate safety concerns.
C§8.2.3.5.2-7	Retain within the EEZ at least 75 ft^2 of basal area or at least 50% of the pre-harvest basal area, whichever is greater.
C§8.2.3.5.2-8	Retain all old-growth trees.
C§8.2.3.5.2-9	Do not sanitize or salvage harvest.
C§8.2.3.5.2-10	Retain LWD.
C§8.2.3.5.2-11	Survey a new or un-surveyed water drafting site for covered species prior to use and apply the conservation measures relevant to the covered species present.
C§8.2.3.5.2-12	Follow water drafting guidelines specified in C§10.2.2.3-4 and Appendix E (section E.7, *Standards for Water Drafting)*.

8.2.3.6 LWD placement

MRC will place LWD in Class I watercourses to improve stream habitat conditions. Our initial focus will be coho "core" watersheds (see section 8.3.3.2.2). Adaptive management will play a role in improving the placement process. MRC will determine locations for LWD placement through watershed analysis. Streams with high LWD demand and channel responsiveness have highest priority. MRC will notify the wildlife agencies about the placement of LWD through a site-specific plan. However, MRC may place individual trees, felled for a cable corridor or safety hazard, in watercourses without a site-specific plan, as long as we notify the wildlife agencies about such placements in an annual report.

Many of the riparian areas adjacent to watercourses that have high demand for LWD consist of stands that are below desirable levels for basal area and riparian canopy cover. They may not reach a harvest trigger for up to 30 or 40 years. MRC will develop, in conjunction with the wildlife agencies, a plan to address LWD demand in these areas, particularly in coho "core" watersheds.

	Conservation Measures for LWD Placement
C§8.2.3.6-1	Do not blade a trail to a tree.
C§8.2.3.6-2	Use existing roads or skid trails rather than building roads or skid trails.
C§8.2.3.6-3	Ensure that there is minimal soil disturbance in placing LWD, including the stump, into a watercourse.
C§8.2.3.6-4	Push standing trees into a watercourse with heavy equipment, as long as rootwads remain attached to LWD.
C§8.2.3.6-5	Ensure that the diameter of any wood placed as LWD in a watercourse is at least 80% of the key piece diameter, if a rootwad is attached, or meets key piece size requirements for diameter and length, if a rootwad is not attached.

	Conservation Measures for LWD Placement
C§8.2.3.6-6	Ensure that LWD, with rootwad attached, is at least as long as the bankfull channel width or 1.5 times the bankfull channel width, if there is no rootwad.
C§8.2.3.6-7	Place a rootwad within a stream channel provided a rootwad exceeds the volume standard for *key pieces*.
C§8.2.3.6-8	Do not exceed minimum numbers for "key pieces" by more than 300% when placing LWD "artificially" in order to moderate the amount of LWD in stream channels (see Appendix G, G.3.3.1, *General methods for LWD recruitment*).

Bankfull Width (ft)	Minimum Number of Key LWD Pieces		
	Per 328 ft	Per 1000 ft	Per Mile
<15	6.6	20	106
15-35	4.9	15	79
35-45	3.9	12	63
>45	3.3	10	53

C§8.2.3.6-9	Do not use downed wood from the AMZ unless the AMZ exceeds its target for LWD.
C§8.2.3.6-10	Permit the placement as LWD of 1 tree designated for large tree retention within a 330 ft segment of an AMZ, if the watercourse does not meet the target for key piece loading.
C§8.2.3.6-11	Fell trees into a stream channel provided the length of the tree segment that will interact with the stream channel is at least 1.5 times the width of the bankfull channel. **NOTE** This primarily refers to trees cut for a cable corridor.
C§8.2.3.6-12	Retain foliage from trees felled into a stream channel.
C§8.2.3.6-13	Do not place LWD pieces in one spot (i.e., within 100 ft of each other) without a site-specific plan developed by an MRC fisheries biologist or hydrologist; notify the wildlife agencies in an annual report of the LWD placement.
C§8.2.3.6-14	Situate LWD to maximize habitat benefit and minimize adverse effects.
C§8.2.3.6-15	Follow the guidelines in the CDFG *Salmonid Restoration Manual* when designing specific structures; otherwise ensure stability of LWD placement by following size requirements for key pieces (see Appendix G, G.3.3.1, *General methods for LWD recruitment*) and wedging LWD between riparian trees when possible.
C§8.2.3.6-16	Add LWD only during the course of PTHP activities, unless there is a site-specific plan.
C§8.2.3.6-17	Tag and mark LWD added to stream channels to allow MRC and the wildlife agencies to track it over time through instream monitoring programs.

	Conservation Measures for LWD Placement
C§8.2.3.6-18	Develop within the first 5 years of the HCP/NCCP and implement within the first 20 years of the HCP/NCCP an LWD placement plan for coho "core" watersheds. **NOTE** These planning watersheds, and in certain cases, sub-watersheds are: East Branch North Fork Big River; Russell Brook; Ramone Creek; a section of South Daugherty Creek, from the confluence of Gates Creek and Daugherty Creek downstream to the MRC property line; Middle Albion River; South Fork Albion River; John Smith Creek; Little North Fork Navarro River; Cook Creek; Lower South Branch Navarro River; Lower Navarro Drainages (Marsh, Flume, and Murray Gulches); Cottaneva Creek; Hayworth Creek; and the South Fork Garcia River. Appendix Z (section Z.1*"Selecting Coho Core Watersheds for Road Restoration*" and Table Z-1 MRC Coho Core Areas), describes the coho "core" watersheds in more detail. Section 8.3.3.2.2 outlines MRC plans for controllable erosion in these areas. The elevated LWD implementation schedule will, at a minimum, ensure that the watersheds contained within Table S-11 (*Future LWD Targets within the Plan Area by Planning Watershed*) will meet half of their target for "% of Segments with Low or Moderate Demand for LWD" by Year 10 of the HCP/NCCP and meet their full target by Year 20. Since the target date is actually Year 80, the coho "core' watersheds will cut their timeline by 75%.
C§8.2.3.6-19	Conduct LWD placement in coho "core" watersheds without equipment access during the first entry into the area under the HCP/NCCP.
C§8.2.3.6-20	Reduce, if necessary, the basal area harvest retention standards by the amount of basal area felled for LWD placement while still maintaining minimum shade requirements.

8.2.4 Rationale

8.2.4.1 Riparian function by watercourse type

Streams transition from headwater Class III intermittent streams supporting no aquatic life downstream to Class I perennial streams supporting abundant aquatic life—Chinook and coho salmon, steelhead, coastal tailed frog, and red-legged frog. Recognizing the interconnectivity of riparian functions from headwaters to downstream is essential in proposing riparian conservation measures. Riparian corridors represent transition zones for the land-water interface; they support both physical and biological functions for stream ecosystems. Functions of the riparian zone have both temporal and spatial scales that are interconnected to maintain equilibrium within aquatic ecosystems (Gregory et al. 1991). From the headwaters to reaches downstream, these functions proliferate with increasing stream class. Riparian processes initiated in the headwaters are transferred downstream and directly affect water and habitat parameters, as well as aquatic organisms using various reaches (Vannote et al. 1980, Naiman et al. 1992).

MRC classifies watercourses based on species use and processes occurring within the watercourses. Riparian functions change from small headwater channels downstream to larger streams and rivers, as do species use. Within the AMZ, MRC proposes different levels of protection based on the classification of each watercourse. For each of these watercourse classes, the contribution of riparian vegetation to the processes and functions that provide habitat for covered species varies. Riparian functions include, but are not limited to, woody debris recruitment; shade retention and water temperature regulation; nutrient and organic matter cycling; microclimate regulation; streambank stability enhancement; and prevention of surface erosion (Swanson et al. 1982, FEMAT 1993, Spence et al. 1996).

8.2.4.2 AMZ widths

The width of an AMZ is based on (1) likelihood of LWD recruitment; (2) potential for sediment delivery from streamside disturbances; and (3) occurrence of covered aquatic species in different watercourse types.

MRC measures the width of an AMZ from the edge of a bankfull channel. Bankfull discharge is the channel-forming flow that transports the bulk of available sediment over time (Wolman and Miller 1960). The presence of a floodplain at the elevation of incipient flooding easily delineates the bankfull stage. However, a trained observer can also estimate it from (a) deposits of fine sediments such as sand or silt at the active scour mark, (b) a break in stream bank slope, and (c) perennial vegetation limit (Flosi et al. 1998). In the absence of a well-defined floodplain surface, other indicators are useful. In any case, the observer should always use parallel lines of evidence (Kondolf et al. 2003).

MRC proposes different levels of protection based on watercourse classification, riparian functions, and processes important for covered species and their habitats. Class I and Large Class II watercourses provide habitat for nearly all of the covered species. Covered species use Small Class II watercourses less often because they lack year-round surface flow and are smaller in size; they do not use Class III watercourses at all.

As streamside slopes increase, the influence of gravity increases the probability that streamside trees will fall toward the stream and sediment will be delivered. Other trees, although farther from the stream, are still likely to provide stream shade. Because slope gradient affects these riparian processes, AMZ width is based on slope gradients adjacent to a watercourse. Width of the AMZ will vary according to 3 slope classes (i.e., 0-30%, 30-50%, >50%),[12] with higher AMZ widths for steeper streamside topography within each class of watercourse.

The height of 1 site-potential redwood tree adjusted to slope distance influences the width of an AMZ for Class I, Large Class II, and Small Class II watercourses. Trees within this distance from a stream provide approximately 90-100% of LWD recruitment from streamside stands (McDade et. al., 1990; Murphy and Koski, 1989; Reid and Hilton, 1998; Van Sickle and Gregory, 1990). On the other hand, LWD recruited through mass wasting events is often from areas farther away; our mass wasting conservation measures allow for large tree retention to provide for this source. The majority of the plan area has trees that are Site Class III. This should yield a redwood tree that ranges in height from 130-150 ft in 100 years (Lindquist and Palley 1963).

Widths of AMZs for Class I and Large Class II watercourses range from 100-190 ft. The maximum AMZ width of 190-ft slope distance is based on the height of a Site Class III redwood tree (150 ft) adjusted to slope distance for an 80% slope gradient. We assume this represents the upper range of slope gradients adjacent to watercourses in the coast range. The 130 and 150 ft AMZ widths represent the range in height of Site Class III redwood trees. A width of 100 ft represents approximately 75% of a Site Class III redwood tree height. Approximately 75% of LWD recruitment occurs within 75% of 1 tree height (slope distance) of the stream channel (Reid and Hilton 1998).

[12] To be consistent with regulations, we use slope classes from the California Forest Practice Rules (circa 2003).

Small Class II and Class III watercourses have reduced AMZ widths because smaller LWD is sufficient for smaller stream channels; in addition, there is less need for streamside shade to cool water temperature because of the lack of year-round water flow.

8.2.4.3 Differentiating smaller watercourses

In differentiating Small and Large Class II watercourses, MRC recognizes that riparian functions vary by watercourse size. The size of a Class II watercourse influences the likelihood of surface water flow in summer and the size and amount of LWD for instream habitat. Therefore, our riparian conservation measures reflect these differences. MRC differentiates Small and Large Class II watercourses by watershed size, which is easily defined and not subject to interpretation or annual precipitation fluctuations. We will consider watersheds with breeding coastal tailed frogs present as Large Class II regardless of the size of the drainage area.

In steep dissected terrain, as found in the plan area within the California Coast Range, ground water aquifers along the stream channel are topographically constrained to the area near the channel and have limited capacity for water storage (Hewlett, 1969). Across the plan area, there is rarely significant summer precipitation to recharge ground water. The storage capacity for ground water accumulates as watershed size increases. This also increases the likelihood of surface water flow in summer. The watershed size likely to provide increased surface water flow varies by (1) the amount and timing of precipitation in an area; (2) localized soil and geology conditions; (3) depth of alluvial material in the channel; and (4) storage capacity and transmissibility of the near-stream aquifer. Until MRC can define this watershed size more precisely with post-harvest monitoring, we will use 100 ac as the dividing line between Small and Large Class II watercourses. Within the plan area, a watershed size less than 100 ac seldom has surface water flow year-round. In the rare situations that surface flow does exist year-round, we assume the proportion of the water downstream is small.

Generally, as stream channel size decreases, vegetation close to the stream provides a relatively higher proportion of riparian functions (ODF 2001). In the smallest streams, the majority of shade comes from under-story vegetation along the bank. Streams less than 6 ft in bankfull-width meet or exceed stream shade targets because of shrub and grass vegetation along the banks (ODF 2001). Using the bankfull regional curve for the San Francisco region (Rosgen 1994), 100 ac corresponds to a bankfull width of approximately 8 ft. This suggests that under-story vegetation will provide summer shade on small watercourses.

Large streams require large sizes of LWD that can remain stable in the channel (Bilby and Ward 1989). Smaller LWD, however, can create habitat features in small channels (ODF 2001, Bilby and Ward 1989), where the cross-sectional area of a stream is smaller and stream power lower. Furthermore, LWD remains in small channels for a longer period of time.

8.2.4.4 Flood-prone and channel migration zones

The majority of streams and rivers that flow through the plan area are within narrow canyons. This results in little floodplain development or stream channel migration. The relatively young age of the Coast Range combined with high uplift rates create frequent narrow canyons. Floodplains along stream channels tend to be small and infrequent, with few exceptions. Further, because the rivers and streams are within narrow and confined canyons, there is little opportunity for migration of stream or river channels through alluvial deposits.

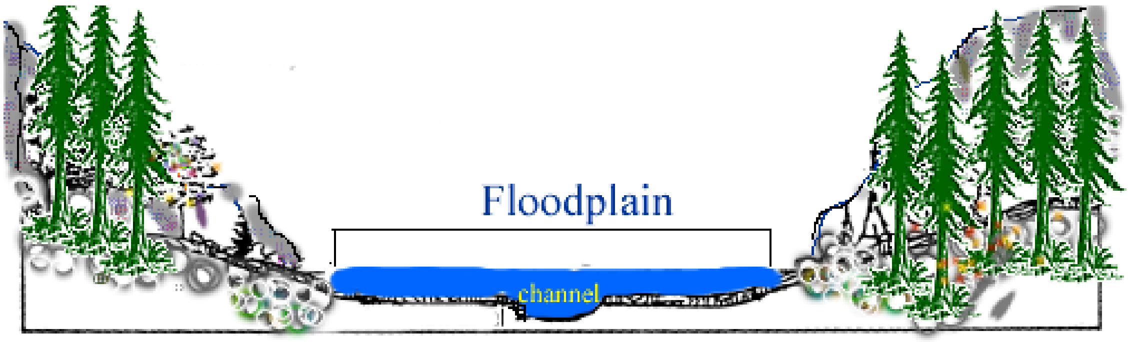

Figure 8-8 Illustration of a Channel and Floodplain

Riparian or streamside vegetation affects channel morphology through a number of mechanisms (Swanson et al. 1982, Sedell and Beschta 1991). Vegetation increases hydraulic resistance and friction. This reduces flow velocity and erosion at high discharges. The root systems of vegetation protect the soil of banks and floodplains from erosion. Plus roots contribute organic matter, which improves soil aggregation. Riparian root systems encourage bank stability and reduce the incidence of bank failure during flood recession. Surface root mats promote the formation of undercut banks, which provide important shelter for fish and amphibians.

The required width of riparian buffers to protect hydraulic functions and bank stability will vary. The effects of vegetation on flow hydraulics depend on flood stage and flood frequency. Where banks are steep and the channel is confined (the most common channel morphology in the plan area), a riparian buffer width of 25-50 ft (7.6–15.2 m) will typically extend beyond the 100-year flood-prone area. This is within the influence of the AMZ inner band for Class I and Large Class II watercourses. Where a wide floodplain is present (more likely on Class I than on Class II or Class III streams), the effects of large floods may extend beyond the inner band, but should be encompassed by the middle band. A vegetated buffer in the inner band, however, would normally maintain most of the hydraulic functions of riparian vegetation in the plan area. This is due to the confined nature of the channels and canyons on our property. MRC has mapped areas where the channel is not confined and the floodplains are wide. In these areas, MRC provides wider AMZ protections and increased basal area retention requirements.

Channel migration zones are infrequent within the plan area. Those that do occur are the result of one or more avulsion channels formed within the flood-prone areas of streams or rivers. During periods of high flow, water occupies these avulsion channels. Over time the active channel may migrate to these avulsion channels. The migration typically will be in response to blockage of the active channel from LWD dams, large mass wasting deposits, or persistent erosion of stream banks. These channel migration areas will require increased riparian protections. If the active channel migrates, new sources of LWD, shade, and other riparian processes need to be provided. Furthermore, the avulsion channels within the channel migration zone often provide refuge for aquatic organisms during high flow events. These channel migration zones are infrequent. MRC has mapped them and provides additional conservation measures there.

The majority of riparian function is provided in the inner and middle bands of the AMZ; these bands encompass the flood-prone or channel migration zone. If the edge of the flood-prone or channel migration zone is wider than the edge of the middle band, MRC will extend the AMZ to encompass the flood-prone or channel migration zone. MRC has mapped the areas where flood-prone or channel migration zones exist within our land and included these maps in our *HCP/NCCP Atlas* (MAPS 3A-3C). These are typically areas with alluvial deposition and high moisture content and are very productive tree-growing sites.

Flood-prone and channel migration areas require the highest basal area retention within the AMZ. Higher basal area will provide for larger and greater numbers of trees. This, in turn, will (a) ensure integrity of the riparian function in the flood-prone environment; (b) serve as a source of future shade should the channel migrate; and (c) provide a good source of LWD across the flood-prone or channel migration zone.

8.2.4.5 Wetlands, wet meadows, and wet areas

Wetlands, which are often adjacent to or contain red-legged frog breeding habitat, provide good foraging habitat for red-legged frogs due to their high moisture and productivity. These habitats are also important breeding, foraging, and hydrating habitats for other native amphibians. Frogs use slow moving, deep, cold water with surrounding or submerged aquatic vegetation, such as cattails and bulrushes. Wetlands, wet meadows, and wet areas generally have grasses, forbs, and aquatic vegetation as ground cover, although some areas dominated by grasses and forbs are not wetlands. There are very few (if any) trees in these areas; thus the potential impacts of timber harvesting are minimal.

MRC will protect wetlands, wet areas, and wet meadows by

- Minimizing disturbance to breeding or foraging habitat of red-legged frogs.
- Preventing soil compaction or alteration.
- Maintaining the natural hydrologic function.

8.2.4.6 Seeps and springs

Seeps and springs provide potential foraging or hydrating sites for red-legged frogs, coastal tailed frogs, and other amphibians, as well as habitat for southern torrent salamanders. The southern torrent salamander requires cold water with minimal substrate embeddedness.

MRC will protect seeps and springs by

- Maintaining cool water temperatures.
- Minimizing sediment input and soil compaction associated with equipment.
- Minimizing disturbances from tree felling.
- Maintaining the natural hydrologic function.

8.2.4.7 LWD recruitment processes

LWD is widely recognized as an important part of the aquatic ecosystem (Swanson and Lienkaemper 1978, Bilby and Likens 1980, Bisson et. al. 1987). It is also a vital component of quality habitat for aquatic organisms (Bisson et. al. 1987). LWD influences channel morphology by

- Dissipating stream energy.
- Controlling grade along the channel's length.
- Increasing channel roughness.
- Storing and sorting sediment and organic matter.
- Increasing the complexity and cover of stream, floodplain, and riparian habitats.

LWD provides an organic energy source for aquatic organisms; controls the routing of sediment through stream systems; and provides structure to the streambed and banks (Swanson and Lienkaemper 1978, Bilby and Likens 1980, Naiman et al. 2000).

In general, LWD is at low levels in the streams throughout the plan area. Forest managers have harvested streamside trees that could have delivered LWD to watercourses; they have salvaged downed LWD from watercourses or adjacent banks. In the name of stream habitat enhancement and fish passage improvement, CDFG and its contractors removed LWD from stream channels across what is now MRC land. These activities no longer continue, but their effect on instream LWD levels will be seen for a long time.

Most of the recruitment of LWD to stream channels comes from windthrow, bank erosion, and mass wasting events (O'Connor and Ziemer 1989, Surfleet and Ziemer 1996, May 2002, Benda et al. 2002). In a mature second-growth redwood and Douglas-fir forest in Caspar Creek, windthrow and bank erosion were the primary mechanisms for LWD recruitment, with mass wasting providing a smaller portion of the instream LWD (O'Connor and Ziemer 1989; Surfleet and Ziemer 1996). Windthrow increased after logging and during intense wind storms, accounting for about 75% of the LWD volume in North Fork Caspar Creek and about 50% in South Fork; significantly, North Fork was 50% clearcut in the early 1990s and South Fork had partial harvest in the early 1970s (Keppeler 1996).

Areas adjacent to clearcuts experienced significantly more LWD recruitment to the channel than other areas. LWD levels in the South Fork of Caspar Creek were lower than the North Fork due to stream clearing of LWD in the early 1970s. LWD in South Fork Caspar Creek was still at low levels 20 years after clearing (Surfleet and Ziemer 1996).

Though mass wasting did not deliver large amounts of LWD to stream channels in Caspar Creek, many areas prone to debris slides and debris flows can deliver very significant amounts of LWD (Benda et al. 2002, May 2002). A debris flow may transport wood and sediment stored on hillslopes to first-to-third order channels. These episodic disturbances play a major role in delivering wood and sediment to stream networks in steep mountainous terrain (Keller and Swanson 1979, Swanson et al. 1982, Benda and Dunne 1997, all as cited in May 2002).

Low-order streams are especially susceptible to large mass wasting events due to their proximity to steep slopes and their narrow channel width and high gradient (Swanson et al. 1982, Benda and Dunne 1997, Naiman et al. 1992, all as cited in May 2002). In such streams, sediment and wood are rarely transported by chronic processes (Swanson et al. 1982), but are stored for longer periods of time. The majority of wood in a debris slide appears to be remobilized wood that was previously stored in low-order streams, indicating a critical link between hillslope and fluvial processes in mountain streams, where episodic events redistribute material that has been stored in small streams for decades to centuries (May 2002).

LWD recruitment from mass wasting processes in redwood ecosystems may be a less important mechanism in larger order streams; it is mainly associated with streamside events. In the Garcia River, about 1% of LWD recruitment occurred by mass wasting (O'Connor Environmental Inc. 2000), as compared to 4% in North Fork Caspar Creek and 11% in South Fork (O'Connor and Ziemer 1989, Surfleet and Ziemer 1996). In Freshwater Creek, only about 3% of LWD in mainstem stream channels comes from landslides (PALCO 2001). Of this 3% contribution, a majority comes from small streamside landslides. In old-growth stream systems, recruitment of LWD from mass wasting processes varies depending on stream gradient, streamside slope, and confinement. For example, in higher gradient Little Lost Man Creek, landslides recruit 40–60% of the volume of LWD; in lower gradient Prairie Creek, there is little or no recruitment from landslides (Benda et al. 2002).

Recruitment of LWD into stream channels can be both frequent chronic inputs and infrequent episodic inputs (Bisson et al. 1987) that create both temporal and spatial variability in LWD abundance. Chronic inputs generally consist of natural tree mortality due to disease or insects, windthrow, and bank undercutting, while episodic inputs result from large-scale insect or disease epidemics, large blowdown events, debris flows, and bank erosion from major floods (Keller and Swanson 1979, Bisson et al. 1987, O'Connor and Ziemer 1989, Keppeler 1996, Surfleet and Ziemer 1996). Further, the movement of LWD in the stream channel network is governed by large flood events that occur infrequently.

Debris loading is generally highest in low-order stream channels (Keller and Swanson 1979, Robison and Beschta 1990a, Montgomery et al. 1995 as cited in Lassettre and Harris 2001). Distribution of pieces within these channels is usually characterized by frequent randomly distributed individual pieces and small jams, since small channels do not have sufficient stream flow to transport LWD. Logs can remain stationary for long periods of time but through time will decay or transport via mass wasting processes (May 2002, Keller et al. 1981).

Channel response to changes in LWD depends upon the role of wood on sediment storage and pool formation; these effects vary through the stream channel. In steep landscapes, source reaches are transport-limited and store sediment; a decrease in supply of LWD can accelerate sediment transport and decrease sediment storage (Bilby 1981, Nakamura and Swanson 1993, Montgomery and Buffington 1993). Further downstream, transport reaches are high-gradient channels with limited supplies of sediment; they convey sediment inputs downstream to response reaches.[13]

MRC will maintain high basal areas of conifer trees at streamside and permanently retain the largest shade trees to ensure recruitment of LWD to stream channels. Section 8.2.4.9 provides some projections of AMZ characteristics over time in the context of instream LWD levels measured in Prairie Creek (Keller et al. 1995). Research indicates that mass wasting deposits some LWD into streams, although the amount is unknown (see section 8.2.4.8). MRC guidelines for tree retention provide for large trees upslope which potentially could enter into streams. In areas of high mass wasting hazard (i.e., TSU1, TSU2, and TSU3), MRC will retain trees to provide LWD input in case of slope stability. Retention of canopy (typically 50%) and of at least 15 ft^2 of conifer trees ≥18 in. dbh per acre will ensure large trees are available to become LWD for streams. The Forest Practice Rules originally developed the "8-18" standard for seed trees. Over the years, the Board of Forestry has modified this rule to create a standard for basal area retention of trees exceeding 18 in. dbh. Wherever the term "8-18" appears in our HCP/NCCP, it signifies 15 ft^2 of basal area of conifers with a dbh of 18 or more inches.

Our level of harvest is based on both economic and regulatory realities. Our decision to harvest more or less, depending on landscape planning and log prices, carries certain benefits and constraints. Economical harvests, for example, allow MRC to do road restoration work that typically occurs during harvesting—clearly a benefit not only for ongoing transportation and hauling but for sediment and erosion control as well. In an effort to maintain economical harvest levels, MRC may at times be unable to follow the "8-18" standard. This deviation from the standard will only apply in select areas that require prescriptions for either seed tree removal or shelterwood removal. Moreover, such deviation will only occur within the first 20 years of our HCP/NCCP and only once within a stand. All other silvicutural prescriptions, apart from seed tree removal and shelterwood removal, must maintain the "8-18" standard. This means that if the requisite basal area does not exist in the pre-harvest stand, MRC cannot harvest trees with a dbh 18 in. or greater.

[13] Refer to Chapter 16, *Glossary*, for more information on source, transport, and response reaches.

8.2.4.8 LWD recruitment rates

Recruitment rates of LWD are variable and depend on health of the stand; age of the stand; harvest history of the stand; position of the stand relative to a stream; stream size; and environmental conditions, such as windstorms and floods. The conservation measures for large tree retention, specifically designed to provide LWD to streams, are C§8.2.3.1.4-1 through C§8.2.3.1.4-5.

Forest harvest practices in riparian areas, including clear-cutting and harvesting old-growth, can decrease the availability of LWD for recruitment. The extent to which windthrow, bank erosion, and mass wasting add LWD to streams depends on several factors, including stand health, stand age, slope, and forest practices (Benda et al. 2002). For example, recruitment of LWD by windthrow is higher if trees fall on a steep slope (Hairston-Stang and Adams 1998). Streamside landslides recruit a high volume of LWD in Little Lost Man Creek (Benda et al. 2002), whereas in Prairie Creek LWD is recruited primarily by bank erosion processes (Benda et al. 2002).

Using clearcut practices can eliminate LWD recruitment up to 100 years (Beechie 1998). Old-growth stands, compared to younger stands, also produce more and larger LWD pieces that are less susceptible to decay and remain in the watershed system for a longer period of time (O'Connor Environmental Inc. 2000, May 2002, May and Gresswell 2003). Benda et al. (2002) show that, in northern California, diameters of LWD were greater in streams surrounded by old-growth redwood forests. Recruitment from forest mortality, however, was lower in old-growth forests than in second-growth forests (2.5 m^3/km/year and 4.0 m^3/km/year, respectively). Based on representative trees per acre and volume per acre estimates, mortality is higher in second growth stands than in old-growth stands because of increased competition for light, water, and nutrients (0.9% and 0.04% per year, respectively).

In North Fork Caspar Creek, LWD from Douglas fir, redwood, and other mixed conifer and hardwood stands was recruited, after logging, at a rate of 5.3 m^3/ha/yr. Most LWD was recruited by windthrow and to a lesser extent bank erosion and logging debris (O'Connor and Ziemer 1989, Surfleet and Ziemer 1996). In the Garcia River, LWD was recruited at an average rate of 3.67 m^3/ha/yr (O'Connor Environmental Inc. 2000). Redwood LWD recruited at an average of 4 m^3/ha/yr (0.21-23.3 m^3/ha/yr).

Redwood LWD recruitment from mortality is generally low in old-growth forests, with higher rates in second growth forests; however, researchers could only identify the sources for 27% of the volume of recruited wood in old-growth sites (Benda et al. 2002). The recruitment processes associated with second-growth sites include logging debris from past timber harvests and higher mortality rates compared to old-growth forest sites (Benda et al. 2002). The mean proportion of LWD volume recruited in second growth sites averaged 21% (0.3-9.7 m^3/ha/yr [mean 6.3]) due to mortality; 18% (0.1-11.8 m^3/ha/yr [mean 4.8]) due to bank erosion; 13% (0-45 m^3/ha/yr [mean 4.4]) due to landsliding; and 50% due to logging (Benda 2002). LWD from old-growth sources was recruited at different rates and varied by watershed (Prairie Creek vs. Little Lost Man Creek). Mortality accounted for 60% of the LWD recruitment in Prairie Creek and only 20% in Little Lost Man; bank erosion accounted for 40% and 22% and landsliding for 0% and 58%, respectively (Benda et al. 2002).

8.2.4.9 Instream LWD levels by streamside tree density

The goal of this analysis was to determine how many trees needed to be retained long-term to meet instream LWD recruitment objectives in redwood-dominated forests. The analysis focused on published empirical relations developed for recruitment processes in old-growth and second-growth forests in coastal northwestern California.

Over the past decade, minimum buffer widths required for LWD recruitment to fish-bearing streams have ranged from less than 1 to 2 site-potential tree heights (FEMAT 1993, Kondolf et al. 1996, Spence et al. 1996). Trees located farther than 1 site potential tree height from the stream, however, are less likely to contribute wood to the channel unless they occur on wide valley bottoms that are periodically occupied by debris flows or are transported to the channel by inner gorge mass wasting (Reid and Hilton 1998). This analysis evaluated long-term instream LWD loading from leave-tree recruitment zones of variable width within 1 site-potential tree height from the channel. For the purpose of this analysis, a distinction is made between a *riparian buffer* and a *LWD recruitment zone* within the buffer where a specified density of mature trees is left for the purposes of long-term LWD recruitment.

The total potential recruitment zone was defined in this analysis as that portion of the valley floor and adjacent slopes within 1 site-potential tree height from the channel bank. This analysis considered three recruitment widths: 50 ft (15.2 m), 100 ft (30.5 m), and 150 ft (45.7 m). Recruitment widths are based on slope distance from the channel bank. Each recruitment area was calculated by multiplying the specified width by a constant channel length of 328 ft (100 m).

Keller et al. (1995) developed a functional equation relating density of old-growth redwood trees growing within 164 ft (50 m) of either streambank to LWD loading (m^3/m^2) in adjacent channel segments of Prairie Creek. Old-growth redwood trees dominated total in-channel LWD loading due to their large size and resistance to decay. In this analysis, LWD loading rates (m^3/m^2) based on stand densities were initially determined using a power function ($y=0.00006x^{2.019}$, $r^2=0.82$) fit to data from Keller et al. (1995) as shown in Figure 8-9. The relation between stand density and LWD loading is valid given the following *assumptions*:

1. The 164 ft (50 m) wide zone in which Keller et al. (1995) measured tree density encompassed the width of the recruitment zone.
2. Stand densities measured by Keller et al. (1995) encompass the range of stand densities found in redwood-dominated forests.
3. Trees within the 164 ft (50 m) wide recruitment zone are equally distributed and recruitment processes are uniform.

The cumulative percent of LWD recruitment from 50-ft, 100-ft, and 150-ft-wide recruitment zones was determined using three empirical LWD source-distance curves generated for second-growth redwood forests in the Caspar Creek basin (Reid and Hilton 1998, as cited in Peters 2000) Figure 8-10 illustrates these source distance curves.[14] Recruitment widths are based on the percent of 1 site-potential redwood tree height. A site-potential redwood tree height of 213 ft (65 m) is based on an average tree height of 164 ft (50 m) at 100 years for Site Class II (CDF 2001) multiplied by 1.2 to correct for the height of a mature tree at 200 years. We assumed for this analysis that tree density, recruitment processes, and cumulative recruitment in Caspar Creek forests where the three empirical relations were generated are similar to those of the Prairie Creek basin where the stand density to LWD loading relation was developed.

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14 Site names in Figure 8-10 do not correspond to site names in Reid and Hilton (1998); they are site names given by Peters (2000).

Although Caspar Creek and Prairie Creek have physically similar LWD input factors, such as channel slope, width, and gravel substrate, Prairie Creek contains a higher frequency of large diameter conifer trees located near the channel and higher LWD loading (Tally 1980, Keller et al. 1981, Napolitano 1998). Old growth conifer stands may contribute LWD to streams from greater distances than stands with younger, shorter trees (McDade et al. 1990). Stands comprised predominantly of smaller, second-growth conifers and riparian hardwoods may, therefore, lead to a much different pattern and density of LWD recruitment than that found in streams draining old growth forests. Napolitano (1998), for example, reports 26-52 large redwood trees per hectare and 49-268 kg of wood per square meter along Little Lost Man Creek (tributary to Prairie Creek); that is 2 to 7 times more than in North Fork Caspar Creek. Furthermore, stream channels in Prairie Creek are largely undisturbed, while stream channels in Caspar Creek were used extensively for transporting logs; this involved removing or blasting large rough elements from the channel and constructing splash dams. These activities have promoted increased hydraulic efficiency and reduced LWD retention decades following disturbance.

Over the term of our HCP/NCCP, MRC assumes that our efforts to recruit instream LWD by leaving trees and artificially placing LWD will achieve the higher rates of LWD recruitment seen in old-growth stands.

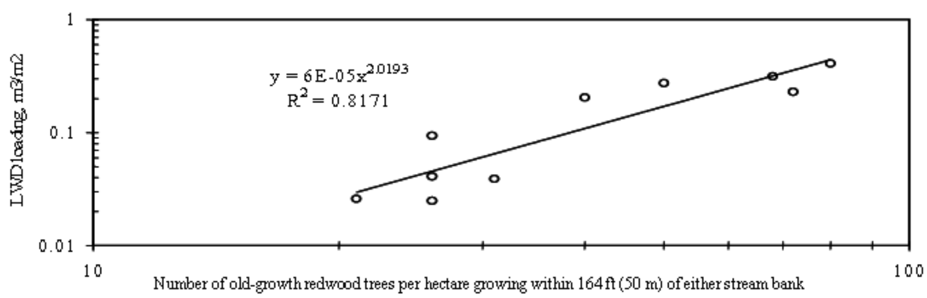


Figure 8-9 Relation between Redwood Tree Density and Instream LWD

LWD loading from a given recruitment zone was calculated by multiplying LWD loading values derived from the stand density relation (Keller et al. 1995) by the maximum and minimum cumulative percent LWD recruitment for the specified recruitment width (Reid and Hilton 1998). The resulting product adjusts LWD loading to recruitment within the specified width.

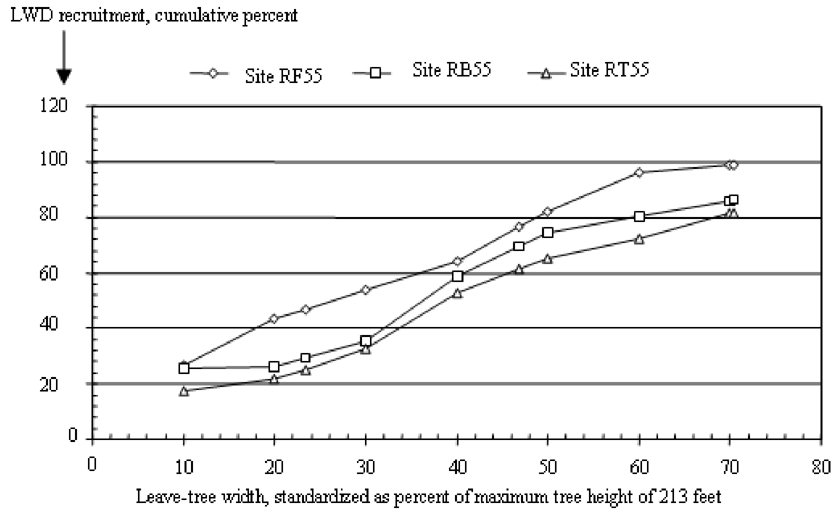


Figure 8-10 Source-distance Curves for LWD Delivery to Caspar Creek

DEFINITION	**Leave trees** are trees intentionally left standing after a harvest or thinning; the decision is a result of a predetermined management strategy.

Figure 8-11 describes the number of leave trees (per 100 m of channel length) required to reach LWD loading values for a given recruitment width. The value was calculated by multiplying the area of the recruitment zone on one side of the channel by the stand density (see Figure 8-9) associated with the LWD loading values. Because the recruitment zone is measured outward from the bank on one side of the channel, the resulting number of leave trees derived by this process pertains to one side of the channel. To meet long-term instream LWD loading objectives, an equivalent number of trees must be retained on the opposite side of the channel.

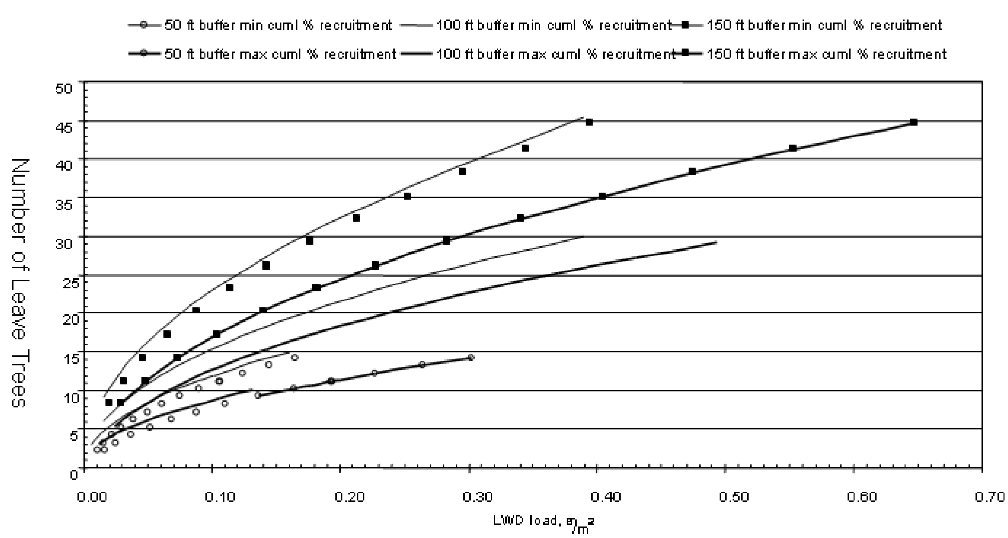


Figure 8-11 Leave Trees in Various Widths per 100 m of Channel

As of 2010, the estimated acres of AMZ in the plan area is 25,817; the proportion of AMZ acres within each site class is 4.3% in Site Class II (1108 ac), 93.1% in Site Class III (24,023 ac), and 2.7% in Site Class IV (686 ac). For our forestlands, MRC modeled tree numbers by size class within AMZ containing differing site classes; we projected forward for the 80-year term of our HCP/NCCP. Table 8-5, Table 8-6, and Table 8-7 show that, through the basal area retention for the AMZ, the number of large trees in the AMZ available for recruitment by varying site class categories will increase over the term of our HCP/NCCP.

Generally, across the plan area, Class I or Large Class II AMZs will meet the basal area trigger about 25-35 years after HCP/NCCP initiation; this will allow high retention selection harvests to occur. Using the modeled results at year 2035 for Site Class II and Site Class III, we concluded that retaining the largest 30% of trees greater than 12 in. dbh would yield 19 trees per acre. This estimate applies to a post-harvest situation.

MRC projects that a combination of riparian conservation measures for basal area and large tree retention will increase the number of large trees significantly over time. By 2035 there should be, on average, 17 trees greater than 24 in. dbh in Site Class II and Site Class III acreage; by 2075, their number should increase to 30. Using a range of 12-32 large trees retained per acre, MRC estimates 14-31 trees greater than 24 in. dbh per 100 m in Class I and Large Class II AMZ. We also estimate that the large tree retention for a 150-ft AMZ may result in LWD loadings ranging from 0.05-0.35 m^3/m^2, which is within the range of LWD loading observed in Prairie Creek, i.e., 0.05-0.31 m^3/m^2 (Keller et al. 1995). Some observations in Prairie Creek exceeded 0.31 m^3/m^2. These occurred exclusively in small channels that drain watersheds less than 1.5 km^2, considerably smaller than planning watersheds in the plan area.

Our analysis combines relations developed from old growth and managed redwood forest stands. Differences in recruitment processes and rates between old-growth and second-growth forests may significantly change the relation between standing tree density and LWD loading. In addition, our analysis focused on defining the number of leave trees necessary to establish a long-term supply of LWD from the buffer zone. MRC implicitly assumes in our analysis that standing tree density and LWD recruitment rate will remain constant despite changing stand characteristics and potential episodic loss of streamside trees from large floods, blowdown, and bank erosion.

Short-term recruitment may differ significantly from estimated long-term recruitment. The results of our analysis are best applied to settings where basin hydrology, valley geometry, and stand characteristics are similar to those in which the relations were developed. MRC will evaluate these parameters, as well as historical debris loading, at a given site before applying the method.

Given all these reservations, MRC still believes this model shows that LWD recruitment in the AMZ provided by our HCP/NCCP conservation measures can come close to providing the natural LWD recruitment levels demonstrated in Prairie Creek.

8.2.4.10 Fluvial transport of LWD

LWD that recruits to streams from adjacent riparian areas or from mass wasting can be relocated downstream through fluvial transport. This fluvial transport of LWD can impact LWD target ratings negatively or positively depending upon the sampling location.

Several characteristics of LWD influence its transport in streams, including size, density of pieces, and presence or absence of rootwads. Overall, smaller logs travel farther than larger pieces (Young 1994, Lienkaemper and Swanson 1987, both as cited in Braudrick and Grant 2000). The frequency of log movement increases with increasing stream size (Bilby 1985, Bilby and Ward 1989, Bilby and Ward 1991). Diameter strongly influences the depth of flow required to entrain and transport logs (Bilby and Ward 1989, Abbe et al. 1993). The presence of rootwads tends to influence transportation by affecting orientation, type of movement, and entrainment. Rootwads tend to anchor LWD (Abbe and Montgomery 1996). Unequal forces exerted on different parts of the log, including effects of rotation, must be considered when predicting entrainment (Braudrick and Grant 2000). Buoyancy is generally not a characteristic influencing LWD transport, as most debris is floating and only a few species contribute dense wood transported as bedload (Jacobson et al. 1999).

Several characteristics of streams influence LWD transport, including stream dimension, flow, sediment, and gradient. Low-order streams are susceptible to debris flows because they are adjacent to steep, landslide-prone slopes and because channels are narrow and high gradient (Swanson et al. 1982, Benda and Dunne 1997, Naiman et al. 1992 as cited in May 2002). In addition, in small streams large debris may influence channel morphology and sediment transport processes as streams may not have the capability to redistribute debris (Keller and Swanson 1979). Stream flow, which is partly a function of watershed and stream size, influences the size of LWD that can be transported as well as the frequency of debris jams. Debris jams tend to occur more frequently in streams with low stream discharge rates. In addition to stream flow, bed roughness may be a factor influencing movements, with coarse sediment being more likely to increase resistance (Braudrick and Grant 2000).

In first order streams, nearly 75% of the standing stock of organic matter is contained in organic debris dams. The proportion decreases to 58% in second-order streams and to 20% in third-order streams (Bilby and Likens 1980). Frequency of dams is higher in smaller streams. Lower discharge makes it possible for smaller pieces to form the framework of a debris dam and also makes it less likely that a large piece of debris will be dislodged and carried downstream. Legacy wood (often unrelated in species or in size to the present day forest) can be stored for long periods in small streams even if the area has recently undergone extensive harvesting (May 2002). The highest reported quantities of woody debris (660 Mg/ha) are found in streams draining basins of less than 2471 ac (1000 ha) and flowing through old-growth coastal redwood stands in north coastal California (Keller et al. 1986, as cited in Lienkaemper and Swanson 1986). Streams of similar size flowing through other types of old-growth coniferous forests in northwestern North America contain 100 to 300 Mg/ha (Harmon et al. 1986, as cited in Lienkaemper and Swanson 1986).

Logs tend to be stable when more than half their length is outside the channel because less of the piece is exposed to flow (Lienkaemper and Swanson 1987). Piece length appears to be the most important factor influencing the stability of a log that is oriented parallel to flow (Abbe and Montgomery 1996, Nakamura and Swanson 1994, both as cited in Braudrick and Grant 2000). Most mobile pieces are shorter than bankfull width (Nakamura and Swanson 1994). Braudrick and Grant (2000) showed that the two most important factors influencing LWD entrainment are orientation of the piece and the presence or absence of rootwads. Diameter strongly influences depth of entrainment depending on substrate size (Braudrick and Grant 2000).

The likelihood of a log jam is higher in low-order streams. Congestion of pieces increases with increase in particle interaction (Braudrick et al. 1997). The ratio of log diameter to water depth (D_{log}/d_w) and the ratio of log length to channel width (L_{Log}/w_c) appear to be important factors in initiating log jams (Abee et al. 1993, Nakamura and Swanson 1994, both as cited in Braudrick et al. 1997). In studies conducted by Braudrick et al. 2000, the type of transport regime—congested, un-congested, or semi-congested—depended mainly on the ratio of log volume delivered to the channel per second (Q_{log}) to discharge (Q_w), varying between 0.015 for un-congested and 0.20 for congested areas

During monitoring and especially through focus watershed studies, MRC collects most of the data relevant to LWD transport on our land, including size, presence of rootwads, and location on or beneath earth's surface. Based on our understanding of this data, we have proposed conservation measures for placement of LWD in Class I watercourses (C§8.2.3.6-1 through C§8.2.3.6-20).

8.2.4.11 Shade retention and stream water temperature

Removal of tree canopy following logging can increase the amount of solar radiation reaching a stream (i.e., loss of stream shade), causing increased maximum temperatures and greater diurnal fluctuations (Beschta et al. 1995). Temperature increases are typically greatest during summer (MacDonald et al. 1991), when stream temperatures are naturally at their peak due to maximum incident radiation. Because the influence of solar radiation diminishes with increasing stream depth and discharge, these effects tend to be greatest in small streams (Beschta et al. 1995, Spence et al. 1996). Long-term effects of timber management on stream temperatures depend on a number of interrelated factors, including spatial distribution of harvesting, amount of overstory canopy removed, and management of riparian vegetation following harvesting (Beschta et al. 1995, Spence et al. 1996). Orientation of a stream (e.g., north-south vs. east-west), steepness of adjacent hillslopes, and amount of groundwater and subsurface flow can also affect the magnitude of temperature increase following riparian canopy removal (Cafferata 1990, Beschta et al. 1995, Murphy 1995).

Canopy cover is important in reducing the net gain of solar radiation. Stream water temperature responds to the input of solar radiation and is directly proportional to exposed stream surface area (Brown and Krygier 1970) and inversely proportional to discharge (Sullivan et. al. 1990). Wide stream exposures receive greater solar radiation then streams with good canopy cover and narrow solar exposure. Several studies have shown that an intact streamside forest canopy will shade streams and minimize increases in summer water temperature. Brown and Krygier (1970) found diurnal variations in a well-shaded coastal Oregon stream to be less than 1^0 C. However, complete removal of the forest canopy has been shown to increase summer maximum temperatures 3-8^0 C (see Beschta et. al. 1987). In a comparison of 20 years of temperature records from Steamboat Creek, Oregon, Hostetler (1991) found that streamside canopy cover was the most important variable linked to changes in stream temperature.

MRC expects our AMZ retention standards for canopy and large trees to ensure adequate streamside shading and maintain cool stream temperatures. Increased canopy closure—85% in the inner band of the AMZ—will ensure solar deflection and direct shading from trees over watercourses. The inner and middle bands of Class I and Large Class II AMZ will retain the largest percentage of trees. Retaining these largest trees along the watercourse will ensure that they are able to grow to tall heights. In the appropriate hillslope aspect (i.e., the south banks of streams), tall trees will help deflect solar radiation that cannot be deflected by direct canopy over or adjacent to the watercourse. Upslope, our long-term strategy is to use uneven-aged management to effectively extend the angular canopy of the riparian zone and provide an extra measure of protection for streams. Table 8-8 **s**hows the average tree height and number of trees per acre greater than 24-32 in. dbh and greater than 32 in. dbh projected for Class I and Large Class II watercourses across the plan area.

After approximately 25-30 years, the average height of trees greater than 24 in. dbh approximates the lower end of the range for a redwood tree height (133 ft) in Site Class III. After approximately 65 years, the average height of trees greater than 24 in. dbh approximates the upper end of the range of a redwood tree height (150 ft) in Site Class III. Furthermore, the number of trees of this size increases. MRC anticipates that this increase in average tree height and number of larger trees in Class I and Large Class II AMZ will improve the stream shade potential of AMZs.

MRC will experiment, through adaptive management and AMZ restoration harvests, with different levels of canopy retention based on various factors: (a) aspects of the stream and adjacent riparian stands; (b) proximity of the stands to the coast with its fog and cool temperatures; and (c) size of the watershed. Our purpose is to improve shade retention guidelines and stream temperature management. Sullivan et al. (1990) developed a concept of threshold distance, i.e., distance from the watershed divide where stream temperature was no longer a function of streamside canopy but a function of air temperature. They suggested this threshold distance from the watershed divide is 40-50 km in Washington State. Stream temperature analysis from coastal northern California (Lewis et. al. 2000) suggests the threshold distance may be 70 km from the watershed divide.

8.2.4.12 Riparian microclimate maintenance

The riparian zone functions as a significant regulator of microclimate, affecting both terrestrial and aquatic environments. The most substantial microclimate controls provided by the riparian corridor include

- Regulation of humidity.
- Interruption of wind velocity.
- Modification of both soil and air temperature.

These functions may have cumulative effects on species within the AMZ and can be routed from headwaters to downstream reaches.

Riparian vegetation effectively works to increase relative humidity by filtering solar radiation and reducing wind velocity (FEMAT 1993, Brosofske et al. 1997). Relative humidity and wind velocity can have modest effects on water quality and, therefore, are not conveyed downstream. They do directly affect covered species residing within Class I and Class II streams and the AMZ. Changes in these functions within the riparian zone can influence the migration and dispersal of flying insects that may be a significant portion of the anadromous salmonid and amphibian prey base (Brosofske et al. 1997, Chen et al. 1995). In addition to food implications, amphibians rely on high levels of relative humidity and reduced levels of wind velocity to prevent dehydration and to ensure that proper respiratory functions can be carried out (FEMAT 1993, Brosofske et al. 1997).

By reducing solar radiation, riparian vegetation also moderates air temperature. Air temperature, like humidity and wind velocity, influences the migration, dispersal, and productivity of flying insects that are food for salmonids and amphibians (Chen et al. 1995). Similarly, amphibians require cool temperatures for respiratory functions and dehydration prevention (FEMAT 1993, Brosofske et al. 1997). In addition, air temperature has a direct influence on water temperature and evapotranspiration rates (Ledwith 1996). Water temperatures and levels affect survival and growth rates of covered species within Class I and Class II streams; changes in these water quality conditions can be routed downstream.

Soil temperature, which is lowered through the action of riparian vegetation, is another microclimate condition that impacts stream systems at the site and downstream. Water temperature is influenced by soil temperature within riparian areas and even upslope regions (Brosofske et al. 1997, Welsh et al. 2005).

Opening canopies in riparian zones may result in modification of climate and landscape processes at the scale of the drainage basin (Chen et al. 1999). Uneven-aged management, as MRC practices, prevents clearcuts adjacent to streams, except for rehabilitation of hardwood-dominated stands or conifer stands with poor growth. MRC will limit these restoration treatments and their effects on stream water temperature through adaptive management.

MRC anticipates that our forest management upslope from streams will influence microclimate. However, various AMZ protections should make this influence minimal, particularly the use of an outer band on the AMZ to buffer the inner and middle bands. Moreover, our harvest methods of selective and variable retention will result in varying tree retentions providing some buffers to riparian micro-climate.

8.2.4.13 AMZ restoration treatments

AMZ restoration treatments will improve riparian function by promoting development of late seral conifer stands. Through active management, this will provide, in the long term, improved LWD recruitment and shade for watercourses. AMZ treatments will take into account water temperatures necessary for coho salmon, steelhead, and coastal tailed frogs, as well as slope stability to minimize mass wasting.

To meet riparian function, one biological objective of our HCP/NCCP is to improve tree species composition and move toward pre-management levels. This requires conversion of hardwood-dominated stands, created from past silvicultural practices, to stands dominated by redwood and Douglas fir. Table 3-19 shows the distribution of acres in the plan area with a significant hardwood component.

As of 2011, 42% of the plan area has a significant hardwood component; this includes the AMZ. Certainly disturbances from fire or mass wasting made this hardwood component fluctuate over time. The climax species, however, for the majority of the plan area is conifer. Conifers grow taller and larger than hardwoods and provide larger, longer-lasting LWD for instream habitat. In addition, they produce multi-storied canopy to shade streams and intercept rainfall. Restoration harvests will accelerate small conifer stands with poor growth toward late seral conifer stands which promote riparian function. Moreover, conifers are commercially more viable than hardwood species.

MRC wants to better understand how to reduce the risk of increased water temperatures. Such increases could adversely impact, in the short term, aquatic species covered in our HCP/NCCP. The majority of AMZ restoration treatments will be in the middle and outer bands of the AMZ of Class I and Class II watercourses. Maintenance of stream temperature will limit the amount of treatment in the inner band. Vegetation closest to the stream, in the inner band of an AMZ, has the greatest influence on stream shading. Therefore, MRC will retain at least 70% canopy in the inner band and will not conduct restoration treatments there if stream temperature exceeds the MWMT upper threshold (Table 8-12). This is specifically to protect cold water species covered in our HCP/NCCP—coho salmon, steelhead, and coastal tailed frogs.

The MWMT upper threshold of 18°C for coho salmon was derived from Welsh et al. (2001), who observed in the Mattole River watershed that coho salmon were not likely to be present in a stream if the MWMT exceeded this level. Our own data on fish distribution and stream temperature indicates that the majority of streams in the plan area with coho salmon have MWMT levels between 16-18°C; this defines the middle threshold. MWMT levels below 16 °C do not present stressful conditions for coho salmon; therefore, this defines the lowest temperature threshold.

Examination in the plan area of fish distribution and stream temperature data for steelhead does not indicate any apparent MWMT threshold. There are streams and rivers where the MWMT is as high as 26°C and juvenile steelhead are present. This suggests that steelhead can exist in higher stream temperatures than coho salmon. In the absence of a published threshold for steelhead, MRC will use a conservative MWMT of 21° C for the upper temperature threshold; this is 3 °C higher than the threshold for coho salmon. Steelhead are commonly found in streams in the plan area with temperatures between 17-21° C; this defines the middle threshold for steelhead. MWMT levels below 17 °C do not present stressful conditions for steelhead; this defines the lowest temperature threshold.

MRC chose a 15% restriction, based on water temperature and species present, for restorative treatments along a linear distance of watercourse within a planning watershed. This appears to be a reasonable level to limit streamside disturbances yet also provides MRC with the opportunity to meet our restoration objectives for riparian stands. The percent of stream length with restoration treatments is limited by a 10-year time frame to ensure sufficient re-growth prior to further restoration treatments. MRC will phase in the restoration treatments slowly in conjunction with monitoring to ensure that the restoration treatments proposed do not create adverse conditions.

The AMZ provides protections that may also lower risk of sediment delivery from mass wasting sediment. The conservation measures that apply for mass wasting hazard still apply when AMZ restoration treatments are used. The exception to this is on steep streamside slopes (not inner gorge slopes) in TSU1 and TSU2. On steep streamside slopes, AMZ restoration treatment must maintain 50% overstory canopy for slope stability. MRC will avoid extreme mass-wasting hazards, such as inner gorge topography or active landslides, in our restoration treatments.

8.2.4.14 Class III AMZ silvicultural treatments

The high amount of hardwood-dominated acres within Class III AMZ will require unique silvicultural treatments, such as restoration harvests. Table 8-14 shows the estimated amount of harvest required to treat significant hardwood components during the first 25 years of our HCP/NCCP. To limit the impacts of Class III restoration treatments, MRC will only treat 15% of a watercourse length within each decade.

Table 8-14 Estimated Amount of Acres in Class III AMZs within the Plan Area

Inventory Block	Estimated Acres of Class III AMZ [2]	Estimated Hardwood Acres in Class III AMZ [1,2]
Albion	1258	142
Big River	2813	1404
Garcia River	1249	538
Navarro East	2534	956
Navarro West	1977	852
Noyo	1628	470
Rockport	3224	1759
South Coast	2865	1147
Ukiah	301	173
TOTAL	17,850	7440

TABLE NOTES

[1]Data includes vegetation strata containing mixed conifer/hardwood and mixed hardwood.

[2]Measurements of Class III watercourses are from sample THP maps. Results of these calculations showed that for the plan area an average of 4.2% of harvest unit acres were in Class III AMZ with a range of 0-13%. Calculations assumed a 50-ft buffer on each side of all Class III watercourses.

8.2.4.15 Streambank stability

Sediment delivery to streams can originate from different sources and be influenced by different factors. In steep, dissected, and soil-mantled hillslopes of the humid and forested Pacific Northwest region, mass wasting processes (i.e., landslides, creep, and biogenic transport) are naturally a dominant source of erosion on hillslopes and a source of sediment delivery to stream channels (Swanson et al. 1982, Dietrich et al. 1986, Dietrich et al. 1998, Roering et al. 1999). Stream bank failures are a product of undercutting and tend to be more numerous in lower parts of basins (Kelsey et al. 1995). Stream bank failure is a naturally occurring process. Its primary cause is erosion from stream processes, such as meandering, where flow impingement concentrates hydraulic force to the outer banks of meander bends causing retreat across and down the valley. Eroded bank material is transported downstream to the next point bar, where outer bank erosion is balanced by bar deposition and advance. Other causes can include heavy rainfall and debris jams. The extent to which such erosion occurs, however, depends on topography, soil composition, bank vegetation, precipitation patterns, as well as human impacts. In some areas with stable slopes, natural erosion of stream banks contributes only a small amount of overall sediment input into the stream channels. In other watersheds, however, it can be a larger percentage of the total input.

Table 8-15 Sediment Delivery to Stream Channels from Stream Bank Erosion (1942-1997)

Sediment Delivery to Stream Channels from Stream Bank Erosion				
Selected Watersheds in the Redwood Region				
Watershed	% Natural Stream Bank Erosion[b]	% Management Related Erosion[c]	Years Analyzed	Source
Freshwater Creek	9	<1	1942-1997	PALCO 2001
Upper Freshwater	20	1		
South Fork	8	1		
Graham Gulch	5	1		
Cloney Gulch	7	0		
Little Freshwater	1	0		
McCready Gulch	2	0		
Lower Freshwater	4	0		

Sediment Delivery to Stream Channels from Stream Bank Erosion				
Selected Watersheds in the Redwood Region				
Watershed	% Natural Stream Bank Erosion[b]	% Management Related Erosion[c]	Years Analyzed	Source
School Forest	0	0		
Grouse Creek	0		1976-1989	Raines 1998
Navarro River[a]	3		1975-1998	USEPA 2000
Redwood Creek	12		1954-1997	USEPA 1998b, Redwood National and State Parks 1997

TABLE NOTES
[a] The plan area is partly in this watershed
[b] Natural processes, such as stream meandering or heavy rainfall, induce stream bank erosion.
[c] Management for fish habitat induces stream bank erosion; bank erosion is influenced by the presence of railroad ties and corduroy roads in the streambed, erosion of sediments deposited in the stream during previous harvest activities (skid trails in the channel), and erosion-related adjustment of headwater channels following the first-cycle harvest.

Bank erosion in second growth redwood was estimated in the Van Duzen watershed (Humboldt and Trinity Counties). Relatively high rates of bank erosion (average 0.11 m/yr) were found when compared to old growth redwood stands in Prairie Creek (average 0.014 m/yr). This difference appeared to be the result of large floods and of channel meandering and migration against erosion-prone banks. In both old and second growth sites, wood recruitment from sources other than landsliding generally originated 65-131 ft (20–40 m) from the stream; wood recruitment from bank erosion was approximately within 16 ft (5 m) of the stream (Benda et al. 2002). In Prairie Creek, bank erosion was responsible for more than 50% of wood volume. The proximity of tree-fall to the channel suggests, however, that mortality is higher closer to the stream. This is due perhaps to wetter soils and susceptibility to windthrow from opened canopy near the channel rather than bank cutting.

Table 8-15 shows that bank erosion is fairly small in watersheds in the Coast Range of northern California. MRC will address bank stability through (a) retention of streamside vegetation, (b) increased vegetation retention within flood-prone and channel migration areas, and (c) exclusion of equipment adjacent to Class I and Class II watercourses.

Data from MRC timber inventory indicates that coast redwood and Douglas-fir trees with 36 in. dbh have crown diameters, on average, of about 25 and 36 ft, respectively. The root strength of conifers declines sharply at distances beyond the radius of the tree crown (FEMAT 1993). With diameters of 25 and 36 ft, the radius of the crown minus the radius of the tree stem is approximately 11 and 16.5 ft respectively (using a 36 in. diameter stem). The 10-ft distance for *no harvest* of single stemmed trees encompasses the majority of a crown radius of a mature tree and provides a consistent measurement for easy implementation. To ensure root structure is present, particularly for undercut banks, MRC will retain all trees that have their roots exposed in the bank. If a rootwad is a redwood clump, we will retain 50% of the stems following a harvest. In addition, we will measure the 10-ft bank stability zone from the start of the undercut bank.

8.2.4.16 Surface erosion in the AMZ

Erosion and the deposition of sediment are natural events. Erosion results from wind, water, gravity, and other processes. A certain amount of erosion can be vital to both terrestrial and aquatic ecosystems. Gravels, for example, continuously move downstream and create spawning beds for fish. When natural erosion is intensified by human land use, it can result in loss of soil or sediment build-up in streams that threatens fish survival.

Riparian areas provide function as "filters" for un-channeled fine sediment originating on roads, skid trails, and tractor landings. Their effectiveness in this capacity depends on (a) sediment size; (b) hillslope gradient; (c) infiltration rate; (d) structural characteristics of the vegetation and litter layer; and (e) runoff characteristics (Johnson and Ryba 1992). Studies reviewed by Johnson and Ryba (1992) suggest that the relationship between the width of a riparian buffer and the efficiency of its vegetation to remove sediment is non-linear. For example, studies indicate that the width of riparian buffer would need to be doubled in order to increase the efficiency of sediment removal from 90 to 95%. On slopes less than 50%, Broderson (1973, as cited in Spence et al. 1996), found that a buffer width of 50 ft (15 m) controlled most sediment.

Much of the sediment (both fine and coarse) that reaches stream channels, however, is transported by channel flow. Runoff from roads and inboard ditches along roads often reach at least an intermittent tributary without passing through a riparian area. Debris torrents and debris slides generally have enough energy to travel through any riparian area in their path. At least on steeper slopes, gullies from concentrated road drainage have the same ability. In specific situations, riparian buffers may trap fine sediment before it reaches a watercourse, but riparian protection should not form the basis of a program to reduce sediment input to stream channels (Spence et al. 1996). The emphasis on greater vegetation retention and fewer disturbances closer to a watercourse in the AMZ (inner band) will limit exposed soils that can deliver to watercourses by surface erosion. This will reduce the flow paths and delivery of sediment from roads and mass wasting.

8.2.4.17 Nutrient cycling

The function of the riparian zone on nutrient supply, storage, and cycling is vital to an aquatic ecosystem. Nutrients and particulate organic matter can move in both downstream and lateral directions, and thus have several important effects on covered species and their food base.

Riparian vegetation is the primary supplier of nutrients for most streams; it provides allochthonous inputs to all reaches. Direct litterfall, in addition to lateral movement of organic debris within the riparian zone, provides an energy base for streams and supplies nutrients for aquatic organisms that are transferred through food webs (Gregory et al. 1991). For example, invertebrate production relies heavily on allochthonous production, which is initiated in headwater reaches. This production then benefits salmonids and amphibians that reside in lower reaches by enhancing their prey base. As this material moves downstream, species abundance and composition will be affected according to levels of this input and degree of processing (Vannote et al. 1980). Constant breakdown of LWD provides a buffer for the energy base of the biota during periods when few leaves or needles are available (Swanson et al. 1982).

Cycling of nutrients within a riparian corridor is largely a function of its vegetation. Riparian vegetation not only supplies nutrients in the form of organic debris, but also regulates the amount of dissolved nutrients entering a stream through active uptake (Gregory et al. 1991). Riparian vegetation can leach nutrients stored in soils and allow excess nutrients to enter a stream during runoff events. The abundance and composition of this vegetation will determine the amount of nutrients extracted and routed downstream.

Finally, riparian vegetation provides for storage of materials. Surface roughness created by riparian vegetation within a floodplain captures and stores nutrient-rich particulate organic matter (Swanson et al. 1982). This trapped material is then exchanged at the land-water interface during periods of overbank flow. Materials are able to move both laterally and downstream during these periods (Gregory et al. 1991), and will consequently affect salmonids and amphibians.

The AMZ protections that MRC proposes provide for vegetation and protection of floodplains on all classes of watercourse, including those watercourses with no aquatic organisms present (Class III). These protections, we believe, should minimize the impacts that forest management has on nutrient cycling in the riparian zone.

Table 8-16 summarizes the rationale for proposing different levels of watercourse protection and the contribution of vegetation to riparian function.

8.3 Sediment inputs

8.3.1 Overview

8.3.1.1 Mass Wasting

It is neither necessary nor beneficial to eliminate all erosion. Some erosion is a natural part of a healthy ecosystem. Forest management, however, can increase incidence of mass wasting and delivery of sediment to streams. This, in turn, can damage aquatic habitat and threaten species dependent on that habitat. MRC proposes to minimize mass wasting and sediment delivery in the plan area. In this section, we address timber activities that can result in significant mass wasting:

- Road and landing construction.
- Use of existing haul roads and landings.
- Tractor yarding.
- Tractor trail construction and reconstruction.
- Timber harvest and site preparation.

MRC will minimize sediment delivery during covered activities. Activities will include PTHPs, road construction, and other forest management. MRC will analyze mass wasting and propose protection measures based on watershed analysis units. For example, we will control reductions in canopy to ensure that sub-surface water levels in a watershed are not significantly altered. This will reduce the likelihood of increased mass wasting from altered hydrologic processes.

MRC strategy emphasizes high protection near watercourses where the risk for sediment delivery from mass wasting is critical. This is especially true for inner gorge terrain and steep streamside slopes. MRC will promote the upslope integrity of hydrologic processes and tree-root strength through default conservation measures for specific terrain. Furthermore, MRC will retain larger trees to provide LWD to stream channels if a hill-slope failure does occur. Within each CalWater planning watershed across our timberlands, MRC will also retain at least 50% average overstory canopy to mitigate the effects of timber harvest on hydrologic changes at the watershed scale.

Table 8-16 Riparian Functions by Watercourse Type

Riparian Functions by Watercourse Type					
Riparian Function	**Processes Common to All Channels**	**Processes Directly Affected**			
		Class I	**Large Class II**	**Small Class II**	**Class III**
Definition					
		Fish bearing	Non-fish bearing but supports aquatic life (basin area >100 ac)	Non-fish bearing but supports aquatic life (basin area <100 ac) No year round flow	Supports no aquatic life or able to deliver sediment via surface flow to a Class I or Class II watercourse
Use by Covered Species					
		All life stages of Chinook salmon, coho salmon, steelhead, and coastal tailed frog	All life stages of amphibians	Winter use by amphibians, and summer use by red-legged frogs for hydration during migration	
Woody Debris Recruitment					
Contributes LWD	Riparian zone provides long-term input of LWD, which is recruited to a channel from windthrow, bank cutting and mass wasting.	Frequent formation of LWD accumulations	Routes LWD to Class I watercourses during high flow and mass wasting events	Routes LWD and SWD to Class I watercourses during mass-wasting events	Routes LWD to Class I and II watercourses during mass wasting events
	LWD stores coarse and fine sediment, provides grade control and channel stability, and collects smaller woody debris (SWD).	LWD creates channel and habitat complexity for salmonids and amphibians through pool formation and sediment sorting.	LWD and SWD can be stable with periodic to frequent accumulations.	LWD provides habitat complexity for amphibians.	Residency time is relatively long, which reduces gullies.
	Size of wood required for stability in channels increases with channel size. Variable residency time depends on channel size, and thus the ability of LWD to function depends on size of woody debris and channel width. (Bilby and Ward 1989).	LWD sorts and supplies small organic material used by invertebrates as a food resource.	LWD provides habitat complexity for amphibians.	Residency time is relatively long; small and large pieces are stable.	Small and large pieces are stable.
	Constant breakdown of LWD provides "a buffer for the energy base of the biota during periods when few leaves or needles are available" (Swanson et al. 1982).	LWD traps anadromous salmonid carcasses that supply nutrients to the ecosystem.	LWD sorts and supplies small organic material used by invertebrates as a food resource.		Provides grade control for channel stability.

Riparian Functions by Watercourse Type					
Riparian Function	**Processes Common to All Channels**	**Processes Directly Affected**			
		Class I	**Large Class II**	**Small Class II**	**Class III**
Shade Retention and Water Temperature					
Provides shade	Riparian vegetation reduces solar input to streams to moderate stream temperature. Stream shading is also influenced by valley aspect. Shade provided by riparian vegetation influences autochthonous production by regulating available light (Vannote et al. 1980).	Overstory canopy provides the majority of shade on large channels to moderate summer water temperatures. Salmonids and amphibians require cool stream temperatures.	Overstory canopy and understory vegetation provide shade to moderate summer water temperature. Cool stream temperatures are necessary for amphibians. Stream temperatures can influence Class I stream temperatures downstream.	There is no flow in Small Class II streams during summer when temperature is a concern. As a result, Small Class II streams do not influence temperatures in Class I or Large Class II streams during summer.	There is no connection between Class III streams and Class I or II watercourses when temperature is a concern (summer).
Nutrients					
Supplies nutrients	Direct litterfall and lateral movement in the form of organic debris provides an energy base for streams, supplying nutrients for aquatic organisms that are transferred through food webs (Gregory et al. 1991).	Invertebrate production provides prey for salmonids and amphibians, and relies heavily on allochthonous inputs; however, this shifts to autochthonous inputs as stream size increases.	Invertebrate production provides food for amphibians and relies heavily on allochthonous inputs. Excess nutrients are transported downstream to Class I streams.	Invertebrate production relies heavily on allochthonous inputs, and invertebrate production affects amphibians. Excess nutrients are transported downstream during periods of flow.	Organic matter is stored and transported downstream during periods of flow.
Functions in nutrient cycling	Riparian vegetation uptake regulates amount of nutrients entering channels that will consequently be routed downstream (Gregory et al. 1991).	Nutrient production affects the prey base salmonids and amphibians, and is transported downstream.	Nutrient production effects the food base for amphibians, and nutrients are transported downstream to Class I streams.	Nutrient production affects the food base for amphibians, and nutrients are transported downstream during periods of flow.	Nutrients are transported downstream during periods of flow.
Traps nutrient-rich particulate organic matter	Surface roughness created by riparian vegetation within the floodplain captures and stores nutrient rich particulate organic matter (Swanson et al. 1982). This material is consequently exchanged at the land-stream interface during over bank flows. Entrained material can move laterally and downstream (Gregory et al. 1991).	Exchange of nutrients and particulate organic matter within the floodplain occurs during overbank flow, and this transfer affects salmonids and amphibians.	Exchange of nutrients and particulate organic matter within the floodplain occurs during overbank flow, and this transfer can affect amphibians.	Exchange of nutrients and particulate organic matter within the floodplain occurs during overbank flow, and this transfer can affect amphibians.	Floodplain processes are not a factor for Class III streams.

Riparian Functions by Watercourse Type					
Riparian Function	**Processes Common to All Channels**	**Processes Directly Affected**			
		Class I	**Large Class II**	**Small Class II**	**Class III**
Microclimate					
Regulates relative humidity	Riparian vegetation increases relative humidity by reducing solar radiation and wind within riparian environments.	Can influence migration and dispersal of flying insects that are prey for salmonids and amphibians (Brosofske et al. 1997, Chen et al. 1995).	Amphibians rely on high levels of humidity to prevent dehydration and allow respiratory functions (Brosofske et al. 1997, FEMAT 1993).	Amphibians rely on high levels of humidity to prevent dehydration and allow respiratory functions during periods of inhabitation (Brosofske et al. 1997, FEMAT 1993).	
Interrupts wind velocity	Riparian vegetation controls wind velocity and degree of wind penetration into riparian environments.	Can influence migration and dispersal of flying insects that are prey for salmonids and amphibians (Brosofske et al. 1997, Chen et al. 1995)	Amphibians rely on low wind velocity to prevent dehydration and allow respiratory functions (Brosofske et al. 1997).	Amphibians rely on low wind velocity to prevent dehydration and allow respiratory functions during periods of inhabitation (Brosofske et al. 1997).	
Moderates air temperature	Riparian vegetation lowers air temperature by reducing solar radiation within riparian environments. Air temperature directly affects water temperature and evapotranspiration rates (Ledwith 1996).	Can influence migration, dispersal, and productivity of flying insects that are prey for salmonids and amphibians (Brosofske et al. 1997, Chen et al. 1995). Salmonids and amphibians have specific thermal ranges for survival and reproduction.	Amphibians rely on cool temperatures to prevent dehydration and allow respiratory functions (Brosofske et al. 1997, FEMAT 1993).	Amphibians rely on cool temperatures to prevent dehydration and allow respiratory functions during periods of inhabitation (Brosofske et al. 1997, FEMAT 1993). Increased air temperatures can lower groundwater levels and soil moisture content, and may dry up intermittent streams. The lack of water in these reaches may deprive amphibians of an essential source of water during dry periods (Ledwith 1996).	
Moderates soil temperature	Riparian vegetation lowers soil temperature by filtering solar radiation within riparian environments.	Water temperature is influenced by soil temperature (Brosofske et al. 1997), and this can affect salmonids and amphibians.	Water temperature is influenced by soil temperature (Brosofske et al. 1997) and can affect amphibians and limit their dispersal (Chen et al. 1999).	Water temperature is influenced by soil temperature (Brosofske et al. 1997) and can affect amphibians and limit their dispersal (Chen et al. 1999).	

Riparian Functions by Watercourse Type					
Riparian Function	Processes Common to All Channels	Processes Directly Affected			
		Class I	Large Class II	Small Class II	Class III
Streambank Stability					
Enhances streambank stability	Intact roots as well as embedded and fallen logs within the riparian zone decrease erosion of banks, reduce water velocity, and promote the formation of undercut banks (FEMAT 1993, Sedell and Bescheta 1991, Swanson et al. 1982).	Salmonids depend on bank habitat for predator avoidance and refuge from high flows. Streambank failure and erosion can become chronic sediment sources.	Amphibians can use bank habitat as cover. Streambank failure and erosion can become chronic sediment sources.	Amphibians can use bank habitat as cover. Sediment delivery from bank failure is transported downstream during periods of flow.	Sediment from stream bank failure can be routed downstream, or delivered during mass wasting events.
Surface Erosion					
Prevents surface erosion	Riparian understory vegetation and associated downed debris, duff, and litter can filter sediment from overland flow off adjacent hillslopes (NMFS 2000c).	Salmonids are sensitive to fine sediment from surface erosion that can directly affect all life history stages (Spence 1996).	Amphibians are sensitive to fine sediment that can inhibit reproduction and foraging (FEMAT 1993).	Amphibians are sensitive to sedimentation that can inhibit reproduction and foraging (FEMAT 1993). Sediment inputs are routed downstream during periods of flow.	Sediment from overland flow is routed downstream.

Mass Wasting Site in the Plan Area

Although MRC is focusing our current and long-term strategy on uneven-aged management, some regeneration of even-aged stands will occur. There are various methods used to regenerate a stand with one age class, including clearcut, shelterwood, and seed steps. During such regeneration, MRC will follow default conservation measures for specific terrain. There will be no even-aged regeneration harvests within inner gorges or other areas of high risk for sediment delivery from mass wasting, such as historically active landslides. A small percentage of hardwood-dominated terrain with a high hazard for mass wasting will require some regeneration of even-aged stands in the initial decades of our HCP/NCCP. Within any 10-year period, this percentage will not exceed 5% of any high hazard terrain unit within a CalWater planning watershed area. MRC will track the percentage of regenerated even-aged stands in each CalWater planning watershed using a 10-year rolling system. The 5% of terrain requiring even-aged management cannot exceed 5 ac in each high hazard terrain unit within a PTHP. Section 8.3.4.5 provides further explanation and justification for the 5% limit on regenerated even-aged stands in high hazard terrain. This alternative to the default conservation measures will likely occur within the first 30 years of our HCP/NCCP, when hardwood conversion and forest restoration are taking place.

Watershed analysis has, as one of its components, an evaluation of the mass wasting and geomorphic setting and its sensitivity to sediment inputs. Mass wasting assessment in watershed analysis targets several objectives:

- Identification of the types of mass wasting processes in a watershed.
- Identification of possible links between mass wasting and forest management.
- Zoning of the plan area based on mass wasting potential.
- Estimation of the magnitude of sediment delivery from mass wasting processes.

DEFINITION

A **Terrain Stability Unit (TSU)** is a categorization of a land area based on terrain similarity, mass wasting potential, and sediment delivery risk.

For our HCP/NCCP, a California professional geologist supervised the identification of mass wasting processes and the zoning of the plan area into 8 TSUs. TSUs serve as a guide to foresters in determining areas of potential mass wasting hazard and suggesting appropriate management action to minimize risks to aquatic habitat.

For each TSU, MRC has default conservation measures. MRC may change default conservation measures through minor modifications to our HCP/NCCP (see section 1.13). Apart from these minor modifications, site, watershed, and plan changes require either adaptive management (see Chapter 13, *Monitoring and Adaptive Management*) or a major amendment to our HCP/NCCP (see section 1.13 and Appendix A, *Implementing Agreement*, section 9.0). Working with the wildlife agencies, MRC will ensure that any change to a default conservation measure does not increase the risk of sediment delivery from mass wasting.

In some cases, MRC will not complete watershed analyses by the time our HCP/NCCP takes effect. These instances will require additional field reviews by individuals trained in identification of mass wasting features, TSU categories, and risks of sediment delivery.

8.3.1.1.1 Implementation of mass wasting strategy at the project level

A project manager, in this case an RPF, will gather all available information on mass wasting issues in a project area. Information sources will include (a) MRC watershed analysis data, such as landslide and TSU maps; (b) landslide and geomorphic maps from the California Geological Survey; (c) designations of unstable areas from past PTHPs; and (d) other sources, if available. Such information will pinpoint potential features and hazards for mass wasting in a project area. MRC reports on anadromous salmonid and amphibian distribution will also help determine the level of risk to aquatic species from a proposed project.

With all this information at hand, MRC will conduct an initial field review. An individual trained by a professional geologist in identification of mass wasting hazards will make the initial determination. The field review will determine if, and where, historically active instability exists. It will also verify the precise location of TSU boundaries and evaluate downstream habitats. The reviewer will use a modified version of the California Licensed Foresters Association (CLFA) checklist for mass wasting (CLFA 1999). The modified *CLFA Checklist* is included in Appendix J (section J.1). The modification includes additional indicators of slope instability; this makes the checklist more comprehensive for identifying historically active landslides (i.e., those landslides that have experienced movement within the past 100 years). If required, an individual knowledgeable in the aquatic biological resources of the area may conduct a follow-up visit. This person will assess the relative sensitivity of the aquatic resource to mass wasting impacts. If, after field review and verification, questions still remain about high hazard slope stability, the reviewer will obtain approval of a professional geologist.

MRC will use all of this field analysis to determine if a proposed PTHP is compatible with our default conservation measures. If a PTHP is compatible, MRC will adopt the default conservation measures as our management plan for the project. If a PTHP is not compatible, MRC will either redesign the PTHP so that it is compatible with default conservation measures or append a report to the submitted PTHP by both a professional geologist and an individual knowledgeable in the relevant aquatic resources at risk.

Even if MRC proposes alternative conservation measures for a project, we must still address their risks to aquatic habitat and species. In effect, a professional geologist must prepare a report which evaluates key issues and concludes, based on a reasoned assessment of site conditions, that the proposed activities do not present a greater risk of sediment delivery from mass wasting than the default conservation measures. In addition, an individual knowledgeable in any relevant aquatic resources at risk must prepare a report. This individual will be an aquatic biologist, hydrologist, or fluvial geomorphologist—either an MRC employee or an outside consultant. The selected person must have knowledge of MRC biological monitoring, watershed analysis data, and the aquatic habitat or species in the area covered by the proposed alternative conservation measures. MRC will use the person best suited for the evaluation. For example, if mass wasting could affect the habitat of coastal tailed frogs, a biologist knowledgeable about these frogs will do the analysis. Likewise, if sediment aggradation in a Class I watercourse is blocking anadromous salmonid migration, a hydrologist or fluvial geomorphologist will examine the consequences of sediment delivery to the fluvial system. Most importantly, the professional geologist, the area manager, and the aquatic specialist must agree on the alternative proposal.

MRC intends to provide appropriate training to foresters that will allow them to identify hazards in the field—nothing more. If a forester identifies hazards in the field and the solutions proposed by management are in conflict with default conservation measures, a professional geologist and a person knowledgeable about the aquatic biological resources must perform a full assessment. Figure 8-12 outlines the decision-making process that MRC will use to determine the level of risk for mass wasting and sediment delivery.

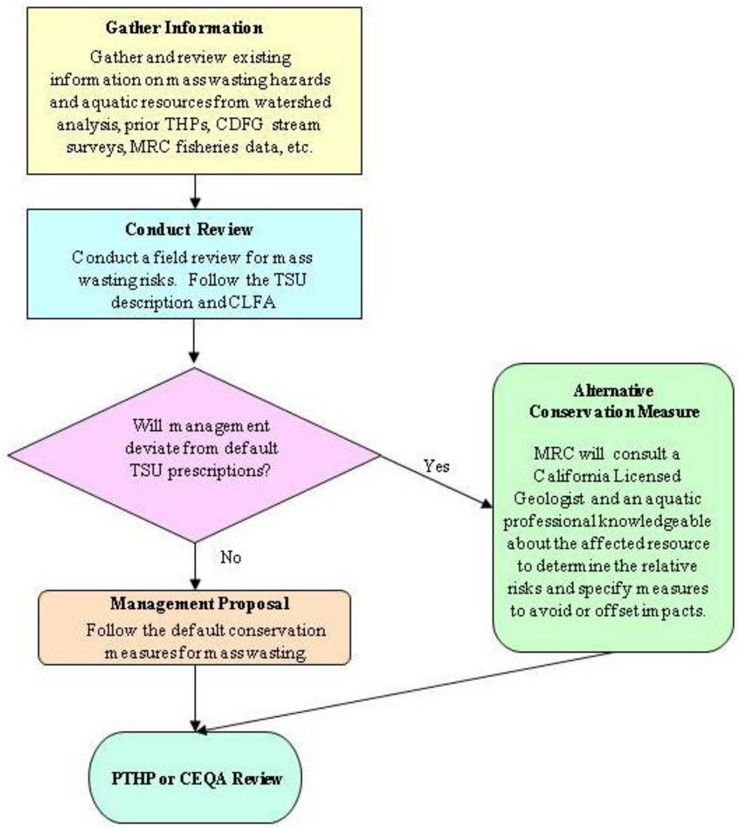


Figure 8-12 Decision Flow Chart for Mass Wasting Hazards

8.3.1.1.2 General description of TSUs and historically active landslides

Our HCP/NCCP refers to 8 TSUs, as well as historically active landslides (see HCP/NCCP Atlas, MAPS 5A-5C). The plan area has been intensively harvested over the past 100-150 years. During that time, numerous hydrologic events have also occurred which have triggered mass wasting. While problems created by management in the past persist today, it is also valuable to look at what did not happen—to look at actions of management that might have resulted in mass wasting or impacts to aquatic habitat but, in fact, did not. All of these observations help us to partition our land into areas of similar terrain stability.

Appendix G, *Watershed Analysis: Background and Methods*, contains illustrations and definitions of some of the geological terms used in the following descriptions and conservation measures for mass wasting, such as scarp, bench, and landslide.

TSU1

DEFINITION	**TSU1** is an area with steep slopes or inner gorge adjacent to low-gradient Class I and Class II streams.

An inner gorge can be isolated to one side of a stream channel. Steep channel banks are generally not considered inner gorge unless they extend upslope a minimum of 10 ft. The stream gradient is typically less than 6%.

The slope gradient within TSU1 is typically greater than 65% with planar slopes; concave slopes greater than 70% are the least stable. The upper extent of TSU1 is highly variable. Therefore, without a visible break in slope, only further field observation can define a TSU1. In some cases, the upslope boundary is defined by a prominent break in slope; this is classified as inner gorge (Figure 8-13). More often such a boundary is absent; this is classified as steep streamside slopes. Delineation of the upper boundary of steep streamside slopes is more subjective and based on professional judgment.[15] During terrain stability mapping, TSU1 is conservatively mapped as a continuous streamside unit; one factor considered in the delineation of the upper boundary of steep streamside slopes is the crown scarps of deliverable (or delivered) landslides to the watercourse transition zone. TSU1 captures shallow landslides typically found on steep slopes; these slides deliver sediment directly to a watercourse.

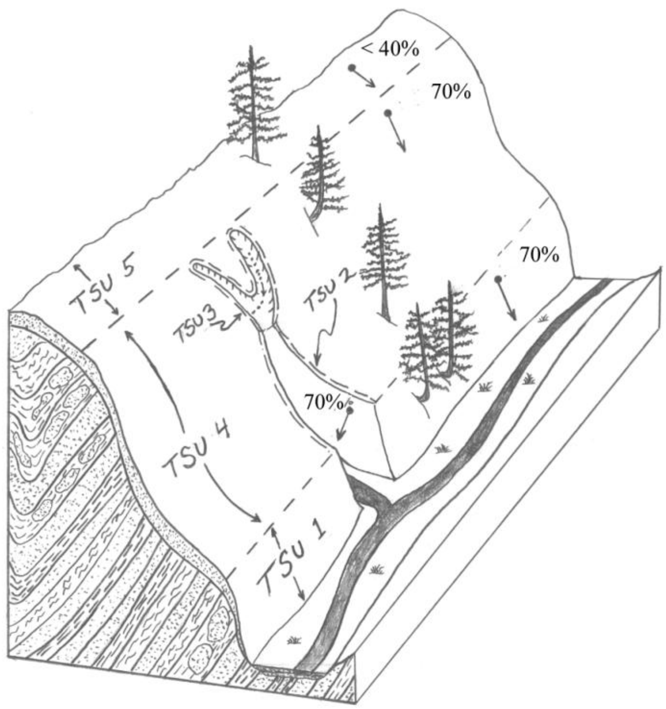


Figure 8-13 Defining TSU1

TSU2

DEFINITION	**TSU2** is an area with steep slopes or inner gorge adjacent to high gradient, intermittent or ephemeral Class II and Class III streams; the stream gradient is typically greater than 6%.

[15] Observations of past landslide activity within the general vicinity of a project area can help the reviewer determine the boundary definitions of TSU1 through TSU3. If, for example, an area has been intensively harvested and subjected to stressing storm events, and there are, as well, no crowns of old slides and no breaks in slope, the reviewer would likely not classify the area as a TSU1, 2, or 3 despite the steepness of slope. However, if there is evidence on gentler slopes than described in the TSU designation of landslides unrelated to roads and these landslides deliver to a watercourse, then the reviewer would classify the area as a TSU1, 2, or 3.

MRC intends to use this mapping unit when there is a high hazard for landslides along Class III or high-gradient Class II streams. While features and conservation measures are the same for TSU1 and TSU2, there are distinctions. TSU2 is, geologically, a more youthful topography with a higher gradient, more confined, stream channel; typically the streams are located higher in the watershed with a distinctly different aquatic habitat at risk.

TSU3

DEFINITION	**TSU3** is an area with primarily steep, convergent, and dissected topography located within steep swales or hollows.

Data from MRC watershed analyses suggests slopes are steep, typically greater than 70%. In addition, the slopes have been sculpted over geologic time by repeated debris slides. There is strong evidence of past landslides as well.

TSU3 does not constitute a continuous streamside unit, like TSU1 or TSU2. TSU3 usually represents isolated high-hazard areas. Headwall swale areas, or zero order swales, are found within TSU3. These are steep (> 70%) un-channeled swales located above Class III streams. Thick deposits of colluvium, which accumulate in the axis of the swale, may be the source for debris flows and torrents. Risk of sediment delivery from landslides is highly dependent upon local soil and bedrock properties, which are spatially variable in Franciscan geology; as such, the presence of past instability is usually an indicator of potential landslides.

TSU4

DEFINITION	**TSU4** is an area with moderate to moderately-steep hillslopes (typically 30-65%) with planar, divergent, or broadly convergent slope forms.

Steeper slopes (> 65%) may be present in this unit but show no evidence of instability or no means for sediment delivery should a landslide occur. TSU4 will occasionally contain areas of steep or strongly convergent slope forms or steep streamside slopes. Field visits can more accurately classify terrain into the appropriate TSU.

TSU5

DEFINITION	**TSU5** is an area with low gradient slopes (typically <30%), although locally steeper slopes may exist.

TSU5 occurs on broad ridge crests, low-gradient side slopes, and large low-gradient marine or river terraces. MRC intends to use this mapping unit to represent areas that have a very low risk of sediment delivery from landslides.

TSU6

DEFINITION	**TSU6** is an area with active or dormant earthflows or earthflow complexes.

TSU6 primarily occurs within Franciscan melange geology, which exists only in a few isolated locations in the plan area, e.g., Ackerman Creek. In addition to the risk for earthflow movement or initiation, TSU6 has a high likelihood of fluvial erosion or gullies when water is concentrated on soils.

During field visits, MRC may identify other TSUs in areas specified as TSU6. For example, areas of inner gorge along watercourses (TSU1 or TSU2) may suggest a very high risk for sediment delivery from landslides within TSU6. In these situations, MRC must weigh the considerations for each TSU, such as the processes for earth flow movement and shallow landslides, and implement the most protective conservation measures.

TSU7

DEFINITION	**TSU7** is an area within Franciscan melange geology that has accelerated creep not associated with any distinct earthflow or landslide.

There is a likelihood that earthflows or earthflow complexes could initiate in TSU7. In addition to the hazard for earthflow development, TSU7 has a high likelihood of fluvial erosion or gullies when water is concentrated on soils. This mapping unit can have similar topography and risk of landslides as TSU4. However, due to the higher rate of soil or rock creep, as well as weak-rock materials in the Franciscan melange geology, MRC classifies TSU7 as a separate map unit.

TSU8

DEFINITION	**TSU8** is a unique geological terrain with low gradient slopes (typically less than 30%) that have a very high potential for surface erosion.

TSU8 was delineated from published maps of outcrops in the Ohlsen Ranch Formation. This unit is white-gray, cohesionless, fine grained marine sandstone, which overlies the Franciscan in isolated locations without conformity. TSU8 has a low potential for slope failure because of its low gradient slopes. It has a high potential, however, for severe surface erosion if water is allowed to concentrate on roads, skid trails, and landings.

Historically active landslides

DEFINITION	**Historically active landslides** are areas which have undergone some type of movement within historic time (i.e., the last 100-150 years).

Historically active landslides are a subset of a TSU; as such, they are geographically smaller than a TSU. Our rationale for having a separate set of conservation measures for historically active landslides is to provide protection to portions of the landscape which have failed in the recent past and delivered sediment to a watercourse. Generally, because of the unfavorable geology and active tectonism of the Franciscan, the majority of the landscape has been shaped by mass wasting processes. Within the Franciscan, areas are more or less susceptible to mass failures and subsequent sediment delivery. The intention of our mass wasting strategy for historically active landslides is to acknowledge that there are locations where mass failures have historically occurred; without appropriate assessment, future failures will also occur that could result in sediment delivery to a watercourse.

Appendix J, *CLFA Checklist and Landslide Form*, gives the field indicators of historical activity. They generally fall into 4 categories:

- Topographic
  - Curved depressions
  - Hummocky ground
- Hydrologic
  - Disrupted drainage network
  - Seeps
  - Ponds
- Vegetative
  - Hydrophytes
  - Jackstrawed trees (tilted in various directions)
  - Linear strips of even aged trees
- Geologic/soils
  - Tension cracks
  - Anomalous erosion (gullies).

Typically, multiple indicators must be present to draw the conclusion that a landslide occurred in the last 100-150 years. Additionally, portions or blocks of a landslide may be historically active while other areas appear dormant. Our conservation strategy is conservative in that landslides are considered to be active if any portion of them shows signs of historical activity.

8.3.1.1.3 Use of TSUs

TSUs encompass all covered lands. In an effort to assess mass wasting hazards, MRC maps 8 TSUs, as well as landslides, during watershed analysis. Appendix G, *Watershed Analysis: Background and Methods* (section G.2.1.4), details the mapping methods. TSU maps are produced through reconnaissance mapping and ground truthing. They are similar to mapped soil series in that each TSU includes areas with different TSU values. Nevertheless, the scale at which MRC maps deep-seated landslides in watershed analysis cannot capture the subtleties of mountainous terrain.[16] Such maps are simply working hypotheses, confirmed or modified by foresters after field review. With new information, GIS generates new maps every 20 years for each watershed analysis. Moreover, GIS will update TSU maps as required and make them available for field staff.

Default conservation measures determine the land management applied to each TSU. Conservation measures apply only to specific terrain which fits a TSU description. For example, MRC may map steep streamside topography (TSU1) along a watercourse, but discover upon field review that isolated low-gradient terraces (TSU5) exist within the same area. These latter areas would then receive protections suitable for TSU5. Whenever there are competing conservation measures, MRC will use the conservation measure with the highest protection standards.

MRC has identified 2 deep-seated landslides in the plan area: earthflows and rockslides. Dormant earthflows are addressed in TSU6; active earthflows and rockslides are addressed in conjunction with the strategy for historically active landslides. A morphological feature created by a rockslide (toe, scarp, or body) may influence the classifications of TSU1 through TSU5. For example, MRC would classify areas in which over-steepened toes of a deep-seated landslide lie directly adjacent to a watercourse as one of the

[16] Typically MRC will use air photos (1:12,000 scale) and transfer the data to base maps (1:24,000 scale). The forester will also create a drainage map from an on-the-ground inspection at the project level.

streamside TSUs—TSU1 or TSU2. Likewise, if the crown or lateral scarps are over-steepened, MRC would map the area as steep mid-slope terrain—TSU3.

In MRC watershed analysis, rockslide maps are super-imposed over a TSU map. This is to ensure that we consider both the rockslide hazards and the terrain hazards. A person trained in identification of mass wasting features, TSUs, and risks of sediment delivery will evaluate the mapped landslides for historical activity, using the *CLFA Checklist* in Appendix J (section J.1), and determine the need for professional geologic review.

8.3.1.1.4 Training in mass wasting hazards

MRC will train our staff to identify unstable areas and risks of sediment delivery. A California Registered Geologist, knowledgeable in issues of both slope stability and forest management, will conduct the training. Any MRC employee who will perform field reconnaissance for unstable areas or TSU locations must attend training. The training program will be 2-tiered (Figure 8-14).

- Tier 1 of the program, required for all employees who will perform field reconnaissance and have not previously been trained, will focus on identification of unstable areas and risks of sediment delivery. The course will address (1) how to interpret watershed analysis and field information, including map review; (2) terminology; and (3) mass wasting attributes.

- Tier 2 of the program will offer a refresher course every 5-7 years to those who have completed Teir-1 training. It will review updates in terminology, regulations, and watershed analysis, as well as new research relevant to mass wasting hazards.

MRC will design the training program. In doing so, we will invite geologists from the wildlife agencies, the California Geological Survey, and the regional Water Quality Control Board to assist in its development and delivery. In addition, we will periodically query the wildlife agencies and other appropriate parties (including, but not limited to CGS and RWQCB) to determine if new knowledge should trigger a refresher course.

8.3.1.2 Roads, skid trails, and landings

Proper management of roads, landings, and skid trails is important to reduce sediment inputs; promote quality habitat for aquatic species; protect beneficial uses of water; provide efficient infrastructure for forest operations; extend protections to terrestrial wildlife species; and limit the introduction of invasive species and pathogens.

The MRC road strategy emphasizes assessment, upgrade, and repair of our roads, landings, and skid trails. Our roads are primarily for timber harvest and forest management with some recreational use. MRC will follow standards for road upgrades, maintenance, decommissioning, construction, and use. These standards apply to

- Road and landing construction and reconstruction.
- Road inspection and maintenance.
- Road and landing closure and decommission.
- Road use restrictions.
- Water drafting from watercourses or ponds.
- Design, construction, maintenance, decommissioning, and use of skid trails.

All of these standards are included in Appendix E, *Road, Landings, and Skid Trails*, and Appendix F, *Road Inventory Protocol*.

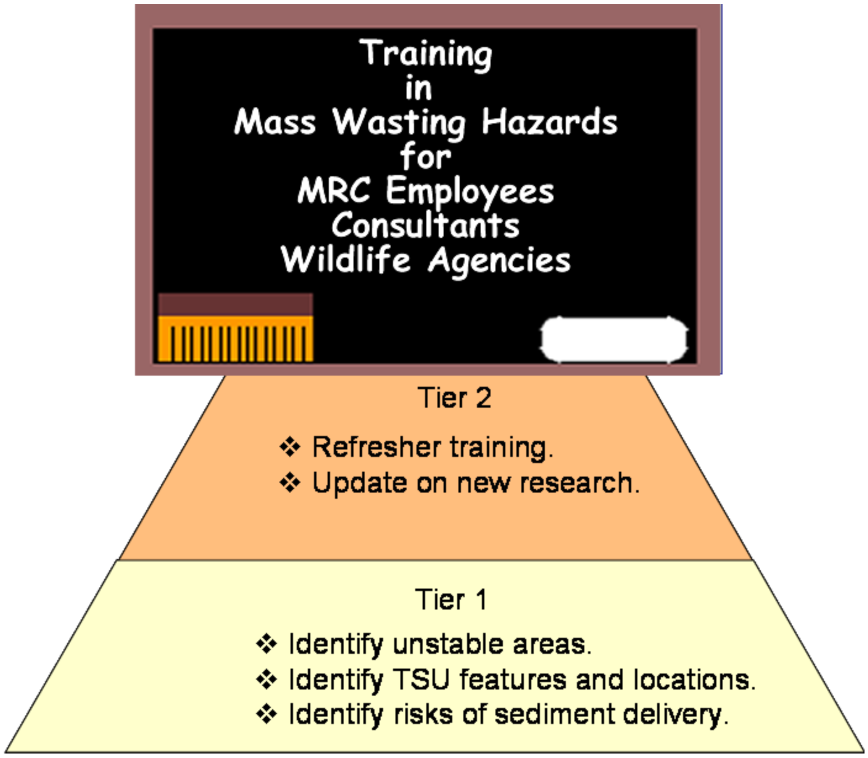


Figure 8-14 Training in Mass Wasting Hazards

Following the road standards in Appendix E, MRC will construct roads to facilitate harvests within the plan area. Historically, roads within the plan area were constructed near streams. Advancements in harvest methods now allow trees to be harvested uphill, away from stream zones, instead of downhill near the streams. This necessitates construction of roads upslope and decommissioning of roads near streams. With this re-designed road network, MRC expects that new road construction will slow down substantially within 20 years of HCP/NCCP commencement. By Year 40 of our HCP/NCCP, 95% of roads should be in place. MRC expects some new road construction throughout the term of our HCP/NCCP, however, as environmental factors and more advanced logging technology make new routes necessary.

8.3.1.2.1 Road inventory and information management

Road Inventory

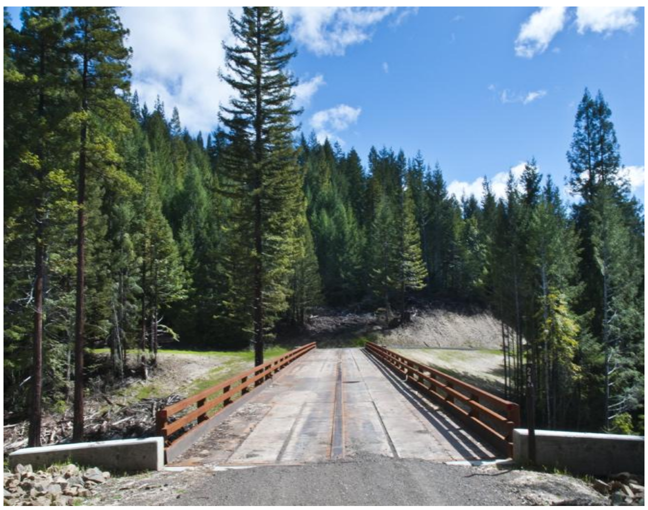
MRC has developed and implemented a road inventory program. It consists of a complete inventory of truck roads in the plan area. The inventory tracks roads and road features with a Global Positioning System (GPS). Road features include road segments, watercourse-crossings and structures (culverts, bridges, etc.), landings, erosion features, rock pits, gates, road slides, waterholes, and spoil piles. For each road feature, MRC has inventoried design specifications, such as dimensions, material type, road surface material, road prism, sediment delivery, and treatment immediacy. Appendix F, *Road Inventory Protocol*, provides further detail.

During our road inventory, MRC collects information on past sediment delivery for each road feature and its associated *controllable erosion*. Controllable erosion is a term developed by the North Coast Regional Water Quality Control Board for Total Maximum Daily Load (TMDL) purposes. It is a condition that could deliver soil to a watercourse during the next 40 years—the duration of a TMDL. Three important points qualify this definition of controllable erosion:

- Human action created the condition.
- Human action can, to a greater or lesser extent, control the condition.
- The condition, if uncontrolled, has the potential to deliver sediment.

Typically, controllable erosion is a measure of fill material in a road that could erode into a watercourse. During road inventory, MRC evaluates the required treatment for all sites with controllable erosion. In addition, MRC inventories any potential diversion for crossings or drainage structures.

In 2011, the MRC road inventory was approximately 90% complete; we will complete the road inventory by the end of 2012 (see Table 7-3). The road inventory will be ongoing and all roads with permanent structures (culverts or bridges) will be re-inventoried within a 10-year interval (2020, 2030, 2040, etc.). The re-inventory effort will update the information on new roads and changes to existing roads and provide an ongoing inspection of the entire MRC road network.




Camp Creek Bridge (Navarro East Watershed) was designed by Morris Engineering Co. and completed by Skip Gibbs Co. in October 2010. The MRC Navarro Road Department (NRD) removed 20,000 yds^3 of dirt (24,300 tons) to replace the old culvert crossing. The distance from bridge deck to the stream is about 40 ft—about the same as for Little Jack Creek Bridge (pictured below) as well.

Before construction of Little Jack Creek Bridge, the bottom of the culvert was rusted out and a fish barrier. The MRC NRD cleared away 12,000 yds^3 of dirt (14,580 tons) for the bridge.

Little Jack Creek Bridge Completed October 2010
Little Jack Creek is a tributary of North Fork Navarro River, a designated "coho core area."

Road information management

MRC will retain information from our road inventory in a database. There will be updates to the database when (1) road work or repairs alter road segment or road site characteristics; (2) maintenance of a road alters road segment or road site characteristics; and (3) monitoring of roads require sites to have treatment priority changed.

These updates will occur at least once a year. In addition to new information and updates, the database will warehouse all historical information on roads, their features, roadwork, and dates of improvements. Through our database, MRC can track and report past and present conditions and improvements.

Watershed analysis and prioritization of road upgrades

Watershed analysis includes road inventory information. This analysis is repeated, on average, every 20 years. From this analysis, MRC prioritizes roads and sites for upgrade, decommissioning, or special maintenance. This prioritization is based on the amount of controllable erosion of a site; the immediacy of treatment required; the risk to aquatic habitat; the risk to beneficial uses of water; hazard ratings; and potential for diversion. MRC takes all of these factors into consideration along with the THPs for any given year, as well as our plans for road upgrades commensurate with THPs. This is important for both economic and environmental reasons. Opening up a long stretch of road to fix 2 or 3 high erosion sites can cause substantial ground disturbance. In some cases, it is better to fix all the erosion sites on the entire road at one time, no matter what their priority status. This would allow the road to be undisturbed until the next harvest operation. Planning for road repairs while other operations are ongoing localizes the disturbance rather than extending and prolonging it.

8.3.1.2.2 Training in repair of controllable erosion

Trained individuals will repair MRC roads and skid trails. MRC will provide this training to coincide with assessment training for mass wasting hazards. Any MRC employee who will perform field reconnaissance for controllable erosion must attend the training. The training program will be 2-tiered years (Figure 8-15).

- Tier 1 of the program, required for all employees who will perform field reconnaissance and have not previously been trained, will focus on identification of controllable erosion sites on roads and skid trails. The course will address how to (1) interpret the terminology in the road inventory system; (2) identify and collect road data; and (3) submit annual data for the road inventory. In addition, training will include 1 day of field visits to pre- and post-repair sites for controllable erosion.

- Tier 2 of the program will offer a refresher course every 5-7 years to those who have completed Teir-1 training. It will review updates in terminology, regulations, and road repair procedures.

MRC will design the training program. In doing so, we will invite geologists from the wildlife agencies, the California Geological Survey, and the regional Water Quality Control Board to assist in its development and delivery. In addition, we will periodically query the wildlife agencies and other appropriate parties (including, but not limited to CGS and RWQCB) to determine if new knowledge should trigger a refresher course.

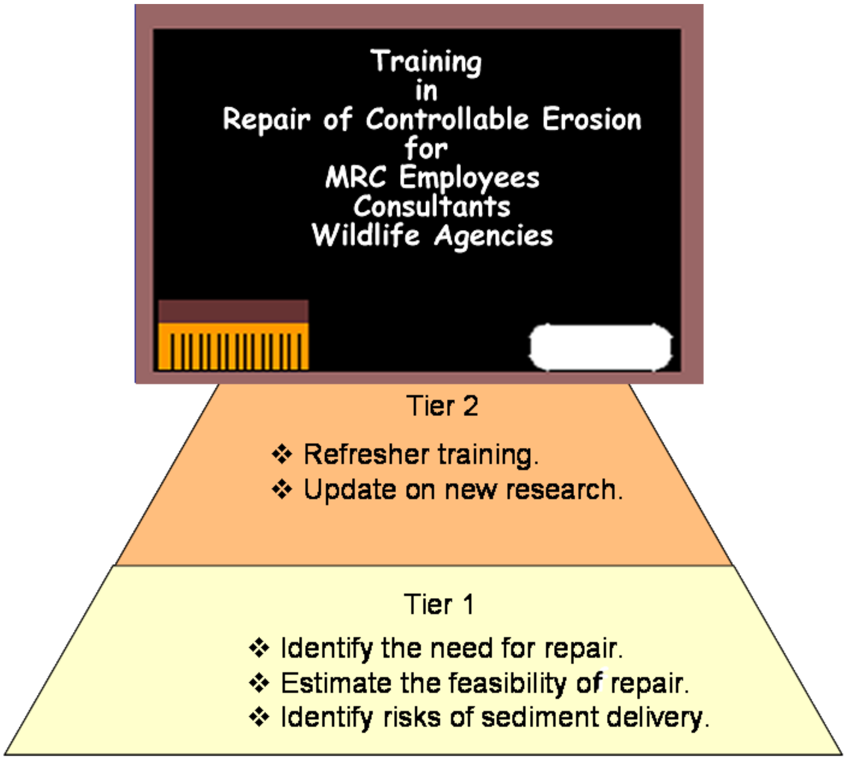


Figure 8-15 Training in Controllable Erosion

8.3.1.3 Instream sediment

Suspended sediment in streams affects water quality and, therefore, the viability and productivity of aquatic populations. Flowing with the current, fine particles create turbidity. Some of these particles deposit on the streambed causing loss of benthic productivity and fish habitat. Young salmon and trout, for example, hide in interstitial spaces between rocks to avoid predation. If fine sediment clogs these interstitial spaces, juvenile salmonids may lose their source of cover and food. Likewise, increased sediment in spawning gravels may decrease survival of salmonid eggs and alevin.

8.3.2 Goals and Objectives

Goal and Objectives for Sediment Input	
Goal	
G§8.3.2-1	Reduce sediment delivery from forest management to (1) promote high quality habitat for covered anadromous salmonid and amphibian species and (2) protect other beneficial uses of water.
Objectives	
Mass Wasting Unrelated to Roads	
O§8.3.2-1	Reduce, by year 40 of the HCP/NCCP, sediment delivery from mass wasting unrelated to roads by at least 10% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions. [17]

[17] Each watershed analysis report located on the MRC website at http://www.mrc.com/Reports-WatershedAnalysis.aspx and on the California State Water Resources Control Board website at http://www.swrcb.ca.gov/water_issues/programs/tmdl/#rb1 contains estimates of erosion rates for specific watersheds.

Goal and Objectives for Sediment Input	
O§8.3.2-2	Reduce, within the 80-year timeframe of the HCP/NCCP, sediment delivery from mass wasting unrelated to roads by at least 20% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
Roads, Skid Trails, and Landings	
O§8.3.2-3	Reduce, by year 40 of the HCP/NCCP, sediment delivery from mass wasting related to roads by at least 30% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
O§8.3.2-4	Reduce, within the 80-year timeframe of the HCP/NCCP, sediment delivery from mass wasting related to roads by at least 60% of the rate (tons/mi^2/year) determined in the initial watershed analyses or established in TMDL load allocation reductions.
O§8.3.2-5	Upgrade, within the first 30 years of the HCP/NCCP, the road network in the plan area to the standards specified in Appendix E, *Roads, Landings, and Skid Trails;* complete upgrades to the road network in coho "core" areas within the first 20 of those 30 years.
O§8.3.2-6	Control 1,302,000 yd^3 of controllable erosion within the first 30 years of the HCP/NCCP. **NOTE** The total amount of controllable erosion may change due to road inventory updates and weather.
O§8.3.2-7	Reduce point source erosion from roads, skid trails, or landings and sediment delivery associated with surface erosion by 50% within the first 30 years of the HCP/NCCP (i.e., from 4000 to 2000 yd^3 per mi^2 per year) and 70% within the initial 70 years of the HCP/NCCP (i.e., from 4000 to 1200 yd^3 per mi^2 per year).
Instream Sediment	
O§8.3.2-8	Demonstrate an improving trend in the following parameters over the life of the HCP/NCCP based on MRC conducting (a) watershed analyses at least every 20 years, (b) long-term channel monitoring every 10 years, and (c) focus watershed studies every 3-5 years: ▪ Quality of stream gravel as measured by increased permeability and percent of fine particles < 0.85 mm. ▪ Stream-reach complexity as measured by residual pool depths and standard deviation of residual pool depths within long-term stream monitoring reaches. ▪ Proportion of fine sediment in pools (V-star). ▪ Decreased sediment inputs to the sediment budget for focus watersheds. **NOTE** 1. MRC has not set benchmarks for instream sediment objectives since rarely do management activities unambiguously or expressly impact instream habitat conditions. 2. Stream gravel permeability will approximate, on average, 10,000 cm/hr across stream reaches. 3. The percent of fine material < 0.85 mm, recovered from dry sieve techniques, will approximate, on average, < 7% across stream reaches. 4. The fraction of pool volume filled with fine sediment should average ≤ 0.21 across stream reaches.

Goal and Objectives for Sediment Input	
O§8.3.2-9	Demonstrate an improving trend in the turbidity and suspended sediment.

8.3.3 Conservation measures

8.3.3.1 Mass wasting

This section details the conservation measures that MRC will apply to minimize sediment delivery and subsequent damage to aquatic habitat. The conservation measures are organized by TSU and historically active landslides. In these conservation measures, we address

- Construction or reconstruction of roads and landings.
- Use of existing roads and landings.
- Construction or reconstruction of tractor trails.
- Tractor yarding.
- Timber harvest.
- Site preparation.

At the end of each section on TSU conservation measures, there is a summary of the expected even-aged regeneration harvests of stands that may occur within each TSU over the next 30 years; this is consistent with the expected time frame to restore poorly stocked stands to conifer dominance. To generate our data, we superimposed a TSU layer over stand data in our landscape model. The stand data relates to specific stands that will be subjected to even-aged regeneration harvests in an effort to restore them to conifer dominance.

An important point to keep in mind in reviewing estimates of acreage on TSU maps is that the numbers precede field verification at the PTHP scale. Typically throughout the mapping process, areas of predicted instability are conservatively mapped and potential impacts likely overestimated. Additionally, since TSU mapping is not complete on our land, the estimates are indicative of about 70% of the plan area or nearly 150,000 ac. Since terrain stability and stand conditions are variable, the estimates probably cannot be extrapolated to the remaining 30% of the plan area.

Any acreage subject to a regeneration harvest for even-aged stands is also subject to conservation measures for its related TSU. For instance, any regeneration step to produce even-aged stands in TSU1 is subject to geologic and biologic review by regulating agencies; there must be documented evidence to support any proposed activity. The 5% alternative, discussed in section 8.3.4.5, provides minimal flexibility to the foresters; in those instances, they can implement a regeneration harvest for even-aged stands in areas of potential instability without the use of geologic and biologic review.

We have not provided estimates of acres of even-aged management on historically active landslides; these areas are delineated during the field review of the PTHP process.

8.3.3.1.1 Deviation from default conservation measures for mass wasting

In some instances, MRC may resort to geological and biological assessments in order to deviate from default conservation measures for mass wasting. Any such deviation must still conform to the limits specified in this sub-section and to guidelines such as Note 45 of the California Division of Mines and Geology. There will not be a reduction of the standard silviculture within an AMZ for these deviations; rather they will occur within the TSU outside of the AMZ. A California licensed geologist must evaluate key issues and conclude based on standard assessments of site conditions that when there is potential for sediment delivery the proposed activities do not present a greater risk of such delivery from mass wasting than the default conservation measures. MRC will notify the wildlife agencies and CGS 60 days prior to submittal of a PTHP that proposes new road construction within an inner gorge and 30 days for road reconstruction within an inner gorge. Notification will include a report submitted by a California PG/CEG of their investigation, evaluations, and recommendations according to Note 45 guidelines. The wildlife agencies will contact MRC within either the 30 or 60 days of receipt of notification to resolve any of their concerns. If the wildlife agencies do not contact MRC within either the 30 or 60 days, MRC may proceed with the proposed activities. MRC will include all geologist evaluations for review by the wildlife agencies within the PTHP and note the frequency of all deviations from conservation measures in annual reports.

8.3.3.1.2 TSU1 and TSU2

INTENT	The intent of the conservation measures for TSU1 and TSU2 is to minimize management actions that increase the potential for sediment delivery from mass wasting on inner gorge and steep streamside slopes. When natural mass wasting processes occur, the conservation measures ensure that trees will be available for delivery to watercourses to mitigate sediment delivery and provide habitat for aquatic organisms.

Inner gorge[18] topography of TSU1 and TSU2

	Conservation Measures for TSU1 and TSU2 Inner Gorge
Roads	
C§8.3.3.1.2-1	Do not construct or reconstruct roads or landings.
C§8.3.3.1.2-2	Do not construct watercourse crossings.
C§8.3.3.1.2-3	Decommission existing roads and landings when they are no longer needed. **NOTE** If relocation of a road poses a higher risk of sediment delivery than maintenance and use of an existing road, MRC will maintain the road to the design standards specified in Appendix E, *Roads, Landings, and Skid Trails*.
Tractor Trails	
C§8.3.3.1.2-4	Do not construct tractor trails.
Tractor Yarding	
C§8.3.3.1.2-5	Exclude equipment.
Timber Harvest	
C§8.3.3.1.2-6	Do not harvest timber.
C§8.3.3.1.2-7	Maintain ≥ 50% canopy on slopes which contribute surface or subsurface flow to the inner gorge.[19]
Site Preparation and Burning	
C§8.3.3.1.2-8	Do not permit site preparation or burning.

[18] Inner gorge conservation measures extend 25 ft beyond the break in slope.

[19] MRC will initially determine these slopes targeted for canopy retention using a 1:24,000 topographic base map. We will interpret the topographic lines as lines of equipotential. Flow lines which cross equipotentials at right angles will depict the likely flow of surface or subsurface water downslope to the inner gorge. In the field, we may do further delineation of the area topographically contributing to the inner gorge including anthropogenic diversions of watercourses. This conservation measure will be applied to Class I and Large Class II watercourses.

Deviation from default conservation measures for inner gorge

	Limits on Deviation from Default Conservation Measures in TSU1 and TSU2 Inner Gorge
C§8.3.3.1.2-9	Retain at least 70% canopy (averaged throughout the inner gorge) and at least 15 ft^2 of conifers ≥18 in. dbh per acre.
C§8.3.3.1.2-10	Ensure that trees are evenly dispersed across the slope after a timber harvest, unless an assessment reveals, from the presence of competent bedrock, that the inner gorge is in fact stable, in which case MRC will retain more trees on the least stable areas.
C§8.3.3.1.2-11	Allow construction and reconstruction of roads, skid trails, and landings within inner gorges only after notification to the wildlife agencies and review by a geologist.

Steep streamside slopes of TSU1 and TSU2

	Conservation Measures for TSU1 and TSU2 Steep Streamside Slopes
Roads	
C§8.3.3.1.2-12	Do not construct new roads or landings.
C§8.3.3.1.2-13	Do not construct watercourse crossings.
C§8.3.3.1.2-14	Adhere to the standards in Appendix E, *Roads, Landings, and Skid Trails*, for reconstructed roads.
C§8.3.3.1.2-15	Decommission existing roads and landings when they are no longer needed. **NOTE** If relocation of a road poses a higher risk of sediment delivery than maintenance and use of an existing road, MRC will maintain the road to the design standards specified in Appendix E, *Roads, Landings, and Skid Trails*.
Tractor Trails	
C§8.3.3.1.2-16	Do not construct tractor trails.
Tractor Yarding	
C§8.3.3.1.2-17	Permit equipment on existing stable trails where other yarding methods could pose a greater risk of sediment delivery to a watercourse or where one-time entry into the TSU is required to control erosion.
Timber Harvest	
C§8.3.3.1.2-18	Retain at least 50% overstory canopy in those portions of the unit that extend above the AMZ.[20]

[20] MRC included this conservation measure to prevent potential mass wasting hazards on soil with increased moisture (see section 8.3.2.14). Observations of past landslide activity within the general vicinity of a project area can help the reviewer determine the boundary definitions of TSU1 through TSU3 (see section 8.3.1.1.2).

	Conservation Measures for TSU1 and TSU2 Steep Streamside Slopes
C§8.3.3.1.2-19	Retain at least 15 ft^2 of conifers ≥18 in. dbh per acre, with trees evenly distributed across the slope in those portions of the unit that extend above the AMZ.[21] **NOTE** The 20 ft reduction on the middle band of the AMZ for helicopter or cable yarding applies only when the AMZ extends **beyond** TSU1 and TSU2 and not when the AMZ is **within** these TSU units. Expected regeneration harvest for even-aged stands on TSU1: 123 ac (Years 0-15); 82 ac (Years 15-30). Expected regeneration harvest for even-aged stands on TSU2: 642 ac (Years 0-15); 254 ac (Years 15-30).
Site Preparation and Burning	
C§8.3.3.1.2-20	Do not permit site preparation or burning.

Deviation from default conservation measures for steep streamside slopes

	Limits on Deviation from Default Conservation Measures in TSU1 and TSU2 Steep Streamside Slopes
C§8.3.3.1.2-21	Permit new construction of roads, skid trails, and landings only after a review and site specific design by a PG or CEG.
C§8.3.3.1.2-22	Permit reconstruction of roads, skid trails, and landings across unstable areas within TSU1 or TSU2 (i.e., steep streamside slopes) only after obtaining approval of the wildlife agencies as well as a review and site specific design by a PG or CEG.
C§8.3.3.1.2-23	Ensure that trees are evenly dispersed across the slope after a timber harvest in TSU1 and TSU2.
C§8.3.3.1.2-24	Permit a one-time use of shelterwood and seed-tree removal steps outside the inner and middle bands of an AMZ, as long as MRC retains 50% overstory canopy. **NOTE** 1. Seed-tree removal will not be a deviation from default conservation measures if it retains 50% overstory canopy and at least 15 ft^2 of conifers ≥ 18 in. dbh per acre, with the trees evenly distributed across the slope. 2. Use of shelterwood or seed-tree removal steps does not preclude the requirement for wildlife trees in the AMZ. MRC will not retain, for this one time entry, 15 ft^2 of conifers ≥18 in. dbh per acre.

[21] MRC included this conservation measure to allow for recruitment of adequate LWD in the event that mass wasting does occur (see section 8.2.4.7). Our best professional judgment determined the specified tree sizes.

8.3.3.1.3 TSU3

INTENT

The intent of conservation measures for TSU3 is to create a low risk of sediment delivery from management actions on steep and dissected slopes. In the event that mass wasting occurs, the conservation measures ensure that trees will be available for delivery to a watercourse to mitigate sediment delivery and provide habitat for aquatic organisms.

	Conservation Measures for TSU3 Steep Dissected Topography
Roads	
C§8.3.3.1.3-1	Do not construct or reconstruct a road to extend more than 50 ft across a headwall swale, excluding watercourse crossings.
C§8.3.3.1.3-2	Decommission existing roads and landings when they are no longer necessary. **NOTE** If relocation of a road poses a higher risk of sediment delivery than maintenance and use of an existing road, MRC will maintain the road to the design standards specified in Appendix E, *Roads, Landings, and Skid Trails*.
Tractor Trails	
C§8.3.3.1.3-3	Do not construct or reconstruct tractor trails.
Tractor Yarding	
C§8.3.3.1.3-4	Permit equipment on existing stable trails where other yarding methods could pose a greater risk of sediment delivery to a watercourse or where one-time entry into a TSU is required to control erosion.
Timber Harvest	
C§8.3.3.1.3-5	Retain 50% overstory canopy and, per acre, 15 ft^2 of conifers ≥ 18 in. dbh, distributed evenly across the TSU.
C§8.3.3.1.3-6	Emphasize tree retention in the axis of headwall swales where pore water pressures are typically greatest. Expected regeneration harvest for even-aged stands on TSU3: 3156 ac (Years 0-15); 1339 ac (Years 15-30).
Site Preparation and Burning	
C§8.3.3.1.3-7	Do not permit site preparation or broadcast burning.

Deviation from default conservation measures for steep dissected topography

	Limits on Deviation from Default Conservation Measures in TSU3 **Steep Dissected Topography**
C§8.3.3.1.3-8	Permit a one-time use of shelterwood and seed-tree removal steps outside the inner and middle bands of an AMZ. **NOTE** 1. Seed-tree removal will not be a deviation from default conservation measures if it retains 50% overstory canopy and at least 15 ft^2 of conifers ≥ 18 in. dbh per acre, with the trees evenly distributed across the slope. 2. Use of shelterwood or seed-tree removal steps does not preclude the requirement for wildlife trees in the AMZ. MRC will not retain, for this one time entry, 15 ft^2 of conifers ≥18 in. dbh per acre.
C§8.3.3.1.3-9	Retain 50% overstory canopy on headwall swales.
C§8.3.3.1.3-10	Permit new construction of roads, skid trails, and landings only after a review and site specific design by a PG or CEG.
C§8.3.3.1.3-11	Permit reconstruction of roads, skid trails, and landings across unstable areas within TSU1 or TSU2 (i.e., steep streamside slopes) only after obtaining approval of the wildlife agencies as well as a review and site specific design by a PG or CEG.

8.3.3.1.4 TSU4 and TSU5[22]

INTENT	The intent of conservation measures for TSU4 and TSU5 are to create a low risk of sediment delivery from management actions that might cause mass wasting on convex, moderate-to-gentle gradient hillslopes.

	Conservation Measures for TSU4 and TSU5 **Non-dissected, Low Relief Topography**
Roads	
C§8.3.3.1.4-1	Construct and maintain roads and landings to the design standards set out in Appendix E, *Roads, Landings, and Skid Trails*.
Tractor Trails	
C§8.3.3.1.4-2	Construct and maintain tractor trails to the design standards set out in Appendix E, *Roads, Landings, and Skid Trails.*
Tractor Yarding	
C§8.3.3.1.4-3	Limit tractor yarding to the fewest number of trails necessary to conduct yarding operations.

22 The difference between TSU4 and TSU5 is that there is a moderate risk of mass wasting in TSU4 and little or no risk in TSU5. Prior to project initiation, MRC emphasizes that there must be field reviews in TSU4 for areas that should be classified as TSU1, TSU2, or TSU3. MRC will also focus on issues surrounding road construction and tractor yarding to minimize mass wasting in TSU4.

8.3.3.1.5 TSU6

INTENT

> The intent of conservation measures for TSU6 is to avoid creating or accelerating movement of earthflows or earthflow complexes, or inducing gully erosion on earthflow complexes. This will ensure there is a low risk of sediment delivery from management actions that might cause mass wasting on earthflows. TSU6 is meant to address earthflows and earthflow complexes which show no evidence of historical activity.

	Conservation Measures for TSU6 Earthflow Complexes[23]
Roads	
C§8.3.3.1.5-1	Do not construct new roads on an earthflow complex.
C§8.3.3.1.5-2	Maintain roads and landings so that water is not concentrated on slide materials.
C§8.3.3.1.5-3	Do not increase or create cuts into a slide body or place fill material on a slide body, except for normal road maintenance.
Tractor Yarding	
C§8.3.3.1.5-4	Minimize new tractor trails and avoid disruption from equipment to the natural drainage of the earthflow.
Timber Harvest	
C§8.3.3.1.5-5	Retain ≥50% canopy, distributed across the TSU. Expected regeneration harvest of even-aged stands on TSU6: 42 ac (Years 0-15); 63 ac (Years 15-30).
Site Preparation and Burning	
C§8.3.3.1.5-6	Do not disturb the existing overstory canopy or disrupt drainage with heavy equipment for site preparation.

8.3.3.1.6 TSU7[24]

INTENT

> The intent of conservation measures for TSU7 is to avoid gully erosion or the movement of debris slides, rockslides, earthflows, or earthflow complexes. The measures will ensure a low risk of sediment delivery from management actions in this accelerated-creep terrain.

	Conservation Measures for TSU7 Accelerated Creep Terrain
Roads	
C§8.3.3.1.6-1	Avoid water concentration on soils in order to prevent gully erosion.
Tractor Trails	

[23] MRC will consult a professional geologist prior to any work on an earthflow, except for road use or maintenance.

[24] The risk for sediment delivery from mass wasting is less in TSU7 than in TSU6. This is because earthflow or earthflow complex morphology is not apparent in TSU7. As a result, the likelihood of triggering or accelerating an earthflow or landslide is considerably less.

	Conservation Measures for TSU7 Accelerated Creep Terrain
C§8.3.3.1.6-2	Maintain, construct, and reconstruct tractor trails so that they do not increase the risk of mass wasting.
Tractor Yarding	
C§8.3.3.1.6-3	Avoid water concentration on soils in order to prevent gully erosion.
Timber Harvest	
C§8.3.3.1.6-4	Retain, on average, 50% canopy that is evenly distributed across the forested portion of the TSU.
Site Preparation and Burning	
C§8.3.3.1.6-5	Do not disturb existing overstory or disrupt drainage with heavy equipment during site preparation.

8.3.3.1.7 TSU8

INTENT

The intent of the conservation measures for TSU8 is to avoid concentration of road drainage which could lead to gully development and the delivery of fine sediment to a watercourse.

	Conservation Measures for TSU8 Ohlsen Ranch Formation
Roads and Tractor Trails	
C§8.3.3.1.7-1	Manage all roads and skid trails with a risk of sediment delivery as "extreme" erosion hazards regardless of their slope gradient.
C§8.3.3.1.7-2	Reduce the spacing between waterbars and rolling dips to 50 ft in order to minimize the concentration of water on a traveled surface.
C§8.3.3.1.7-3	Slash pack or mulch outlets of waterbars and rolling dips to dissipate the energy of concentrated surface run-off and minimize the likelihood of gully development.

8.3.3.1.8 Historically active landslides

INTENT

The intent of the conservation measures for historically active landslides is to minimize impacts that could reactivate a landslide. In the event that reactivation occurs, the conservation measures ensure that trees will be available for delivery to a watercourse to mitigate sediment delivery and provide habitat for aquatic organisms.

	Conservation Measures for Historically Active Landslides
Roads	
C§8.3.3.1.8-1	Do not construct or reconstruct roads or landings.
C§8.3.3.1.8-2	Maintain existing roads so that excessive water is not concentrated onto slide materials.
Tractor Trails	
C§8.3.3.1.8-3	Do not construct tractor trails.
C§8.3.3.1.8-4	Avoid concentration of excessive water drainage from skid trails on rockslide materials.

Conservation Measures for Historically Active Landslides	
Tractor Yarding	
C§8.3.3.1.8-5	Limit equipment to existing stable trails or roads.
Timber Harvest	
C§8.3.3.1.8-6	Do not harvest timber.
Site Preparation and Burning	
C§8.3.3.1.8-7	Do not permit heavy equipment for site preparation.
C§8.3.3.1.8-8	Limit equipment on dormant landslides to existing stable trails or roads.

Deviation from default conservation measures for historically active landslides

Limit for Deviation from Default Conservation Measures Historically Active Landslides	
C§8.3.3.1.8-9	Retain at least 50% canopy with trees evenly dispersed across the historically active landslide.

8.3.3.2 Roads, skid trails, and landings

While necessary for forest and wildlife management, roads may fragment terrestrial habitat and lead to modified animal behavior. Roads may be a source of harassment for some animals and a source of attraction for others. In fact, roads and their adjacent surroundings may qualify as a distinct habitat for species of birds and animals that live and thrive on the road edge. In addition, roads may contribute sediment to nearby streams and thereby threaten aquatic habitat. There is always, as well, an inherent danger to wildlife from vehicles travelling on roads. Even rare plants, near the road edge, may be crushed by truck tires.

While we are not proposing specific conservation measures for roads and road habitat, many of our conservation measures set restrictions on road use and reference our road standards, described fully in Appendix E, *Road, Landing, and Skid Trail Standards*. In the following sub-sections, we describe some of those standards, particularly as they relate to covered species and their habitat.

8.3.3.2.1 Road upgrade and controllable erosion repairs

MRC will upgrade roads to the standards outlined in Appendix E, *Roads, Landings, and Skid Trails*, and repair controllable erosion sites; we will decommission roads that are no longer needed. MRC will use the following criteria, which take into account the greatest risks to covered species and beneficial uses of the water, to prioritize road repairs for controllable erosion:

1. Artificial barriers to fish passage.
2. Risk of imminent failure.
3. Size of controllable erosion volume.
4. Watersheds that contain coho salmon and other sensitive aquatic species.
5. Sediment delivery receptor (Class I or Class II are highest priority).
6. Crossings within fire affected areas.
7. Immediacy of site treatment.
8. Priority of road or road site for repair from watershed analysis.
9. Culvert sizing (watercourse culverts are higher priority than ditch relief culverts).
10. Timing of adjacent harvest operations and availability of equipment.

11. Distance from other sites. (For example, if a low-priority site is located next to a high-priority site, they may be fixed simultaneously to save time and money.)
12. Risk of sediment delivery from the proposed treatment.
13. Cost effectiveness of the treatment, defined as less than $19 per yd^3 of sediment controlled (in 2011 dollars).[25]

Each of the criteria is a priority for road sediment control work; however, multiple criteria will influence a site’s prioritization. Figure 8-16 shows 2 examples of how the criteria determine the priority for maintenance. The size of the culvert is less important than its potential for delivering sediment to a stream and impacting aquatic species.

Using a baseline road inventory, MRC assigns treatment priorities (high, moderate, low) to controllable erosion sites. Table 8-17 stratifies these estimates of controllable erosion by priority designation within the watershed analysis units. MRC may accelerate repair of controllable erosion through increased effort or grant-funded projects. This acceleration could alter the amount of controllable erosion targeted for repair.

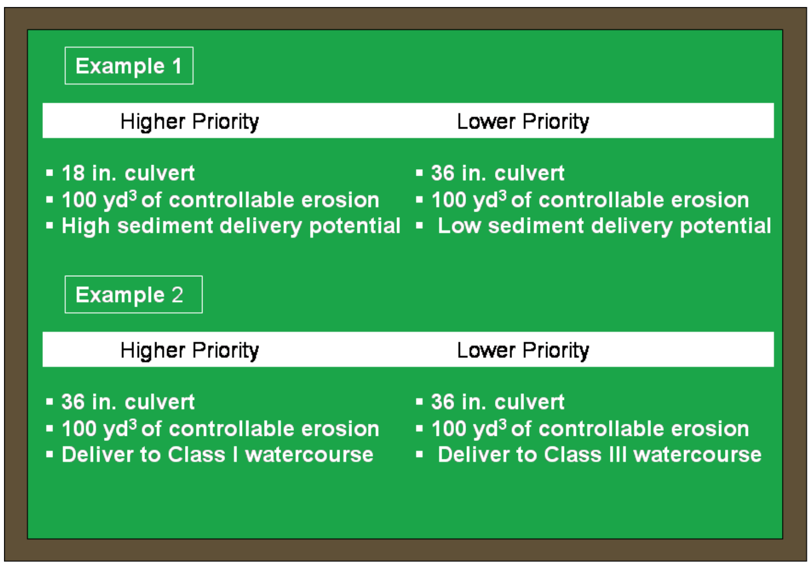


Figure 8-16 Examples of Prioritization

Our initial estimates are for units where road inventory is complete, which, in 2011, represents about 90% of the plan area. To extrapolate this volume (V) of controllable erosion to the remainder of the plan area, we took the initial estimates (I) and subtracted the controllable volume from Masonite Road (M)[26]—approximately 513,300 yd^3— as shown in the following equation:

$$(I - M) * 1/0.90 = V$$

$$(1{,}222{,}300\ yd^3 - 513{,}300\ yd^3) * 1/0.90 = 787{,}778\ yd^3$$

[25] MRC used a 2002 dollar amount from a CDFG review process for road work grants ($15) and adjusted for 24.35% cumulative inflation since 2002 based on www.inflationdata.com. The result was $18.65 rounded up to $19. We use this dollar amount for a rule of thumb to set priorities, not as an absolute trigger for decision-making.

[26] We do not extrapolate results from Masonite Road to the remainder of our land because Masonite Road is unique and does not represent the rest of our roads. Instead we extrapolate all other data then add the Masonite Road totals to a total estimate for all MRC timberland.

We then added the volume of controllable erosion for Masonite Road (M) to the extrapolated volume (V) to obtain total volume (T) of controllable erosion or approximately 1,302,000 yd^3.

$$M + V = T$$

$$513{,}300\ yd^3 + 787{,}778\ yd^3 = 1{,}301{,}078\ yd^3 \approx 1{,}302{,}000\ yd^3$$

Table 8-17 Controllable Erosion Estimates (2011)

Watershed Analysis Unit (WAU)	Treatment Priorities and Volumes (yd^3)		
	High	Moderate	Low
Albion	3,100	1,900	11,800
Big River	97,200	130,300	68,800
Rockport	47,100	19,700	63,300
Elk Creek	2,200	900	14,700
Greenwood Creek	6,600	6,400	30,300
Garcia River	29,100	8,900	84,800
Navarro River	157,100	105,600	189,500
Northern Russian River	20,700	44,600	34,500
Noyo River	13,000	8,900	21,300
Total	376,100	327,200	519,000
Initial Estimate (I)	1, 222,300 yd^3		

8.3.3.2.2 Coho "core" watersheds

During the first 20 years of HCP/NCCP implementation, MRC will treat controllable erosion sites which (a) have a high or moderate priority and (b) are within coho "core" watersheds (see Appendix Z, *Coho Recovery Strategies*). CDFG, NMFS, and MRC have identified these watersheds as sensitive coho salmon areas with a high potential for restoration (see Table Z-1, *MRC Coho Core Areas*). Our HCP/NCCP Atlas (MAPS 26A-C) shows the locations of these watersheds. Within 10 years of HCP/NCCP implementation, MRC will treat at least 70% of the controllable erosion sites with a high priority and 50% of the sites with a moderate priority. We will treat the remainder of the high and moderate priority sites in coho core watersheds by Year 20 of HCP/NCCP implementation and all low priority sites by Year 40 (Tables 8-18 and 8-19).

8.3.3.2.3 Other watersheds

Outside the coho core watersheds, MRC will treat controllable erosion sites commensurate with our routine operations. MRC will, at a minimum, treat 1/3 of the controllable erosions sites with high and moderate priorities every 10 years. As a result, MRC will treat all high and moderate sites by Year 30 of HCP/NCCP implementation and all low priority sites by Year 40 (Tables 8-18).

Table 8-18 Percentage of Controllable Erosion Treated Per Decade in the Plan Area

Controllable Erosion							
Treatment Sites Identified in Baseline Road Inventory							
Treatment Priorities	Core area			Non-core area			
	HCP/NCCP Implementation						
	Year 10	Year 20	Year 40	Year 10	Year 20	Year 30	Year 40
High	70%	30%		33%	33%	33%	
Moderate	50%	50%		33%	33%	33%	
Low	25%	25%	50%	25%	25%	25%	25%

Table 8-19 Percentage of Controllable Erosion Treated Per Year in the Plan Area

Controllable Erosion							
Treatment Sites Identified in Baseline Road Inventory							
Treatment Priorities	Core area			Non-core area			
	HCP/NCCP Implementation						
	Years 1- 10	Years 11-20	Years 21-40	Years 1-10	Years 11-20	Years 21-30	Years 31-40
High	7%	3%		3.3%	3.3%	3.3%	
Moderate	5%	5%		3.3%	3.3%	3.3%	
Low	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%

There will be annual fluctuations in the percentage of road sites repaired due simply to operational issues and management decisions. The annual percentages in Table 8-19 represent an average.

8.3.3.2.4 Grants for sediment reduction

Table 8-17 sets forth ESA and NCCPA mitigation requirements for sediment reduction which will occur every year, even if there is no timber harvest. Any road repairs or other sediment reduction work over and above the requirements in Table 8-17 will exceed mitigation requirements and is expected to be eligible for state and federal grant funding. Additional sediment reduction work funded by grants or other means would reduce sediment at an even faster pace than is required by our HCP/NCCP.

8.3.3.2.5 Ongoing road inventories

So far the discussion in this sub-section has addressed the treatment of controllable erosion sites identified through the baseline road inventory. MRC will complete additional road inventories every 10 years, starting at Year 20. The Year-20 road inventory will identify further controllable erosion sites and designate a treatment priority for each one. Starting at Year 30 of HCP/NCCP implementation, MRC will treat, every 10 years, the top 1/3 of these newly-identified sites from a list sorted by treatment priority. This sorted list will exclude those controllable erosion sites previously designated in the baseline road inventory.

8.3.3.2.6 Low priority sites

Treatment will differ in low-priority sites. Many road features, such as culverts or rocked fords, have adequate design but present a risk of sediment delivery if a site is not properly maintained. This is an example of a low priority site. MRC will consider erosion at low-priority sites “controlled” if a site is maintained according to standards. We will treat all low-priority sites, as determined from the initial road inventory, within 40 years of HCP/NCCP implementation (Tables 8-18 and 8-19).

8.3.3.2.7 Road erosion not associated with a treatment site

Roads can contribute sediment to streams through erosion of the road surface itself. While not directly associated with individual sites, such as culverts, this surface erosion can, cumulatively, impair streams especially during heavy rain. MRC will reduce road surface erosion within specific timelines. Within the coho core areas (HCP/NCCP Atlas, MAPS 26A-C), MRC will accelerate the improvement of road networks. During the first 10 years of HCP/NCCP implementation, MRC will upgrade 70% of the road systems in accordance with Appendix E, *Road, Landing, and Skid Trail Standards*. We will upgrade the remainder of the roads by Year 20 of HCP/NCCP implementation. Again, this schedule ensures that MRC will upgrade all roads within coho core area within 20 years of HCP/NCCP implementation, and all roads in non-core areas within 30 years of HCP/NCCP implementation.

8.3.3.2.8 Impact of harvest rate on erosion treatment

Finally, road repairs will generally be commensurate with harvest operations. Regardless of harvest rate, however, MRC will treat all controllable erosion identified in our baseline road inventory within the first 40 years of HCP/NCCP implementation. Between 1998 and 2007, MRC controlled approximately 737,000 yd^3 of sediment or roughly 73,000 yd^3 per year.

8.3.3.2.9 Road construction and decommissioning

Approximately 10% of the plan area is AMZ. As of 2009, there are 294.6 miles of active roads, i.e., permanent, seasonal, or temporary roads, within the AMZs of Class I, Large Class II, and Small Class II streams (see Table 3-14). In addition, as of the same date, there were 73.92 miles of decommissioned or historic roads,[27] within Class I, Class II, and Class III AMZ (see Table 3-14). The far right columns of Table 8-20 also include the number of decommissioned watercourse crossings and culverts throughout the entire plan area. Particularly in AMZs, MRC intends to limit new road construction, where possible, and promote road decommissioning across our land. Table 8-21 provides estimates for road work within 10 years of HCP/NCCP implementation.

Table 8-20 Decommissioned Roads, Crossings, and Culverts

HCP/NCCP Plan Area (2009)									
Decommissioned and Historic Roads within AMZs					Entire Plan Area				
					Decommissioned Crossings or Culverts				
Watershed	Total Miles	Class I AMZ (miles)	Large Class II AMZ (miles)	Small Class II AMZ (miles)	Total	Class I	Large Class II	Small Class II	Class III
Albion River	1.08	.33	.50	.25	22	3	2	6	11
Alder/Schooner	2.98	2.32	.43	.24	0	0	0	0	0
Big River	5.41	1.73	2.07	1.61	67	5	8	11	43
Cottaneva Creek	.00	.00	.00	.00	3	2	0	0	1
Elk Creek	4.58	4.16	.17	.25	31	14	6	7	4

[27] In defining a historic road we say that it "will not be opened, rehabilitated, or used, based on a review of the sediment delivery consequences and feasibility of repair." In other words, it is more likely that a historic road would deliver more sediment if we tried to "fix" it than if we left it alone. Consequently, we let nature, undisturbed, take its course and obliterate the road over time. Where it is called for, decommissioning is a more active, expensive, and immediate process. It involves removing culverts, stream crossings, and ditches. In some cases, roads are re-contoured and slopes re-shaped to reflect their natural grade before any cut-and-fill took place. Where the ground was disturbed or excavated, fill, compaction, and stabilization may be required. Finally, re-vegetation puts the road to rest.

HCP/NCCP Plan Area (2009)									
Decommissioned and Historic Roads within AMZs					Entire Plan Area				
					Decommissioned Crossings or Culverts				
Watershed	**Total Miles**	**Class I AMZ (miles)**	**Large Class II AMZ (miles)**	**Small Class II AMZ (miles)**	**Total**	**Class I**	**Large Class II**	**Small Class II**	**Class III**
Garcia River	1.47	.79	.36	.32	47	10	4	15	18
Greenwood Creek	5.53	4.38	1.00	.14	30	9	3	3	15
Hollow Tree Creek	26.07	19.46	3.63	2.97	325	102	45	64	114
Navarro River	18.45	11.87	4.14	2.45	103	35	16	25	27
Noyo River	8.35	6.23	1.24	.88	35	13	7	5	10
Upper Russian R.	.00	.00	.00	.00	7	5	0	0	2
Total	**73.92**	**51.27**	**13.54**	**9.11**	**670**	**198**	**91**	**136**	**245**

Table 8-21 Estimated Road Work within 10 Years of HCP/NCCP Implementation

Plan Area					
Watershed Analysis Units	**Decommissioned Roads (miles)**	**New Road Construction (miles)**	**% of Roads on Slopes > 50%**	***New Road Construction in Class I or Large II AMZ (miles)**	****Future Construction of Class I or Large Class II Crossings**
Albion River	0	0	0%	0	0
Big River	8.0	17.0	50%	0.5	10 Large II
Garcia River	0	2.0	50%	0	0
Navarro River	23.0	20.0	50%	1.0	5 Large II
Hollow Tree Creek (SF Eel)	7.3	7.3	50%	0	0
Noyo River	5.0	15.0	50%	0.5	10 Large II
Cottaneva, Howard, Hardy, and Juan Creeks	0	0	50%	0	0
Alder, Elk, Greenwood, and Mallo Pass Creeks	0	0.4	0%	0	0
Russian River	2.0	3.5	50%	1.0	2 Large II 1 Class I

TABLE NOTES
* Does not include crossings
** Does not include replacements

8.3.3.2.10 Increase the proportion of temporary roads

During wet weather, roads with heavy traffic produce substantially more sediment than do abandoned or low-use roads (Reid and Dunne, 1984). The majority of MRC roads are seasonal—often with permanent structures, such as culverts, which require maintenance and pose risks for sediment delivery. The removal of high-maintenance culverts from low use-roads, followed by installation of low-maintenance crossings, will decrease the risk of sediment delivery across the plan area.

Table 8-22 shows the percentage and mileage of MRC roads by class (permanent, seasonal, temporary) within the plan area as of 2009. MRC will shift to a road system in which more than half the roads are *temporary*. This will lower road maintenance. It will also reduce sediment delivery because there will be fewer culverts or high maintenance stream crossings that could fail. In addition, less road usage in the winter will lead to less erosion from traffic. All of this activity will coincide with the initial phase of our harvests throughout the plan area.

Table 8-22 Percentage and Mileage of Roads by Class within the Plan Area

Plan Area (2009)							
Watershed Analysis Unit	**Permanent Roads**		**Seasonal Roads**		**Temporary Roads**		**Total Miles (rounded)**
	%	**Miles**	**%**	**Miles**	**%**	**Miles**	
Albion River	23.4	37.4	37.7	60.3	38.8	62.2	160
Alder Creek/Schooner Gulch	21.5	9.6	75.3	33.8	3.1	1.4	45
Big River	12.8	45.8	56.8	203.6	30.3	108.5	358
Cottaneva Creek	6.3	6.8	47.0	50.8	46.6	50.4	108
Elk Creek	3.9	4.7	47.6	57.6	48.4	58.6	121
Garcia River	7.5	9.5	62.7	79.9	29.7	37.9	127
Greenwood Creek	2.3	2.1	65.8	58.5	31.7	28.2	89
Hollow Tree Creek	10.7	15.0	36.6	51.1	52.6	73.5	140
Navarro River	6.0	36.4	61.5	372.5	32.4	196.7	606
Noyo River	2.1	4.3	84.6	173.0	13.2	27.0	204
Rockport Coastal Streams	13.8	15.9	48.5	55.9	37.5	43.2	115
Upper Russian River	18.3	8.0	45.5	19.8	36.0	15.7	44

8.3.3.2.11 Skid trail system plan

During preparation of a PTHP, MRC will inventory skid trails to pinpoint the controllable erosion sites. We propose within the first 5 years of our HCP/NCCP to also complete a baseline inventory of skid trails. The baseline inventory will use aerial photographs combined with limited field visits for sampling verification. In a trial survey done in the Garcia, MRC mapped skid trails crossing watercourses or skid trails adjacent to watercourses; the survey was completed from aerial photographs for a variety of locations, including several hillslope morphologies (swales, planar slopes, open canyons, incised canyons) and varying watersheds. MRC did not find controllable erosion sites from skid trails in swales, planar slopes, and open canyons. However, we frequently found such sites where skid trials were directly adjacent to or crossed incised canyons. Mapping and field sampling will allow MRC to (a) gauge overall controllable sediment from the skid trail network on our land and (b) guide foresters to areas of high sediment production for planning analysis.

When MRC identifies with aerial photographs skid trails likely to produce controllable erosion, we map the site for later verification. A forester will visit the site during PTHP preparation. This field visit substantiates whether the site is indeed a controllable erosion site. If it is, MRC will then determine the volume of controllable erosion. Once the inventory from the baseline aerial photo is complete, MRC will assign the site a priority and schedule the repair using prioritization categories (see section 8.3.3.2.1). We will treat most of the controllable erosion during the first timber harvest operation in the area. Treatment will depend on whether equipment or personnel can perform erosion control without creating more sediment than the site would produce if left untreated.

In the State of California, operations that affect the bed or banks of a lake or stream require approval from CDFG through an alteration agreement, also called a 1600 permit (see Appendix T, *Master Agreement for Timber Operations*). CDFG must also approve maintenance to a skid trail if it involves the banks or beds of a stream. This oversight from CDFG will continue even when our HCP/NCCP is in place. MRC estimates that we will treat historic sources of skid trail sediment, when feasible, within the first 30 years of our HCP/NCCP.

8.3.3.2.12 Reducing sediment from point source erosion and surface erosion

MRC will reduce sediment from point source erosion (i.e., wash-outs and gullies at watercourse crossings) and surface erosion off roads in several ways: (1) through upgrades to controllable erosion sites; (2) through appropriate surfacing of roads in close proximity to watercourses; (3) through limitation of road use during the winter period; and (4) through reducing permanent watercourse crossings.

Treatment of controllable erosion sites and upgrades of road design standards will reduce sediment from roads. Some have estimated that such treatment and upgrades reduce sediment from roads by 90% (NCRWQCB 1998). Treatment of sites initially identified with high and moderate erosion and upgrade of a majority of the road design standards will occur in the first 30 years of our HCP/NCCP. However, it is likely that new erosion sites will develop and treatment will occur over the entire 80-year term of the plan. MRC will further minimize controllable erosion by reducing the number of permanent watercourse crossings. Still, a 90% reduction of sediment inputs from point source erosion at any one time is unlikely. MRC estimates, however, that a 75% reduction is possible.

MRC can control surface erosion from logging roads by limiting road use during wet periods and providing road cover to bind or armor the road surface (i.e., vegetation, rock, or pavement). Based on data from our road inventory, 80% of MRC roads are native surface (compacted soil) and 20% have a rock or paved surface. According to the surface erosion model in the Standard Methods for Conducting Watershed Analysis, Version 4.0, Washington Forest Practices Board (WFPB), application of at least 6 in. of rock to a road surface reduces sediment production by 80%. Furthermore, according to the same model, roads with moderate to high traffic can have sediment inputs reduced by at least 50% when road use is limited in wet periods.

Our road design standards require that road surfaces be rocked, paved, or suitably covered (slash, grass, mulch, etc.) within the AMZ, depending on watercourse and road type. Use of roads during wet periods is restricted as well. We assume that applying 6 in. of rock or other material to road surfaces (as in the WFPB model) will reduce sediment production by 80%. We further assume that watercourse crossings with native surfaces are proportionate to the amount of roads with native surfaces (80% in 2002). Sediment delivery also comes from road cut-and-fill portions of the prism that cannot have armoring (rock, pavement) applied. Also surface erosion from outside the AMZ, where road surface treatments may not be required, can deliver sediments. However, it is not likely that these sources will produce large amounts of erosion. We assume that limiting road use in wet periods will make up for surface erosion from outside the AMZ and from the cut-and-fill portions of the road prism.

The spacing of waterbreaks—such as waterbars, rolling dips, and ditch relief culverts—can affect erosion rates of road surfaces. Raindrops are very effective in detaching soil particles (Chang 2003). The impact energy of raindrops is the major initiator of soil detachment (Young and Wiersma 1973). Sediment yield is the net result of (a) sediment detachment by raindrops and flowing water; (b) sediment transportation by raindrop splash and flowing water; and (c) sediment deposition (Lane et al 1995). The product of sediment concentration (mass per unit volume of water) and flow rate (volume of water per unit time) gives the sediment discharge rate in mass per unit time. By integrating sediment discharge rates throughout the period of flow, sediment yield is obtained from the contributing area above the point of interest (Lane et al 1995). In summary, the goal is to reduce surface erosion on roads; minimizing the distance between waterbreaks reduces the contributing area on road surfaces.

MRC analyzed data on logging roads from the Navarro River and Noyo River watersheds. We compared sediment inputs from point source erosion with total sediment inputs from surface erosion and point source erosion combined. According to the analysis, point source erosion amounted to 22-71% of the total sediment inputs, with a median value of 52%. Using this median value, with point source erosion lowered by 75% and surface erosion lowered by 65%, overall road point source and surface erosion sediments is estimated to be lowered by 70%. Over time, roads will deteriorate and require constant maintenance and upgrade; this ongoing maintenance and upgrade will further improve MRC roads and reduce sediment inputs.

MRC **estimates** that

1. At least 50% of sediment inputs from point source and surface erosion will be reduced within the first 30 years of our HCP/NCCP.
2. At least 70% of sediment inputs from point source and surface erosion will be reduced by the end of the 80-year term of our HCP/NCCP.

8.3.3.3 Instream sediment

MRC is not proposing specific conservation measures for instream sediment. However, we will reduce stream inputs through our conservation measures for mass wasting and our road standards, all outlined in sections 8.3.3.1 and 8.3.3.2.

8.3.4 Rationale

8.3.4.1 Greatest protection for greatest risk of sediment delivery

Delineation of the landscape into TSUs is fundamental to the success of the mass wasting conservation measures; therefore, during watershed analysis geologists consider several factors:

- Landslide characteristics
  - Size.
  - Frequency.
  - Delivery to watercourses.
  - Spatial distribution.
- Hill slope characteristics
  - Slope form (convergence, divergence, planar).
  - Slope gradient.
  - Contributing area.
  - Magnitude of stream incision.
  - Overall geomorphology.

The geologist uses these factors to make a “best professional judgment” as to the proper location of the TSU boundary.

The MRC strategy for mitigating anthropogenic mass wasting emphasizes high protection near watercourses where mass wasting hazard is high and subsequent risk of sediment delivery is high. Examples of high protection would be inner gorge and steep streamside slopes of TSU1 and TSU2. MRC also focuses on protections for steep, dissected terrain where mass wasting hazard is moderate-to-high and subsequent risk of sediment delivery is moderate-to-high. This would apply to TSU3. MRC analysis of sediment delivery in select watersheds is consistent with findings from other landscapes which show that a great majority of sediment delivery comes from these areas (Table 8-23).

Table 8-23 Percent Mass Wasting Sediment by High Hazard TSU

Watershed Analysis Unit	Inner Gorge or Steep Streamside Slopes (TSU1 and TSU2)	Steep, Dissected Topography (TSU3)	Total Sediment Delivery from High Hazard TSU (TSU1-TSU3)
Albion WAU	15%	29%	44%
Big River WAU	53%	22%	75%
Noyo WAU	40%	51%	91%
Navarro WAU	31%	51%	82%
Garcia WAU	76%	8%	84%
Greenwood WAU	47%	9%	56%

Table 8-23 suggests that by mitigating mass wasting concerns on TSU1, TSU2, and TSU3, MRC will reduce most of the management-created sediment delivered from landslides. Accomplishing this will require training foresters to recognize hazard areas in the field.

Research conducted in similar terrain reveals there are two unstable areas of a hillslope that are most likely to fail: headwall swales (a.k.a. bedrock hollows or zero-order swales) and inner gorges (Benda et al. 1998). Our mass wasting strategy addresses these areas in the conservation measures for TSU1 and TSU2 (inner gorges and steep streamside slopes), and TSU3 (headwall swales or locally steep slopes). If we assume homogenous bedrock and soil conditions (which is certainly not the case in Franciscan geology), there are two parameters with a significant influence on slope stability: slope gradient and shape (Sidle et al. 1985, Dietrich et al. 1998, Benda et al. 1998). In general, shallow mass movements increase as hillslope gradient increases (Sidle et al. 1985). Preliminary results from our mass wasting inventories for watershed analysis indicate that most shallow mass movements occur on slopes >65%. Slope shape also has an influence on shallow mass failures. Concave slopes tend to accumulate soil (colluvium) to greater depths and build up pore water pressures which can contribute to slope failure (Dietrich et al. 1998). The discharge rate of accumulated subsurface water from unstable soils is probably the most important hydrologic function affecting slope stability (Sidle et al. 1985). Repeated failures in and around old landslide initiation sites are common in steep terrain with relatively shallow soils (Sidle et al. 1985). Our mass wasting approach relies heavily on our foresters to decide, based on indicators of potential and past slope failure, whether the assessment of a professional geologist is necessary.

8.3.4.2 Canopy retention for mass wasting concerns

Many of the default conservation measures for mass wasting rely on canopy retention to maintain hydrologic functions and root strength on areas with mass wasting hazard.

INTENT	The intent of canopy retention is to provide forest stands with canopy for precipitation interception, evapotranspiration, and root structure in the soil mantle. Additionally, when slope failures do occur, canopy retention will ensure that LWD is delivered to the stream channel.

Canopy retention intercepts precipitation and facilitates subsequent evaporation of incoming precipitation. In addition, tree canopy is a surrogate for root strength; through canopy retention, vegetation retains root strength.

The effect of clearcut harvesting and subsequent increases in mass wasting and sediment inputs has been documented (i.e. Bishop and Stevens 1964, Gray 1970, O'Loughlin 1974, Montgomery et al. 2000). Still, there is little documentation on the effects of partial harvest on mass wasting and sediment delivery.

Generally, timber harvest reduces soil cohesion through root degradation and increases soil moisture by reducing the amount of rainfall interception and evapotranspiration. This, in turn, impacts slope stability.

8.3.4.3 Reduced root strength

The gradual decay of root systems in non-sprouting tree species can predispose provisionally stable slopes to failure (Gray and Megahan 1981, Ziemer 1981b, O'Loughlin and Ziemer 1982). Root systems contribute to the strength of the soil by providing a component of effective cohesion (Sidle et al. 1985). Increased landslide rates, occurring about 3-10 years after clearcutting, have been attributed to loss of root strength (Megahan et al. 1978). This period of increased landslides corresponds to the minimum rooting strength of the site following initial root decay and prior to substantial regeneration of trees (Sidle 1992). In fact, it may take as many as 25 years for a regenerating clearcut to restore over 50% of its original root strength (Ziemer 1981b). The positive effect of root strength is most pronounced in shallow cohesionless soils on steep slopes (Chatwin et al. 1994). In cohesive soils, the positive effect of root systems is less pronounced; additionally, where sprouting species are harvested and the root network does not decay, the negative effect of the harvest would be significantly less.

The effect of root decay on slope failures seems to be more pronounced in regions where there is harvesting of non-sprouting species. In the redwood region, where sprouting species such as coastal redwood and tanoak maintain a viable root mass even when cut, loss in root strength should be much less pronounced. In Caspar Creek, which is located in the redwood region, Cafferata and Spittler (1998) found little difference between landslide-associated sediment delivery in clearcut versus uncut stands; this was despite rainfall of high intensity and long duration that could potentially trigger a slope failure. Preliminary findings from a mass wasting inventory conducted on JDSF reveals no observed increase in the rate of shallow landsliding from timber harvest in clearcut units (Bawcom 2003, as cited in Keppeler et al. 2003). However, not all root masses of these species survive; among those that do, there will be a period during which the effective roots diminish (Ziemer and Lewis 1984). A USDA Forest Service report documents the decline and recovery of root biomass in redwood and mixed conifer forests of northwestern California (Ziemer and Lewis 1984).

8.3.4.4 Increased soil moisture

The hydrologic consequences of vegetation removal are less well known. Without rainfall interception, increased levels of precipitation infiltrate the ground surface; this increases pore water pressure and perhaps the potential for triggering a mass wasting event. In a 100-year-old second growth stand of redwood and Douglas fir in Caspar Creek, measurements of rainfall, through-fall, and stem-flow indicate that approximately 22% of rainfall is lost to storage or evaporation before it reaches the ground (Reid and Lewis 2004).

While increased amounts of rainfall after timber harvest may or may not initiate slope failure, soil will drain accumulated sub-surface water for a longer period after rainfall; this may leave the slope more susceptible to failure when it receives additional sub-surface water in the next rainfall. It is well known that shallow slope failures typically occur during peak groundwater conditions (near saturation) in response to intense rainfall (Sidle et al. 1985). Therefore, the likelihood that a slope will fail may be more influenced by the recurrence interval of high intensity, long duration, rainfall, rather than vegetation removal; such removal only incrementally increases the amount of water reaching the soil mantle during each rainfall. Vegetation removal, however, would certainly have a worse effect on slopes approaching failure prior to rainfall.

Thomas Spittler, Senior Engineering Geologist with CGS, has noted that in at least one example in northern California—Bear Creek, Humboldt County—harvesting most (i.e., >50%) of the watershed significantly increased landslides in inner gorge.[28] The observations at Bear Creek, which followed high intensity rainfall in January 1997, suggest that where inner gorges are present and where a regeneration harvest of even-aged stands was applied to 50% or more of the slope above the inner gorge, landslides and sediment delivery were common. When an inner gorge was not present or little canopy was removed, landslides were uncommon. According to a California Department of Conservation (1998) memorandum, debris slides are more common in sub-watersheds where 50% or more of the slopes are harvested.

The observations in Bear Creek support the hypothesis that reduction of upslope vegetation increases soil water levels down slope. During rainfall of high intensity and long duration, this also increases the number of landslides. Observations by other hydrologists support the hypothesis. For example, Keppeler and Ziemer (1990) found increases in water yield in a watershed with 67% of the timber volume harvested. Hibbert (1967) suggested that increases in stream flow increased proportionately to the amount of cover removed. Similarly, Rothacher (1971) suggested that forest harvest increased baseflow.

Removing vegetation in a watershed does increase baseflow, and one might conclude that this would increase mass wasting. However, Rothacher (1971) pointed out that partial cutting is less effective than clearcutting at increasing baseflow. Some observations have suggested that partial cutting may actually deplete soil water due to increased evapotranspiration by understory vegetation; it may also promote forest regeneration with increased energy and water for the understory (Greenwood et al. 1985).

Our mass wasting conservation measures propose standards for canopy retention to use evaporation and transpiration of soil moisture. Trees also provide root structure in the soil mantle. This increases the cohesive properties of the soil and creates flow paths along root macro-pores that facilitate soil water infiltration and hillslope drainage. If mass wasting does occur, large wood and woody debris from the canopy and other trees will retain a certain amount of the resulting sediment. The fact that failed slopes may deliver large wood to streams could mitigate impacts on stream habitat or even enhance stream habitat. For this reason, the conservation measures for TSU1 through TSU3 retain, per acre, at least 15 ft^2 of conifers with a dbh $\geq$18 in.

We acknowledge the inherent uncertainty in estimating the precise level of canopy retention needed to relieve mass wasting concerns. However, based on (1) a review of the literature, (2) findings from landslide studies in the redwood region, (3) the conservation measure for no harvest on inner gorge slopes and historically active areas, and (4) the proposed AMZ protections, the MRC proposal to retain 50% of the canopy on potentially hazardous ground appears adequate to minimize the impact of harvest-related landslides. Furthermore, MRC will retain 50% canopy on average across each watershed (excluding pygmy forest, natural grassland, oak woodland, and natural brush areas).[29] Use of uneven-aged management techniques over time will lead to increased canopy closure on both the harvest scale and the watershed scale.

8.3.4.5 5% alternative

To meet our long term objectives, MRC will use a limited amount of regeneration harvest management. As we have already said, those objectives include the reduction of hardwood in areas where hardwood is a significant component and the transition of MRC forest toward uneven-aged management. These regeneration harvests will primarily occur during the first 30 years of our HCP/NCCP. They may occasionally go below the default prescriptions for areas of mass wasting hazard.

[28] Email from Tom Spittler (CGS) to Kirk Vodopals (MRC) on August 10, 2006

[29] This is a simple example of canopy calculation across a watershed: (1) ½ of a watershed has partial harvest leaving 50% canopy; (2) ½ of the same watershed has 100% canopy; (3) the average canopy across the watershed is 75%, i.e., (0.5*50% + 0.5*100% = 75%).

MRC will limit regeneration harvests to 5% of the area of all the high hazard terrain units within a CalWater planning watershed over a 10-year period. Additionally, within a PTHP, we will only allow 5 ac of such harvests to occur for each high hazard terrain unit (i.e., TSU1 through TSU3).

Table 8-24 provides an example from a planning watershed where MRC controls most of the basin. MRC owns approximately 90% of the Little North Fork Navarro planning watershed which is tributary to the North Fork Navarro. Since the area where regeneration harvests will occur is based on a percentage of the high hazard ground, the level of impact ties directly to the total amount of the plan area in the planning watershed and the total amount of high hazard ground on that land.

Table 8-24 Example of the 5% Alternative

Little North Fork Navarro	
Area	Acres
Total Planning Watershed	7085
MRC Timberland	6423
TSU1, 2, 3	1857
5% of TSU1, 2, 3	**93**

In the above example, MRC could reduce forest canopy below the default harvest limit (i.e., 50% canopy cover) in 93 ac of the Little North Fork Navarro during a 10-year period. However, we could not harvest more than 5 ac per TSU in any given PTHP. Therefore, the default canopy of TSU1 could only be reduced 5 ac. The same would apply to TSU2 and TSU3. Essentially, this means that a maximum of 15 ac per PTHP could be reduced below the default conservation measures without a geologic or biologic assessment. Sticking with this example of the Little North Fork Navarro, MRC could propose 6 PTHPs, all with the maximum 15-acre alternative, to reduce canopy below the 50% default within a 10-year period (6 * 15 ac = 90 ac of regeneration harvest).

The intent of the *5% alternative* is to provide some flexibility where default conservation measures would normally not allow it, without significantly increasing sediment yield from mass wasting. MRC believes the *5% alternative* is reasonable based on estimates of sediment delivery from mass wasting in select watershed analysis units. There will be no alternative to the default conservation measures for timber harvesting on historically active areas or inner gorge slopes; conservation measures describe the geologic and biologic assessment for these areas. Table 8-25 gives an estimate of the potential impact from the *5% alternative* in the individual watershed analysis units.

Table 8-25 Estimated Sediment Delivery From 5% Alternative

Estimated Sediment Delivery From 5% Alternative					
WAU	**Total MRC Acres in TSU 1 to 3**	**Area of WAU in TSU1-3 (% of acres owned)**	**Acres of Canopy Reduction below 50% by WAU per Year***	**Sediment Delivery Rate from Non-Road Related Landslides (tons/mi^2/yr)**	**Estimated Sediment Delivery from 5% Alternative (tons/mi^2/yr)**
Noyo	5495	60%	58	371	19
Navarro	14,553	27%	74	218	11
N. Russian	550	47%	13	65	3
Albion	2290	15%	12	161	8
Greenwood	1830	18%	9	111	6

Estimated Sediment Delivery From 5% Alternative					
WAU	**Total MRC Acres in TSU 1 to 3**	**Area of WAU in TSU1-3 (% of acres owned)**	**Acres of Canopy Reduction below 50% by WAU per Year***	**Sediment Delivery Rate from Non-Road Related Landslides (tons/mi^2/yr)**	**Estimated Sediment Delivery from 5% Alternative (tons/mi^2/yr)**
Garcia	2642	21%	12	602	30
Big River	8004	23%	39	172	9

TABLE NOTE
* If MRC harvests the maximum 5% per decade

To arrive at the numbers in the last column of Table 8-25, MRC multiplied the sediment delivery rates from non-road-related landslides within each WAU by 5% and rounded up. For example, in the Noyo WAU, 371*.05=18.55≈19 tons/mi^2/yr. The assumption is that rates of non-road-related landslides from watershed analysis, analyzed for the past 20-30 years, simulate future canopy reduction below 50%. The rationale for this assumption is that a common silvicultural technique from the 1970s through the 1980s was the use of shelterwood removal, where a majority of overstory canopy was removed. Previous landowners used this practice extensively in the plan area.

Prior to the 1993 Forest Practice Rules related to silviculture, use of shelterwood removal did not follow current industry standards. A typical shelterwood removal would harvest large shelter trees and leave only a well-established forest of mainly younger conifers. In the 1980s, shelterwood removal allowed for the harvest of an unlimited number of trees per acre, even in old-growth forest. Only a minimum amount of stocking was left behind. Changes to the Forest Practice Rules in 1993 reigned in the use of this method of even-aged management to more acceptable acreage restrictions and post-harvest stocking levels. As well, during the 1993 Forest Practice Rule revisions, "late seral" stands of 20 ac or more had to be described in the THP and were offered more protection than previously. Today, in typical post-harvest stands where MRC has applied seed tree removal, stands have an uneven-aged appearance and characteristic to them.

The analysis also assumes that a majority of non-road-related sediment is generated from TSU1, TSU2, and TSU3. Additionally, we assumed that our estimates are minimum amounts of sediment delivery, as explained in Appendix G, *Watershed Analysis: Background and Methods*. Although field reconnaissance plays a significant role in determining sediment delivery rates, we do not conduct ground surveys over an entire WAU; as a result, estimates are considered minimums. While estimates are minimums, the delivery rates are from landslides where past harvesting occurred not only on inner gorge slopes, but also on historically active areas. The proposed conservation measures for mass wasting are more restrictive on streamside harvesting; they do not allow timber harvesting on inner gorge slopes or historically active areas unless an assessment is conducted by a geologist and a biologist. An assessment evaluates the impacts of proposed operations and draws conclusions based on site conditions. In light of this, the proposed *5% alternative* is not likely to result in a significant increase in sediment delivery from landslides related to timber harvest.

8.3.4.6 Estimates of sediment reduction

Estimates from select watershed analysis units suggest that approximately 60% of sediment inputs in the last 30-40 years have been from mass wasting. Of these inputs, 57% are from mass wasting associated with roads and 43% from other sources. Some portion, though difficult to determine, of non-road-related mass wasting occurs naturally. MRC believes the conservation measures proposed in this plan will reduce sediment delivery from mass wasting caused by management practices.

Road construction on any hillslope will inevitably decrease the stability of the site by adding weight to the fill slope; steepening the cut-slope and potentially the fill-slope; removing buttressing support of the cut-slope; and concentrating and rerouting drainage water (Sidle et al. 1985). For road-related mass wasting, our protection measures focus on avoiding road layouts on mass wasting hazards; improving drainage and design on the existing road system; and improving the design of future road prisms to minimize the impact of a road on the stability of a slope. The road prism consists of the road surface, as well as other features such as cutslope, fillslope, ditches, and storm drainage (Figure 8-17). There is considerable study and literature on the effects of logging roads on mass wasting, but little literature on the effects of improved road design in reducing mass wasting hazards.

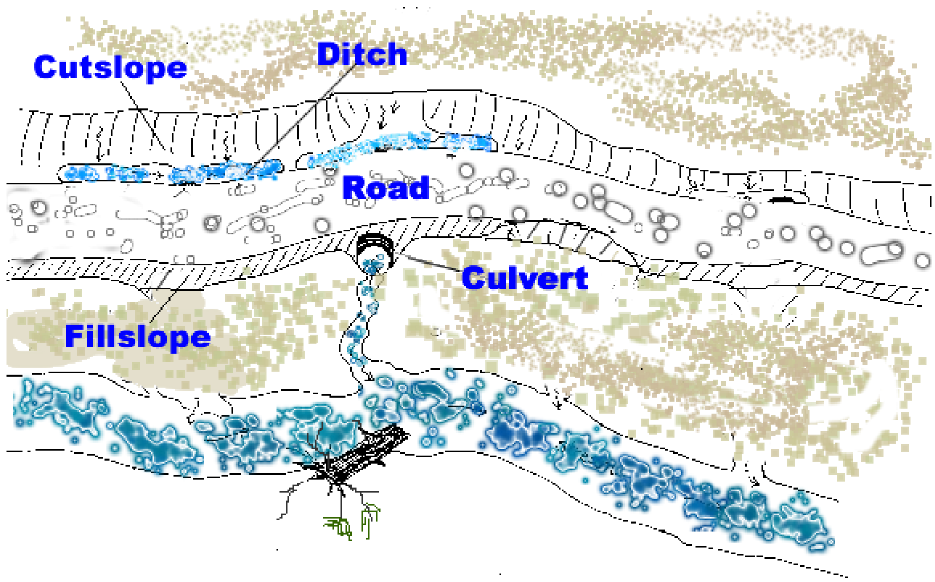


Figure 8-17 Road Prism

Sidle et al. (1985) presents a comprehensive review of comparative rates of soil mass movements from road-related disturbance versus undisturbed land. Results from the many studies show a 30-300 fold increase in the erosion rate dues to road-related mass wasting (Swanson and Dyrness 1975, Morrison 1975, Marion 1981, Ketcheson and Froehlich 1978, Swanson et al. 1977, Fiksdal 1974, O'Loughlin 1972, Gray and Megahan 1981, O'Loughlin and Pearce 1976). Much of the research has been conducted in the Oregon Coast Range and Oregon and Washington Cascades, where geomorphic conditions are not unlike those in the plan area.

This research is consistent with studies in the redwood region where a majority of sediment delivery from mass wasting is attributed to roads. In Caspar Creek, Cafferata and Spittler (1998) noted that almost all of the recent landslides delivering sediment to South Fork Caspar Creek were associated with roads and skid trails constructed prior to implementation of the California Forest Practice Rules. Prior to implementation of the Forest Practice Rules, many miles of road were constructed on steep unstable slopes using sidecast construction methods, with stumps and logs buried on the outside of the road prism. These methods resulted in thick un-compacted fills on steep slopes—in many cases directly adjacent to a watercourse. Field reviews conducted during watershed analysis confirm that a majority of road-related failures in the plan area originate from thick sidecast fills on steep slopes. A concise summary of forest road-related mass wasting by NCASI (2001) reveals these findings are consistent with other studies; these studies show that road-related landslides that prove most damaging to streams occur primarily from fill and sidecast failures on slopes >70%, and secondarily from culvert and stream crossing failures (Bush et al. 1997, Fiksdal 1974, Gonsior and Gardner 1971, Gray and Megahan 1981, Megahan et al. 1978, McClelland et al. 1997, Sidle et al. 1985, Skaugset et al. 1996, Swanson and Dyrness 1975, Jones et al. 2000).

Sessions et al. (1987) found that sidecast construction and moderate road grades in stable soil types in western Oregon resulted in 40 times more slides per mile of road then full bench roads on steeper grades. The difference in less stable sandy or gravelly soils was only a factor of 2 (NCASI 2001). This shows the importance of underlying geology and soils as a controlling factor in road-related mass wasting. While sidecast road construction on steep slopes is a significant contributor to mass wasting, the effects of construction method are overwhelmed by the effects of underlying geology if unstable bedrock or soil conditions are traversed. Conservation measures proposed in our HCP/NCCP prohibit road building across historically active slide areas unless a geologic and biologic assessment of site conditions is conducted.

Despite the inherent uncertainty about improved road design and its effect on sediment delivery, MRC believes road-related mass wasting can be significantly reduced as old roads on steep slopes are upgraded and new road layouts are carefully planned prior to construction. Therefore, we make the assumption that improved road design and avoidance of historically active slide areas can reduce sediment delivery from road-related mass wasting by 60%.

8.3.4.7 Mass wasting related to timber harvest

The influence of a particular timber harvest on slope stability depends on the density of residual trees and understory vegetation; rate and type of regeneration; site-specific physical characteristics; and patterns of water inflow (storms) after harvesting (Sidle et al. 1985). Our primary protection against mass wasting from timber harvest is canopy retention to provide root strength, interception of precipitation, and transpiration of soil moisture.

While attributing mass wasting to roads is typically a trivial task, attributing mass wasting to timber harvest can be quite problematic. Past research on the subject of timber harvest has focused on undisturbed forest and clearcuts (e.g., Swanson and Dyrness 1975, Morrison 1975, Marion 1981, Ketcheson and Froehlich 1978, Swanson et al. 1977, Fiksdal 1974, O'Loughlin 1972, Gray and Megahan, 1981, O'Loughlin and Pearce 1976). After clearcutting, all inventoried landslides are typically attributed to timber harvest. This may take the subjectivity out of interpretation, but it likely overestimates the actual rate of mass wasting as a result of timber harvests; clearly, it doesn't account for natural landslides occurring in harvested units. Additionally, aerial photo analysis, which is the typical inventory method for landslides, is not foolproof at detecting them, particularly small landslides, under dense forest canopy. As a result, observers can underestimate the rate of landslides in undisturbed forest conditions (Robison et al. 1999).

Robison et al. (1999) reported that sediment volumes from landslides were greater in stands 0-9 years old (i.e., recently clearcut), than stands over 100 years old. However, the greatest volume of sediment from landslides was in a stand that had not been harvested in 100 years. This example illustrates the variability in sediment delivery from mass wasting in mountainous forested terrain, especially in the Pacific Northwest where earthquakes and rainfall of high intensity and long duration are relatively common.

Numerous landslide studies summarized by Sidle et al. (1985) reveal an increase in the rate of mass wasting after clearcuts, namely, 2-40 times that in undisturbed forest, with a median 3.7 fold increase (Swanson and Dyrness 1975, Morrison 1975, Marion 1981, Ketcheson and Froehlich 1978, Swanson et al. 1977, Fiksdal 1974, O'Loughlin 1972, Gray and Megahan 1981, O'Loughlin and Pearce 1976). These studies find that the increase in landslide rates after clearcutting is significantly less than the increase after road construction.

Landslide studies conducted in the redwood region on Jackson Demonstration State Forest (JDSF) show no significant increase in the rate of landslides from clearcutting (Cafferata and Spittler 1998). Recent research conducted on JDSF looked at 50 clearcut units (1800 ac) in Hare Creek, Caspar Creek, Big River, and South Fork Noyo. Results reveal that 28 of the 32 mapped failures in the clearcut blocks were attributed to roads, not timber harvest (Bawcom 2003, as cited in Keppeler et al. 2003).

Because of the complexity in identifying mass wasting related to timber harvest, most researchers simplify the process by only comparing undisturbed forest and clearcuts. Very little research is currently available on how partial harvest affects slope stability. One model found that a 75% partial harvest reduced the probability of slope failure 5 times compared to clearcuts (Sidle 1992). However, the probability of failure was largely influenced by root decay, which is probably not as prevalent in the redwood region where harvested redwoods sprout vigorously from the stump.

Despite the inherent uncertainty in attributing mass wasting to timber harvests, we believe the conservation measures proposed in this plan will reduce sediment delivery from timber harvest. Therefore, we make the assumption that canopy retention on potentially hazardous areas and no harvest defaults on historically active slide areas will reduce sediment delivery from harvest-related mass wasting by 20%.

8.3.4.8 Combined goal

The 60% or more reduction in sediment inputs from road-related mass wasting plus the 20% reduction from harvest-related mass wasting is a final objective of our HCP/NCCP—an objective to be achieved by the end of its 80-year term. At current harvest levels, it will take approximately 30-40 years to upgrade the road network and transition forest management to uneven-aged silviculture. We will not know if our objective is on course until the first 30-40 years of our HCP/NCCP transpire. Nevertheless, based on an up-to-date review of forest research, MRC believes the conservation measures proposed in this plan will ensure our objective is met within the term of our HCP/NCCP.

8.4 Hydrologic change

8.4.1 Goals and objectives

Goal and Objectives for Hydrologic Change	
Goal	
G§8.4.1-1	Limit the adverse impact of hydrologic change on covered anadromous salmonid and amphibian species or on beneficial uses of water.
Objectives	
O§8.4.1-1	Reduce hydrologic change by maintaining at least 50% canopy cover,[30] averaged across CalWater planning watersheds in the plan area.
O§8.4.1-2	Minimize hydrologic connectivity of road systems to watercourses as outlined in Appendix E, *Roads, Landings, and Skid Trails* by upgrading, within the first 30 years of the HCP/NCCP, the MRC road network to these standards.

[30] MRC only measures canopy cover for trees >30 ft in height.

Goal and Objectives for Hydrologic Change	
O§8.4.1-3	Maintain, during water drafting, equivalent temperatures downstream and upstream and limit the reduction of the wetted width of the 1st downstream riffle as well as pool volume.

8.4.2 Conservation measures

MRC is not proposing additional or new conservation measures to address hydrologic change due to forest management. Rather, we will use conservation measures and policies already cited in our HCP/NCCP:

- Uneven-aged management will provide forest canopy to minimize peak and low stream flow changes.
- Increases in LWD recruitment will improve over-wintering habitat for salmonids and make downstream displacement of young-of-the-year from increased peak flows unlikely.
- Implementation of road design standards which minimize concentrated drainage will reduce erosion of channels and banks.
- Adherence to guidelines on water drafting in the Master Agreement for Timber Operations (MATO) will protect covered fish and amphibian species.

8.4.3 Rationale

Forest harvesting influences the stream flow of a watershed through loss of evapotranspiration and interception of precipitation from the forest canopy; increased surface run-off from compacted soil surfaces, such as roads, landings, skid trails, firelines, and cable corridors; and changes in snow accumulation from canopy openings (Harr 1981, Wemple et al. 1996, Ziemer 1998, Lewis et al. 2001). These alterations of the water balance can change size, duration, and frequency of peak flows; low flow discharges; and annual water yield.

The amount and timing of forest harvest and the physical and geographical characteristics of a watershed influence the magnitude of hydrologic change. Hydrologic change due to forest harvest does occur. Do these changes, however, negatively impact aquatic organisms? To target potential damage to aquatic organisms or their habitat, we need to consider the following questions:

- Do increases in peak flow create adverse scour to the streambed and banks?
- Do increases in stream power displace young-of-the-year salmonids or amphibians downstream?
- Can increased peak flow create barriers to upstream anadromous salmonid migration?
- Is there increased potential for transporting LWD?
- Do increases in localized stream flow, due to road drainage, create more sediment from fluvial erosion of a channel or its banks?
- Do changes to low-flow conditions impact aquatic organisms?

8.4.3.1 Peak flow changes due to forest canopy removal

Research at Caspar Creek (Lewis et al. 2001), located adjacent to the plan area in coastal Mendocino County, shows that changes in peak flows can be predicted. The equation to estimate those changes is in Appendix I, *Peak Flow Predictions*. MRC applies this equation to our uneven-aged forest management, assuming it is a reasonable, perhaps conservative, approximation. Jack Lewis, retired statistician with the USDA Forest Service, characterized the peak flow equation in this way:

> For anything but individual tree selection the equation should, for the most part, be a good approximation. In that case, water uptake from live roots of surrounding trees interwoven with the harvested trees, might result in more water use than a harvest of the same volume in a clear-cut. And the recovery period would probably be accelerated as

> formerly competing trees took over. For group selection cuts, water gains should be fairly similar to an equivalent clear-cut. There is one caveat. If the size of the group selection is small enough, then edge effects will become important. For example, roots from border trees will be able to exploit a certain amount of soil water from within the blocks.[31]

In the Caspar Creek research, no relationship was found between increased peak flow and number of roads, skid trails, or other compacted surfaces (Ziemer 1996). However, roads, landings, and skid-trails in North Fork Caspar Creek are all located near ridges and well away from any streams. Further, soil compaction from roads and timber harvest represent only 3.2% of the North Fork watershed and range from 1.9–8.5% for the tributary watersheds. So it is not surprising that roads, soil compaction, and overland flow did not produce changes in peak flow response of the North Fork watershed.

Using our model for landscape planning, MRC estimated canopy retention for 10-year periods. For the canopy predictions, we modeled growth, yield, and harvest in each of the time periods. Canopy retention from individual stands was averaged across the plan area in CalWater planning watersheds; the result represents canopy retained in the plan area. Canopy retention on land not owned by MRC is unknown. Therefore, any estimates of peak-flow increase are for effects created in the plan area.

Peak flow increases were estimated for each decade from 2002-2060 (see Appendix I, *Peak Flow Predictions*). Lewis et al. (2001) state that peak flow increases recovered at a rate of 8% per year after the first harvest. Later research reached a similar conclusion, namely, that such increases return "to pre-harvest flow conditions after about 12 years" (Keppler et al. 2003, 5). MRC actually estimated recovery of peak flow effects at 10 years based on our own silvicultural practices and experience, as well as early conversations between our hydrologist and a mathematical statistician with the Pacific Southwest Research Station, the research and development branch of the USDA Forest Service.[32] Consequently, our analyses for 10-year time periods do not include effects from the previous timeframe.

Our long-term plan is to develop an uneven-aged forest structure where sustainable selective harvest can occur. Uneven-aged forest management ensures that forest canopy is maintained across the landscape. Furthermore, rapid recovery of forest canopy, with canopy returning to pre-harvest conditions, typically occurs within 10 years. Regulated, uneven-aged management will schedule forest harvests in stands approximately every 20 years. Over time the size of trees within the stands will increase, as will the average canopy. We hypothesize that this increase of average canopy, over time, will reduce the intensity of peak flow events in the plan area.

Table 8-26 shows that canopy will increase, as averaged across the plan area within CalWater planning watersheds. Estimated average canopy in 2010 by planning watershed was 65%, with a minimum canopy of 48% and a maximum of 76%. Average canopy increases in 2060 to 73%, with a minimum canopy of 61% and a maximum of 80%. As canopy increases, the cumulative effect of forest harvest on increases in peak flows decreases in the planning watersheds.

[31] Jack Lewis clarified an earlier statement of his in an email to Kirk Vodopals (MRC) sent on 03/08/2011.

[32] Located in Arcata, CA, Redwood Sciences Lab (RSL) is a field facility of the Pacific Southwest Research Station. Jack Lewis, a mathematical statistician at RSL, discussed this issue in a telephone conversation with Chris Surfleet, the MRC hydrologist at the time, on June 10, 2002. Chris left MRC in 2004 to pursue graduate work at Oregon State University, while Jack retired from RSL in 2008.

Table 8-26 Canopy Closure and Estimated Percent Increase of the Peak Flow[33]

Canopy Closure and Estimated Percent Increase of the Peak Flow															
Inventory Block	**CalWater Planning Watershed**	**Average Percent Canopy Closure by Time Period**							**Percent Increase in Peak flow 2 Year Return Interval**						
		2002	2010	2020	2030	2040	2050	2060	2002	2010	2020	2030	2040	2050	2060
Albion River	Lower Albion River	72	76	76	75	78	78	80	7.1	6.1	6.1	6.1	5.4	5.4	5.1
	Middle Albion River	60	62	61	62	62	67	69	10.0	9.4	10.0	9.7	9.7	8.1	7.6
	South Fork Albion River	63	64	69	71	73	72	76	9.2	9.2	7.6	7.4	6.6	6.9	6.1
	Upper Albion River	66	66	61	60	64	70	75	8.7	8.4	10.0	10.0	9.2	7.4	6.1
	Upper Noyo River	67	70	71	71	75	74	74	8.4	7.4	7.4	7.4	6.1	6.6	6.6
Big River	East Branch North Fork Big River	53	55	61	53	55	55	63	11.8	11.5	10.0	11.8	11.5	11.3	9.4
	Lower North Fork Big River	58	60	60	61	63	65	69	10.5	10.0	10.0	10.0	9.2	8.9	7.9
	Martin Creek	59	67	68	70	72	74	73	10.5	8.4	7.9	7.6	6.9	6.4	6.6
	Mettick Creek	64	48	55	64	68	68	69	9.2	13.4	11.3	8.9	7.9	8.1	7.6
	Russell Brook	69	61	62	65	67	70	70	7.9	10.0	9.4	8.9	8.1	7.6	7.4
	South Daugherty Creek	61	53	56	62	66	70	70	9.7	12.1	11.0	9.4	8.4	7.6	7.6
	Two Log Creek	58	57	58	65	67	72	73	10.5	10.7	10.5	8.7	8.4	6.9	6.9
Garcia River	North Fork Garcia River	61	63	66	69	67	68	73	9.7	9.4	8.4	7.9	8.1	8.1	6.6
	Rolling Brook	68	68	68	69	70	69	72	8.1	8.1	7.9	7.6	7.6	7.6	6.9
	South Fork Garcia River	65	68	68	68	70	74	75	8.7	8.1	8.1	7.9	7.4	6.6	6.4
Navarro East	Dutch Henry Creek	60	58	61	64	64	70	69	10.0	10.5	9.7	8.9	9.2	7.6	7.6
	John Smith Creek	64	60	61	62	65	68	72	9.2	10.2	9.7	9.4	8.9	8.1	7.1
	Little North Fork Navarro River	57	54	57	62	65	69	71	11.0	11.8	11.0	9.4	8.7	7.6	7.1
	Lower South Branch Navarro R.	67	59	59	58	66	68	70	8.1	10.5	10.2	10.7	8.4	8.1	7.6
	Middle South Branch Navarro R.	59	55	55	55	60	60	63	10.5	11.5	11.5	11.3	10.2	10.0	9.4
	North Fork Indian Creek	65	64	67	66	67	73	71	8.9	8.9	8.4	8.4	8.1	6.6	7.1
	Upper South Branch Navarro River	61	58	58	67	67	68	68	9.7	10.5	10.7	8.4	8.1	8.1	7.9
Navarro West	Flynn Creek	74	71	69	75	78	73	75	6.6	7.4	7.9	6.4	5.4	6.6	6.4
	Hendy Woods	68	67	65	72	73	74	75	8.1	8.1	8.7	7.1	6.6	6.4	6.1
	Lower Navarro River	73	66	63	60	65	65	65	6.9	8.4	9.2	10.0	8.9	8.7	8.9
	Middle Navarro River	67	65	63	72	75	73	74	8.1	8.9	9.2	6.9	6.1	6.9	6.6
	North Fork Navarro River	74	70	70	77	80	76	76	6.4	7.4	7.4	5.9	5.1	5.9	5.9

[33] Versus watershed conditions of dense second-growth forest

Canopy Closure and Estimated Percent Increase of the Peak Flow															
Inventory Block	**CalWater Planning Watershed**	**Average Percent Canopy Closure by Time Period**							**Percent Increase in Peak flow 2 Year Return Interval**						
		2002	2010	2020	2030	2040	2050	2060	2002	2010	2020	2030	2040	2050	2060
	Ray Gulch	63	65	66	74	75	75	75	9.4	8.9	8.7	6.4	6.4	6.4	6.4
	Upper Navarro River	68	63	69	72	75	74	70	8.1	9.2	7.6	6.9	6.4	6.4	7.4
Noyo River	Hayworth Creek	66	68	75	77	77	77	77	8.7	7.9	6.1	5.6	5.6	5.9	5.6
	McMullen Creek	69	73	73	68	76	68	70	7.6	6.9	6.9	7.9	6.1	7.9	7.4
	Middle Fork Noyo River	49	69	75	79	79	79	79	13.1	7.9	6.1	5.4	5.4	5.1	5.1
	North Fork Noyo River	64	65	65	74	76	73	76	9.2	8.7	8.7	6.4	6.1	6.9	6.1
	Olds Creek	66	63	65	66	70	69	70	8.7	9.2	8.9	8.4	7.6	7.6	7.4
	Redwood Creek	56	65	66	69	69	74	76	11.3	8.9	8.7	7.9	7.9	6.6	5.9
Rockport	Cottaneva Creek	73	69	71	75	75	71	72	6.6	7.6	7.1	6.4	6.4	7.1	7.1
	Hardy Creek	58	68	78	79	78	76	77	10.7	7.9	5.6	5.4	5.4	5.9	5.9
	Howard Creek	66	70	73	76	75	78	76	8.7	7.6	6.6	6.1	6.1	5.4	6.1
	Jack of Hearts Creek	67	67	69	73	74	78	75	8.1	8.1	7.6	6.6	6.4	5.6	6.1
	Juan Creek	65	67	77	78	75	74	76	8.7	8.1	5.6	5.4	6.1	6.4	5.9
	Lower Hollow Tree Creek	66	67	71	74	74	73	75	8.7	8.1	7.4	6.4	6.6	6.6	6.1
	Middle Hollow Tree Creek	63	65	69	74	74	73	77	9.2	8.9	7.6	6.6	6.4	6.9	5.9
	Upper Hollow Tree Creek	58	58	59	72	72	77	79	10.7	10.7	10.2	6.9	6.9	5.6	5.4
South Coast	Lower Alder Creek	72	73	71	73	77	77	77	7.1	6.9	7.1	6.6	5.9	5.9	5.9
	Lower Elk Creek	74	75	76	73	74	71	74	6.4	6.4	5.9	6.9	6.4	7.1	6.4
	Lower Greenwood Creek	76	73	73	73	74	74	74	5.9	6.6	6.6	6.6	6.4	6.4	6.4
	Mallo Pass Creek	65	65	73	70	71	72	73	8.9	8.7	6.9	7.6	7.1	7.1	6.9
	Upper Elk Creek	67	65	67	70	73	71	73	8.1	8.7	8.1	7.4	6.6	7.4	6.9
	Upper Greenwood Creek	68	61	67	72	75	74	76	8.1	9.7	8.1	6.9	6.4	6.4	6.1
Ukiah	Upper Ackerman	60	52	54	58	61	63	61	10.2	12.1	11.5	10.5	9.7	9.2	9.7
Median Value		***65***	***65***	***67***	***70***	***72***	***73***	***73***	***8.7***	***8.9***	***8.1***	***7.4***	***6.9***	***6.9***	***6.6***

It is estimated that, for average wetness conditions observed for a 2-year event (wetness index value of 304), increases in current peak flow range from 5.9% to 14.5%. The median observation is 8.7% greater than peak flows expected from a fully forested, second growth watershed condition. By 2060, the cumulative effect of forest harvest on increases in peak flows will be lowered to a range of 5.1-9.7%, with a median observation of 6.8%.

Estimates of increase in peak flow, presented in Table 8-27, are based on an average wetness index. As we stated earlier, the peak flow equation is very sensitive to the wetness index. When conditions in a watershed are very dry, then peak flow increases can be much higher than shown. When watershed conditions are very wet, peak flow increases will be lower.

Table 8-27 Estimates of Increase in the Peak Flow

		CalWater Planning Watersheds					
		Conditions in 2009			Conditions in 2060		
Antecedent Wetness	Index Value (w)	Minimum Peak Flow Increase (%)	Maximum Peak Flow Increase (%)	Median Peak Flow Increase (%)	Minimum Peak Flow Increase (%)	Maximum Peak Flow Increase (%)	Median Peak Flow Increase (%)
Dry	50	17.2	41	***26***	14.9	29.4	***19.9***
Average Wetness	304	5.9	14.5	***8.7***	5.1	9.7	***6.8***
Wettest	600	1.9	4.5	***2.8***	1.7	3.1	***2.2***

Peak flows greater than or equal to a 2-year return interval for gauged watersheds (or historically gauged rivers) in the plan area (Noyo River, Navarro River, Albion River, and Big River) have occurred predominately in January and February. There have been few 2-year-or-greater events in late December and only one in March. Though extended dry periods can occur at that time of year, it is reasonable to assume that peak flows greater than or equal to a 2-year return interval occur in predominately wet antecedent conditions. The use of peak flow increase derived from average wetness (w=304) is the best estimate of recurring conditions for a 2-year event.

8.4.3.2 Effect of increased peak flows on aquatic habitat and organisms

At the North Fork Caspar Creek weir (drainage area approximately 1200 ac), where the peak flow equation that we use was developed, the 2-year peak flow was increased by 9% (Ziemer 1998). This increase followed approximately 50% removal of canopy across the watershed, due to clear-cutting. In North Fork Caspar Creek, Lisle and Napolitano (1998) were not able to distinguish a substantial channel modification from this magnitude of peak flow increase. The level of peak flow increase in North Fork Caspar Creek is comparable to what MRC is currently predicting for our land. Over time MRC will not have any watersheds with 50% of the canopy removed; currently there is only one. In most cases, the percentage of canopy will be much higher because of MRC uneven-aged management. Given that the amount of canopy removed will decrease over time, we do not anticipate substantial scour or channel modification. De Vries (2000) found that small changes in peak flow from logging, like those predicted here, would have minimal effect on anadromous salmonid survival. Depth of streambed scour is dominated by streambed sediment supply and distribution, not by flow rate. This is important because channel modification from increased peak flows could negatively influence aquatic habitat.

As stated previously, the largest increase of peak flows are from first stream flow events in the fall, when antecedent wetness conditions in a watershed are low. Though these events do not have a high probability of being large events (i.e., 1-year recurrence intervals or greater) that could influence channels or modify habitats, they might create a direct impact on young-of-the-year salmonids. It has been hypothesized that increased peak flow from forest harvest may result in displacement of young-of-the-year salmonids downstream. Providing good over-wintering habitat in streams for refuge from high flows could likely offset the effect of increased peak flows. LWD is a significant habitat component in forested streams for improving over-wintering habitat. Conservation measures outlined in our HCP/NCCP will increase LWD recruitment to stream channels. Small increases in peak flow are not expected to provide enough additional stream power to create increased transport of LWD. Increases in LWD and subsequent improvement in over-wintering habitat should minimize downstream displacement of young-of-the-year salmonids. Displacement of amphibians covered in our HCP/NCCP is unlikely. By fall, most amphibians will be in their adult form—able to leave a stream to evade high stream flow events. Finally, channel roughness, increased by LWD, will slow water velocities and prevent barriers to upstream anadromous salmonid migration.

Localized increases in stream flow, due to road or other compacted surfaces, could result in increased sediment yield from streambed scour and bank erosion; down-cutting of stream channels and degradation of channel banks; increased turbidity due to increased sediment inputs; and formation of gullies.

In steep headwater streams, increased channel erosion or streambed scour could result in reduction of pool habitat for amphibians which are breeding and rearing; increased turbidity; and less substrate for amphibians to attach to or burrow in.

MRC considers conservation measures to reduce concentrated run-off from roads or other compacted surfaces that creates gullies or localized channel and bank erosion an important issue and addresses this in our road design standards (see Appendix E, *Road, Landing, and Skid Trail Standards*).

8.4.3.3 Water yield and low flow after forest canopy removal

Water yield typically increases following forest harvest. Lewis et al. (2000) reported increases in storm run-off as much as 400%; most increases were less than 100%, including 50% clear-cut harvest in the North Fork Caspar Creek. The increase in water yield can be short-lived, with effects diminishing within a few years due to re-growth of vegetation following harvest (Keppeler and Ziemer 1990). While Keppeler and Ziemer do not specifically attribute the reduced water yield to increases in conifer growth, ample evidence exists to suggest that, in a well-stocked redwood forest, such a reduction can indeed be attributed to conifers.

Low flows in summer tend to increase after forest harvest but were found to diminish 5 years after selective harvest in South Fork Caspar Creek (Keppeler and Ziemer 1990, Keppeler 1998). This was due to new water demands from the regenerated forest after harvest (Keppeler and Ziemer 1990). In North Fork Caspar Creek 6-8 years after a 50% clear-cut harvest, no reduction in summer low flow had been observed (Keppeler 1998). Data suggests that water yield will persist longer after clearcutting than when a similar timber volume is removed from a watershed with selective cutting. These differences in water yield recovery are probably related to changes in rainfall interception and evapotranspiration.

At Caspar Creek, enhanced low flows in summer increased aquatic habitat in stream channels. In the Caspar Creek study, higher levels of low flow increased habitat volumes and lengthened the flowing channel network along logged reaches (Keppeler 1998). However, an increase in biomass of invertebrates was not observed (Nakamoto 1998). The majority of MRC harvest will use selective harvest techniques. We expect this to minimize low-flow impacts.

8.4.3.4 Fog and hydrologic change

Fog is a significant hydrologic input to coastal watersheds of the Pacific Northwest. Fog precipitation or fog drip occurs when fog droplets encounter an obstruction, coalesce, and fall to the ground. Forest canopy is particularly efficient at intercepting water droplets and inducing fog drip. In a study site at the mouth of the Klamath River, Dawson (1996) determined that 8-34% of water used by coastal redwood trees and 6-100% of water used by under-story vegetation originated as fog drip. In Point Reyes, Ingraham (1995, as cited in Keppeler 1998) found the isotopic composition of groundwater reflected contribution of fog water.

That part of the plan area directly adjacent to the coast receives fog precipitation for 30-50% of the days in June, July, and August (Goodridge 1978). However, just a few miles inland, there is fog precipitation for 10-35% of the days for the same time period (Keppeler 1998). Most inland areas of the plan area receive little fog. The coast range ridges and mountains provide an effective barrier to inland penetration of marine fog layers.

At Caspar Creek, observation in upslope swales (i.e., soil pipe studies) and stream flow observations both have indicated increased water yield after logging. This suggests that loss of fog drip did not play a significant role in hydrologic changes following forest harvest (Keppeler 1998). In addition, loss of evapotranspiration from forest harvest may be a more significant variable to changes in watershed hydrology than fog drip. If fog drip was an important component of hydrologic change at Caspar Creek, then soil moisture and stream flow should have decreased after logging. However, it increased, suggesting little effect (Keppeler 1998).

8.4.3.5 Water drafting

Drafting of water from watercourses, ponds, and springs is necessary for the maintenance of the road network during the dry summer season. Inadequate surface wetness combined with heavy traffic can deteriorate the running surface of the road to a powdery fluff which fall precipitation can easily transport. Roads with heavy traffic may require multiple applications of water per day in order to properly maintain the road surface. This necessitates removing thousands of gallons of water from a drafting site on a daily basis. Road surface preparations, such as lignin, may reduce the amount of water needed for maintenance, but applications of this product can be cost prohibitive. Drafting from watercourses may also impact biological resources within close proximity to the drafting site by

- Reducing the water of rifle crests and side-channel pools, thereby limiting the movement of aquatic wildlife.
- Increasing predation in pools as a result of decreased pool volume.
- Altering stream temperature by decreasing water volumes.

In order to minimize such impacts, MRC will adhere to guidelines on water drafting within MATO. Furthermore, MRC will submit annual compliance monitoring reports on water drafting activities. An example of this annual report is in Appendix D, *HCP/NCCP Report Timelines and Samples* (section D.2.11).

Chapter 9

Conservation Measures for Terrestrial Habitat

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9 CONSERVATION MEASURES FOR TERRESTRIAL HABITAT

9.1 Introduction

Chapter 9 addresses the conservation measures for terrestrial habitat under the separate topics of snags, wildlife trees, and downed wood; hardwoods; old growth; rocky outcrops; and natural communities. Each of these sub-sections includes goals and objectives, conservation measures, and rationales.

9.2 Snags, Downed Wood, and Wildlife Trees

9.2.1 Overview

Snags, downed wood, and wildlife trees add complexity to forest habitat and provide critical elements for the survival of many species; all are essential to a healthy forest ecosystem. MRC maintains these existing elements in our forests and provides for their additional recruitment.

DEFINITION

A **snag** is any standing dead tree.

Downed wood is any tree or part of a tree that rests on the forest floor as a result of natural causes (e.g., windfall and fire) or deliberate felling for the specific purposes of creating downed wood.

A **wildlife tree** is any standing live or dead tree that possesses special and uncommon characteristics providing valuable habitat for wildlife.

A **recruitment tree** is a standing live tree that is retained during a harvest in order to develop into a snag or wildlife tree in an area deficient in these habitat elements; recruitment trees are generally older, larger trees that exhibit signs of decadence, deformity, or structure.

9.2.1.1 Snags

A popular misconception is that a healthy forest is composed entirely of beautiful, proportioned, living trees. In reality, snags or dead trees are also part of a healthy forest and play a critical role in MRC conservation measures for wildlife habitat. Snags are classified as either hard or soft.

DEFINITION

A **hard snag** is composed primarily of sound wood; its top is intact as well as some of its branches and most of its bark, although a redwood hard snag may actually lack considerable bark.

A **soft snag** is composed of wood softened by weather, insects, and fungal rot; its top is generally missing, as well as its bark and branches.

Hard snags provide nest sites and food sources for wildlife while soft snags provide recruitment for downed logs. As they decompose, hard snags become soft snags. Consequently, MRC chooses to concentrate our efforts on maintaining enough hard snags to provide sufficient nest sites as well as potential recruitment for downed logs.

9.2.1.2 Downed wood

Downed wood includes downed logs and large limbs on the forest floor. As a key element of redwood ecology, this woody debris provides habitat and food sources for small animals and *mesocarnivores*, like ringtail, marten, and fisher, as well as nutrient cycling for the forest ecosystem. It also provides a moist microclimate for various plants and animals, including many mosses, invertebrates, and terrestrial amphibians. As wood decays, a downed log contributes additional nutrients to the forest. Downed wood can be either hard or soft logs.

DEFINITION

A **hard log** consists of primarily sound wood with mostly intact bark, although a redwood hard log may actually lack considerable bark.

A **soft log** consists of wood softened by weather, insects, and fungal rot, with most of its bark missing.

Hard logs provide shelter while soft logs provide food for forest animals. As they decompose, hard logs become soft logs. Consequently, MRC chooses to concentrate our efforts on maintaining enough hard logs to provide sufficient animal shelter and potentially recruit as soft logs. Figure 9-1 illustrates stages of decay in downed wood.

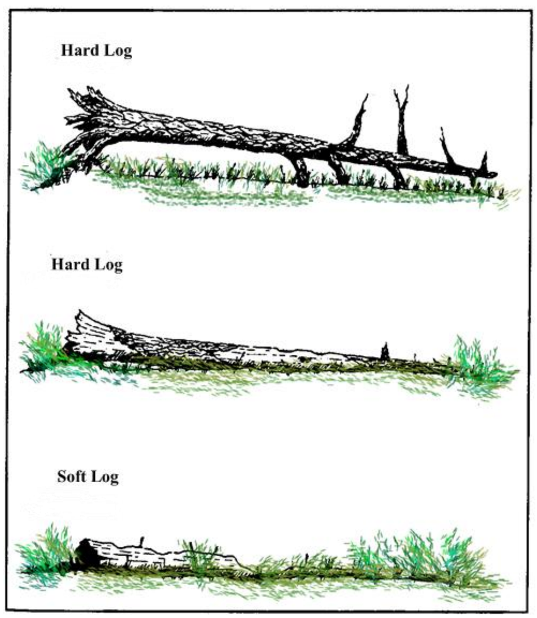


Figure 9-1 Decaying Log

9.2.1.3 Wildlife trees

Wildlife trees provide valuable attributes for wildlife. MRC has established numerical objectives for wildlife trees; we will mark these trees for retention during the PTHP process.

Wildlife trees are[1]

- Old-growth trees.
- Primary murrelet trees (see section 10.3.2.3.5).
- Trees in which the diameter of the entrance hole leading to a cavity is greater than 3 in. and 10 ft or more above the ground.
- Trees over 24 in. dbh with basal hollows that are more than 12 in. in any horizontal dimension and extend at least 6 in. vertically inside the cavity from the topmost point of the entrance hole (Figure 9-2).
- Trees with known raptor nests.
- Granary trees.

DEFINITION	A **granary tree** has at least 100 small holes on the tree that are either filled with acorns or capable of containing acorns.[2]

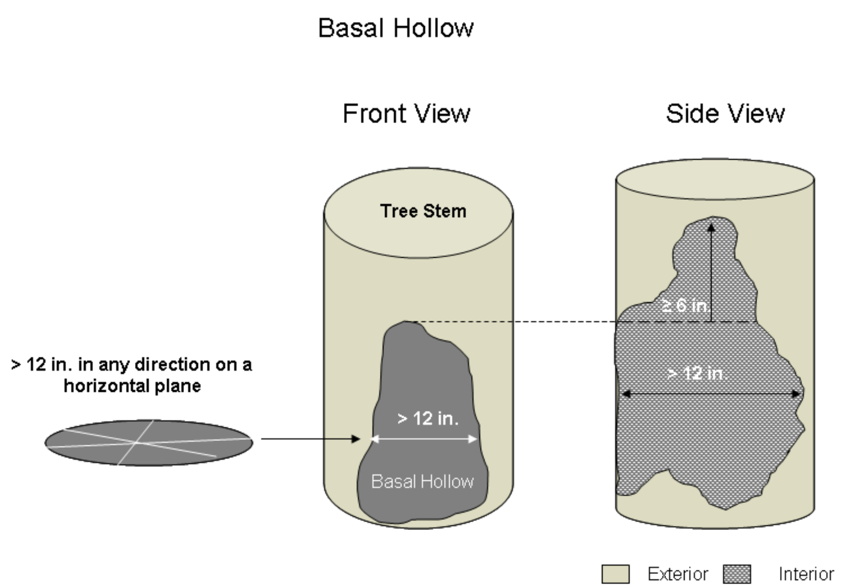


Figure 9-2 Basal Hollow Dimensions

9.2.1.4 Recruitment trees

A recruitment tree should show imminent potential to become a hard snag or wildlife tree. Generally, recruitment trees are larger and older trees that exhibit signs of decadence, deformity, or structure. In the selection of recruitment trees, whitewoods are preferable to redwoods but not to the exclusion of redwoods. MRC manages the plan area for hard snags and wildlife trees. In Figure 9-3, illustrations 1 and 2 are potential recruitment trees; 3, 4, and 5 are hard snags; 6 is a soft snag.

[1] MRC and the wildlife agencies recognize that during the term of this plan we may learn of other attributes that are highly valuable to wildlife. If either MRC or the wildlife agencies determine that we should add or change attributes, we will meet and confer. Changes or additions to the attribute list require concurrence of both MRC and the wildlife agencies.

[2] In an e-mail to Robert Douglas (MRC) on 1/31/06, Dr. Walter Koenig (UC-Berkeley) suggested this definition.

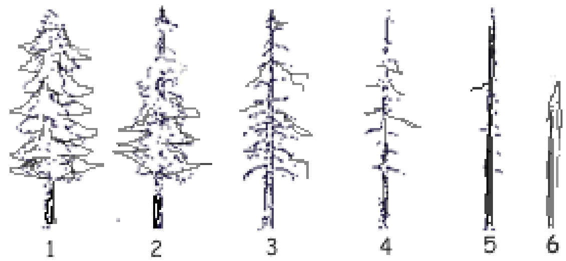


Figure 9-3 Snags and Snag Recruitment Trees

9.2.2 Goals and objectives

Goals and Objectives for Snags, Downed Wood, and Wildlife Trees	
Goals	
G§9.2.2-1	Retain and recruit snags in managed stands and downed wood on the forest floor.
G§9.2.2-2	Retain all wildlife trees.
G§9.2.2-3	Manage wildlife trees and downed wood so that they ▪ Are well distributed across the forest—in both riparian and upslope areas, in groups and singly. ▪ Exist in sufficient quantity and quality across the forest.
Objectives	
O§9.2.2-1	Retain[3] in Class I and Large Class II AMZ at least ▪ 1 hard snag or recruitment tree *on average per acre*[4] that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 2 hard snags or recruitment trees o*n average per acre* that are ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 6 hard logs *on average* per acre that are (a) ≥ 16 in. average diameter, (b) ≥6 ft long, and (c) derived from at least 3 trees.
O§9.2.2-2	Retain in general forested areas at least [5] ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 5 hard logs *on average per acre* that are (a) ≥ 16 in. average diameter, (b) ≥ 6 ft long, and (c) derived from at least 3 trees.

[3] MRC may retain trees without marking or counting them. We will only mark and count trees in Class I and Large Class II AMZs if harvest will occur there.
[4] MRC calculated the value by silvicultural unit and then standardized the value per acre.
[5] These areas exclude designated core areas of northern spotted owls, as well as Class I and Large Class II AMZs.

9.2.2.1 Implementation contingencies

9.2.2.1.1 Snags and wildlife trees

DEFINITION

A **silvicultural unit** is an area within a PTHP with only 1 type of silviculture that is non-contiguous with other areas of that same type (Figure 9-4).

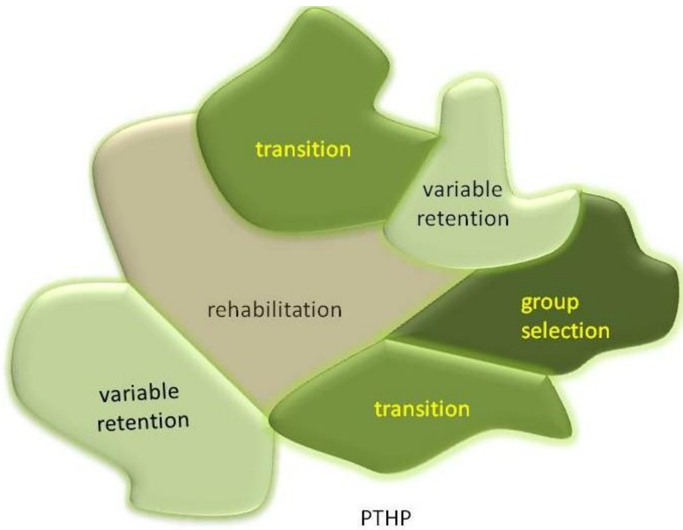


Figure 9-4 PTHP with Silvicultural Units

Intent of the implementation contingencies
The intent of the implementation contingencies is to retain in general forested areas snags and wildlife trees and, if density is low, to recruit *on average* 3 trees per acre. MRC will retain a recruitment tree during subsequent entries for harvest unless (a) it is no longer standing, or (b) there are better choices now for a wildlife recruitment tree in the silvicultural unit, or (c) the number of new wildlife trees in the silvicultural unit already meets or exceeds the target number of wildlife trees per acre. MRC expects wildlife trees and snags to provide the "highest value" habitat for wildlife. Therefore, once MRC meets or exceeds the target number of snags, wildlife trees, and recruitment trees in a silvicultural unit, we may harvest any recruitment tree in that area of equal or lesser value to wildlife.

Recognizing the limitation of forest inventory
A forest is a dynamic environment. New trees are continually sprouting; old trees are decaying, dying, and falling. At the time MRC assesses a silvicultural unit for snags and wildlife trees, we will substantiate that the unit contains the requisite number of wildlife trees, snags, and recruitment trees, i.e., *on average* 2 hard snags and 1wildlife tree or an equivalent combination of recruitment trees per acre in upland forests. We cannot guarantee how long those trees will remain or in what condition. After a harvest, a managed stand may not be re-visited for 10 or even 40 or 50 years, depending on the silviculture. During that time, a living tree might become a snag. A snag might topple and become downed wood. A tree recruited as a potential snag might still be vigorous 50 years later. Realistically, at any point in time post-harvest, there is no way to guarantee that a silvicultural unit has the same wildlife trees, snags, or recruitment trees targeted and marked by MRC during an inventory. What we can guarantee is that we are continually

managing the entire plan area for 2 snags and 1 wildlife tree, *on average* per acre, in general forested areas—and we may, in fact, exceed that target.

Linking objectives for snags and wildlife trees to the PTHP process

MRC is proposing that, to be workable, the objectives for wildlife trees and snags must be implemented through the PTHP process. As part of the PTHP process, a registered professional forester (RPF) or a designee from MRC will do an on-site field visit or pre-harvest assessment of a silvicultural unit. At that time, the RPF or a designee will determine if there is the requisite number of snags and wildlife trees in the silvicultural unit, recruit additional trees if necessary, and paint their bark with a "W" for snag and wildlife trees or an "R" for recruitment tree. MRC recognizes that worker safety is the number one priority in the forest, and a tree initially designated as a snag, wildlife tree, or recruitment tree may, in fact, present a safety hazard and need to be felled. If MRC fells a snag or wildlife tree for safety reasons, we will designate a new tree as a recruitment tree during harvest operations. By doing assessment and recruitment during the PTHP process, we will not only ensure that MRC is in compliance with HCP/NCCP objectives but that we are systematically covering the entire plan area as each new PTHP is initiated.

First entry into a silvicultural unit after HCP/NCCP commencement

MRC will initiate new PTHPs once the term of the HCP/NCCP commences. When MRC enters a silvicultural unit for this post-commencement harvest, we will assess whether there are already the requisite number of snags and wildlife trees per acre. If not, MRC will make up for the deficiency by recruiting additional trees within the silvicultural unit. In selecting recruitment trees, MRC will choose whitewoods over redwoods, larger trees over smaller trees, and trees with obvious signs of rot. We will look for trees that have the most attributes valuable for wildlife or that will likely develop such attributes, namely

- Secondary murrelet trees.
- Trees with less than 10% live crown and no terminal leader.
- Whitewoods likely to become snags, evidenced, for example, by conk (wood-rotting fungus) or fire scars.
- Trees with basal hollows that do not yet meet the definition for a wildlife tree.
- Trees with broken tops, forked tops, or reiterated crowns.
- Trees with large limbs.
- Trees with old-growth characteristics (see section 9.4.1.3).[6]
- Trees with vegetative deformities (e.g., witches broom).
- Trees in the upper 20th percentile for dbh within the silvicultural unit (i.e., large trees).
- Trees with usnea (uncommon lichen).

To meet HCP/NCCP objectives, a forester may recruit trees in any acceptable area of the silvicultural unit. Trees for upland forest, for example, cannot be recruited from a Large Class II AMZ. This is necessary because snags and wildlife trees are often patchily distributed. Table 9-1 shows how the number of recruitment trees in a silvicultural unit relates both to the current number of snags and wildlife trees in that silvicultural unit and to the location of the silvicultural unit. The table only addresses the first entry into a silvicultural unit following HCP/NCCP implementation of the plan. In later entries, MRC foresters will also need to retain previous

[6] Each old-growth attribute counts as one in the decision-making for recruitment trees.

recruitment trees, unless an alternative tree has grown into a better recruitment tree or actually become a snag or wildlife tree.

Table 9-1 Recruiting Snags and Wildlife Trees

Location of PTHP Unit	Average Number of Snags and Wildlife Trees per Acre Currently in PTHP Unit	Snag and Wildlife Recruitment Trees per Acre Required in PTHP Unit
General Forest	0	3
	1	2
	2	1
	3	0
Class I and Large Class II AMZ	0	4
	1	3
	2	2
	3	1
	4	0

Figure 9-5 illustrates a silvicultural unit in a general forested area that is deficient in snags and wildlife trees at the time of inventory. There are 16 ac in the sample silvicultural unit. According to our HCP/NCCP objectives, such a unit must have an *average* of 2 snags or 2 recruitment trees per acre and an average of 1 wildlife tree or 1 recruitment tree per acre. This comes to 32 snags and 16 wildlife trees or a sufficient number of recruitment trees to make up any disparity. In fact, in this example there are only 28 snags and wildlife trees.

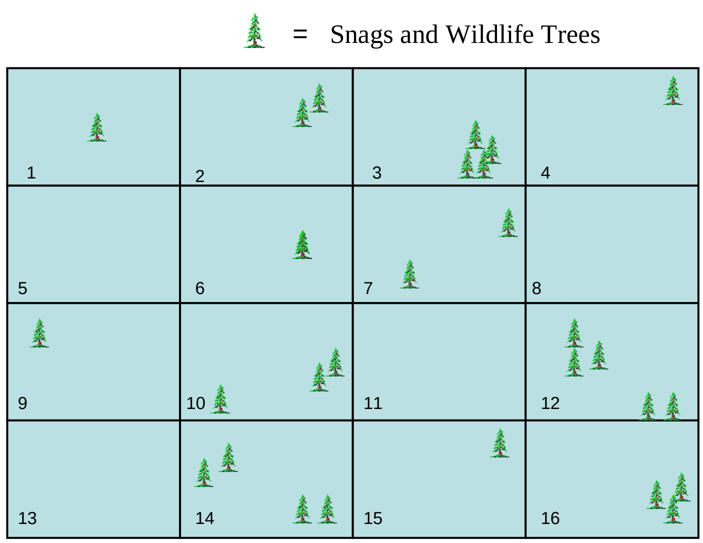


Figure 9-5 Silvicultural Unit in One Acre Plots - Before PTHP

To bring this silvicultural unit up to our HCP/NCCP objective, an MRC forester would need to mark an additional 20 recruitment trees. Figure 9-6 shows that the forester recruited 3 trees in acre-5, 1 in acre-6, 4 in acre-15, 5 in acre-8, 5 in acre-13, and 2 in acre-11. This brings the total number of snags, wildlife trees, and recruitment trees for the silvicultural unit up to 48 or an *average* of 2 snags and 1 wildlife tree per acre—sufficient numbers to make up for any initial deficiencies in snags or wildlife trees. While Figures 9-5 and 9-6 appear to be two stages of one process, in reality a forester would only walk through a stand once to assess the number of snags and wildlife trees and designate recruitment trees.

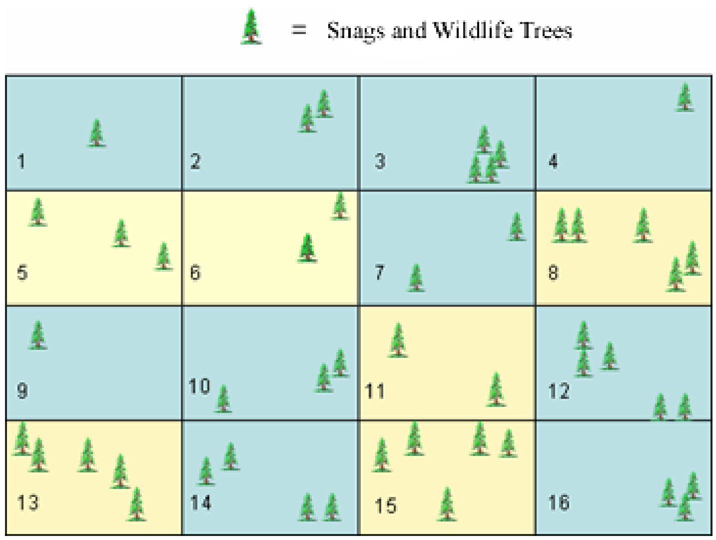


Figure 9-6 Silvicultural Unit in One Acre Plots - After PTHP

Subsequent entries into a silvicultural unit after HCP/NCCP commencement

The same rules apply for subsequent entries into a silvicultural unit. If there is not the requisite number of snags, wildlife trees, or marked recruitment trees *on average* per acre, MRC will once again need to recruit snags. In this way, we will always address the possibility that trees, designated as snags, wildlife trees, or recruitment trees in an earlier PTHP, may no longer be standing or may not have developed as expected. On subsequent entries into a silvicultural unit, however, we operate under an additional constraint, namely that we must always retain recruitment trees marked during a previous PTHP entry unless (a) there is an alternative tree within the same acre that we conclude will more quickly become a snag or wildlife tree or (b) retaining a snag presents a safety issue for forest workers..

Core areas for northern spotted owls

MRC may designate core areas for northern spotted owls after marking wildlife trees for retention and prior to harvest because a northern spotted owl could locate to a PTHP area after MRC has finished marking wildlife trees and snags. In these instances, the RPF will use professional judgment to estimate whether removing the core area from wildlife tree calculations would significantly lower the number of wildlife trees retained. If so, the RPF will mark additional trees for retention outside of the core area. Our intent is always to maintain each designated area (e.g., core area and non-core area) within the PTHP location at or above MRC objectives.

9.2.2.1.2 Downed wood

MRC will only survey for downed wood if we intend to harvest existing downed wood within a silvicultural unit. In harvesting such wood, we will complete a census of all downed wood throughout the silvicultural unit and, if necessary, fell trees to make up for any deficiencies of downed wood in the unit. MRC will not conduct a survey if we are simply removing downed logs that are blocking a roadway. MRC will include downed wood within our timber inventory data (see Appendix U, *Inventory Strategy*, section U.3.2).

9.2.3 Conservation measures

9.2.3.1 Snags and wildlife trees

The following conservation measures refer to, *on average*, 2-3 snags or recruitment trees and 1 wildlife tree or recruitment tree per acre. For clarification, this means 2 snags in general forested areas and 3 snags in Class I and Large Class II AMZs (O§9.2.2-1 and O§9.2.2-2).

	Conservation Measures for Snags and Wildlife Trees within a PTHP
C§9.2.3.1-1	Retain[3] in Class I and Large Class II AMZ a minimum of ▪ 1 hard snag or recruitment tree *on average per acre*[7] that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 2 hard snags or recruitment trees o*n average per acre* that are ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall.
C§9.2.3.1-2	Retain in general forested areas a minimum of [8] ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall. ▪ 1 hard snag or recruitment tree *on average per acre* that is ≥ 24 in. dbh and ≥ 40 ft tall. ▪ 1 wildlife tree or recruitment tree *on average per acre* that is ≥ 16 in. dbh and ≥ 30 ft tall.
C§9.2.3.1-3	Retain, if present, 1 additional hard snag ≥ 16 in. dbh and ≥ 30 ft tall per acre during sanitation/salvage operations; do not retain additional recruitment trees if a hard snag is not present.
C§9.2.3.1-4	Fell snags only when they (a) present safety hazards to workers, (b) create excessive fuel loads, or (c) are part of a sanitation/salvage PTHP or exemption: ▪ **Safety hazards** ▫ If MRC determines after a thorough review that we must cut a very large hard snag (i.e., >36 in. dbh and more than 20 ft tall), we will provide written notification to the wildlife agencies about (a) our intent to fell the tree, (b) our reasons, and (c) other alternatives considered. If we do not receive a response within 5 business days, we will fell the tree. MRC may fell other snags and wildlife trees for safety reasons without obtaining approval of the wildlife agencies; in those instances, we will include the number of felled trees in an annual report (see D.4.2.3). ▫ If a snag which is > 16 in. dbh and > 30 ft tall presents a safety hazard, MRC will attempt to cut the tree at least 4 ft above the ground (always consistent with safe harvest operations) and leave the felled snag in place unless it is blocking a road right-of-way, an existing road, or skid trail. In that case, it will be necessary to move the felled snag but place it near the location where it originally was felled. MRC will notify the wildlife agencies of all such incidences in a yearly compliance report (see D.4.2.3). • **Fuelwood** ▫ If a snag which is < 16 in. dbh and < 30 ft tall presents a safety hazard along a road or landing, a Licensed Timber Operator (LTO) can cut it for fuelwood.

7 MRC calculated the value by silvicultural unit and then standardized the value per acre.
8 These areas exclude designated core areas of northern spotted owls, as well as Class I and Large Class II AMZs.

	Conservation Measures for Snags and Wildlife Trees within a PTHP
C§9.2.3.1-5	Do not leave trees harvested within LACMA[9] (at the discretion of the wildlife agencies) to meet the retention goals for downed wood (see O§9.2.2-1 and O§9.2.2-2).
C§9.2.3.1.6	Prevent, as feasible, the loss of snags and wildlife trees during preparation and execution of prescribed burning.
C§9.2.3.1-7	Choose for recruitment those trees with the most characteristics valuable for wildlife (see 9.2.2.1.1). **NOTE** MRC will tally snags, wildlife trees, and recruitment trees within forested areas separately from Class I and Large Class II AMZs and from core areas for northern spotted owls. If MRC cannot meet the objective for snags or wildlife trees, we may choose recruitment trees that also meet the minimum size requirement for retained trees. MRC will paint a "W" on the tree trunk for a snag or wildlife tree, and an "R" for a recruitment tree.
C§9.2.3.1-8	Harvest, in subsequent entries, trees marked with an "R" only if there is a tree within the same acre more likely to recruit to a snag in a shorter time.
C§9.2.3.1-9	Assess snags within a silvicultural unit using only contiguous silvicultural units; exclude Class I and Large Class II AMZs and core areas for northern spotted owls. **NOTE** If a PTHP consists of 6 non-contiguous silvicultural units, MRC will assess each unit separately.
C§9.2.3.1-10	Ensure that no more than 50% of snag recruitment trees for each silvicultural unit are hardwoods.
C§9.2.3.1-11	Permit firewood cutting only in amounts that still allow MRC to meet snag or LWD objectives.
C§9.2.3.1-12	Provide to the wildlife agencies, in an annual report, maps and tables showing the number of old-growth trees, wildlife trees, and recruitment trees within each silvicultural unit (see Appendix D, section D.4.2.1*)*.
C§9.2.3.1-13	Retain all wildlife trees. **NOTE** ▪ MRC will permit the harvest of trees > 24 in. dbh with basal hollows that "heal over" as long as they do not otherwise fall into one of the protection categories. ▪ MRC will permit the harvest of stump sprouts growing over the basal hollows of previously harvested trees as long as this does not diminish the basal hollow characteristics of the original stump. ▪ MRC will permit the harvest of a former raptor-nest tree once the nest is no longer evident as long as the tree does not otherwise fall into one of the protection categories. ▪ MRC will retain trees that support nests with structural deformities (e.g., broken tops and forked tops) whether or not a raptor nest is present. ▪ MRC will obtain approval of the wildlife agencies on alternative conservation measures for protection of the characteristics most valuable to wildlife in a

[9] Lower Alder Creek Management Area (see section 10.3.2.1.1)

	Conservation Measures for Snags and Wildlife Trees within a PTHP
	stand that is exceedingly dense with wildlife trees which, in many cases, appear limited in their actual wildlife value. These alternative conservation measures will not include harvesting old-growth trees. In any case, MRC will retain a minimum of 3 wildlife trees, snags, or recruitment trees per acre.

9.2.3.2 Downed wood

! In preparing a PTHP for LACMA, MRC may not follow conservation measures for downed wood in an effort to reduce potential predators of murrelet nestlings and eggs, such as deer mice and squirrels. In such cases, MRC must first obtain approval from the wildlife agencies that this is an appropriate action.

	Conservation Measures for Downed Wood within a PTHP
C§9.2.3.2-1	Retain the requisite number and size of logs per acre, if harvesting hard downed wood in the stand: ▪ In Class I and Large Class II AMZs and in extended protection areas for northern spotted owls, 6 pieces of downed wood *on average* per acre, each ≥ 16 in. average diameter, ≥ 6 ft long, and derived from at least 3 trees. ▪ In general forested areas, 5 pieces of downed wood *on average* per acre, each ≥ 16 in. average diameter, ≥ 6 ft long, and derived from at least 3 trees.
C§9.2.3.2-2	Do not harvest downed wood embedded in the bed or bank of any watercourse.
C§9.2.3.2-3	Leave downed logs where they fall, if possible; otherwise place them so that they follow the contours of a hillslope, if possible.[10]
C§9.2.3.2-4	Retain all hollow logs and hollow standing trees[11] for future recruitment as downed wood.
C§9.2.3.2-5	Permit cutting of firewood only on roads and landings. **NOTE** This requirement does not apply to commercial harvest of firewood.
C§9.2.3.2-6	Leave non-commercial pieces of downed wood ≥16 in. average diameter and ≥ 6 ft long on the forest floor, if possible.
C§9.2.3.2-7	Return to the forest floor, before completing landing operations, any piece of wood that is > 24 in. average diameter.

[10] This may increase their use by wildlife, especially on steep slopes (Bull et al. 1997).

[11] Evidence that large-diameter trees may have hollow chambers include (1) a broken bole with a “bayonet” top; (2) more than one pileated woodpecker cavity; (3) fruiting bodies of Indian paint fungus; or (4) an old injury or bend along the bole where a new leader formed a trunk many years ago.

9.2.4 Rationale

Snags, downed wood, and wildlife trees are important habitat features for many species of terrestrial vertebrates. The dependency of wildlife species on snags and wildlife trees ranges from incidental to absolute. California Wildlife Habitat Relationships (CWHR) is a database with information on the state's wildlife. According to CWHR, over 90 vertebrate species in Mendocino County prefer or require snags to fulfill a portion of their life-history needs (CDFG 1996e); this includes 2 species of amphibians, 54 birds, and 36 mammals.

In forests managed for timber extraction, the size, condition, abundance, and distribution of snags, cavity trees, and downed wood is reduced or changed by

- Short harvest rotations.
- Elimination of recruitment trees.
- Changes in growing conditions of crop trees.
- Management for optimal growth, e.g., reducing resource competition and shade.
- Management of diseases and insect infestations.

MRC believes continual maintenance and recruitment of snags and wildlife trees, along with the downed wood that results from their decay and from harvest operations, will benefit not only the listed species in the plan area, but also many others.

9.2.4.1 General forested areas

To ensure sufficient snags, wildlife trees, and downed wood in our forest, MRC will retain and, if necessary, recruit wildlife trees and hard snags during timber operations. Even in areas where the number of snags and logs are currently considered on target, retaining wildlife trees as an HCP/NCCP conservation measure should ensure that future stands and watersheds will remain on target as well.

Based on our last timber cruises in 2007 and 2008, there are approximately 0.36 snags per acre in the plan area; similarly, with regard to downed wood, the plan area has, on average, 6.4 logs per acre (see Appendix O, *Snags and Downed Wood*). Extrapolating from this inventory data, MRC has set an objective for general forested areas to retain *on average* per acre *2* snags and 1 wildlife tree or an equivalent combination of snags, wildlife trees, and recruitment trees. We have chosen to frame the objective for snags as an *average per acre* over a silvicultural unit because snags and other wildlife trees are common in some areas while scarce in others. Most silvicultural units are at least 30 ac; this allows for areas with clumps of snags and other areas with few or none. MRC is confident that meeting these objectives for snags will easily provide for the habitat needs of the northern spotted owl, as well as other covered species. Moreover, recruiting and retaining wildlife trees and snags provides over time the requisite downed wood for the forest biota.

9.2.4.2 Class I and Large Class II AMZ

MRC recognizes that Class I and Large Class II AMZs are likely to have greater need for snags and downed logs. Rivers, streams, and adjacent land are particularly valuable habitats for wildlife. Terrestrial wildlife needs access to rivers and streams for drinking water and sometimes for hunting; many animals spend their lives both in water and on land. Additionally, since AMZs are less susceptible to destructive fires, they have more snags and downed wood than the general forested areas. Therefore, MRC increased the goal for retention and recruitment in these areas to *on average* 4 snags and wildlife trees per acre and *on average* 6 pieces of downed wood per acre. Given our AMZ management standards including retention of the largest trees, MRC believes we will meet and generally exceed these goals.

9.2.4.3 Stump requirement

To ensure personnel safety or reduce fuel hazards, MRC may need to cut snags and wildlife trees. In doing so, we will retain as tall a stump as is consistent with safe operations; the minimum height of the stump will be 4 ft, if consistent with safe harvest operations. As of 2011, the average stump for felled trees is 1 to 1.5 ft high. Generally, a higher stump provides potential den sites for mesocarnivores and microhabitat for small mammals. These stumps will also eventually decay and provide food sources for small mammals as well.

9.2.4.4 Cavity size and height of wildlife trees and snags

Primary excavators, like northern flickers and pileated woodpeckers, create large nesting cavities. Other species, such as swallows and small owls, do not create cavities but use smaller cavities created by flickers and pileated woodpeckers. According to Bull (1987) the average nest cavity of a pileated woodpecker is 3.5 x 4.7 in. Erskine and McLaren (1972) reported the average nest cavity of a northern flicker is 2.5 x 2.8 in. In proposing a maximum cavity of 3 in. as a wildlife tree attribute, MRC is including the smaller cavities used by the smaller species.

Existing cavities are a requisite for all secondary cavity-nesters as well, including western screech owls, northern pygmy owls, northern saw-whet owls, purple martins, and violet green swallows. Generally, these species select cavities well above ground height to avoid predation. For instance, the western screech owl nests in cavities ranging from 15-60 ft high (Zeiner et al. 1990b, 324) while the northern saw-whet owl nests in cavities ranging from 5-50 ft high (Zeiner et al. 1990b, 342). Cavity size must be large enough for the birds to enter and exit the cavity with relative ease. While many nest box plans for smaller birds call for holes 1-2 in. in diameter, MRC believes a 3 in. diameter will provide for these species in addition to the larger species that will use the holes on the landscape, such as western screech owls.

9.2.4.5 Density and size of wildlife trees and snags

Snags and wildlife trees are important landscape features for wildlife. They provide nesting cavities and platforms, roosting habitat for bats, food in the form of invertebrates and mast from hardwood trees, as well as protection from predators. A landscape manager must tackle the difficult task of assigning a set number of large trees to be retained for wildlife in order to balance ecological and economical demands. MRC determined wildlife tree requirements for retention, density, and height after careful review of the available literature and discussions with the wildlife agencies.

9.2.4.6 Density and size of downed wood

Downed wood is a key habitat element for multiple taxa of wildlife. It provides shelter, food, cover, and travel pathways for smaller animals. As it decomposes, downed wood provides food and cover for multiple wildlife species. Our forest landscape contains a large amount of downed wood from previous harvest operations. We determined our retention standards by density and average diameter after careful review of the available literature and discussions with the wildlife agencies.

9.2.4.7 Justification in scientific literature

9.2.4.7.1 Snags

Snags are essential structural components of a healthy forest. They provide substrate for saprophytic fungi and invertebrates that not only supply prey for many birds and mammals, but also facilitate decomposition. When a snag falls, it continues to support many fungus, plant, and wildlife species (WDFW 1995). Lack of standing dead trees can be a limiting factor for some cavity-dependent wildlife populations; the density of cavity-nesting birds is closely associated with snag density (Thomas et al. 1979, Zarnowitz and Manuwal 1985, Schreiber and deCalesta 1992). Snags also provide roost sites for many species, foraging perches, and sunning sites.

Wildlife species dependent on snags can be divided into (1) those that nest or den on the branches or broken tops of snags, and (2) those that inhabit interior hollows or cavities. The great blue heron, osprey, and bald eagle are examples of bird species that sometimes nest in the branches or broken tops of snags; they also make use of green trees with dead tops. Woodpeckers are the primary hole-nesters, or birds that excavate their own nest holes. In northwestern California, the most abundant nesting woodpecker is the northern flicker, followed by the downy, hairy, and pileated woodpeckers (Harris 1993). These species nest mostly in cavities within dead trees as well as in live trees with dead limbs or tops (Shuford 1993). Pileated woodpeckers use large snags for both roosting and nesting. Secondary cavity-nesting species depend on woodpecker holes or other natural cavities for nesting and roosting. Examples in northwestern California include the wood duck (Bellrose 1980) and purple martin (Shuford 1993). Bats use cavities in snags for maternity and communal roosts (Christy and West 1993). Vaux's swifts build nests inside large, hollow trees (Bull and Cooper 1991, Sterling and Paton 1996). Female Pacific fishers choose living or dead standing trees that have cavities with relatively small openings as den sites in which to raise their young (Powell and Zielinski 1994, Aubry 1996, Golightly 1997); both sexes use hollows in live trees or snags as resting sites (Powell and Zielinski 1994).

Other species, such as the northern spotted owl, can nest in snag cavities, but do not appear to require snags for nesting because they frequently nest in live trees. High-quality habitat for these species often contains a high proportion of snags, such as those found in old growth or “decadent” forests, along with a high incidence of large trees with large cavities or broken tops. In addition, high-quality habitat includes a forest floor with heavy accumulations of downed logs, dead limbs, and other downed wood (Thomas et al. 1990).

9.2.4.7.2 Downed wood

Wood on the forest floor is a critical habitat component for many wildlife species. As with snags, lack of downed wood of sufficient sizes or specific decay stages may be a limiting factor for some species of wildlife. Several species of terrestrial amphibians are more common in areas with more downed wood. Downed wood provides a feeding site for many animals, including small rodents, American martens, Pacific fishers, and various invertebrates. Downed wood also provides a moist growing substrate for mosses and lichens. Of the 320 species of fungi associated with redwood forest, 77 are dependent on downed wood as a growing substrate (Noss 2000, 64-68).

On old-growth forest floors, downed wood is usually a dominant structural feature with downed logs "strewn about like titanic pickup sticks" (Norse 1990, 50). The downed logs in old-growth forests are not only large on average, but are also present in a variety of sizes and decay classes (Norse 1990). In general, old-growth forests tend to have a greater volume of large downed wood than do second-growth forests (Franklin et al. 1981, Carey and Johnson 1995).

Size, character, abundance, and distribution of large downed wood in managed forests depends on many factors, including tree species; growing conditions; fire, flood, and windstorm frequency; distribution and abundance of snags; timber harvesting and salvage; and harvesting for fuel wood. Timber harvesting can significantly affect the distribution and abundance of large downed wood on the forest floor of managed stands. Untreated logging debris or slash (branches, foliage tops, and un-merchantable wood) can provide refuge and cover for some wildlife, although excessive slash can form a barrier to animal movement. However, these sources are too limited to provide for all wildlife. Moreover, if retained, logging debris and slash have a short longevity. Due to increased fire hazards and the need for reforestation, logging debris and slash are sometimes removed by prescribed burning. In recent years, large downed wood on the forest floor has been further depleted in many U.S. forests; it has become economical for timber operators to salvage downed logs left behind from earlier timber operations. Reductions in organic matter can have important consequences for chemical, biological, and physical properties of soil (Jurgensen et al. 1997) and for surface erosion rate. Removal of a large percentage of coarse downed wood and use of prescribed burning after timber operations can result in loss of soil nitrogen (Jurgensen et al. 1997). Finally, logging equipment can inadvertently crush downed logs; crushed logs do not provide the same wildlife value as intact logs (McCarthy and Bailey 1994).

Populations of many forest species, such as the ensatina (salamander), western red-backed vole, and Pacific fisher, can be limited by the reduction or absence of large downed wood. Large downed logs and scattered debris piles offer cover for larger mammals and birds (Bartels et al. 1985, Beschta et al. 1995). For example, downed wood on the forest floor provides natal dens and resting sites for fishers. Large downed wood serves as a food resource for wildlife species that forage on fungus and invertebrates. When LWD ultimately decays, it contributes nutrients critical to the health of a forest.

Even the spaces between loose bark of freshly downed logs and stumps are used for cover by many invertebrate and small vertebrate species (Maser et al. 1979, Schowalter et al. 1997). Downed wood is rapidly colonized by insects, especially beetles (Norse 1990). Beetles provide an important function in primary decay processes because they not only create tunnels with corridors for earthworms, carpenter ants, termites, millipedes, mites, spiders, amphibians, and plant roots, but also carry mutualistic fungi that further the decomposition process (Bartels et al. 1985, Hendrix 1996). Many amphibian species depend on decayed logs for cover and food (Corn and Bury 1991a, Beschta et al. 1995).

When downed logs begin to decompose, small mammals, such as the Pacific shrew, Trowbridge's shrew, and red-backed voles create burrows in interior portions of a log. The under portions of both freshly downed and decomposed logs also provide small mammal cover (Norse 1990). At JDSF, Fitts and Northen (1991) found that Sonoma chipmunk populations were positively correlated with the presence of high levels of large downed wood. Maintenance of rodent populations benefits predators, such as the northern spotted owl.

Small mammals burrowing inside and beneath downed wood enhance habitat for fungi, which in turn provides food for small mammals (Maser et al. 1979). In moist soil underneath downed logs, hypogeous (underground-fruiting) fungi or truffles are an important food source for many rodents, squirrels, and chipmunks (Maser et al. 1979, Fogel 1995, Mills 1995). Fungus-feeding rodents distribute fungal mycorrhizae across the forest floor through spores in their feces (Maser et al. 1978, Levy 1997). This process can be important in re-establishing fungus in areas that have been clear-cut or burned; rodent populations return more quickly to sites rich in downed wood.

Logs on the forest floor are important for nutrient and water turnover and storage. Leaves, other debris, and soils often accumulate on logs and are used by other organisms. Bacteria decompose a fallen log by feeding on it and releasing nitrogen. Mycorrhizal fungi also grow into the log from seedlings and can transfer nutrients and moisture to the plant. Although the specifics of nutrient cycling from downed wood are not understood, it is clear that downed wood plays an important role in forest productivity. Mycorrhizal fungi have a symbiotic relationship with the roots of conifers. Fungus enhances a conifer's uptake of nutrients and water from the soil; the tree nourishes the fungus with sugars and amino acids. In addition, decomposing downed wood and leaf litter contribute phosphorous and nitrogen to the growth of new vegetation (Bartels et al. 1985). According to Jurgensen et al. (1997), organic components of soil contributed in part by downed wood are important factors in forest health and productivity.

Downed logs are also important reservoirs of moisture during dry months. Downed wood helps create favorable microsites for tree seed germination and seedling establishment; large pieces can serve as "nurse logs" for tree seedlings (Kuuluvainen 1994, Norse 1990). Large downed wood provides moist refuges for wildlife, such as amphibians, during dry periods and especially during fires. Larger debris has a greater ratio of volume to surface area, and thus a greater likelihood of maintaining moist interior conditions.

9.3 Hardwoods

9.3.1 Overview

Hardwoods, in particular tanoak, are aggressive competitors in early seral stages of redwood and Douglas-fir forests in Mendocino and Sonoma counties. The Regional Committee on Hardwood Retention (1996) calculated that hardwood contribution to standing volume increased by a factor of 3 from 1953 to 1994 due to fire suppression and heavy clearcutting without post-harvest control treatments. Due to an apparent overabundance of hardwoods, MRC needs to control them at both the stand and landscape level.

While hardwoods are not the main focus of this plan, they are important to the ecology of MRC forests and many wildlife species, like the northern spotted owl and pileated woodpecker. One of our main goals is to restore an ecological and economical balance between conifer and hardwood species on our land. The first challenge is assessing the “natural” proportion of hardwoods in conifer stands. The second is deciding which stands should be retained as complete hardwood stands.

We know that hardwoods are a natural component of the understory of mixed redwood and Douglas-fir forests; however, there is limited data on the natural density of hardwoods within these forests. Current data is from small patches of old-growth stands that have not experienced wildfires in 40-60 years. A recent study by Giusti (2007) in an old-growth state reserve in Mendocino County found that hardwoods made up 80% of the trees less than 10 in. dbh. According to the study, stocking of tanoaks greater than 10 in. dbh exceeded 25 ft^2/ac. Giusti also reports in the study that tanoaks dominate the smaller size classes (2-10 in. dbh) but this dominance of tanoak stems is inversely proportional to size class. The larger the size class, the fewer the tanoaks. This seems to indicate that hardwoods are a heavy understory component even in old-growth stands; but, again, the reserve studied by Giusti has not experienced a fire event in at least 50 years.

In northwestern California, Bingham and Sawyer (1992) found hardwoods and conifers were most dense in young stands (40-100 years) and least dense in old stands (more than 200 years). The study showed 131 hardwoods to 41 conifers per acre for young stands and 82 hardwoods to 24 conifers per acre for old stands. Associated with the decreased density from young to old stands, both hardwood and conifer average diameters increased. Among hardwoods, dbh increased from 12 to 15 in.; among conifers, from 14 to 38 in. Using average density and diameter, the study concluded that the hardwood basal area of the old stands approximated 50 ft^2/acre or just over 20% of the total area.

While MRC definitely wants to retain oak-woodlands, true oak stands, and oak stands that are a result of natural processes rather than intensive harvest, we do not want to retain all tanoak-dominated stands. There are very few guidelines for deciding the amount of hardwood stands to retain. One researcher (Wimberly 2002) ran a spatial simulation of Oregon Coast Range forests, simulating fire regimes 1000 years prior to European settlement. He examined possible scenarios for distribution of various successional stages. His model indicated that old-growth forests generally occupied at least 40% of the landscape while young forest ranged from 15-31% of the landscape with a median of 21%.

Rather than modeling our landscape with fire regimes, we are assessing our hardwood-dominated stands to distinguish stands with native hardwoods and no history of conifer harvest from stands that are the direct result of intense conifer harvest. MRC will not manage for timber production the stands with native hardwoods and no history of conifer harvest. Our forests will always contain a certain amount of tanoak that we will remove or control on an ongoing basis. However, we will also protect some tanoak for wildlife species; for example, we will retain most hardwoods in the AMZs and in core areas for northern spotted owls. In addition, we will retain a small proportion of hardwoods in every harvest unit.

Upon review of an initial draft of our HCP/NCCP, a Science Panel, convened as part of the NCCP process, expressed concerns about our restoration of conifer forests:

> In the MRC presentation to our team, a plan for conversion of a portion of the broadleaf upland forest to conifer forest was discussed…Conversion to conifer forest could endanger some populations of sensitive species (Noss et al. 2003, 27).

MRC believes that the Science Panel did not fully understand our intended goal. Within the plan area, we are proposing (a) to attain an ecological and economical balance of conifers-to-hardwoods; (b) to leave natural oak stands unmanaged; and (c) to retain some tanoak stands as representative samples of early successional stands.

Our conservation measures protect the most important hardwoods; retain a certain basal area of hardwoods in all stands; retain stands that have naturally progressed to hardwood-domination; and retain some hardwood stands as representative of the early seral condition of a conifer-dominated stand type. MRC recognizes that the “natural” hardwood component of any stand will vary according to site conditions; for instance, Site Class I and Site Class II are apt to grow more conifers and fewer hardwoods. However, maintaining and recruiting hardwoods in the plan area will not only enhance structural diversity of the forest but encourage greater diversity of wildlife species. We have designated 15 ft^2/acre of hardwood basal area for retention post-harvest. This number, we believe, reflects an appropriate level of hardwood retention given site conditions on our land and based on literature review, site capability, and internal discussions. Furthermore, we have designed an adaptive management strategy (M§13.9.1.4-6) that assesses how this hardwood retention affects spotted owl productivity.

9.3.1.1 Hardwood control

After timber harvests in north coastal California, some hardwood species, such as tanoak, often out-compete seedlings of coniferous species (Holland and Keil 1995). Conifers may not regain dominance in the canopy for more than 100 years. Historically, landowners have removed conifers during commercial timber harvest while retaining hardwoods. This practice results in overstocking of hardwoods relative to conifers. In general, MRC will remove or control hardwoods where they impede the regeneration or growth of conifers.

MRC does not have specific conservation measures for hardwood control; however, we do have certain operational guidelines. MRC will

- Determine potential areas for hardwood control from (1) recent harvests, including but not limited to variable retention, past clearcuts, seed tree and shelterwood removal, transition, and rehabilitation; (2) conifer sites with excessive hardwood (generally tanoak) competition; and (3) sites with a high probability of conifer release.
- Prohibit elimination of all tanoak stands on covered lands.
- Prevent, where feasible, the expansion of eucalyptus, an invasive non-native tree, and attempt to eradicate it.

9.3.1.2 Hardwood classifications

MRC initially estimated the number of our hardwood acres from aerial photos. Prior to any harvest, we will complete an on-the-ground assessment of each hardwood-dominated stand and assign them to one of 3 classes:

- Class I stands are dominated by native hardwoods (tanoak, madrone, true oak, etc.) and have never been managed for conifer timber production.
- Class II stands are dominated by native hardwoods and may have had some conifer harvest, although their suitability for conifer restoration is unknown.
- Class III stands are dominated by native hardwoods only because of past management and are clearly suitable for conifer restoration.

The significance of these classifications for MRC timber management and conservation is as follows:

- MRC will not harvest in Class I stands.
- MRC may harvest in Class II stands. Prior to any harvest in a Class II stand, however, we will assess the feasibility of restoring the stand for conifer timber production. If feasible, we will re-classify the Class II stand as a Class III stand. If not feasible, we will re-classify the Class II stand as a Class I stand.
- MRC may harvest Class III stands and restore them to conifer dominance.

The HCP/NCCP Atlas (MAPS 4A-C) shows Class I, Class II, and Class III hardwood stands.

9.3.1.3 Representative samples of early seral hardwood stands

In addition to Class I, Class II, and Class III stands, MRC has designated a portion of our hardwood-dominated stands as representative samples of the early seral condition of a conifer-dominated stand type. These areas represent the current conditions of hardwood-dominated stands throughout the plan area. As MRC restores the plan area to conifer dominance, these representative hardwood areas will retain hardwood dominance, much as they do now. Hardwoods provide unique habitat for terrestrial wildlife and plants. MRC may only manage these stands to maintain the relative proportion of hardwoods to conifers. The HCP/NCCP Atlas (MAPS 4A-C) shows representative sample areas of early seral hardwood stands.

9.3.2 Goals and objectives

Goals and Objectives for Hardwoods	
Goals	
G§9.3.2-1	Restore stands that historically were dominated by conifers.
G§9.3.2-2	Exclude harvests from Class I hardwood stands.
G§9.3.2-3	Maintain patches dominated by early seral hardwoods in variable retention units.
G§9.3.2-4	Provide representative samples of early seral hardwood stands throughout the plan area.
Objectives	
O§9.3.2-1	Retain, after harvest**,** 15 ft^2/ac of hardwoods > 6 in. dbh, if such hardwoods comprised at least 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-2	Prohibit treatment of hardwoods > 6 in. dbh if such hardwoods comprise less than 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
O§9.3.2-3	Maintain true oak stands.
O§9.3.2-4	Retain hardwood components of riparian stands (AMZs) unless the riparian stand has been identified for conversion to conifer.
O§9.3.2-5	Retain hardwood areas within variable retention units.
O§9.3.2-6	Harvest in representative sample areas only to maintain the relative proportion of hardwoods to conifers.
O§9.3.2-7	Designate 1487 ac as representative sample areas for early seral hardwood stands (Appendix B, *HCP/NCCP Atlas*, MAPS 4A-C).

9.3.3 Conservation measures

9.3.3.1 Hardwood retention in AMZs

The hardwood retention guidelines refer to all hardwood species except eucalyptus. MRC will control eucalyptus, where possible, through vegetation management.

	Conservation Measures for Hardwood Retention in AMZs
C§9.3.3.1-1	Do not manage hardwoods in riparian stands (AMZs) unless this management enhances riparian or instream habitats; establishes cable corridors for harvesting operations; or creates safer working conditions.
C§9.3.3.1-2	Retain the boles of felled hardwoods to provide instream and terrestrial woody debris.

9.3.3.2 Hardwood retention in general areas

	Conservation Measures for Hardwood Retention **General Areas**
C§9.3.3.2-1	Retain, after harvest, 15 ft^2/ac of hardwoods > 6 in. dbh, if such hardwoods comprised at least 15 ft^2/ac of the total basal area of a silvicultural unit prior to harvest.
C§9.3.3.2-2	Prohibit treatment of hardwoods > 6 in. dbh if they comprise < 15 ft^2/ac basal area in a silvicultural unit prior to harvest.
C§9.3.3.2-3	Retain all hardwood trees ≥ 24 in. dbh when these hardwoods constitute ≤ 20% of the basal area of the harvest unit, unless it is necessary to remove them for safety, road right-of-way, or yarding corridors.
C§9.3.3.2-4	Retain clusters of mast-producing hardwoods.
C§9.3.3.2-5	Retain true oaks and madrones > 18 in. dbh unless it is necessary to remove them for safety, road right-of-way, or yarding corridors.
C§9.3.3.2-6	Leave true oaks and madrones > 18 in. dbh—felled for safety, road right-of-way, or yarding corridors—on the ground as downed wood, unless it is necessary to move them to clear a road or road right-a-way.
C§9.3.3.2-7	Retain trees, regardless of size, that show evidence of significant wildlife use (e.g., whitewash, acorn granaries of woodpeckers, nests of raptors or other birds) and that provide valuable structural complexity or decay elements (e.g., cavities, broken or dead tops, or loose bark).
C§9.3.3.2-8	Retain hardwoods, when possible, in clumps that include a variety of size classes and that surround large individual trees or those with significant wildlife value.
C§9.3.3.2-9	Place priority on retaining hardwood clumps where they enhance connectivity between wildlife habitats, such as in AMZs, atop ridgelines, and in low spots between two large drainages.
C§9.3.3.2-10	Retain aggregate hardwood patches in variable retention units for the life of the HCP/NCCP.[12]
C§9.3.3.2-11	Harvest oak woodlands and true oak forests only to remove invasive conifers.
C§9.3.3.2-12	Exclude Class I hardwood stands (Appendix B, *HCP/NCCP Atlas*, MAPS 4A-C) from harvesting. **NOTE** MRC will not harvest native hardwood stands that we type as Class I (288 ac); we may harvest Class II hardwood stands (333 ac) if we re-classify them as Class III in future on-the-ground assessments.

[12] In the process of preparing a variable retention PTHP, an RPF will decide how to meet the minimum retention requirements, i.e., through either dispersed or aggregate retention. If the RPF selects aggregate retention (targeted, in this case, at hardwoods), MRC will retain all aggregate hardwood patches within the silvicultural unit throughout the term of our HCP/NCCP.

9.3.3.3 Representative sample areas

	Conservation Measures for Representative Sample Areas
C§9.3.3.3-1	Maintain a mixed-age stand of hardwoods, representative of an early seral hardwood stand.
C§9.3.3.3-2	Maintain the relative proportion of conifers to hardwoods.
C§9.3.3.3-3	Meet the minimum stocking standards of the Timber Management Plan (TMP).

9.3.4 Rationale

9.3.4.1 Hardwood control and retention

Hardwood species in the assessment area include Pacific madrone, California black oak, live oak, tanoak, California bay laurel, chinquapin, red alder, bigleaf maple, willow, Oregon ash, white oak, and eucalyptus (a non-native species). Many hardwood tree species in the assessment area occur as components of coniferous forests. One of these species, tanoak, has become overabundant in many stands and is out-competing redwood and Douglas fir. This pattern of tanoak overabundance has been observed throughout the redwood region, with the Regional Committee on Hardwood Retention[13] stating that,

> in 1953, hardwoods accounted for approximately 10% of all standing volume…hardwood volume increased dramatically because hardwood logging and mortality were largely incidental…by 1968, hardwoods accounted for 15% of all standing volume in Mendocino and Sonoma counties. This increased to 33 percent by 1994. (Regional Committee on Hardwood Retention 1996)

The dominance of tanoak in the plan area has 2 causes: (1) heavy clearcutting of redwood stands with no post-harvest treatment to reduce tanoak; and (2) fire suppression resulting in longer fire-free intervals with higher intensity fires. These practices have caused a dramatic increase in the proportion of tanoak in the redwood region. Tanoak is a long-lived shade-tolerant species that is able to survive in the understory of conifer stands, sprout vigorously when injured, and quickly dominate vegetation when an intense disturbance occurs, such as clearcut harvest or catastrophic fire (Tappeiner et al. 1990). Heavy logging with little or no post-harvest treatment of tanoak was often conducted in the redwood region; this allowed tanoak to dominate many heavily harvested stands. The pre-settlement interval of fires in the redwood region ranged from 6-20 years on coastal and inland sites; fire frequency was related to site-specific patterns rather than inland distance (Brown and Baxter 2003). Typically, pre-settlement fires were low intensity surface fires that opened stands by clearing understory species and shrubs, such as tanoak and huckleberry (Brown and Baxter 2003). These fires left the redwood overstory but cleared the tanoak understory. According to Mayer and Laudenslayer (1988) the climax stage of redwood occurs when redwoods and Douglas fir dominate the overstory. In drier sites hardwoods may be dominant or co-dominant in mid-seral stages but will eventually be over-topped and dominated by redwoods or Douglas fir.

[13] The Integrated Hardwood Range Management Program (IHRMP) was established in 1986 to ensure sustainability of California's 10,000,000 ac of hardwood rangelands. The Regional Committee on Hardwood Retention was formed in 1996 to assess the ecological role of hardwood species in the timberlands of the California north coast and develop guidelines for retaining and increasing hardwood acreage.

The "natural" proportion of tanoaks that would occur in mature redwood and Douglas-fir stands is unknown. MRC believes it is close to 15 ft^2/ac based on site class, topography, and moisture conditions. Following disturbance, hardwoods can dominate stand development during early stages of succession. In order to retain examples of this successional stage on other areas of the landscape, MRC will maintain aggregate retention patches in variable retention units specifically for hardwoods. Over the course of our HCP/NCCP term, MRC estimates this will result in approximately 2900 ac of additional hardwood retention.[14] In the plan area, hardwoods tend to dominate (a) on south-facing slopes, (b) in areas where soils are shallow, and (c) on or near a ridge top (Cafferata and Yee 1991). True oak woodlands comprise approximately 1084 ac of the plan area; we will not harvest them except to enhance the woodlands by removing invasive conifers. Alder, maples, and willows are generally restricted to riparian areas. MRC will not rehabilitate deciduous riparian stands (see section 3.4.3.6). Moreover, we will retain 1487 ac of hardwood representative sample areas. These sample areas range in size from 1 ac to upwards of 20 ac. They occur from the southern portion of the plan area to the northern—from the Garcia forest to the Rockport forest. Given this coverage, they should persist as a unique vegetation type throughout the term of our HCP/NCCP.

9.3.4.2 Classification of native hardwood stands

In 2006, during the initial typing of stands in the plan area, we identified approximately 4431 ac of mixed hardwood stands. At least 70% of the species in these stands were hardwoods. Many of these hardwood-dominated stands were created by past harvest practices and burning. Others occurred as the result of environmental conditions, like soil type and slope aspect. To capture these distinctions in hardwood stands, MRC created 3 classifications—Class I, Class II, and Class III (see 9.3.1.2). In many cases, we could easily identify hardwood stands from aerial photos as Class I because either there was no indication of previous harvest or surrounding forest types indicated poor soil conditions. Likewise, we could identify stands as Class III from the presence of old skid trails and yarding corridors or from surrounding conifer stands. Some hardwood stands, however, were difficult to classify. We designated these as Class II to reflect our uncertainty about the aerial typing. In the case of Class I and Class III stands, we made several field trips to ground-truth our initial judgments. These trips generally confirmed that our aerial classifications were accurate. However, since the majority of our stands (including Class I and Class III) were not ground-truthed, we may change classifications after field verification.

9.3.4.3 Importance of hardwoods for wildlife

In order to maintain and restore biodiversity and the integrity of natural communities in the plan area, it is important that we consider hardwoods. Hardwood stands and hardwood inclusions in predominantly coniferous stands produce valuable cover as well as reproductive and foraging habitat for a variety of wildlife species. The acorn and berry crops of several hardwood species provide important food for many bird and mammal species. A variety of insects feed on hardwoods; birds and mammals, in turn, eat the insects. MRC will afford special protection to madrone, chinquapin, and alder because they are important to wildlife and generally do not out-compete conifers in the plan area. Tanoaks are not true oaks, but still provide wildlife habitat.

Large hardwoods, such as those specified for retention, can to some degree maintain dense canopy closure and large average tree size in a stand; this helps to maintain connectivity of mature or late-successional forest stands. Hardwoods in the plan area with

[14] This is an estimate based on the landscape planning model. We predict approximately 58,000 ac of hardwood-dominated forest will receive variable retention silviculture. Approximately 10% of this acreage will be retained in aggregate (5800 ac), half of which will have hardwood patches.

a dbh of 24 in. or more represent mature trees that likely provide superior wildlife habitat (RCHR 1996). Especially important to wildlife are hardwoods with cavities (Giusti and Tinnin 1993), hardwood snags (Chambers et al. 1997), and hardwoods situated near streams and other surface water. MRC will generally protect individual large hardwoods and hardwoods with large cavities as wildlife trees. Hardwoods tend to develop larger and more complex cavities than similarly sized conifers (RCHR 1996). Retaining groups of hardwoods in a post-harvest stand is preferable to retaining individual trees. Groups of trees are less likely to be affected by windthrow and more likely to provide suitable microclimate and habitat structure, especially for small mammals. They can also enhance habitat connectivity across the landscape.

Red alders are an important hardwood component adjacent to watercourses in the plan area. Unlike most tree species, alders are able to fix their own nitrogen due to the presence of special root nodules containing nitrogen-fixing symbionts (Schoenherr 1992). In northwestern California, riparian areas consisting of alders and willows are heavily used by migratory land birds and provide potential nesting habitat for yellow warblers and yellow-breasted chats (Harris 1993). It is a common forestry practice to remove alders to encourage growth of conifers; the intent is either to increase the amount of valuable timber or increase recruitment of large woody debris and streamside shade levels. However, Cole et al. (1997) determined in a study conducted in the Oregon coast range that uncut red alder stands supported higher populations of red-legged frogs and other amphibians than Douglas-fir stands. They suggested that prescriptions for type conversion should incorporate plans to retain alders adjacent to streams.

Dead hardwoods can be as important to ecological diversity as live hardwoods. Snags are critical to many species, such as the acorn woodpecker. In Douglas-fir forest, both timber harvesting and natural successional processes often eventually result in high tanoak mortality from shading by conifers (Barbour and Major 1977). This mortality can benefit wildlife by recruiting substantial quantities of downed wood. Downed wood on the forest floor is used by many oak woodland denizens, including the California quail, which often nests adjacent to downed logs.

Although few if any wildlife species are completely dependent on mixed coniferous forest, this natural community supports a high diversity of amphibians, reptiles, birds, and mammals (Mayer and Laudenslayer 1988). The acorn crops of oaks and chinquapin, as well as the berries of the madrone, provide an important food resource for many bird and mammal species (Hagar 1960, Keator 1994, Pavlik et al. 1991, Diller 1996). Hardwoods in California support a large guild[15] of insects—up to 5000 species, such as true bugs, moths and butterflies, beetles, and gall wasps (Pavlik et al. 1991). Many edible fungus species are also associated with hardwoods (Arora 1986).

Hardwoods are important for many amphibians and reptiles. Oaks play a role for the arboreal salamander, for example, which often uses cavities in oaks for estivation and laying eggs; in addition, they choose trunks and branches of oaks for feeding (Pavlik et al. 1991). When appropriate aquatic habitat is available nearby, other amphibians and reptiles in a mixed hardwood-conifer forest might include the southern torrent salamander (Welsh et al. 1992, Welsh and Lind 1996), northern red-legged frog, foothill yellow-legged frog (Zeiner et al. 1988), coastal tailed frog (Diller and Wallace 1999), and western pond turtle (Reese 1996).

[15] A guild is a group of organisms or species that exhibit similar habitat requirements and that respond in similar ways to changes in their environment.

Many species of thrushes, flycatchers, vireos, and warblers depend on California's oaks and other hardwoods (Pavlik et al. 1991). Tanoak stands receive considerable bird use in the spring and summer, primarily by insect-gleaning canopy feeders (RCHR 1996). During early winter, birds that feed on acorns and madrone seeds are more prevalent (RCHR 1996). The bird species most closely associated with oaks is the acorn woodpecker, because it relies heavily on acorns for food (Shuford 1993). Pacific madrone berries are an important dietary element for several bird species (RCHR 1996). Studies indicate that in forests adjacent to the plan area many bird species are associated with hardwood inclusions in Douglas-fir forests, including Neotropical migrants, such as the olive-sided flycatcher, warbling vireo, and black-headed grosbeak (Kitchen 1992). Large, old hardwood trees are particularly valuable for birds because they tend to produce more acorns, provide more diverse structure for foraging, and are most suitable for excavation by cavity-nesting birds (RCHR 1996). Purple martin, Vaux's swifts, and pileated woodpeckers may also use oaks for nesting. The northern spotted owl uses mixed coniferous forests for nesting, roosting, and foraging habitat, depending on the structural stages of the trees. In coastal Mendocino County, Pious (1994) found that 8% of the nests on Louisiana-Pacific property were in tanoaks. Of the 24 northern spotted owl nests recorded in Jackson State Demonstration Forest, immediately adjacent to the plan area, 2 were located in tanoaks and 1 in a chinquapin (CDFG 1997c).

Bear Track on MRC Land

Mammals also depend on hardwoods in California's north coast region. The dusky-footed woodrat, a primary prey species of the northern spotted owl, feeds on foliage of the tanoak (Tevis 1956, as cited in Fitts and Northen 1991). In forests adjacent to the plan area, the abundance of the dusky-footed woodrat is loosely correlated with the density and abundance of tanoaks (Fitts and Northen 1991); this species requires 15 to 30-ft wide brushy clumps of hardwoods that typically occur in early successional stands of tanoak (RCHR 1996). Black-tailed deer and black bears feed extensively on acorns (Weckerly 1993, Schmidt and Gilbert 1978). Deer may be dependent on acorn mast during fall and winter and browse on hardwood foliage during spring and summer. Large, mature tanoaks with a dbh greater than 30 in. produce the largest acorn crops (RCHR 1996). Rare and sensitive mammal species that rely on oaks as cover include the Pacific (Townsend's) western big-eared bat (Kunz and Martin 1982) and the pallid bat (Zeiner et al. 1990a, Nowak 1991).

Bear from Hidden Camera MRC Land, October 2004

Pacific fishers often choose cavities in hardwoods as resting sites (Powell and Zielinski 1994). Fishers have been found by researchers to prefer forested habitats with a significant hardwood component (Thomasma et al. 1991, Buskirk and Powell 1994, Self and Kerns 2001). In intensively managed young-growth forests in northwestern California, Klug (1996) found fisher detections to be associated with stations that have a greater basal area of hardwoods. In coniferous forests with a higher hardwood component, there may be more available and diverse prey for the fisher (Self and Kerns 2001); mast-producing hardwoods may also attract more prey for the fisher (Powell and Zielinski 1994). Information on the distribution of larger hardwoods may be important for managing fisher habitat quality and connectivity—at both the home-range and landscape scale (Carroll et al. 1999). A systematic survey completed in the plan area in 2008, however, detected no fishers.

9.3.4.4 Rationale for retention level of hardwoods

The MRC retention standards for hardwoods are built around 5 objectives:

1. Retain, on average, 15 ft^2/ac of hardwood in managed stands.
2. Retain all hardwood stands that would not naturally support conifers.
3. Retain aggregate hardwood patches in variable retention units for the life of our HCP/NCCP.
4. Retain all hardwoods ≥ 24 in. dbh when they constitute < 20% of the basal area of a stand.
5. Retain hardwood representative sample areas to conserve the early seral stage of hardwoods across the plan area.

MRC has worked with the wildlife agencies to develop a hardwood retention policy that meets the needs of our covered species and enhances the value of the forest for other wildlife species as well. There are few guidelines on how many hardwood stands to retain in order to maintain the ecological value of a forest. However, we believe our objectives will provide a forest landscape similar to a mature mixed forest of redwood and Douglas fir with openings for hardwood stands and patches of hardwoods. In our experience, this is the best way to provide habitat for the wildlife species in the plan area.

9.4 Old-growth Trees and Late-seral Forest

9.4.1 Overview

9.4.1.1 Decline in old growth

Old-growth coniferous forest historically covered much of the land west of the Cascade and Sierra Nevada crests. Douglas fir or coast redwood generally dominated these forests. According to most estimates, less than 20% of pre-settlement old growth remains (Spies and Franklin 1988, Morrison 1991, Bolsinger and Waddell 1993, FEMAT 1993, Lehmkuhl et al. 1994). Recent estimates indicate that there is approximately 3-5% of the original old-growth redwood stands remaining (Thornburgh et al. 2000, 229; Fox 1996).

There is very little old growth in the plan area. Future old growth may develop where individual trees surround wildlife trees or existing old growth. Since MRC foresters manage our timberland on harvest rotations of less than 100 years, however, new stands of old growth are unlikely to develop.

9.4.1.2 MRC definitions of old-growth trees and stands

DEFINITION

An individual **old-growth tree** is (1) ≥ 48 in. dbh, if coastal redwood,[16] or ≥ 36 in. dbh, if Douglas fir, and greater than 200 years old; or (2) any tree older than 200 years with a preponderance of old-growth characteristics specific to that species of tree regardless of its dbh; or (3) any tree greater than 200 years old that cannot be replaced in size or ecological function within 80–130 years, regardless of dbh or presence of old-growth characteristics.[17]

A **Type I** old-growth stand is 3 ac or more that has never been logged and that displays old-growth characteristics.[18]

A **Type II** old-growth stand is a previously harvested stand of old growth on a minimum of 3 contiguous acres with an average of 6 old-growth trees per acre.

In the scientific literature, there are a number of other definitions for old-growth forest (Old-Growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988). In general, the characteristics of this habitat are (1) a heterogeneous mix of trees of different ages and sizes consisting of both fast and slow growing individuals; (2) abundant shade-tolerant species; (3) numerous large, standing snags and downed logs in various sizes and decay classes; and (4) abundant tree cavities (Franklin et al. 1981, Old-Growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988, Norse 1990). The Revised Final Pacific Coast (USA) Regional Forest Stewardship Standard defines 3 specific types of old-growth stands:

> *Type I stands* are those of at least 20 contiguous acres that have never been logged and that display late successional/old-growth characteristics. Stands that have never been logged, but which are smaller than 20 acres, are assessed for their ecological significance, and may also be classified as Type I stands. Areas containing a low density of roads may still be considered Type I stands, provided the roads have not caused significant, negative ecological impacts. Type 2 stands are old unlogged stands smaller than 20 acres that are not classified as Type 1, and other stands of at least 3 contiguous acres that have been logged, but which retain significant late-successional/old growth structure and functions. Type 3 stands are those that have residual old-growth trees and/or other late-successional characteristics, but do not meet the definition of Type 2 stand. (Forest Stewardship Council-US. 2005, 23)

MRC, on the other hand, uses the definitions for Type I and Type II stands given at the beginning of section 9.4.1.2; in our definition, we state that there must be a minimum number of old-growth trees per acre to qualify as Type II. In the case of individual trees rather than stands, we retain all individual old-growth trees with their screen trees. Since old-growth trees clumped in areas less than 3 ac are highly questionable as habitat for any species, we generally define the trees within these areas as individual old-growth trees.

[16] In areas rated Site Class V or in pygmy transition areas, 32 in. is considered old growth. Site class reflects the potential productivity of forest stands for present and future timber growth. Classes range from I-V. Site Class I is the most productive while Site Class V is the least productive. It is important to note that site classes are only for specific regions. A Site Class I in the mixed conifer region of the Sierra Nevada, for instance, is not likely to have the same growth potential as a Site Class I in the north coast redwood region.

[17] This generally applies to areas with low site classes, such as pygmy forest, pygmy transition forest, serpentine soils, and rocky outcrops.

[18] This is per the FSC-US Forest Management Standard (approved 8 July 2010).

Type I stands best approximate a true old-growth forest. The term “old-growth forest” implies stands large enough to indefinitely sustain the processes (tree growth, death, and replacement) and properties (i.e., interior habitat) of old growth. A single old-growth tree or group of old-growth trees may have some of the habitat values shared by trees in an old-growth forest, but its properties are diminished. Stands containing Type II or residual old-growth trees do not approximate an old-growth forest but still provide multiple characteristics valuable to wildlife. Moreover, individual wildlife trees provide valuable “legacy trees” on the landscape with important habitat elements used more frequently by wildlife than other large trees in the same area (Mazurek and Zielinski 2004).

9.4.1.3 Defining old-growth trees

9.4.1.3.1 Redwood

By MRC definition, old-growth redwood is a tree more than 200 years old that (a) is greater than 48 in. dbh; or (b) cannot be replaced in size or ecological function in 80-130 years; or (c) has a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Deep, furrowed, and fissured bark.
- Fire-resistant bark patterns.
- Flattened or irregular crowns and highly complex structure.
- Highly reiterated crowns (multiple sprouting, replicated growth patterns).
- Large limbs whose diameter exceeds 6-8 in.
- Crown debris accumulation.
- Presence of platforms.
- Cavities or partial snag formation.
- Common or abundant epiphytic vascular plants, complex lichens, and moss.
- Large cat-faces[19] or basal burn cavities.
- Fire scars on lower boles.

9.4.1.3.2 Douglas fir and other conifers

By MRC definition, old-growth Douglas fir and other conifers (aside from redwood) are trees more than 200 years old that (a) are greater than 36 in. dbh; or (b) cannot be replaced in size or ecological function in 80-130 years; or (c) have a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Thick bark, deeply fissured and fire resistant.
- Common or abundant epiphytic vascular plants, complex lichens, moss, and, where crown soils are present, ferns.
- Large lateral limbs whose diameter exceeds 8-10 in.
- Flattened, irregular crowns, with crown thinning and lower limbs showing signs of decay.
- Presence of conks.
- Partial sagging in tops; broken tops.
- Crown debris accumulation.
- Fire scars on lower boles.

[19] A cat-face is a scar or deformed section at the base of a tree where equipment or a falling tree has “skinned” the bark and precipitated healing over-growth or rot.

9.4.1.3.3 Hardwood

By MRC definition, old-growth hardwood is a tree more than 200 years old that (a) cannot be replaced in ecological size or function in 80-130 years or (b) has a preponderance of the following characteristics:

- Rating in the upper 20% dbh for species on site.
- Flattened or irregular crowns, highly complex structure.
- Multiple branching crowns with few large, well-developed limbs.
- Large limbs whose diameter exceeds 4-12 in.
- Crown debris accumulation.
- Presence of platforms.
- Presence of cavities, partial snag formation.
- Crown die-back.
- Cat-faces or basal burn cavities.
- Fire scars on lower boles.

9.4.1.4 Old growth in the plan area

Old growth in the plan area includes un-harvested stands, remnant old-growth components of previously harvested stands, and scattered residual old-growth trees. These trees, both conifers and hardwoods, are remnants of the primary forest that existed prior to Euro-American influence (ca. 1800).

As of 2010, the plan area has an estimated 101 ac (41 ha) of un-harvested old growth considered Type I, 520 ac (210 ha) of Type II old growth, and 12,000 individual old-growth trees.[20] We have included maps of Type I and Type II stands in the *HCP/NCCP Atlas* (MAPS 4A-C); however, we have not confirmed their typing with ground reconnaissance. Additionally, residual old-growth trees may occur singly or in small groups of less than 6 trees; MRC protects these single or clumped trees that, as such, do not qualify as Type I or Type II old growth. Moreover, we assess un-harvested stands less than 20 ac for their ecological significance; in some cases, we may classify these stands as Type I. MRC tracks the size of Type I and Type II stands via site visits and aerial photos (M§13.8.1-5). As MRC comes across individual old-growth trees, we will submit maps of the silvicultural units with the PTHP along with the number of old-growth trees within each silvicultural unit. In addition, we will track the number of old-growth trees within our wildlife tree database.

9.4.2 Goals and objectives

Goals and Objectives for Old Growth	
Goals	
G§9.4.2-1	Preserve and enhance the character and function of old growth and late-successional forests in the plan area.

[20] Our inventory database stores sampled information on tree species and certain tree attributes, e.g., old growth and tree volume. To provide an estimate for the residual old-growth trees scattered across the plan area, an MRC inventory analyst queried our inventory database for old-growth redwood and calculated the average volume of an old-growth redwood tree. The analyst then took the total volume of old-growth redwood divided by the average volume for an old-growth redwood tree to obtain an estimate for the number of old-growth redwood trees. Since we have based this estimate only on sampled data use to drive our landscape computer model, it is very rough.

Goals and Objectives for Old Growth	
Goals	
G§9.4.2-2	Promote the development of mature and late-successional forest.
G§9.4.2-3	Protect the remaining old-growth trees and forest in the plan area.
Objectives	
O§9.4.2-1	Maintain 101 ac of Type I old growth currently identified in the plan area, as well as any new Type I old-growth stands later discovered in the plan area, in order to retain their stand acreage and enhance stand function.
O§9.4.2-2	Maintain 520 ac of Type II stands currently identified in the plan area, as well as any new Type II stands later discovered in the plan area in order to retain their stand acreage and enhance stand function.
O§9.4.2-3	Increase acreage of mature and late successional forest within AMZ and LACMA (see M§13.9.2.2-1, M§13.5.1.2-2, M§13.5.1.1-1, M§13.5.1.1-2).

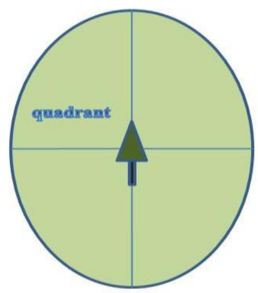
9.4.3 Conservation measures

9.4.3.1 Type I stands

	Conservation Measures for Type I Old Growth
C§9.4.3.1-1	Do not harvest in previously un-harvested stands of old growth.
C§9.4.3.1-2	Pursue conservation easements to permanently protect old-growth stands.
C§9.4.3.1-3	Protect a 150-ft buffer that retains at least 75% of the basal area of conifers in the Type I old-growth stand. **NOTE** A Type I stand with a basal area of 200 ft^2, for example, will have a 150-ft wide buffer with a minimum basal area of 150 ft^2.
C§9.4.3.1-4	Obtain the approval of the wildlife agencies before initiating any burning in old-growth stands.
C§9.4.3.1-5	Cooperate if the wildlife agencies, on their own initiative, decide to re-introduce ecological burns in old-growth stands.

9.4.3.2 Type II stands

	Conservation Measures for Type II Old Growth
C§9.4.3.2-1	Harvest using single-tree selection to maintain and increase mean stand diameter.

	Conservation Measures for Type II Old Growth
C§9.4.3.2-2	Maintain screen trees for old-growth trees and mark them with an "R" so that they are retained during harvest. **DEFINITION** A **screen tree** creates a barrier of protection, e.g., from wind, for an adjacent tree and for wildlife that might be occupying it. Its limbs must intermingle above or at the height of the canopy of the tree to be screened, while its tree top must be at least half the height of the tree to be screened.
C§9.4.3.2-3	Follow these procedures, if a tree to be screened does not have at least 4 screen trees, in order to assess and retain screen recruitment trees: ▪ Use 2 times the canopy spread as the distance within which to assess and retain potential screen trees. ▪ Ensure that a potential screen tree is the tallest tree in the assessment quadrant and at least ½ the height of the tree to be screened.  Tree To Be Screened **NOTE** If there are no trees which meet the criteria in C§9.4.3.2-3, do not retain additional trees.
C§9.4.3.2-4	Permit harvesting of a screen tree only if (a) there are at least 6 screen trees with intermingling limbs; (b) felling will not damage the tree to be screened; and (c) removing the harvested tree will not damage the tree to be screened.
C§9.4.3.2-5	Preserve all individual old-growth trees identified by size, characteristics, and dbh.
C§9.4.3.2-6	Obtain the approval of the wildlife agencies before initiating any burning in old-growth stands.
C§9.4.3.2-7	Cooperate if the wildlife agencies, on their own initiative, decide to re-introduce ecological burns in old-growth stands.

9.4.3.3 Residual old-growth trees

	Conservation Measures for Residual Old-growth Trees
C§9.4.3.3-1	Protect and preserve individual old-growth trees, both conifers and hardwoods. **NOTE** If MRC determines that we must cut a very large hard snag (i.e., >36 in. dbh and more than 20 ft tall) or an old-growth tree, we will provide written notification to the wildlife agencies about (a) our intent to fell the tree, (b) our reasons based on a thorough review, and (c) alternatives considered. If we do not receive a response from the wildlife agencies within 5 business days, we will fell the tree. MRC may fell other snags and wildlife trees for safety reasons without obtaining the approval of the wildlife agencies; in those instances, we will leave the felled trees on the forest floor and include the number of felled trees in an annual report (see C§9.2.3.1-4).
C§9.4.3.3-2	Retain all screen trees around individual old-growth trees per the guidelines in C§9.4.3.2-2 and C§9.4.3.2-3.

9.4.4 Rationale

9.4.4.1 Old growth and late seral forest

MRC conservation measures provide a functional ecosystem for the covered species and natural communities within our forestlands. Old growth, while not a natural community, is an important part of a functioning forest and plays a vital role for many species, such as the marbled murrelet. Over the course of HCP/NCCP implementation, some locations in the plan area will produce forests similar to late seral or old growth (Table 9-2).

Table 9-2 Sample Locations Trending to Late Seral or Old Growth

Plan Area (2010)		
Location	Current Acres	Silviculture
Class I and Class II AMZ	20,474	high retention
LACMA	1237	high retention
Easements (Comptche and Navarro Strip)	462	no harvest
Murrelet Habitat Recruitment Stands[21]	231	manage for murrelet habitat

Smaller areas throughout the property will also trend towards late seral or old-growth forest. These include high hazard terrain stability units, owl core areas that remain in the same location for long periods of time, and variable retention patches that we designated to protect a forest legacy (i.e., large snags). These areas provide the habitat elements required by species that are dependent on old growth and late seral structures.

MRC will not fell individual old-growth trees (except in rare situations); even an 80-year management plan cannot replace these trees. Our policies for retention and screen trees will offer protection to individual old-growth trees.

[21] See C§10.3.2.3.2-1 through C§10.3.2.3.2-3

9.4.4.2 Scientific literature

Loss of old-growth forest in the Pacific Northwest has created tremendous concern; potential loss of biological diversity accompanies its decline. Biological diversity can also be affected if the remaining pockets of old growth are too small to be ecologically viable. Estimates are that 76 animal species rely on old-growth as their primary breeding habitat while 65 animal species use it as their primary feeding habitat (Brown 1985). In addition, an unknown number of plants, lichens, and fungi depend on old growth.

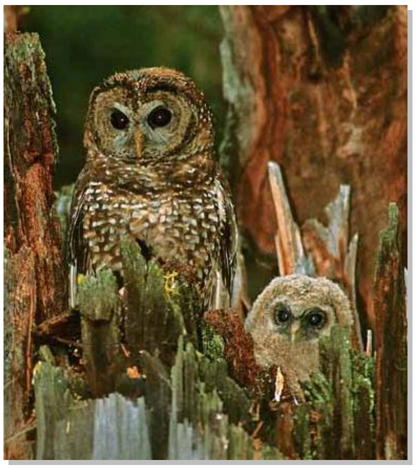


Photo by Jared Hobbs from USFWS 2010 Draft NSO Recovery Plan

Dependence of many terrestrial organisms on old-growth features, such as snags, dead and downed woody material, and tree cavities, is well documented in the Pacific Northwest (Norse 1990, Ruggiero et al. 1991). Approximately one-third of vertebrates using western forests are "closely associated" with old-growth habitat (Olson et al. 2001). Most of these species use other types of habitat as well. However, in many cases, it is old-growth features that allow these species to persist in alternative habitats. For example, in British Columbia, black bear dens are found in second-growth forest, but primarily within structures (live trees, snags, or logs larger than 3.2 ft in diameter) that remain from a previous old-growth forest (Bunnell and Chan-McLeod 1997). Spotted owls may nest in second growth redwoods only because of the structural legacies left from previous old-growth stands (Noon and Murphy 1997). Additionally, Mazurek and Zielinski (2004) found that wildlife used individual old-growth trees more often than other trees. Individual old-growth trees had

- Greater species diversity and richness.
- Greater bat activity.
- Greater number of observable birds.

Certain species found primarily in old-growth forests persist in younger forests as well; nevertheless, they find optimum breeding and foraging habitat within old-growth ecosystems (Franklin et al. 1981). Moreover, many species are associated with old growth only for specific phases of their lives. For example, many Neotropical migrant birds spend their winters in Mexico or Central America, but rely on old-growth forest for breeding habitat. Also, many aquatic-breeding amphibians reproduce in lotic and lentic habitats within old-growth habitats, and move into upland areas after metamorphosis (Olson et al. 2001).

Sonoma tree vole
Photo from Oregon Natural Resources Council

Several species of mammals are dependent on old-growth structures for reproductive success, such as red tree voles in the Oregon Coast and Cascade Ranges (Corn and Bury 1991b, Gilbert and Allwine 1991b). This small arboreal rodent is an important prey of the northern spotted owl (Forsman et al. 1984). Although red tree voles usually build their nests in old-growth trees in Oregon and Washington, nests of Sonoma tree voles are also commonly observed in young second-growth trees in northern California (Carey 1989, Gillesberg and Carey 1991, both as cited in Carey 1991). Meiselman and Doyle (1996) found that certain forest characteristics contribute to habitat use by voles, including large diameter Douglas-fir trees, high percentage of canopy cover, high stump density, low snag density, and lower elevation. Several other small mammals are found in old growth in the Pacific Northwest, including deer mice, Trowbridge's shrew, and the shrew-mole (Gilbert and Allwine 1991b).

Population sizes of Pacific fishers and American martens have drastically dwindled in California. In fact, a 2008 survey in the plan area did not detect either species. These species are typically associated with mature, mesic forests with large diameter trees for resting and denning (Buskirk and Ruggiero 1994). While fur-trapping reduced populations of these species prior to the mid-1900s, habitat loss due to timber harvest is considered to be the major threat now facing them (Cooperider et al. 2000). Fishers and martens are likely affected by reduced canopy; smaller tree diameters; snag and log abundance; and changes in floristic composition. Canopy cover provides protection from predators, lowers the energy costs of travel between foraging sites, and provides more favorable microclimates (Buskirk and Ruggiero 1994, Powell and Zielinski 1994). Preferred prey species may be more abundant or vulnerable with greater canopy closure or coarse woody debris (Buskirk and Powell 1994). Moreover, as logging reduces the density of large trees, there are fewer denning and resting sites.

pallid bat

Bats represent another group of mammals linked to old growth. Recent research on the use of basal hollows by bats in old-growth redwoods confirmed that these hollows are important roost sites; this is evident from large quantities of bat guano in the hollows (Mazurek and Zielinski 2004). Further study determined that bats use hollows primarily in small, residual stands of old growth in commercial forests, as opposed to larger areas of un-fragmented old growth (Zielinski and Gellman 1999).

Studies of bird communities indicate that in old-growth forests there is a greater abundance and diversity of cavity-nesting species. In forests of the Oregon Coast Range, such birds included the pileated woodpecker, hairy woodpecker, red-breasted sapsucker, brown creeper, northern spotted owl, chestnut-backed chickadee, red-breasted nuthatch, and Vaux's swift (Carey et al. 1991). Similar results were found in forests of the Oregon Cascades (Gilbert and Allwine 1991c); additional species in old growth of this region were the rufous hummingbird, varied thrush, and winter wren. Another study in the southern Cascades Range of Washington found that old growth provided optimal habitat for all but 3 of 17 species (Manuwal 1991).

basal hollow

The marbled murrelet, listed in California as an endangered species, relies heavily on old-growth forest for breeding. General characteristics of preferred nesting habitat in the Pacific Northwest include a dominance of old-growth trees in a multistoried stand with moderate to high canopy closure (Miller et al. 1995); dense crown cover of old-growth trees was a dominant factor for stands occupied by marbled murrelets in northwestern California (Miller and Ralph 1996). The average canopy cover over identified nests is 85% (USFWS 1995a). In California, stand dominance by redwood, in conjunction with a dense canopy cover, is important in predicting marbled murrelet occupancy (Nelson 1997). A typical old-growth forest used for nesting by marbled murrelets is characterized by large trees greater than 32 in. (80 cm) dbh (Miller et al. 1995). Mature second-growth forest stands are not known to support nesting if they are isolated from old-growth forest stands (Larsen 1991, as cited in Miller et al. 1995).

Northern spotted owls in Oregon and Washington are generally found in old-growth forests characterized by more than 70% canopy closure, multi-layered canopy structure, large diameter trees, downed logs, and snags (Thomas et al. 1990, Buchanan 1991). Multi-layered canopy provides various microclimates, which help spotted owls regulate their body temperature and provide foraging, roosting, and nesting habitat. Spotted owl nests outside of coastal California are found mainly in mature stands. Spotted owls have also been located nesting in younger stands. Nests are found in tree or snag cavities, on platforms (abandoned raptor or raven nests, squirrel nests, mistletoe brooms, debris accumulations), or on top of broken-off snags. In more mature forests, spotted owls tend to use broken-top trees and cavities more frequently than platforms (LaHaye 1988, Buchanan 1991, Gutièrrez et al. 1995). In coastal Mendocino County, Pious (1994) noted that the majority of nests occurred in coastal redwood (73%), with fewer in Douglas fir (14%), and tanoak (8%).

Amphibians represent a distinctive and important component of the vertebrate fauna in old-growth ecosystems. Although the number of species occurring in Douglas fir and redwood forests is low relative to mammals and birds, amphibians are dominant in biomass in many habitats and supply an important proportion of the energy present in terrestrial and aquatic ecosystems. Researchers evaluated the habitat of 17 species of amphibians in forests throughout Oregon, in southern Washington, and in northern California. Of these, 6 species were found to be strongly associated with old-growth habitat in at least 1 of the survey regions (Corn and Bury 1991a). The coastal tailed frog and the southern torrent salamander—2 of the 6 species— occur in the plan area. These species are generally characterized by restricted distributions, specialized niches, and narrow climatic tolerances. Older, taller, and more structurally complex old-growth forests have greater daily and seasonal microclimate stability and relatively lower overall mean substrate and air temperatures than do younger forests (Harris 1984). They are, therefore, likely to provide higher-quality amphibian habitat.

Distinct invertebrate assemblages are associated with 3 primary habitats in Pacific Northwest old-growth forests: (1) the forest floor and understory; (2) the forest canopy; and (3) riparian habitats. Forest invertebrates drive many key ecological processes. They control decomposition and nutrient cycling; check epizootic outbreaks; catalyze natural disturbance and successional processes; and regulate growth and reproductive success of some fungi, plants, and vertebrates (Cooperrider et al. 2000). The forest floor harbors a large proportion of wingless and flightless invertebrates with low tolerances for changes in moisture and temperature (Lattin and Moldenke 1992, Frest and Johannes 1996, both as cited in Cooperrider et al. 2000). This group includes species of oribatid mites, harvestmen, millipedes, springtails, beetles, flies, wasps, spiders, crickets, land mollusks, and isopods. Some taxa lack a waxy cuticle, making them very susceptible to desiccation stress and restricting them to moist habitats. Some species are predictably associated with different combinations of soil temperature, moisture, structure, fungal abundance, limiting nutrients, and leaf litter (McIver et al. 1990, Moldenke 1990). Their specialized requirements make these species poor dispersers; populations and locally endemic species are prone to extinction. Many species of millipedes and harvestmen known only from single patches of old growth have not been collected again since these localities were logged

(Olson 1992, as cited in Cooperrider et al. 2000). Little is currently known about canopy invertebrates; the few studies that have been conducted indicate that the invertebrate fauna of this unique habitat is highly diverse and distinctive (Schowalter 1989; Winchester 1993, 1996, 1997; Winchester and Ring 1996).

Canopy arthropod faunas are dominated by phytophagous (plant-feeding) and predator/parasite guilds, a pattern typical of functionally diverse and complex ecosystems (Winchester and Ring 1996). Increasing evidence suggests that a sizeable component of the canopy biota consists of species restricted to specialized microhabitats, such as moss mats. If such species have limited geographic ranges, as observed for many forest floor invertebrates, then loss and fragmentation of old-growth forest will lead to increasing extinctions, perhaps before species are even discovered (Winchester and Ring 1996). Invertebrates associated with riparian and aquatic habitats in old growth are not well studied, but some species of stoneflies, caddisflies, and ground beetles are known to be restricted to these habitats. Removal of old-growth forests is known to severely affect streams and their biota (Frest and Johannes 1996, as cited in Cooperrider et al. 2000).
A number of fungi and plants characterize old-growth habitats. Relatively little information is available concerning the ecological relationships of these species in old-growth forests. Of the 46 species of hypogeous (subsoil) fungi identified in Douglas-fir forests of the Oregon Cascade Range, 41 were present in old-growth habitat; 6 of these were statistically associated with this habitat type (Ruggiero et al. 1991). Fungal diversity is very high in redwood forests; so far, 320 species have been identified. However, potential associations between fungi and old-growth conditions require further study. Douglas-fir and redwood forests also support nonvascular epiphytes including mosses, liverworts, cyanolichens, alectorioid lichens and other green algal lichens (Sawyer et al. 2000a). Little is known about the distributions of these plants through forest succession, though many, such as *Lobaria oregana*, a foliose canopy lichen occurring in Douglas-fir forests, appear to find optimal habitat in old-growth stands (Franklin et al. 1981, Spies 1991).

Vascular plants, particularly ferns, also occur as epiphytes in redwood and Douglas-fir forests. No vascular plants are known to occur exclusively in old growth, but a number of species are associated with this habitat (Ruggiero et al. 1991, Spies 1991). The strongest association currently documented is that of the Pacific yew (*Taxus brevifolia*), a very slow-growing, shade-tolerant species that appears to attain optimal growth and development in the understory of old-growth habitat (Spies and Franklin 1988, Ruggiero et al. 1991).

Much of the remaining old growth occurs in fragments that are too small to be ecologically viable because of edge effects. A forest less than 25 ac (10 ha) in area may be so vulnerable to edge effects, such as windthrow and increased rates of predation, that it may not serve as true old-growth habitat (Harris 1984, Franklin and Forman 1987). Similarly, old-growth redwood stands of less than 80 ac may not be viable because "outside influences can easily penetrate and because they are vulnerable to disturbances such as windthrow" (Morrison 1988). Russell and Jones (2001) found that 53% of the old-growth redwood forest preserved in Redwood National Park and state parks was influenced by edge effects, leaving only 47% as effective old growth. The minimum viable stand size for old growth ultimately depends on a number of factors, including the species composition of the stand, specific management objectives, the location of the stand in the landscape, and successional stages of neighboring stands (Spies and Franklin 1988).

By protecting both single residual trees and stands of old-growth trees, MRC will continue to maintain features typical of old-growth forests. Although the size and configuration of MRC old-growth stands varies, our implementation strategies for both un-harvested and previously harvested old-growth stands will protect and enhance the integrity and ecological viability of our existing old growth, regardless of stand size. The research highlighted in this sub-section underscores the importance of retaining these remnant stands of old growth; MRC old-growth policies provide substantial benefits to many species vitally connected to old-growth habitat.

9.5 Rocky outcrops

9.5.1 Overview

DEFINITION	**Rocky outcrops** are at least (a) 1 ac in size with ground cover entirely of rock or (b) near-vertical rock faces at least 50 ft high and 100 ft long whose appearance suggests they have never been quarried.

Rocky outcrops occur as isolated patches of bare or mostly bare rock in a variety of landscapes and habitat types. In the plan area, rocky outcrops are in 3 planning watersheds and cover a combined area of 63 ac (25 ha). We have provided a map of all known rocky outcrops in the plan area in Appendix B, *HCP/NCCP Atlas* (MAPS 3A-C, 4A-C, 8A-C, and 14A-C). Although rocky outcrops generally represent only a small fraction of the landscape, their unique qualities and insular nature make them important habitat for many plant and animal species, including the peregrine falcon. The thin, dry, rocky soils of rocky outcrops can support some types of woody vegetation but generally preclude large trees. This makes rocky outcrops of little value for timber harvest operations. In the plan area, rocky outcrops may include, but are not limited to cliffs, talus, and serpentine barrens.

In protecting rocky outcrops, MRC is focusing on the peregrine falcon, which uses this habitat for nesting. However, other species will clearly benefit from the fact that we are preserving this habitat and, when necessary, avoiding disturbance.

9.5.2 Goals and objectives

Goals and Objectives for Rocky Outcrops	
Goals	
G§9.5.2-1	Retain and preserve known rocky outcrops in the plan area.
G§9.5.2-2	Minimize disturbance of rocky outcrops.
G§9.5.2-3	Avoid adverse impacts to sensitive species that may inhabit or use rocky outcrops for reproduction, cover, or foraging, particularly the peregrine falcon.
Objectives	
O§9.5.2-1	Preserve and maintain 3 rocky outcrops comprising 63 ac (20 ha) across 3 planning watersheds.

9.5.3 Conservation measures

	Conservation Measures for Rocky Outcrops
C§9.5.3-1	Survey for peregrine falcon when timber operations occur within ½ mile of rocky outcrops or within 1 mile of any proposed helicopter yarding.

	Conservation Measures for Rocky Outcrops
C§9.5.3-2	Survey newly discovered rocky outcrops for sensitive species if there are plans to convert them to quarries. ▪ If sensitive species are not present, MRC may convert the site to a quarry. ▪ If sensitive species are present, MRC will obtain approval of the wildlife agencies prior to any conversion of the site to a quarry.
C§9.5.3-3	Coordinate with adjacent landowners, as appropriate, to determine the status of adjacent peregrine falcon eyries.
C§9.5.3-4	Consult with the wildlife agencies for operations within ¼ mile of a peregrine falcon nest in order to determine site-specific conservation measures, including disturbance measures.

9.5.4 Rationale

Bobcat from Hidden Camera MRC Land, November 2004

Rocky outcrops are structurally complex and stable; they provide cover from wind, rain, and sun. For many species, ranging from lichens to mammalian carnivores, rocky outcrops are islands of high-quality habitat in an otherwise inhospitable landscape. In forested habitat, canopy gaps created by rocky outcrops allow for the establishment of shade-intolerant plants; dry soils associated with these areas may support rare or sensitive plants and animals (BLM 2001, Imster 2001). In California, rocky outcrops can serve as nesting, roosting, or denning habitat for bats, woodrats, bobcats, mountain lions, grey foxes, ringtails, coyotes, raccoons, fishers, and skunks (Cato 2002, Zeiner et al. 1990a). In an Oregon lodgepole pine forest, American martens were documented, on at least one occasion, using rocky outcrops for a maternal den site (Raphael et al. 1997). Cliffs and steep rocky outcrops can be especially important as nesting sites for birds. Lizards and snakes also commonly use rocky outcrops for cover, foraging, and thermoregulation. MRC will avoid disturbance of these unique habitats and establish disturbance buffers, if needed, to protect nesting peregrine falcons and other sensitive species.

9.6 Natural Communities

In section 1.11, we introduced the subject of natural communities in the plan area. Within our HCP/NCCP, we address North Coast coniferous forest, upland broadleaved forest, deciduous riparian forest, oak woodlands, closed-cone forest, and grasslands. The first 3 communities in this list, we designate as common natural forest communities and the last 4, as uncommon natural communities.

9.6.1 Common natural forest communities

9.6.1.1 Overview

This category applies to Northcoast coniferous forest, upland broadleaved forest, and riparian forest (see *HCP/NCCP Atlas*, MAP 8A-C). Natural communities can be stressed by many anthropogenic and environmental factors, including commercial development, population growth, and climate. While outright destruction of natural communities is obvious—such as the conversion of a conifer forest to vineyards—their alteration, fragmentation, and degradation can be much subtler and even concealed over a long period of time. This can be the result of roads, changes in water quality, spread of non-native species, forest management which results in over-simplification, modified ecological processes (e.g., fire regimes and grazing or browsing dynamics), and many other sources. Next to habitat loss, invasive non-native plants and animals may be the biggest threat to biodiversity. Invasive plant control is important for maintaining natural communities, especially when there is repeated soil disturbance from road maintenance, road construction, and logging.

Another important, though less obvious, threat to natural communities is the disruption of natural disturbance processes, most notably fire regimes. Not only does urbanization directly eliminate natural communities, it alters natural disturbance patterns. As areas urbanize, prevention and suppression of wildfire, for example, become more urgent and prescribed fire for ecological purposes becomes more difficult.

For natural communities with commercial timber value, timber harvest can also cause loss of species abundance through over-simplification of the coniferous forest. This is a primary threat to MRC natural communities.

9.6.1.2 Goals and objectives

MRC is not proposing to convert any of our existing natural communities to other land use. In the case of our conifer forest, harvesting obviously will occur. However, we will regenerate this same land, typically with stock derived regionally and with a mix of conifer species similar to the harvested stand. Using several silvicultural practices, we will maintain various successional stages of coastal forest. Actively managed upslope stands will vary from early to mid-seral stages throughout the term of our HCP/NCCP. The amount of late seral stands will increase as a result of the conservation measures for Class I and Large Class II watercourses. We estimate that late seral habitat within the plan area will increase from approximately 4300 ac in 2010 to 28,000 ac by Year 80 of HCP/NCCP implementation; this will be due mainly to increased protection of watercourse zones.

Goal and Objectives for Common Natural Communities	
Goal	
G§9.6.1.2-1	Maintain existing natural communities.
Objectives	
O§9.6.1.2-1	Regenerate harvested conifer forest with a mix of conifer species similar to the harvested stand.
O§9.6.1.2-2	Maintain various successional stages of coastal forest, including Type I and Type II old-growth stands as well as representative hardwood forests.

Goal and Objectives for Common Natural Communities	
Goal	
O§9.6.1.2-3	Maintain existing stand dominance of native conifers other than redwood and Douglas fir where this occurs.

9.6.1.3 Conservation measures

MRC conservation measures for natural communities directly correlate to the potential impacts these communities might incur as a result of covered activities. Our conservation measures are specific to a covered activity or covered species, not to a natural community per se. However, individual conservation measures taken in total can contribute both directly and indirectly to the conservation of natural communities.

MRC has "weighted" the conservation measures in areas where covered activities are most likely to occur. Mixed forest of coastal redwood and Douglas fir, mixed evergreen forest, and riparian forest comprise 98% of the plan area. Consequently, these areas face the greatest number of potential impacts from covered activities. By the same token, they also receive the lion's share of the conservation measures.

	Conservation Measures for Common Natural Communities
C§9.6.1.3-1	Restore coastal redwoods and Douglas fir.
C§9.6.1.3-2	Restore a balance of conifers-to-hardwoods.
C§9.6.1.3-3	Maintain Class I hardwood stands (section 9.3.1.2).
C§9.6.1.3-4	Maintain existing stand dominance of native conifers other than redwood and Douglas fir where this occurs.
C§9.6.1.3-5	Follow all other conservation strategies related to common natural communities: ▪ *Riparian areas and wetlands* Protect distinct habitat features, such as watercourses, marshes, seeps, and springs. ▪ *Sediment and mass wasting* Limit the anthropogenic sources of mass wasting, thereby maintaining more ground in the forest and less sediment impairment of watercourses. ▪ *Wildlife trees, snags, and downed wood* Retain and recruit habitat elements necessary to maintain a diverse habitat structure. ▪ *Hardwoods* Maintain hardwood tree species within MRC conifer forests, as well as representative hardwood stands across the plan area. ▪ *Old- growth trees* Retain old-growth trees, a significant habitat element. ▪ *Northern spotted owl* Create and retain older and denser forest stands; this, in turn, increases the diversity of seral stages throughout the natural community.

	Conservation Measures for Common Natural Communities
	▪ *Marbled murrelet* Retain large, uncommon trees with significant structural elements for nesting, such as platform branches or broken tops. ▪ *Point Arena mountain beaver* Retain existing burrow systems. ▪ *Rare plants* Protect and conserve covered rare plants.

9.6.1.4 Rationale

The ultimate threat to most of the natural communities in the MRC assessment area is habitat destruction and modification due to development and urbanization, such as vineyards and subdivisions. The primary protection extended by MRC to the common natural communities within our forestlands is forest management that conserves species abundance and habitat diversity while promoting conifer-dominated forest and improving habitat for covered species. Appendix P, *Natural Community Schemes*, provides a “crosswalk” between MRC names for natural communities and other names used by various authors and alliances, as well as identified threats to these communities.

! MRC will map, with the assistance of the wildlife agencies, the natural communities in the plan area to the scheme of Sawyer and Keeler-Wolf.[22]

9.6.2 Uncommon natural forest communities

9.6.2.1 Overview

This category applies to (1) closed-coned forest (pygmy or Bishop pine); (2) oak woodlands; (3) natural grasslands; and (4) salt marsh (see *HCP/NCCP Atlas*, MAP 8A-C).

9.6.2.2 Goals and objectives

Goal and Objectives for Uncommon Natural Communities	
Goal	
G§9.6.2.2-1	Maintain existing natural communities.
Objectives	
O§9.6.2.2-1	Reintroduce and manage ecological processes or surrogates after obtaining approval of the wildlife agencies.

[22] Refer to Appendix P, *Natural Community Schemes*, Table P-1. The VegCAMP program (shown in column 2 of the table) uses the classification scheme of Sawyer and Keeler-Wolf 1995 and Sawyer, Keeler-Wolf, and Evens 2009.

Goal and Objectives for Uncommon Natural Communities	
Goal	
O§9.6.2.2-2	Conserve 3274 ac of uncommon natural communities by limiting MRC activities within them: ▪ 135 ac of pygmy forest. ▪ 319 ac of Bishop pine. ▪ 1084 ac of oak woodlands. ▪ 1669 ac of grasslands. ▪ 67 ac of salt marsh.
O§9.6.2.2-3	Control any species which the wildlife agencies and MRC designate as an exotic invasive.

9.6.2.3 Conservation measures

MRC will conserve these uncommon natural communities primarily by limiting our activities within them. When activities must occur, there will be strict levels of protection in place. By avoiding these communities during covered activities, however, disruption of natural processes, such as fire, becomes a threat. This may result in atypical communities or successional mixes. The following conservation strategies promote the overall health of these uncommon natural communities.

9.6.2.3.1 Closed-cone forest (pygmy or Bishop pine)

	Conservation Measures for Closed-cone Forest
C§9.6.2.3.1-1	Follow all conservation measures for rare plants detailed in Chapter 11.
C§9.6.2.3.1-2	Avoid conducting covered activities in closed-cone forest, if feasible.
C§9.6.2.3.1-3	Conduct covered activities in closed-cone forest to allow access to adjacent timber stands only if no other routes are feasible.
C§9.6.2.3.1-4	Conduct road maintenance and construction in accordance with the prescribed protections and take limitations on rare plants in Chapter 11.
C§9.6.2.3.1-5	Do not disturb, over the 80-year term of the plan, more than 5 ac of pygmy forest for construction of new facilities, such as roads, landings, and skid trails; obtain approval of the wildlife agencies if the proposed construction will impact additional acres.
C§9.6.2.3.1-6	Request technical assistance from USFWS, if necessary, to prevent take of the Lotis Blue Butterfly.
C§9.6.2.3.1-7	Apply surrogates for natural disturbance agents (e.g., fire) within natural communities, if the wildlife agencies concur.
C§9.6.2.3.1-8	Decommission, close, and re-vegetate historic roads (see Appendix E, *Roads, Landings, and Skid Trails*, section E.2.1)

9.6.2.3.2 Oak woodlands and natural grasslands

	Conservation Measures for Oak Woodlands and Natural Grasslands
C§9.6.2.3.2-1	Follow all conservation measures for rare plants detailed in Chapter 11.
C§9.6.2.3.2-2	Avoid conducting covered activities in oak woodlands and natural grasslands, if feasible.
C§9.6.2.3.2-3	Conduct covered activities in oak woodlands and natural grasslands to allow access to adjacent timber stands only if no other routes are feasible.
C§9.6.2.3.2-4	Conduct road maintenance and construction in accordance with the prescribed protections and take limitations on rare plants in Chapter 11.
C§9.6.2.3.2-5	Apply surrogates for natural disturbance agents (e.g., fire) within natural communities, if the wildlife agencies concur.
C§9.6.2.3.2-6	Decommission, close, and re-vegetate historic roads (see Appendix E, *Roads, Landings, and Skid Trails*, section E.2.1)
C§9.6.2.3.2-7	Harvest encroaching Douglas fir and avoid replanting the harvested area with conifers, if feasible and cost-efficient.

9.6.2.3.3 Salt-marsh

	Conservation Measures for Salt Marsh
C§9.6.2.3.3-1	Map, within 5 years of HCP/NCCP commencement, the boundaries of any salt marsh in the plan area with ground surveys, extending out at least as far as the dominant species identified, including Zostera spp.
C§9.6.2.3.3-2	Prohibit water drafting within the boundaries of the salt marsh.
C§9.6.2.3.3-3	Maintain a 50-ft EEZ (excluding existing roads) around a salt marsh.
C§9.6.2.3.3-4	Provide AMZ Class I protections around watered areas of the marsh.

9.6.2.4 Rationale

The primary protection extended by MRC to the uncommon natural communities within our forestlands is strictly limiting activities within them. Appendix P, *Natural Community Schemes*, provides a “crosswalk” between MRC names for natural communities and other names used by various authors and alliances, as well as identified threats to the these communities.

9.7 Invasive Species Management

9.7.1 Overview

Invasive species can pose a high risk to natural forest and wildlife communities (see Chapter 14, section 14.11). We have conservation measures to protect rare plants in close proximity to invasive plant species (C§11.7.1-19, C§11.7.2-21, C§11.7.3-15, and C§11.8.2-18). In addition, we have specific conservation measures to combat bullfrogs that invade ponds known to be breeding sites for red-legged frogs (C§10.2.2.3-6 and C§10.2.2.3-7). When feasible, MRC controls occurrences of invasive plant species. To date, our main efforts are targeted at jubata grass, broom, and eucalyptus.

9.7.2 Goals and objectives

Goal and Objectives for Invasive Species	
Goal	
G§9.7.2-1	Reduce the adverse ecological effects of invasive species in the plan area in order to enhance natural communities and protect covered species.
Objectives	
O§9.7.2-1	Eradicate or reduce the cover, biomass, and distribution of target, non-native invasive plants, such as jubata grass, broom, and eucalyptus, in the plan area through an Invasive Plant Control Program (IPCP).
O§9.7.2-2	Reduce the number and distribution of non-native, invasive animals, such as bullfrogs, if they threaten the ecological balance in natural communities or the populations of covered species.
O§9.7.2-3	Implement, with external or MRC funding and with the cooperation of the wildlife agencies as well as other land agencies, control programs for existing and newly discovered invasive species which benefit the region.

9.7.3 Conservation measures

MRC cannot effectively control many exotic plants and animals due to (a) their great abundance, high reproduction rate, and proficient dispersal ability; (b) the high cost of control measures; (c) the unacceptable environmental impacts of the control measures; or (d) public resistance to forms of control considered inhumane. Therefore, the focus of control efforts in the plan area will be on the most invasive non-native plants and animals.

Covered activities may specifically exacerbate the spread of invasive plants. For example, timber harvest operations may spread invasive plant seeds to remote areas. Logging roads may become dispersal corridors for invasive plant and animal species. Accordingly, MRC will implement a control program to minimize the adverse impacts of invasive plants and animals on covered species and enhance natural communities. Moreover, we expect our management efforts to increase the resilience of our natural communities to new invasions. MRC adopted and adapted the conservation measures detailed here as well as our Invasive Plant Control Program (IPCP) and Invasive Animal Control Program (IACP) from the Contra Costa County HCP/NCCP (Jones and Stokes, 2006) to address our own ecological setting and covered species.

	Conservation Measures for Invasive Species
C§9.7.3-1	Develop, within the first 5 years of HCP/NCCP implementation, an *Invasive Plant Control Program* and *Invasive Animal Control Program* for the plan area.
C§9.7.3-2	Incorporate applicable elements of the *Invasive Plant Control Program* and *Invasive Animal Control Program* into individual PTHPs and other site-specific projects.
C§9.7.3-3	Evaluate and revise the *Invasive Plant Control Program* and *Invasive Animal Control Program* as needed, with a formal evaluation and revision at least every 5 years.[23]
C§9.7.3-4	Continue current control efforts on invasive plants and animals in the plan area during development of the *Invasive Plant Control Program* and *Invasive Animal Control Program*

9.7.3.1 IPCP and IACP

The goals of the MRC Invasive Plant Control Program (IPCP) are to (1) control the spread of noxious weeds[24] and invasive exotic plants[25] into new areas and (2) control infestations of noxious and serious weeds, where practicable.

The Invasive Plant Control Program must distinguish those species for which eradication or control will be an objective of our HCP/NCCP and those species that MRC will address through landscape-level management.

The goals for the MRC Invasive Animal Control Program (IACP) are to (1) control invasive animal species where they directly threaten covered species or natural communities, (2) contain the spread of non-native invasive animal species, if they are within a small area, and (3) work in cooperation with local, state, and federal agencies to address invasive animal species that have spread throughout the plan area.

9.7.3.2 Elements of IPCP and the IACP

Both the IPCP and the IACP will include the following:

- Assessment of species likely to be invasive in the plan area.
  - Maps and descriptions of their distribution and abundance.
  - Known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species.
  - Means and risk of their spread to other areas.
  - Cost, feasibility, and effectiveness of available control measures for each species.
- Assessment of species in locations near the plan area or in habitat similar to those in the plan area which pose potential threats.
  - Known or potential effects on ecosystem function, native biological diversity, sensitive natural communities, and covered species.

[23] This is the approximate interval at which the California Invasive Plant Council updates its list of invasive plants.
[24] Per the definition of noxious weeds by the California Department of Food and Agriculture
[25] See the latest listings of the California Invasive Plant Council at http://www.cal-ipc.org/.

- Establishment of priorities for invasive species control:
  - Level of impacts to sensitive natural communities and covered species.
  - Expected rate of spread.
  - Expected success of control measures.
  - Secondary environmental impacts of control measures.
  - Cost and technical feasibility of control.
  - Availability of external funding (e.g., state or federal grants).
- Integration and coordination of efforts to control invasive species in the plan area with similar efforts in other locations.
- Description and evaluation of methods to control and prevent the establishment of invasive species based on site-specific conditions.
- Process to evaluate future invasive species and to effectively remove or control them.

MRC will coordinate the development of our IPCP with the Mendocino County Agriculture Division, the Mendocino Coast Cooperative Weed Management Area, and other major resource management agencies, as appropriate. Because control of many invasive plants is a regional issue, coordination with these agencies is essential. Coordination may include sharing costs, staff, and equipment, as well as conducting joint management programs to address the regional problem of invasive plants. MRC will prioritize management to initially address invasive plants with the greatest impacts on covered species.

MRC will coordinate the development of our IACP with the wildlife agencies, and invite other local, regional, state, and federal groups to join in the control effort. To the maximum extent possible, we will cooperate with these groups. Control of invasive species which threaten covered species will be an MRC priority.

To date, MRC has had mixed results in controlling invasive species on our land. For invasive plants, the best way to control them is to treat the entire seed source of the plant. In locations where adjacent landowners do not treat the invasive plants on their property, MRC is seldom successful in controlling the plant. Seed blown from the adjacent property establishes itself on our land. Controlling species, such as jubata grass, under these circumstances is generally futile and unfeasible. MRC will maintain a database with information on all our attempts, both successful and unsuccessful, at invasive species management. Data will include species, location, treatment type, treatment timing, and post-treatment evaluation after 1-2 years.

MRC will be as proactive as possible by participating in regional planning and control efforts for invasive species and by highlighting issues and identification of invasive species in venues such as our Rare Plant Training Program (RPTP). This program emphasizes prevention and eradication of initial infestations; as such, it is the most effective management strategy for invasive species. Once invasive species become established, eradication efforts become more difficult and less effective; control measures become the norm. If authoritative sources determine that an invasive species is established, widespread, and beyond elimination, MRC may take other measures to control it which are consistent with our HCP/NCCP. Finally, to more effectively implement our IPCP and IACP, we will actively seek external funding sources to supplement HCP/NCCP funds, especially for invasive plant control.

Chapter 10

Conservation Measures for Fish and Wildlife

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10 CONSERVATION MEASURES FOR FISH AND WILDLIFE

10.1 Introduction

Chapter 10 proposes conservation measures for all fish and wildlife species covered under our HCP/NCCP. Since the habitat requirements and proposed protection measures for aquatic species differ from those of terrestrial species, we have organized our conservation measures under these 2 categories.

Table 10-1 Covered Fish and Wildlife

Aquatic Species	Terrestrial Species
• coho salmon	• northern spotted owl
• Chinook salmon	• marbled murrelet
• steelhead	• Point Arena mountain beaver
• red-legged frog	
• coastal tailed frog	

10.1.1 Aquatic overview

The conservation measures for aquatic species focus on aquatic habitat. As a result, they are fairly brief and often cross reference Chapter 8, *Conservation Measures for Aquatic Habitat*.

10.1.2 Terrestrial overview

The conservation measures for terrestrial species focus on 3 very different animals—a forest raptor, a seabird, and a rodent—and are much more detailed than the aquatic measures. Most of the discussion in this chapter is actually about 2 of these animals: the northern spotted owl and the marbled murrelet. These 2 species make the "front page," as it were, because they play a major role in our HCP/NCCP.

- *Northern spotted owl*

  The northern spotted owl is the species that potentially will experience the most impact from covered activities. The reason is that they occur over a very large area, namely all across the plan area. Their forest habitat is the one most threatened by timber operations. To protect them in a systematic way that is also biologically relevant requires detailed planning.

- *Marbled murrelet*

  Unlike the northern spotted owl, marbled murrelets occupy a very small area on covered lands—Alder Creek. While murrelets scour the ocean to feed on fish and other marine organisms, they inhabit forested areas where they can breed in old growth trees and nest high in forest canopy. Aside from Russian Gulch, Lower Alder Creek is the only place in Mendocino County where long-term, continuous murrelet activity occurs. For this reason, MRC is proposing special protection for Lower Alder Creek as part of a regional effort to restore murrelets in Mendocino County.

- *Point Arena mountain beaver*

  The Point Arena mountain beaver is also geographically isolated within Mendocino County. As their name implies, mountain beavers occur primarily around Point Arena, a narrow peninsula jutting ½ mile into the Pacific Ocean.

There are many more mountain beaver burrow systems outside the plan area than inside it. Since mountain beavers prefer herbaceous ground cover rather than tree canopy cover, their habitat is relatively more plentiful on coastal bluffs and in coastal scrub. With many burrow systems scattered throughout their small geographic range, mountain beavers are in a much better recovery position than murrelets. Therefore, MRC conservation measures propose a basic approach, relying on surveys and protections for existing burrow systems.

10.1.3 Measure up

A primary thrust of the MRC conservation effort is habitat protection. Certainly, measurement is key to that effort. In providing protection, particularly for terrestrial species, MRC creates buffer areas around species habitat. Determining the distance of those buffers in a forest with rough terrain and various slope gradients requires different types of measurement. MRC has used slope distance for any measurement ≤ 250 ft and horizontal (or map) distance for any measurement more than > 250 ft.[1]

10.2 Aquatic species

10.2.1 Chinook salmon, coho salmon, and steelhead

10.2.1.1 Overview

The conservation measures for coho salmon, Chinook salmon, and steelhead protect aquatic habitat and strive to improve the abundance and distribution of anadromous salmonids throughout the plan area. Although each of the covered salmonids occurs in very different habitats, MRC intends to protect all fish habitat with very conservative measures. Descriptions of the habitat for coho, Chinook, and steelhead are in sections 4.2.5, 4.3.5, and 4.4.5 respectively.

Chinook salmon tend to occur only in the lowest reaches of some of the largest watersheds in the plan area. Coho salmon occupy smaller coastal watersheds as well as the lower and middle reaches of larger watersheds. Steelhead occur in the lower, middle, and uppermost reaches of all of the watercourses in the plan area accessible to fish. Conservation measures for steelhead will protect many miles of watercourses, even where Chinook and coho salmon do not occur. In Hollow Tree Creek, for example, conservation measures applied to headwater areas where only steelhead occur will directly improve habitat further downstream for Chinook and coho salmon. Improving water temperatures, increasing habitat complexity, improving riparian function, and reducing sediment will contribute to habitat improvement for all 3 species regardless of which species may be present in a watercourse at the time we apply our aquatic conservation measures.

Many factors may limit anadromous populations, including

- Freshwater conditions.
- Ocean conditions.
- Timber harvest.
- Disease.
- Genetic integrity.
- Fishing pressure (in the ocean and rivers).

[1] MRC defines horizontal (or map) distance as the measured distance between 2 points on a map, while slope distance is the measured distance between 2 points on the ground.

- Temporary or anthropogenic barriers to migration.
- Hatcheries.
- Predation.

Improvement in any one of these factors does not ensure the population will be stable or increase. Moreover, MRC can only influence aquatic conditions within the plan area and downstream; we cannot control the marine environment which influences the number of adult salmonids returning from the sea to spawn in freshwater streams on our land. However, it is entirely possible that improving freshwater conditions will increase the number of out-migrants and returning adults.

10.2.1.1.1 Protecting salmonid life stages

MRC has chosen to protect and conserve the 3 covered salmonids in all their freshwater life stages. Each of these life stages has unique habitat requirements for which MRC provides a network of Aquatic Management Zones (AMZs). Since all these life stages may be present in all fish-bearing watercourses at any time, we will use standard conservation measures for all Class I (i.e., fish-bearing) watercourses, regardless of which salmonid species is present. This approach provides a simple means of protecting all Class I watercourses and avoids problematic approaches such as single species management.

10.2.1.1.2 Annual salmonid monitoring basins

Each year, MRC will conduct surveys for salmonid presence in our Annual Salmonid Monitoring Basins (ASMB). We selected basins in which we own all or most of the land to ensure that results reflect our own practices as opposed to activities outside our control. Those basins include

- Hollow Tree Creek.
- Cottaneva Creek.
- Hardy Creek.
- Juan Creek.
- Howard Creek.
- North Fork Noyo River.
- Big River (above South Fork Big River).
- South Fork Big River.
- Albion River.
- South Fork Albion River.
- North Branch North Fork Navarro River.
- South Branch North Fork Navarro River.
- Greenwood Creek.
- Elk Creek.
- Mallo Pass Creek.
- Alder Creek.
- South Fork Garcia River.
- Ackerman Creek.

10.2.1.2 Biological goals and objectives

Goals and Objectives for Coho Salmon, Chinook Salmon, and Steelhead	
Goals	
G§10.2.1.2-1	Maintain and improve anadromous salmonid distribution throughout the plan area.
G§10.2.1.2-2	Maintain and improve aquatic habitat.
Objectives	
Major Drainage Basins	
O§10.2.1.2-1	Maintain presence of ▪ Steelhead in 100% of the ASMB where baseline data and new information indicate their presence. ▪ Coho salmon in 100% of ASMB, where baseline data and new information indicate their presence. **NOTE** MRC considers anadromous salmonid species *present* if we detect them once during 3 annual consecutive surveys in a basin. We will consider that basin able to *support* the new species only if we detect them on 2 or more occasions in a continuous 6-year time period.
Distribution	
O§10.2.1.2-2	Maintain steelhead in 90% of sampling sites throughout the plan area, where baseline data and new information indicates their presence.
O§10.2.1.2-3	Maintain coho salmon in 85% of sampling sites throughout the plan area, where baseline data and new information indicates their presence. **NOTE** MRC set objectives for coho salmon and steelhead distribution at less than 100% to account for natural variations in flow and temporary barriers, such as log jams, which may impede accessibility. When we detect new fish species in a sampling site, we will consider that sampling site able to support the new species only if we detect them on 2 or more occasions in a continuous 6-year time period.
Chinook Salmon Monitoring Reaches	
OS10.2.1.2-4	Maintain Chinook salmon in the Chinook Salmon Monitoring Reaches (CSMR) currently identified for annual monitoring: Hollow Tree Creek and North Fork Noyo River (see *HCP/NCCP Atlas*, MAPS 3A-3C).

10.2.1.3 Conservation measures

	Conservation Measures for Coho Salmon, Chinook Salmon, and Steelhead
C§10.2.1.3-1	See 8.2, *Riparian and Wetland Areas.*
C§10.2.1.3-2	See 8.3, *Sediment Inputs*.
C§10.2.1.3-3	See 8.4, *Hydrologic Change.*
C§10.2.1.3-4	See Appendix E, *Roads, Landings, and Skid Trails.*
C§10.2.1.3-5	See Appendix T, *Master Agreement for Timber Operations.*

10.2.1.3.1 Treatment of fish barriers

Although MRC does not have an explicit plan to treat fish barriers, they are a top priority for restoration work. Section 8.3.3.2.1 explains how MRC prioritizes road work. As of 2010, MRC will have removed 34 fish barriers throughout the plan area. The lineal extent of habitat upstream of these barriers, which is, in effect, an enhanced or restored area, is 106,433 ft—roughly 20 miles. MRC will continue to treat all man-made fish barriers as a high priority in order to improve and increase the amount of fish habitat; we will report annually on treatment of fish passage barriers and miles of stream enhanced (see D.9).

10.2.1.3.2 CDFG recovery strategy for coho salmon

CDFG, with the assistance of recovery teams representing diverse interests and perspectives, created the *Recovery Strategy for California Coho Salmon*, a guide for recovering coho salmon on the north and central coasts of California. Released in 2004, the *Recovery Strategy* has the primary objective of returning coho salmon to a level of sustained viability. At the same time, it aims to protect the genetic integrity of both its Southern Oregon/Northern California Coast (SONCC) ESU and its Central California Coast (CCC) ESU so that they can be delisted. In that case, there will be no further need for regulations or other protections under CESA.

CDFG has subdivided each coho salmon ESU into watershed recovery units. The recovery units are groups of smaller drainages related hydrologically, geologically, and ecologically. CDFG considers these units as unique and important components of an ESU. To provide consistency with existing resource databases, CDFG aligned recovery units with the geographic divisions of the CALWATER 2.2a system, the standard watershed mapping system used by the State of California. The CALWATER classification system includes (from largest to smallest) hydrologic regions, hydrologic units (HU), hydrologic areas (HA), hydrologic subareas (HSA), and planning watersheds. HSAs come into play when there are environmental conditions distinct from the hydrologic unit (HU) and specific recovery recommendations are warranted.

MRC intends to incorporate, wherever pertinent, the CDFG *Recovery Strategy* into our HCP/NCCP. We have designated 3 geographic recovery units within our plan area—the South Fork Eel River HA, the Mendocino Coast HU, and the Russian River HU. The South Fork Eel River HA is the only recovery unit within the plan area which belongs to the SONCC ESU; the other 2 units (Mendocino Coast HU and Russian River HU) belong to the CCC ESU.

In keeping with the CDFG *Recovery Strategy*, Appendix Z details the watershed recommendations for the hydrologic areas of South Fork Eel River, Mendocino Coast, and the Russian River, along with the MRC proposals to comply with these recommendations and, where relevant, to incorporate them in our HCP/NCCP.

10.2.1.3.3 NOAA draft recovery strategy for coho salmon

In March 2010, NOAA Fisheries Service released a public review draft of their "Recovery Plan for the ESU of Central California Coast Coho Salmon." NOAA estimates that the plan will be finalized by 4th quarter 2011. MRC has identified numerous conservation measures for watersheds which NOAA designates as coho *core areas* in their recovery plan. Our implementation of these measures will accelerate over the course of our HCP/NCCP. For example, we have committed to upgrading our roads to HCP/NCCP standards and increasing levels of LWD in order to restore and improve habitat conditions at a faster pace in coho core areas. Elements of the final NOAA plan will be incorporated into Appendix Z, *Coho Recovery Strategies*.

10.2.1.3.4 Basic comparison of CDFG and NMFS strategy

CDFG recovery units generally correspond to CALWATER hydrologic units. These units are 2 hierarchical levels above planning watersheds. Within their coho strategy, CDFG ranks entire basins for recovery efforts. Most of the MRC plan area has a ranking of 5, meaning the land has a high potential for restoration and management.

The NMFS recovery plan is more specific to planning watersheds. Low coho populations concentrated in small portions of a stream make the coho subject to catastrophic loss from a single event, such as a landslide. NMFS identifies the best sub-watersheds, known as coho core areas, for protection and restoration.

10.2.1.4 Rationale

Natural habitat for anadromous salmonid species is within streams and rivers. Chapter 8, *Conservation Measures for Aquatic Habitat*, details how MRC will maintain and enhance aquatic habitat by addressing rising temperatures and sediment in our watercourses.

10.2.2 Red-legged frog

10.2.2.1 Overview

MRC has undertaken efforts to identify the baseline distribution of red-legged frogs throughout the plan area (MRC 2008). As of 2011, we have identified 119 potential breeding sites, of which 11 had red-legged frogs present and 9 were documented breeding sites. By Year 2 of HCP/NCCP implementation, the baseline distribution will be complete.

The conservation measures for red-legged frogs (California and northern) focus on protecting habitat and maintaining red-legged frog occupancy in breeding sites in the plan area. Appendix N, *Amphibian Monitoring*, describes the survey methods MRC will follow to locate breeding sites. The *HCP/NCCP Atlas* (Maps 9a-c) shows the surveyed planning watersheds for red-legged frogs.

In Chapter 8, we presented conservation measures to enhance aquatic habitat, including that of adult (post-metamorphic) red-legged frogs, for example, C§8.2.3.5.1-1 to C§8.2.3.5.1-12 (wetlands, wet areas, and wet meadows) and C§8.2.3.5.2-1 to C§8.2.3.5.2-12 (seeps and springs). In this sub-section, we present more specific conservation measures for both potential and documented red-legged frog breeding sites that will maintain or improve both embryonic and larval rearing habitat. Taken in conjunction, these conservation measures will provide adequate protection for all life stages of red-legged frogs.

10.2.2.1.1 Potential red-legged frog breeding habitat

We identify potential breeding habitat for red-legged frogs during baseline distribution surveys (M§13.6.2.1-1). Table 10-2 outlines the characteristics of potential breeding sites. If we survey a potential breeding site and determine that it is occupied by larval or embryonic life stages of red-legged frogs, we consider it a documented breeding site.

Table 10-2 Characteristics of Potential Red-legged Frog Breeding Sites

Characteristics of Potential Red-legged Frog Breeding Sites	
Habitat	Site must have standing, slow, or still water (lentic environment).
Depth	Site, measured during high water conditions, must have water to a depth of 10 in. or more (USFWS 2002).
Persistence of Water	Site must retain water, given average rainfall, until June 1st and meet 1 of the following criteria: 1. Presence of hydrophytic or obligatory wetland plant species and presence of aquatic invertebrate life. 2. Presence of aquatic phases or newly metamorphosed amphibian species which use "pond type" habitats for reproduction (northwestern salamanders, pacific newts, bullfrogs, etc), excluding pacific tree frogs. **NOTE** Pacific tree frogs are not good indicators of water persistence; they often use water puddles to breed which dry up before the larvae complete metamorphosis. 3. Presence of fish species.

10.2.2.1.2 Red-legged frog management units

Red-legged frogs may not use the same breeding site each season, especially when there are several breeding sites within close proximity to one another. In those instances, the species may use some sites in one season and different sites the next season. Consequently, MRC assigned each *potential* or *documented* breeding site to a Red-Legged Frog Management Unit (RLFMU). According to our data, variation in breeding site selection occurs when sites are within 1000 ft of each other. An RLFMU, therefore, encompasses all sites within this distance. As of 2009, the number of documented or potential breeding sites in each RLFMU has ranged from 1 to a maximum of 6.

10.2.2.2 Biological goals and objectives

Goals and Objectives for Red-legged Frogs	
Goals	
G§10.2.2.2-1	Manage for well distributed meta-populations (i.e., partially isolated sub-populations) of red-legged frogs.
G§10.2.2.2-2	Maintain and manage red-legged frog habitats for native species.
Objectives	
Distribution	
O§10.2.2.2-1	Establish the baseline distribution of both potential and documented red-legged frog breeding sites by Year 2 of HCP/NCCP implementation.
Occupancy	
O§10.2.2.2-2	Maintain red-legged frogs in 100% of the red-legged frog management units

Goals and Objectives for Red-legged Frogs	
	(RLFMU), where baseline surveys and new surveys indicate their presence. **NOTE** MRC considers red-legged frogs *present* if we detect them once during 3 annual consecutive surveys. Since red-legged frogs live approximately 6 years, this survey period covers about half their life expectancy.
Habitat	
O§10.2.2.2-3	Maintain habitat quality (e.g., maximum depth and surface area) at 90% of potential breeding sites identified during distribution surveys, including water drafting sites. **NOTE** MRC set habitat objectives at less than 100% to account for the temporary nature of some sites; for example, pools upstream of log jams may dissipate after the log jam shifts.
O§10.2.2.2-4	Create amphibian habitat when constructing new water drafting ponds in the course of covered activities.

10.2.2.3 Conservation measures

Our conservation measures for red-legged frogs will

- Enhance aquatic habitat.
- Minimize disturbance to wet areas, wet meadows, and breeding habitats.
- Control non-native species (bullfrogs).
- Ensure that breeding habitats remain available throughout the plan area.

Maintaining the quality and quantity of potential red-legged frog breeding habitats will ensure that other native amphibians using "pond type" habitats will also persist throughout the life of our HCP/NCCP. Maintaining potential breeding habitats (i.e., habitats not yet occupied by red-legged frogs) also provides the means for an expansion of red-legged frog distribution.

Our conservation measures for AMZs provide protection to red-legged frogs within the buffered areas of all watercourses (see section 8.2.3). MRC expects habitat in the AMZs to improve in quality and quantity during the term of our HCP/NCCP; this will result in improved habitat for red-legged frogs as well. Conservation measures for wetlands, wet areas, wet meadows, seeps, and springs provide additional protection to red-legged frogs that breed or reside in aquatic habitats other than watercourses (see C§8.2.3.5.1-1 to C§8.2.3.5.1-12 for wetlands, wet areas, and wet meadows as well as C§8.2.3.5.2-1 to C§8.2.3.5.2-12 for seeps and springs).

! Effective April 16, 2010, USFWS designated 1.6 million ac in California as critical habitat for the red-legged frog. The area covers 27 counties, including Mendocino County. Our HCP/NCCP plan area falls within the boundaries of this designated critical habitat (see HCP/NCCP Atlas, MAPS 9A-C). Because of the conservation measures in our HCP/NCCP, however, this critical habitat unit lying within the plan area will not be adversely impacted.

Pre-project surveys

To minimize or avoid take, MRC will require pre-project surveys before heavy equipment enters any buffered area (i.e., EEZs or ELZs) near aquatic habitats with visible standing water during the time of the proposed activity (i.e., seeps, springs, wet areas, wet meadows, or wetlands). The pre-project surveys will consist of 1 survey conducted during the day and a second survey conducted at night. The daytime survey will be a 30-minute time-constrained search (TCS) for any life stages of the red-legged frog in the water, under woody debris, or anywhere within the buffered area. The nocturnal survey will be a 30-minute TCS that uses eye-shine techniques to detect adult life stages near the wet feature. Surveyors will complete their work within 10 days of the documented survey proposal. In the event we detect a red-legged frog, the buffer will remain an EEZ. MRC will obtain approval of the wildlife agencies for other actions, if relevant circumstances fall outside these guidelines.

Conservation Measures for Red-legged Frogs	
Disturbance Minimization	
C§10.2.2.3-1	Follow these standards in maintaining documented red-legged frog breeding sites (both natural and man-made): ▪ Maintain and manage vegetation after July 1. ▪ Do not conduct vegetation management more than once every 3 years. ▪ Limit vegetation management to 50% of the breeding site's perimeter.
C§10.2.2.3-2	Maintain a 25 to 50 ft equipment limitation or exclusion zone (ELZ or EEZ) around wetlands, wet areas, wet meadows, seeps, and springs, excluding existing roads (see C§8.2.3.5.1-1, C§8.2.3.5.1-2, and C§8.2.3.5.2-3).
C§10.2.2.3-3	Maintain a 50 ft equipment exclusion or limitation zone (EEZ or ELZ) around all potential and documented red-legged frog breeding sites excluding existing roads. **NOTE** If MRC needs to enter an EEZ with equipment, we will conduct pre-project surveys as described in section 10.2.2.3.
C§10.2.2.3-4	Limit water drafting on documented red-legged frog breeding sites (both natural and man-made): ▪ Do not draft more than 50% of pond volume before July 1. ▪ Do not draft more than 80% of pond volume after July 1. ▪ Do not draft when egg masses are present. ▪ Use a screen with a mesh size less than 1/8 in. and an approach velocity of 0.33 ft/sec or less.
C§10.2.2.3-5	Ensure that all pump intakes are screened and, if feasible, are at least 6 in. off the bottom of the waterbody; follow the water-drafting prescriptions in Appendix E, *Roads, Landings, and Skid Trails,* E.7.
Bullfrog Control Plan	
C§10.2.2.3-6	Construct new ponds with drain fixtures, where topographically possible. **NOTE** MRC will do this as the opportunity arises during covered activities with the concurrence of the wildlife agencies.

Conservation Measures for Red-legged Frogs	
C§10.2.2.3-7	Control bullfrog populations if they are present in 1 or more documented red-legged frog breeding sites in a planning watershed, according to the following order of priority: 1. Remove bullfrog egg masses from the site. 2. Attempt to remove (e.g., gig, shoot, trap, and seine) metamorphic bullfrogs (i.e., frogs with legs) at least once a week until the CPUE (catch per unit effort of time) declines to < 1 bullfrog per hour—evidence that the bullfrog population has been reduced. 3. Drain a pond manually or mechanically during bullfrog invasion if there is no drain fixture. **NOTE** MRC will not drain ponds to control bullfrogs if there are larval forms of red-legged frogs in the pond. Moreover, it is not possible to drain some large ponds manually.
Take Minimization	
C§10.2.2.3-8	Conduct pre-project surveys to determine the presence of covered aquatic species when proposing that heavy equipment enter into an EEZ or ELZ of any wet feature (wet areas, seeps, springs, wet meadows, and wetlands), including potential and documented red-legged frog breeding sites.
Habitat Conservation	
C§10.2.2.3-9	Maintain at least 75% of both maximum depth and maximum total surface area of potential breeding sites as measured during baseline distribution surveys.
C§10.2.2.3-10	Construct new ponds with drain fixtures, where topographically possible. **NOTE** MRC will do this as the opportunity arises during covered activities with the concurrence of the wildlife agencies.
C§10.2.2.3-11	See 8.2, *Riparian and Wetland Areas*.
C§10.2.2.3-12	See 8.3, *Sediment Inputs*.
C§10.2.2.3-13	See 8.4, *Hydrologic Change.*
C§10.2.2.3-14	See Appendix E, *Roads, Landings, and Skid Trails.*
C§10.2.2.3-15	Prohibit herbicide use within 150 ft of habitat occupied by red-legged frogs or within an AMZ of a Class I or Class II stream unless the wildlife agencies concur.

10.2.2.4 Rationale

Habitat for red-legged frogs includes streams or rivers, ponds, wetlands, and almost any other aquatic feature used by foraging or hydrating adult frogs. With C§10.2.2.3-1 through C§10.2.2.3-15, we identified specific conservation measures for both potential and documented breeding habitats to protect the sensitive early life stages of red-legged frogs. Upon metamorphosis, juvenile red-legged frogs disperse throughout aquatic habitats. Conservation measures C§8.2.3.5.1-1 through C§8.2.3.5.1-12 and C§8.2.3.5.2-1 through C§8.2.3.5.2-12 also address aquatic habitat for all life stages of red-legged frogs.

10.2.3 Coastal tailed frogs

10.2.3.1 Overview

MRC has undertaken efforts to identify the baseline distribution of coastal tailed frogs throughout the plan area. As of 2009, we surveyed 356 sites, 75 of which had coastal tailed frogs present. By Year 2 of HCP/NCCP implementation, the baseline distribution will be complete.

On average once every 7-8 years, MRC will monitor all occupied streams identified during baseline distribution surveys, new surveys, or incidental observations throughout the term of our HCP/NCCP. Monitoring will focus on (1) determining whether coastal tailed frogs continue to remain present in occupied sites and (2) determining the relative abundance of coastal tailed frogs at occupied sites. Over time, information on the occupancy and relative abundance of coastal tailed frogs throughout all occupied streams in the plan area should provide a sufficient source for effectiveness monitoring data. In any given year, there will be at least 10 streams monitored for occupancy and relative abundance; on average, MRC will cycle through 13% of occupied sites per year.

10.2.3.2 Biological goals and objectives

Goal and Objectives for Coastal Tailed Frogs	
Goal	
G§10.2.3.2-1	Maintain or enhance baseline distribution of larval coastal tailed frogs.
Objectives	
Distribution	
O§10.2.3.2-1	Establish a baseline distribution of larval coastal tailed frogs by Year 2 of HCP/NCCP implementation.
O§10.2.3.2-2	Maintain larval coastal tailed frogs in 95% of sites where either the baseline distribution survey, incidental observation, or a new survey indicates their presence. **NOTE** MRC set the distribution objective at less than 100% to account for sampling error.

10.2.3.3 Conservation measures

Our conservation measures for coastal tailed frogs focus on enhancing aquatic habitat. Coastal tailed frogs occur in both Class I and Large Class II watercourses. Consequently, measures developed for watercourses, such as riparian conservation measures, as well as measures to reduce sediment and minimize hydrologic change will benefit coastal tailed frogs (see sections 8.3 and 8.4).

Our conservation measures for AMZs provide protection to coastal tailed frogs within the buffered areas of all watercourses (see section 8.2.3). MRC expects habitat in the AMZs to improve in quality and quantity during the term of our HCP/NCCP; this will result in improved habitat for coastal tailed frogs as well. Our conservation measures for wetlands, wet areas, wet meadows, seeps, and springs provide additional protection to coastal tailed frogs that breed or reside in aquatic habitats other than watercourses (see C§8.2.3.5.1-1 through C§8.2.3.5.1-12 and C§8.2.3.5.2-1 through C§8.2.3.5.2-12).

Pre-project surveys

To minimize or avoid take, MRC will require pre-project surveys before heavy equipment enters any buffered area (i.e., equipment exclusion or limitation zones) near aquatic habitats (i.e., seeps, springs, wet areas, wet meadows, or wetlands). This restriction does not apply to use of existing roads. The surveys will attempt to locate any life stage of covered aquatic species within the buffer. If the surveyors find covered species, MRC will employ conservation measures to avoid direct take. Surveyors will complete their work within 10 days of the documented survey proposal. Our HCP/NCCP *Atlas* (Maps 11a-c) shows the surveyed planning watersheds for coastal tailed frogs.

The pre-project surveys will consist of 1 survey conducted during the day and a second survey conducted at night. The daytime survey will be a 30-minute time-constrained search (TCS) for any life stages of coastal tailed frog in the water, under woody debris, or anywhere within the buffered area. The nocturnal survey will be a 30-minute TCS that uses eye-shine techniques to detect adult life stages nearby the wet feature.

MRC will require pre-project surveys only if there is visible standing water in the wet feature during the proposed activity. If that is the case, MRC will conduct 1 daytime survey and 1 nocturnal survey prior to the proposed activity. In the event we detect a coastal tailed frog, the buffer will remain an EEZ. MRC will obtain approval of the wildlife agencies for other actions, if relevant circumstances fall outside these guidelines.

Conservation Measures for Coastal Tailed Frogs	
Disturbance Minimization	
C§10.2.3.3-1	Maintain a 25 to 50-ft equipment limitation or exclusion zone (ELZ or EEZ) around wetlands, wet areas, wet meadows, seeps, and springs, excluding existing roads.
Take Minimization	
C§10.2.3.3-2	Conduct pre-project surveys to determine the presence of covered aquatic species when proposing that heavy equipment enter into the EEZ or ELZ of any wet feature (wet areas, seeps, springs, wet meadows, and wetlands).
Habitat Conservation	
C§10.2.3.3-3	Designate and manage all basins or sub-basins with breeding coastal tailed frogs present as Large Class II regardless of their drainage area size (see Table 8-1). **NOTE** If MRC finds only an adult life stage of coastal tailed frog, we will conduct a second survey for larval forms to evaluate if the sub-basin supports breeding frogs. If we find larvae, we will manage the sub-basin as a Large Class II.
C§10.2.3.3-4	See 8.2, *Riparian and Wetland Areas*.
C§10.2.3.3-5	See 8.3, *Sediment Inputs*.
C§10.2.3.3-6	See 8.4, *Hydrologic Changes*.
C§10.2.3.3-7	See Appendix E, *Roads, Landings, and Skid Trails.*
C§10.2.3.3-8	See Appendix T, *Master Agreement for Timber Operations.*
C§10.2.3.3-9	Prohibit herbicide use within an AMZ of a Class I or Class II stream unless the wildlife agencies concur.

10.2.3.4 Rationale

Coastal tailed frogs occur in both Class I and Large Class II watercourses. Chapter 8, *Conservation Measures for Aquatic Habitat*, details how MRC will implement riparian conservation measures and reduce stream sediment to benefit coastal tailed frogs.

10.3 Wildlife Species

10.3.1 Northern spotted owl

10.3.1.1 Overview

The northern spotted owl is a species of concern in northern California. During the 80-year term of our HCP/NCCP, MRC proposes to increase the population of spotted owls in the plan area and boost spotted owl conservation in our region. Our conservation measures take aim at both spotted owl territories and the overall landscape.

Recently, MRC biologists have begun to detect barred owls—competitors of spotted owls—with increased frequency. We have based our conservation strategy for spotted owls on our historical knowledge of spotted owl biology in the plan area and throughout northern California. Barred owls are a new threat to spotted owl success in the plan area. Only as barred owl detections began to increase sharply in late 2006 did we begin to think seriously about this threat. The goals and objectives in our HCP/NCCP for spotted owls presume that we will develop measures to manage barred owl populations or that the wildlife agencies will give us authorization to actively control barred owl populations within spotted owl territories. In addition, we may need to seek permits from USFWS and CDFG outside the directives of our HCP/NCCP to actively control barred owl populations within spotted owl territories. MRC intends to maintain and increase spotted owls by growing habitat and following established conservation measures. If our biologists can actively manage barred owl populations, we believe our overall plan will succeed.

Territory scale

MRC will provide spotted owl territories producing the greatest number of offspring with protection that exceeds 2007 take-avoidance standards.[2] Moderately productive territories will receive protection approximately equivalent to 2007 take-avoidance. Territories that do not produce offspring will receive very limited protection. By focusing our protection on the territories that produce the most offspring, we will enhance the population viability of northern spotted owls on our land.

Landscape scale

MRC will protect and recruit wildlife trees in every PTHP, providing more potential nest trees. In addition, we will continue to grow nesting/roosting habitat and, thereby, multiply the opportunities for spotted owl incursion.

[2] Essentially, take-avoidance standards are a 1000 ft disturbance buffer during breeding season; a 500 ft no-harvest core area at all times; and a ½ mile helicopter buffer during breeding season.

10.3.1.1.1 Defining terms

An owl **territory** is an area defended by a single owl or a pair of owls against members of the same species—generally during the breeding season.

An **activity center** (AC) is a location pin-pointed on a map where a single owl or a pair of owls nests or consistently roosts during the breeding season (see *HCP/NCCP Atlas*, MAPS 14A-C).[3]

The **initial activity center** (IAC) is the nest or spot around which MRC establishes a new core area for a spotted owl territory; a spotted owl territory may have different IACs in different core areas that may or may not overlap.

DEFINITION

A **core area** is forest habitat surrounding an activity center that MRC will manage as a no-harvest zone because it is critical to nest-site selection and survival of the spotted owl.

An **extended protection area** is 267 ft beyond the core area of a spotted owl territory with high protection and 500 ft beyond the core area of a territory with moderate protection, where MRC maintains existing habitat quality.

Suitable habitat consists of forested stands with the characteristics needed by northern spotted owls for nesting, roosting, foraging, and dispersal.

Nesting and roosting habitat, in general, has trees at least 16 in. dbh and more than 60% canopy closure.

Foraging habitat, in general, has trees at least 11 in dbh and 40% or more canopy closure.

10.3.1.1.2 Activity centers and core areas

The extent of a core area varies according to the amount of protection that MRC provides an activity center. Subsequent sub-sections explain these levels of protection. For activity centers receiving high protection, a core area is essentially a circle with a radius of 1000 ft circumscribed around the initial activity center; in land area, this equals 72 ac.[4] MRC has chosen to increase the core area to 80 ac. As a result, the actual shape of any specific core area will vary from the shape of a "perfect circle" (Figure 10-1). The 1000-ft radius acts as a *minimum boundary* between the activity center and any timber operations. During the spotted owl breeding season, MRC protects this area within 1000 ft of an activity center from disturbance. Outside the core area, an additional extended protection area (267 ft from the core area boundary) maintains existing habitat quality (Figure 10-1).

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[3] Although there can be multiple roost sites in a territory within a single year, MRC biologists will select the roost site to receive activity center status according to the flowchart in Appendix K, *Northern Spotted Owl Data and Protocol*, Figure K-4. Activity centers for the same owl or pair of owls can occur in different locations each year.

[4] $A=\prod r^2$, i.e., $A = 3.14 * (1000\ ft)^2 = 3140000\ ft^2$. $3140000\ ft^2 / 43560\ ft^2$ per ac = 72 ac.

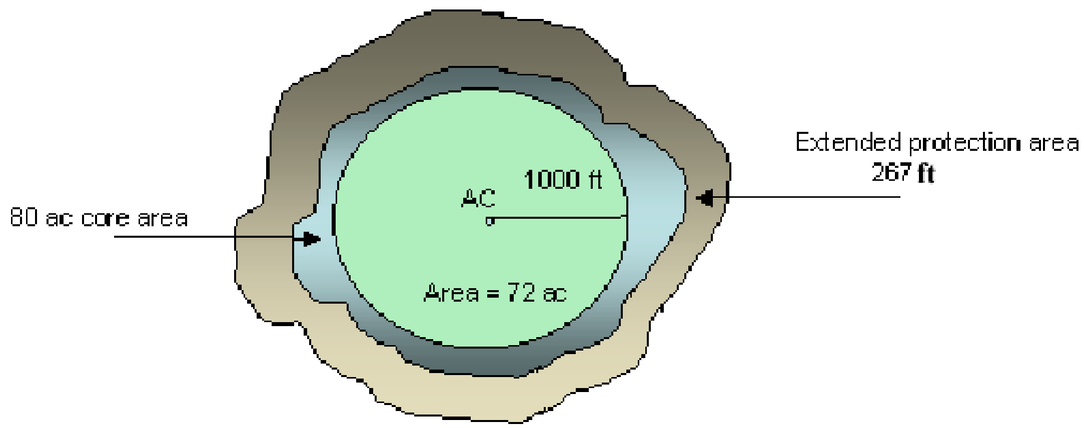


Figure 10-1 Habitat Management for Spotted Owls with High Protection

Figure 10-2 depicts an activity center with moderate protection that includes an 18-ac core area and a disturbance buffer, during the breeding season, of at least 1000 ft from the activity center in all directions.

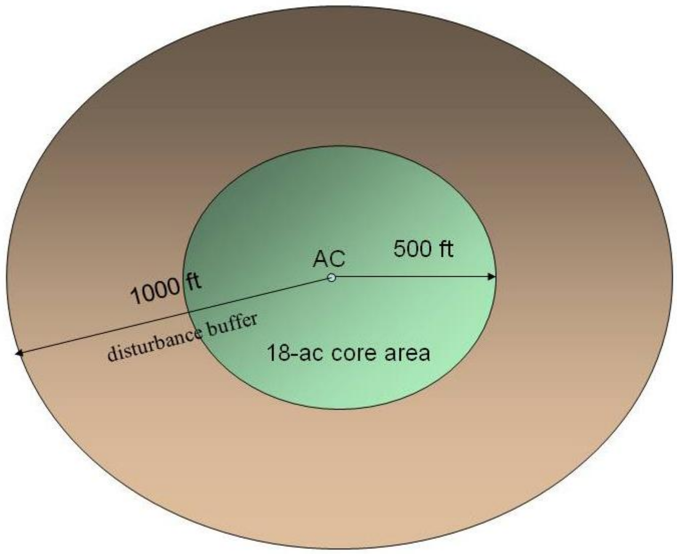


Figure 10-2 Habitat Management for Spotted Owls with Moderate Protection

10.3.1.1.3 Mobile activity centers

A spotted owl may have different activity centers with different core areas in different years or multiple activity centers in the same core area in different years. Core areas may or may not overlap; they may also be completely or partially on covered lands. Figure 10-3 depicts a portion of the plan area on which an owl has used several different activity centers with different core areas—1 completely in the plan area and the other 2 partly in the plan area.

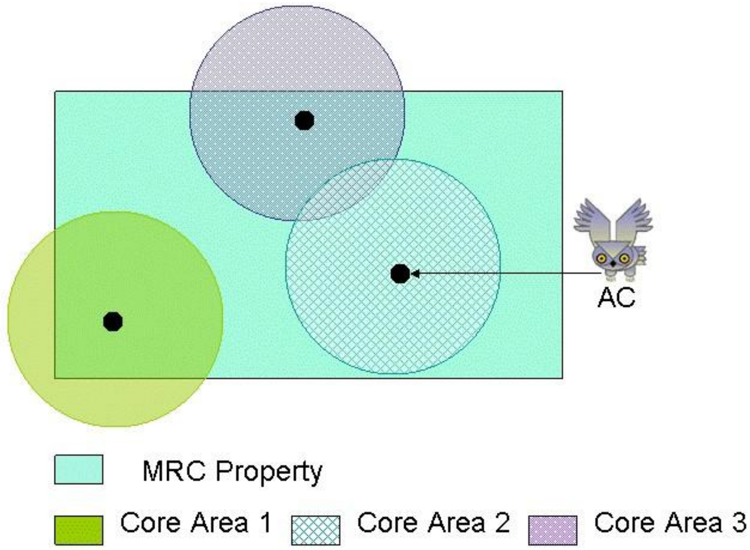


Figure 10-3 Territory with Three Separate Activity Centers

10.3.1.1.4 Real world example of activity centers and core areas

To put "flesh" on this concept of core areas and disturbance buffers, Figure 10-4 shows a 2006 aerial photo[5] of Rockport forest. Super-imposed on the photo is a graphic depicting activity centers and core areas of 2 northern spotted owls (MD481 and MD513) actually located in this area. The yellow dots denote their activity centers. Because the owls are receiving moderate protection, they have at least an 18 ac core area (represented by the inner circle with the 500 ft radius) and a disturbance buffer (represented by the outer circle with the 1000 ft radius).

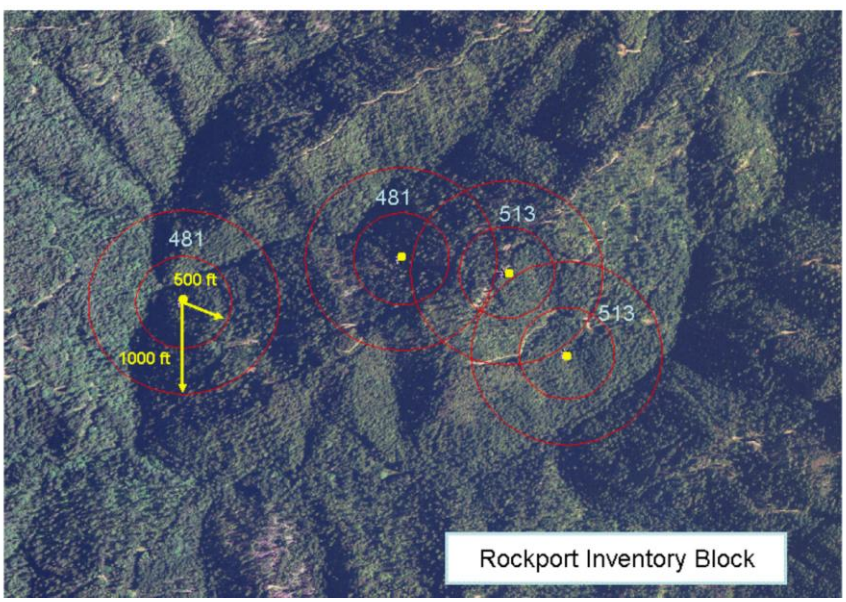


Figure 10-4 Activity Centers and Core Areas in Aerial Photo

[5] The photo is from a U.S. Department of Agriculture website (http://datagateway.nrcs.usda.gov/NextPage.asp) accessed December 2006. In Figure 10-4, the core areas and distance buffers are in horizontal distances. The aerial photo and the super-imposed graphic are synched to scale.

10.3.1.1.5 Protection levels

The conservation measures for the northern spotted owl are designed to provide protections both at the territory and landscape scale. MRC has created 3 protection levels—high, moderate, and limited. We are basing our protections for owl territories on their recent and historic productivity and on their consistent length of occupation (see Table 10-3).

Territory scale

Owls that produce the most offspring initially receive more protection than 2007 take-avoidance standards. Owls that produce fewer offspring receive protection approximately equivalent to 2007 take-avoidance standards. Owls that have not successfully reproduced receive limited protection. Providing limited protection to owls that have not reproduced gives MRC operational flexibility when we approach owl territories. In any event, spotted owl territories, even with limited protection, have at least a 500-ft disturbance buffer. In addition to these protections, MRC will generally give an activity center not associated with a known territory limited protection as long as we are meeting the population objectives for spotted owls (O§10.3.1.2-1 and O§10.3.1.2-2).

We believe this strategy is more effective than 2007 take-avoidance standards. With 2007 take avoidance standards, a territory that is not producing offspring receives standard protection. However, single owls often move about frequently—from one activity center to another and back again. With 2007 take avoidance standards each of these activity centers, whether occupied or not, would be protected with core areas for up to 3 years. Owls in highly productive territories, however, tend to remain for longer periods in the same core area; 2007 take-avoidance standards, in effect, protect more core areas for single and less productive owl pairs than for highly productive owl pairs. MRC, on the other hand, provides fewer protections to the less productive owls and greater protection to the more productive owls, including a larger core area.

Landscape scale

On the landscape scale, MRC will provide adequate foraging and nesting/roosting[6] habitat to protect the current population of northern spotted owls and increase their population by 20% during the term of our HCP/NCCP. As of June 2010, approximately 86% of the plan area is a mix of foraging and nesting/roosting habitat. About 65% is foraging habitat and about 21% nesting/roosting habitat. This offers more than the minimal dispersal habitat under the 50-11-40 rule (Thomas et al. 1990). The intent of the 50-11-40 rule is to provide a forested condition sufficient to sustain dispersing owls between conservation areas. The rule calls for 50% of stands to have trees averaging 11 in. dbh and 40% canopy closure. Although the 50-11-40 rule originally applied to habitat in each quarter township, MRC applies the same rule to the entire plan area. Additionally, our HCP/NCCP has habitat objectives for minimum nesting/roosting habitat within each inventory block. Current predictions from the MRC landscape model indicate that the amount of suitable habitat on our land will not drop below 60% during the term of our HCP/NCCP; this means there will always be enough dispersal habitat for fledging owls. Moreover, there will be an increase in nesting/roosting habitat over the term of our HCP/NCCP that will provide additional areas for new territories. This is key since nesting/roosting habitat provides for all the life functions of spotted owls (e.g., breeding, feeding, resting), while foraging habitat does not.

[6] MRC considers nesting and roosting habitat a single habitat type; generally if roosting habitat is available (i.e. large trees with dense canopy), then nesting habitat is available as well (i.e., stands with some nest structures). Some biologists do classify these 2 types separately. Since they generally occur concurrently, MRC lumps them together. In terms of our management activities, there is no distinction between nesting/roosting habitat.

Assumptions of strategy

In proposing our conservation strategy for northern spotted owls, we assumed that

1. Survival of spotted owls depends on the amount of nesting/roosting habitat available to them. Temporal variation in populations is linked to climate patterns (Franklin et al. 2000) and, potentially, to prey base. By increasing nesting/roosting habitat, MRC will conserve current spotted owl populations, increase their numbers, and balance their distribution across our land.
2. Owls in territories that produce more fledglings should receive greater levels of protection. This approach improves the survival of very productive adults and, thereby, enhances survival of the species.
3. Nesting/roosting habitat and foraging habitat are an equivalent resource for foraging spotted owls. Reassigning habitat in the MRC landscape model from foraging to nesting/roosting will result in a similar density and productivity of spotted owls, unless nesting/roosting habitat is a limiting resource.
4. MRC is making habitat assignments based on a correct assessment of the features that spotted owls use and require in their habitat selection.
5. MRC will receive authorization from the wildlife agencies to control barred owls in order to make a positive contribution to spotted owl populations.

10.3.1.1.6 Proposed projects requiring owl surveys

DEFINITION

Disturbance, in this context, is the presence, sound, and movement of people using vehicles or mechanized equipment that adversely affects spotted owls, especially during their breeding season.

MRC will survey new and continuing projects for owl territories; these projects include only PTHPs or management actions that would cause disturbance or reduce suitable habitat. Surveys may extend different distances based on the type of project proposed. A monitoring program (13.9.1.3-1) addresses additional surveys for our overall HCP/NCCP monitoring effort.

For northern spotted owls, MRC will apply disturbance protections only during the breeding season;[7] disturbance protections will apply to most road work[8] including road construction, blasting, log yarding, log loading, timber felling, hauling, and use of heavy equipment. MRC will compile survey results into a report forwarded to the wildlife agencies at the end of each year. Our survey protocol is in Appendix K, *Northern Spotted Owl Data and Protocol*.

[7] By prior agreement with the wildlife agencies, MRC defines the breeding season from February 1 through August 31. If we determine, however, that the owls in a territory are absent or non-nesting, or if their nesting efforts have failed, we will consider the breeding season over for owls in that territory. Section 10.3.1.3.1 lists the conditions under which the conservation measures for the breeding season do not apply.

[8] MRC will not provide disturbance protections for the following operations: (1) emergency maintenance to remove and replace failed culverts, bridges, and rock slides; (2) maintenance, use, or hauling on mainlines; and (3) work and blasting in mainline rock pits identified in our HCP/NCCP Atlas.

10.3.1.2 Goals and objectives

Goals and Objectives for Northern Spotted Owls	
Goals	
G§10.3.1.2-1	Contribute to overall population increases and species recovery in northern California.
G§10.3.1.2-2	Maintain well-distributed and productive owl populations in the plan area.
G§10.3.1.2-3	Increase the owl nesting/roosting habitat by allowing a larger proportion of stands to progress and persist to a point where they have characteristics suitable for owl nesting and roosting.
Objectives	
Population Objective 1	
O§10.3.1.2-1	Maintain at least 28 Level-1 territories and 67 Level-2 territories during the first 60 years of the HCP/NCCP.
Population Objective 2	
O§10.3.1.2-2	Increase to 34 Level-1 territories and 80 Level-2 territories by Year 75 of the HCP/NCCP.
Distribution Objective 1	
O§10.3.1.2-3	Achieve by Year 40 of the HCP/NCCP a distribution of spotted owl territories in each inventory block that is proportionate to its potential nesting/roosting habitat, i.e., an inventory block with 10% of the total potential nesting/roosting habitat in the plan area should have at least 10% of the Level-1 and Level-2 territories specified in the population objectives (see Table 10-7).
Distribution Objective 2	
O§10.3.1.2-4	Achieve by Year 75 of the HCP/NCCP a distribution of spotted owl territories in each inventory block that exceeds *Distribution Objective 1* by 20% (see Table 10-7).
Habitat Objective 1	
O§10.3.1.2-5	Achieve by Year 40 of the HCP/NCCP a landscape configuration in which 23% of all potential habitat is nesting/roosting habitat, while still maintaining separate objectives for each inventory block (Table 10-10).
Habitat Objective 2 (+75 years)	
O§10.3.1.2-6	Achieve by Year 75 of the HCP/NCCP a landscape configuration in which 25% of all potential habitat and 25% of each inventory block are nesting/roosting habitat (see Table 10-10).

10.3.1.2.1 Revising objectives for additions and deletions to the plan area

During the 80-year term of our HCP/NCCP, MRC will likely acquire additional land. In such cases, we will protect all owls in the newly acquired land with moderate protection until we collect 3 years of reproduction data that will determine the productivity of the new owl territory.

Likewise, MRC may sell land during the term of our HCP/NCCP. Buying or selling land may require an adjustment of the population objectives for spotted owls. Whether we adjust Population Objective 1 or Population Objective 2 will depend on the year of the land purchase or sale. In Years 1 through 60, we will adjust Population Objective 1. Subsequently, we will adjust Population Objective 2.

The criteria for the adjustment are as follows:

OWL TERRITORIES - YEARS 1 THROUGH 60 OF HCP/NCCP IMPLEMENTATION

- MRC will increase or decrease the number of Level-1 owl territories by 1 for every 7615 ac added to or subtracted from the plan area, respectively. The total number of acres in the plan area (213,244) divided by the total number of Level-1 owl territories (28) equals 7615.

- MRC will increase or decrease the number of Level-2 owl territories by 1 for every 3182 ac added to or subtracted from the plan area, respectively. The total number of acres in the plan area (213,244) divided by the total number of Level-2 owl territories (67) equals 3182.

  EXAMPLE

  In Year 5 of HCP/NCCP implementation, MRC adds 10,000 ac to the plan area.[9] Since 10,000 is more than 7615 but less than 15, 230 (i.e., 2 * 7615), we would increase the number of Level-1 territories in Population Objective 1 from 28 to 29, i.e., by 1. Likewise, since 10,000 is more than 3182 but less than 12,728 (i.e., 4 * 3182), we would increase the number of Level-2 territories in Population Objective 1 from 67 to 70, i.e., by 3. The territory with the greatest productivity would receive high protection; the 3 territories with the next greatest productivity would receive moderate protection. All other owl territories in the newly acquired land would receive limited protection.

OWL TERRITORIES - YEARS 61 THROUGH 79 OF HCP/NCCP IMPLEMENTATION

- MRC will increase or decrease the number of Level-1 owl territories in Population Objective 2 by 1 for every 6271 ac added or subtracted from the plan area respectively. The total number of acres in the plan area (213,244) divided by the total number of Level-1 owl territories (34) equals 6271.

- MRC will increase or decrease the number of Level-2 owl territories by 1 in Population Objective 2 for every 2665 ac added or subtracted from the plan area respectively. The total number of acres in the plan area (213,244) divided by the total number of Level-2 owl territories (80) equals 2665.

  EXAMPLE

  In Year 65 of HCP/NCCP implementation, MRC adds 20,000 ac to the plan area. Since 20,000 is more than 6271 but less than 25,084 (i.e., 4 * 6271), we would increase the number of Level-1 territories in Population Objective 2 from 34 to 37, i.e., by 3. Likewise, since 20,000 is more than 2665 but less than 21,320 (i.e., 8 * 2665), we would increase the number of Level-2 territories in Population Objective 2 from 80 to 87, i.e., by 7. The 3 territories with the greatest productivity would receive high protection; the 7 territories with the next greatest productivity would receive moderate protection. All other owl territories in the newly acquired land would receive limited protection.

INDIVIDUAL INVENTORY BLOCKS - YEARS 1 THROUGH 80 OF HCP/NCCP IMPLEMENTATION

- Adjustment of population objectives based on future land purchases and sales will require adjustment of inventory block totals if the purchase or sale increases or decreases the total acreage of an individual inventory block.

[9] In any given year, MRC may add or delete acres to the plan area. For the calculations in this section, we are interested only in the net result. For example, if in Years 1-60, MRC added 15,000 ac to the plan area but also sold 5000 ac, MRC would add 1 Level-1 territory to Population Objective 2, since 10,000 net acres is more than 7165 ac but less than 15,230 ac (2*7615).

10.3.1.2.2 Population objectives

Productivity levels

MRC has divided its northern spotted owl territories by productivity level. The productivity level is an indicator of how many fledglings the northern spotted owls within a territory have produced (Table 10-3). In initially determining productivity for Level 1 through Level 5, we assigned territories based on information from 2007 and previous years.

DEFINITION

Baseline productivity is the mean number of fledglings produced per year in what is now the plan area, calculated with historical data from 1989 to 2007 and accepted by the wildlife agencies as the basis for target objectives in O§10.3.1.2-1 and O§10.3.1.2-2.

Territories in Level 1 through Level 3 must have had activity centers on covered lands in the last 3 years they were located (see *HCP/NCCP Atlas*, MAPS 14A-C), except for territories found within Navarro River Redwoods State Park, of which the baseline number is 5. The park is a long, narrow strip of land; in many cases, an activity center of a spotted owl is on that strip but the core area of the owl is primarily in the plan area. Most of the foraging activities of these park owls also occur in the plan area. Table 10-5 shows the baseline number and distribution of territories by productivity level and inventory block, i.e., the data as of 2007.

Table 10-3 Productivity Levels and Locations of Northern Spotted Owl Territories

Productivity Levels and Locations of Northern Spotted Owl Territories	
Productivity Level and Location	**Description**
	All Level-1, Level-2, and Level-3 territories must be on covered lands or within Navarro River Redwoods State Park in the last 3 years they were located.
Level 1 on covered lands	• Territories that produce > 0.8 fledglings per year as determined by a 10-year running average
Level 2 on covered lands	• Territories that produce > 0 and ≤ 0.8 fledglings per year as determined by a 10-year running average • Territories which are newly discovered and awaiting completion of at least 3 years of productivity surveys, only if the number of Level 1 and Level 2 owls are below objectives
Level 3 on covered lands	• Territories that produce 0.0 fledglings per year as determined by a 10-year running average • Territories which are newly discovered and awaiting completion of at least 3 years of productivity surveys, only if the objectives for Level-1 and Level-2 owls are met
Level 4 off covered lands	• Territories that have had activity centers in the last 3 years which are outside the plan area but within 1000 ft (305 m) of the MRC property line **NOTE** While surveying the plan area boundary from 2002-2007, MRC gathered information on off-property territories. We surveyed approximately 90% of the boundary area. Although we made every effort, at that

Productivity Levels and Locations of Northern Spotted Owl Territories	
Productivity Level and Location	**Description**
	time, to survey all known territories within 1000 ft of covered lands, we placed a higher priority on locating territories within covered lands. We identified 22 Level-4 territories and surveyed 10 of the 22 in 4 out of 6 years and 4 of the 22 in 5 out of 6 years. The baseline number for Level-4 territories, therefore, is 22. The stated percentages in the following definitions are *percentages of this baseline.* ▪ 4A Owls MRC designates Level-4A territories. Their number will not exceed 77% of their baseline (.77 * 22) or 17 territories. Our initial list of Level-4A territories is in Appendix K, *Northern Spotted Owl Data and Protocol*. MRC selects Level-4A territories primarily on our current knowledge of a territory's productivity and secondarily on the impact its selection will have on timber harvest operations. The wildlife agencies have reviewed and approved our list of Level-4 territories. MRC can replace a Level-4A territory with a Level-4B territory if the Level-4B territory produces at an equal or greater level than the Level-4A territory. In addition, if a Level-4A territory becomes abandoned, MRC can replace it with the highest producing Level-4B territory. The wildlife agencies must approve all changes to Level-4A and Level-4B territories submitted in the MRC annual report. ▪ 4B Owls Level-4B territories are adjacent to MRC covered lands; they are either known to be mid-to-low level producers or they are designated as such by MRC biologists. The number of territories we have designated 4B is 5, i.e. 23% of the Level-4 baseline. The actual number of Level-4B territories may increase over time, if the total number of Level-4 territories exceeds the baseline. **NOTE** MRC selected—and the wildlife agencies reviewed and approved—our assignments of Level-4A and Level-4B territories. The initial list is in Appendix K, *Northern Spotted Owl Data and Protoco*l.
Level 5 on/off covered lands	• Territories that have had activity centers in the last 3 years which are both inside and outside the plan area. **NOTE** The spotted owls within these territories are within 1000 ft of the MRC property line. In the baseline distribution, there are 26 Level-5 territories. Unlike Level-4 territories, there is no sub-division of Level-5 territories by productivity; they will all receive moderate protections regardless of productivity.

Methodology for determining baseline productivity levels

MRC surveys to determine the number of fledglings produced in each spotted owl territory. Covering the time period 2001-2008, Table 10-4 shows the number of surveys for the Level-1 through Level-3 territories, as well as the Level-4 and Level-5 territories. For example, in 2001, MRC surveyed 108 (i.e., 86%) of the possible 125 Level-1 through Level-3 territories 3 times or more.

Table 10-4 Spotted Owl Survey Percentages

Possible # of Territories	Minimum # of Surveys	2001	2002	2003	2004	2005	2006	2007	2008
Level-1 through Level-3 Northern Spotted Owl Territories									
125	1	118/94%	118/94%	114/91%	119/95%	124/99%	124/99%	120/96%	121/97%
	2	114/91%	114/91%	107/86%	114/91%	121/97%	122/98%	119/95%	115/92%
	3	108/86%	108/86%	96/77%	104/83%	117/94%	117/94%	105/84%	108/86%
Level-4 and Level-5 Northern Spotted Owl Territories									
52	1	40/77%	39/75%	29/56%	37/71%	40/77%	44/85%	37/71%	33/63%
	2	33/63%	33/63%	20/38%	32/66%	35/67%	38/73%	23/44%	24/46%
	3	22/42%	27/52%	13/25%	23/44%	25/48%	29/56%	14/27%	18/35%

TABLE NOTES

- Level-4 territories are off MRC land and Level-5 territories are on and off MRC land but within 1000 ft of the MRC property line.
- The number of possible territories is, in reality, a sliding scale. Every year we find new territories. Moreover, a spotted owl does not necessarily occupy each identified territory in a given year. The data in Table 10-4 is our best determination for the number and percentage of owl territories surveyed from 2001-2008.

In some instances, however, we could not determine whether owls produced fledglings; this was because of factors such as weather conditions and turnover within owl territories, i.e., 1 owl moving out and another owl moving in. As a result, we sometimes had difficulty finding an owl during daytime surveys or getting an owl to take mice during a survey. In such situations, we assigned the owl a status of *nesting unknown*. In our survey results, we considered these instances a *missed year*. All survey results, including how many fledglings were located in each territory per year, are entered into a database. Refer to Appendix K, *Northern Spotted Owl Data and Protocol*, Table K-1.

MRC used historic survey information to calculate a baseline productivity that determines whether an owl territory is designated Level 1, Level 2, or Level 3. We designate a territory as Level 4 or Level 5 based on whether the owl's most recent location was on or off covered lands. MRC used Louisiana Pacific (LP) data from 1989-1998 and collected new data from 1999-2007 to determine baseline productivity and productivity trends of spotted owls. If we were unable to assess the number of fledglings produced in a specific year, we omitted that year from our calculations. To calculate the mean, we included all years in which the territory was surveyed through the 2007 breeding season. All baseline territories had to be in the plan area for 3 years with the exception of those found on Navarro River Redwoods State Park. MRC counted territories as Level-4s and Level-5s if they were within 1000 ft of our property line.

Methodology for determining productivity after HCP/NCCP commencement

Prior to timber operations in each calendar year, MRC will again assess owl productivity by calculating the 10-year running average of each owl territory; we will then re-assign a productivity level to each territory. The 10-year timeframe takes into account the annual variability of spotted owl productivity, while not exceeding their typical reproductive lifespan.

MRC will use the number of owl territories in each productivity level to determine whether we are meeting our numerical population objectives. Level-1 and Level-2 territories must have at least 3 years of productivity data. MRC will automatically assign any new owl territories to Level 3 and provide limited protection while collecting 3 years of productivity data. If, however, we did not meet our owl population objectives in the year prior to such an assignment, we will provide moderate protection to the new territories.

An owl territory, unoccupied for 3 consecutive years, is abandoned. MRC will not assess an abandoned territory for productivity until there is evidence of re-occupation. When we determine that an owl territory is re-occupied, we will immediately re-start productivity calculations. For example, the territory MD236 in the Albion had 1 fledgling in 2011, 0 in 2012, 3 in 2013 and 1 in 2014. MD 236 was abandoned from 2015-2017. In 2018, either a spotted owl establishes its territory in MD236 for the first time or a spotted owl re-establishes its territory in MD236. The 10-year running average for MD236 is reset to 0 for 2018. In the event a spotted owl territory may only appear abandoned due to barred owl invasion, MRC has adjusted our protocol to require additional surveys.

With implementation of our HCP/NCCP, the 28 spotted owls which produce the greatest number of offspring receive high protection for each 5-year period of the plan (Table 10-6). The following conditions apply:

- If, after the first 5-year period, MRC assesses more than 28 owl territories as Level-1 producers, we will assign high protection to the top 28 producers, using a 10-year running average; the remaining Level-1 producers will receive moderate or limited protection.
    - If there is a tie in the productivity of the 10-year running average, MRC will assign high protection to the owl territory with the greatest productivity in the last 5 years.
    - If MRC requires further tie breakers, we will obtain approval of the wildlife agencies on the appropriate protection assignment.

- If, after the first 5-year period, MRC assesses less than 28 owl territories as Level 1 producers or less than 67 owl territories as Level 2 producers, we will assign high protection to the top 28 producing territories and moderate protection to at least 67 owl territories.

- If, after the first 5-year period, MRC assesses less than 22 owl territories as Level 1 producers or less than 54 territories as Level 2 producers for 2 consecutive years, we will implement contingency strategies (see section 10.3.1.2.5). MRC will decide which additional owl territories should receive the high protection and which moderate protection; however, MRC must receive approval for these decisions from the wildlife agencies.

MRC will assess productivity and protection levels for each owl territory and submit this information in a report to the wildlife agencies annually. This will include all owl activity centers known to be within 1000 ft of the plan area. Prior to operations in any calendar year, the wildlife agencies and MRC must concur that all assignments of protection levels to NSO territories coincide with our HCP/NCCP. Unless the contingency strategies trigger a change, protection levels lock in place for a 5-year period.

10.3.1.2.3 Distribution objectives

DEFINITION	**Baseline distribution** is the number of Level-1 and Level-2 spotted owl territories in each MRC inventory block, calculated with historical data from 1989-2007 and accepted by the wildlife agencies as the basis for target objectives in O§10.3.1.2-3 and O§10.3.1.2-4.

MRC inventory blocks have different acreages, management histories, site classes, and stocking levels. As a result, there is an uneven distribution of owl territories across the inventory blocks. MRC is targeting a distribution of Level-1 and Level-2 territories proportionate to the amount of potential nesting/roosting habitat available throughout the inventory blocks, i.e., a more even distribution. We will meet this objective for owl distribution directly or indirectly—directly by locating new territories and indirectly by growing additional acres of nesting/roosting habitat (see Appendix U, *Inventory Strategy,* section U.7). Table 10-7 shows the baseline and projected distribution of northern spotted owl territories in the plan area.

Methodology for determining distribution objective

To define the distribution objective, we established a target number of territories for each inventory block based on acreage of potential nesting/roosting habitat. Across approximately 213,244 ac, MRC designated 28 territories as Level 1 and 67 territories as Level 2. The potential number of Level-1 and Level-2 territories is proportionate to the potentially suitable habitat within an inventory block. For example, Navarro West has 11% of the potential nesting/roosting habitat (Table 10-7) and, therefore, should have 11% of the Level-1 and Level-2 territories. By this reasoning, Navarro West should have 3 Level-1 territories in 40 years (0.11 * 28 = 3.08) and 7 Level-2 territories (0.11 * 67= 7.37). Navarro West has 11 Level-1 territory and 7 Level-2 territories in the 2007 baseline distribution (Table 10-7).

Methodology for defining spotted owl habitat

MRC defined habitat types for northern spotted owls using information from the plan area (Pious 1994; Appendix K, *Spotted Owl Data and Protocol*, section K.3) relevant information from current literature; and input from the wildlife agencies. Table 10-8 shows the 24 MRC structure classes, located in MAPS 13A-C, and their assigned spotted owl habitat types. In general, nesting/roosting habitat has trees at least 16 in. dbh and more than 60% canopy closure. Foraging habitat has trees at least 11 in dbh and 40% or more canopy closure (CDF 2007, 14 CCR 895.1, 10). This also serves as dispersal habitat based on the 50-11-40 guideline. Table 10-9 is a reiteration of Table 10-8, sorted by "dominant size class." Together the tables provide a crosswalk between forest stand conditions and northern spotted owl habitat. Such information assists MRC foresters in stand typing. Appendix U (section U.7) has information on how MRC actually assigns owl structure classes and habitat types.

10.3.1.2.4 Habitat objectives

MRC designed our habitat objectives to allow for a 20% increase in the population of productive spotted owls over the term of our HCP/NCCP. Our objectives focus on nesting/roosting habitat which appears to be the limiting factor for spotted owls in the plan area. Deliberately conservative, we designate only the highest quality habitat as nesting/roosting.

Using a proportional assessment (10.3.1.4.4), we have determined the number of nesting/roosting acres required to produce an increase in the number of spotted owl territories after 40 and 80 years of HCP/NCCP implementation. Table 10-10 shows the acres of nesting/roosting habitat within each inventory block at the start of HCP/NCCP implementation, as well as the required acres at Year 40 and Year 75.

MRC proposes to apply more uneven-aged silviculture over the term of our HCP/NNCP, as detailed in our Timber Management Plan (TMP). Currently, we use special prescriptions in tanoak-dominated stands, such as variable retention and rehabilitation, to restore them to conifer, and uneven-aged techniques in conifer- dominated stands. While over time, more stands will grow into nesting/roosting habitat than currently exist, most nesting/roosting stands will rotate between foraging and nesting/roosting habitat during a typical harvest cycle.

Table 10-5 2007 Northern Spotted Owl (NSO) Territories by Inventory Block

Baseline Distribution												
MRC Inventory Block	Level 1		Level 2		Level 3		Level 4		Level 5		TOTAL	
	> 0.80 Fledglings (on property)		> 0 and ≤ 0.80 Fledglings (on property)		0 Fledglings (on property)		(off property last 3 years)		Activity Center within 1000 ft of MRC Property (on and off property last 3 years)			
	NSOs	% of NSOs	NSOs	% of NSOs	NSOs	% of NSOs	NSOs	% of NSOs	NSOs	% of NSOs	NSOs	% of NSOs
Albion	4	20%	6	30%	4	20%	5	25%	1	5%	20	100%
Big River	1	6%	11	64%	1	6%	2	12%	2	12%	17	100%
Garcia	0	0%	3	21%	3	21%	2	15%	6	43%	14	100%
Navarro East	1	5%	9	43%	6	28%	3	14%	2	10%	21	100%
Navarro West	11	45%	7	29%	3	13%	0	0%	3	13%	24	100%
Noyo	1	6%	8	50%	3	19%	1	6%	3	19%	16	100%
Rockport	0	0%	13	48%	7	26%	5	19%	2	7%	27	100%
South Coast	10	36%	10	36%	2	7%	4	14%	2	7%	28	100%
Ukiah	0	0%	0	0%	0	0%	0	0%	0	0%	0	100%
Total	**28**	**17%**	**67**	**40%**	**29**	**17%**	**22**	**13%**	**21**	**13%**	**167**	**100%**

Table 10-6 Conservation Strategies for Years 0-60 of the HCP/NCCP

Conservation Strategies for Northern Spotted Owls Years 0-60 of HCP/NCCP			
Productivity Level and Location	Protection Levels		
	High	Moderate	Limited
Level 1 (>0.80 fledglings) on covered lands	28	Territories exceeding 28 will receive either moderate or limited protection.	Territories exceeding 28 will receive either moderate or limited protection.
Level 2 (>0 and ≤ 0.80 fledglings) on covered lands	< 28 Level-1s, some Level-2s will receive high protection.	67	Any territories exceeding 67 level 2s will receive limited protection unless the territory is needed to meet productivity objectives for Level-1 territories.
Level 3 (0 fledglings) on covered lands	Some may receive high protection if MRC is not meeting population objectives.	Some will receive moderate protection, if MRC is not meeting population objectives.	28+ Any additional non-productive territories or potentially productive territories beyond NSO population objectives will receive limited protection.
Level 4 off covered lands	0	17	5 New territories off covered lands will receive limited protection.
Level 5 on and off covered lands but within 1000 ft of MRC property line	0	21 Throughout the term of the HCP/NCCP, all Level-5s will receive moderate protection.	0

Table 10-7 Distribution of NSO Territories to Meet Distribution Objectives

Inventory Block	2007 Baseline Distribution of NSO[10]			Year 40 of HCP/NCCP Distribution of NSOs (Distribution Objective 1)			Year 75 of HCP/NCCP Distribution of NSOs (Distribution Objective 2)		
	Level-1	Level-2	Total	Level-1	Level-2	Total	Level-1	Level-2	Total
Albion	4	6	10	2	5	7	2	6	8
Big River	1	11	12	4	11	15	5	13	18
Garcia	0	3	3	2	5	7	2	6	8
Navarro East	1	9	10	4	10	14	5	12	17
Navarro West	11	7	18	3	7	10	4	8	12
Noyo	1	8	9	3	6	9	4	7	11
Rockport	0	13	13	5	12	17	6	14	20
South Coast	10	10	20	5[11]	11	16	6	13	19
Ukiah	0	0	0	0	0[12]	0	0	1	1
Total	**28[a]**	**67[a]**	**95**	**28[a]**	**67[a]**	**95**	**34[b]**	**80[b]**	**114**

TABLE NOTES
[a] Population Objective 1
[b] Population Objective 2

Table 10-8 Structure Classes for Categorizing NSO Habitat

Structure Classes for Categorizing NSO Habitat				
Structure Class	**Tree Type**	**Dominant Size Class (in.)**	**% Minimum Canopy**	**NSO Habitat Type**
0	Non-forested	0	0	Non-suitable
1	Mixed Hardwoods	<8	<40	Non- Suitable
2	Mixed Hardwoods	>16	<40	Non-Suitable
3	Mixed Hardwoods	<16	>40	Non- Suitable
4	Mixed Hardwoods	>16	>40	Foraging
5	Mixed Hardwoods	<16	>60	Non-suitable
6	Mixed Hardwoods	>16	>60	Foraging
7	Mixed Conifers/Hardwoods	<16	<40	Non-Suitable
8	Mixed Conifers/Hardwoods	16-24	<40	Non-Suitable
9	Mixed Conifers/Hardwoods	<16	>40	Non-Suitable
10	Mixed Conifers/Hardwoods	> 8	>40	Foraging

[10] As explained earlier in this sub-section, 2007 is the baseline date for NSO distribution. The 40- and 80-year dates begin from the actual implementation date, which is projected to be 2012.
[11] While mathematically, South Coast should decrease from 10 to 4 Level-1 spotted owl territories (0.16*28=4.48) MRC biologists added an additional Level-1 territory to correct for rounding error. This allows for an integer sum (28).
[12] While mathematically, the Ukiah block should increase from 0 to 1 Level-2 spotted owl territories (0.01*67=0.6), MRC biologists instead allowed for 0 Level-2 territories to correct for rounding error.

Structure Classes for Categorizing NSO Habitat				
Structure Class	**Tree Type**	**Dominant Size Class (in.)**	**% Minimum Canopy**	**NSO Habitat Type**
11	Mixed Conifers/Hardwoods	<8	>60	Non- Suitable
12	Mixed Conifers/Hardwoods	16-24	>60	Foraging
13	Conifer	<8	<40	Non-Suitable
14	Conifer	16–24	<40	Non-Suitable
15	Conifer	24–32	<40	Non-Suitable
16	Conifer	>32	<40	Non-Suitable
17	Conifer	<16	>40	Foraging
18	Conifer	16–24	>40	Foraging
19	Conifer	24–32	>40	Foraging
20	Conifer	>32	>40	Foraging
21	Conifer	<16	>60	Foraging
22	Conifer	16–24	>60	Nesting/Roosting
23	Conifer	24–32	>60	Nesting/Roosting
24	Conifer	>32	>60	Nesting/Roosting

Table 10-9 Stand Typing

Stand Typing				
Structure Class	**Tree Type**	**Dominant Size Class (in.)**	**% Minimum Canopy**	**NSO Habitat Type**
22, 23, 24	Conifer	> 16	> 60	Nesting/roosting
20,18, 19	Conifer	> 16	40-60	Foraging
14, 15, 16	Conifer	> 16	< 40	Non-suitable
6	Mixed Hardwood	> 16	> 60	Foraging
4	Mixed Hardwood	> 16	40-60	Foraging
2	Mixed Hardwood	> 16	< 40	Non-suitable
12	Mixed Conifer/Hardwood	> 16	> 60	Foraging
8	Mixed Conifer/Hardwood	> 16	< 40	Non-suitable
21	Conifer	8-16	> 60	Foraging
17	Conifer	8-16	40-60	Foraging
13	Conifer	8-16	< 40	Non-suitable
5	Mixed Hardwood	8-16	> 60	Non-suitable
3	Mixed Hardwood	8-16	40-60	Non-suitable
3	Mixed Hardwood	8-16	< 40	Non-suitable
9	Mixed Conifer/Hardwood	8-16	> 60	Non-suitable
9	Mixed Conifer/Hardwood	8-16	40-60	Non-suitable
7	Mixed Conifer/Hardwood	8-16	< 40	Non-suitable
13	Conifer	< 8	> 60	Non-suitable
13	Conifer	< 8	40-60	Non-suitable
13	Conifer	< 8	< 40	Non-suitable

Stand Typing				
Structure Class	**Tree Type**	**Dominant Size Class (in.)**	**% Minimum Canopy**	**NSO Habitat Type**
3	Mixed Hardwood	< 8	> 60	Non-suitable
3	Mixed Hardwood	< 8	40-60	Non-suitable
1	Mixed Hardwood	< 8	< 40	Non-suitable
9	Mixed Conifer/Hardwood	< 8	40-60	Non-suitable
9	Mixed Conifer/Hardwood	< 8	40-60	Non-suitable
7	Mixed Conifer/Hardwood	< 8	< 40	Non-suitable

10.3.1.2.5 Contingencies

A key part of our HCP/NCCP process is not simply setting goals and objectives but designing contingency plans if those goals and objectives are not met.[13]

DEFINITION

A **contingency** is an alternate plan for an unexpected event.

A contingency trigger is the numeric threshold that initiates implementation of an alternate plan.

Contingencies for population and distribution objectives

MRC may or may not achieve our population objectives for northern spotted owls. Failure to achieve our objectives may be the result of management practices or it may be completely out of our control, e.g., the spotted owl population may decline as the result of climate changes, viruses similar to West Nile, or expansion of barred owl populations. Through monitoring and consultation with the wildlife agencies, MRC will attempt to isolate the causes of any decline in the spotted owl population. Finding actual causes can be a long and elusive process. In the interim, we have developed contingency strategies for declines in Level-1 and Level-2 owl territories—those that are the most productive and receive the highest protections.

In designing the contingency strategies, MRC has balanced the requirement to maintain a specific number of spotted owls across our forests against the effort to grow more owl habitat and distribute spotted owls across our inventory blocks. The intent of our conservation and contingency measures is an increased owl population that is biologically more secure to threats of natural disaster and environmental change as they disperse across our forests. Our assumption is that if we grow more owl habitat in inventory blocks that are deficient in spotted owls, spotted owls will disperse and build new territories in these deficient blocks. If our assumption proves incorrect, we will put contingency strategies into play.

The population contingencies fall into distinct time periods, as Figure 10-5 illustrates. In addition, our contingency strategies reflect a *cascade* approach, with both ongoing continuity and adjustments as environmental and biological factors change and as the endpoint for our

[13] Like the goals, objectives, and conservation measures, we have given the contingencies a code: Y§10.3.1.2.5-n. The letter "Y" suggests a divergence of a path in 2 directions and the need to make a decision.

HCP/NCCP draws closer. Initially, we focus on a population objective—maintaining the same number of Level-1 and Level-2 owls that were present in MRC forests at the start of our HCP/NCCP. We do not expect, at this early stage, for there to be much movement among the owl population. As 20 years pass, though, we turn our attention to the distribution of the owl population. In the intervening decades, we do expect to see the establishment of new owl territories in deficient inventory blocks where habitat has had time to grow and mature. In the final 20 years, we focus on a new population objective as owls re-distribute across our forests and the number of Level-1 and Level-2 owl territories increase by our projections.

A key element in project management, particularly one as complex as our HCP/NCCP, is to create milestones or checkpoints to track progress toward a goal. We need to know before a deadline whether efforts are veering off course or are right on target. Earlier, MRC specified population and distribution objectives for northern spotted owls (O§10.3.1.2-1 through O§10.3.1.2-4). With milestones established in the contingency strategies, we begin tracking our progress toward these objectives through annual owl survey reports—right at the start of HCP/NCCP implementation. We do not wait until 40 or 75 years have elapsed to see if we are meeting these objectives. At these milestones, we implement specific measures if contingency conditions arise. If the number of Level-1 and Level-2 owl territories falls 20% or more below Population Objective 1 (O§10.3.1.2-1) in years 2012-2071 or Population Objective 2 *(*O§10.3.1.2-2) in years 2072-2092, this constitutes a contingency and triggers a corrective response.

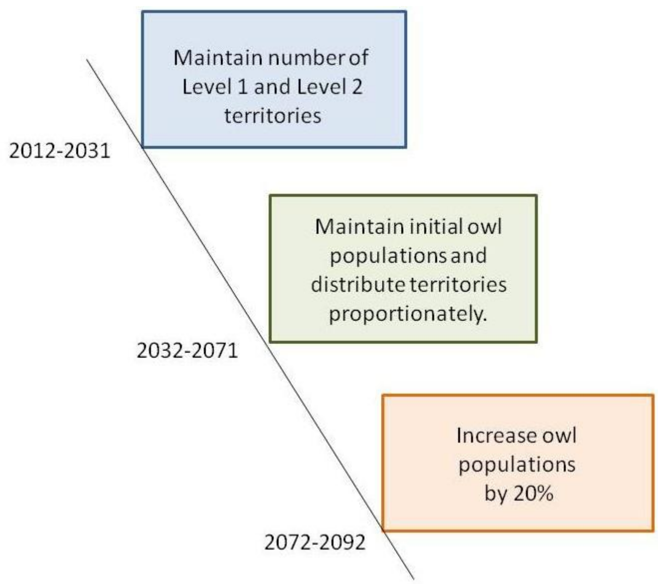


Figure 10-5 Contingency Timelines

MRC purposely chose a 20% variance as the population contingency. From owl surveys on our land, we know that owl productivity (i.e., the number of owl fledglings per year) has varied by more than 20% even with moderate protection roughly equivalent to 2007 *take-avoidance* standards. We do not know the reason for these historical variances. By agreeing to set aside, grow, and protect habitat on a continuous and consistent basis and by implementing measures to limit owl disturbances, MRC is doing all that we realistically and economically can to ensure the survival of the spotted owl on our land. Throughout the term of our HCP/NCCP, our goal is to meet or exceed the specified population objectives. At any one point in time, however, we may find ourselves ahead or behind our projections. As shortfalls occur, we anticipate that natural correction will eventually occur as well. The contingency strategies indicate when those shortfalls exceed the acceptable variance and mandate a change in the standard measures.

Later in this sub-section, we provide the step-by-step procedures for responding to each contingency. Many of these procedural steps are repetitious; as we said, the cascade approach implies continuity. However, as a brief introduction, we highlight some of the basic distinctions in the contingency strategies.

> YEARS 2012-2092
> CONTINGENCY: Y§10.3.1.2.5-1
> MRC will determine whether or not we meet each objective for northern spotted owls. If a territory falls below its assigned productivity level, for example, MRC will designate another territory which is producing the minimum number of fledglings for that productivity level. In the case of a Level-1 territory for which no replacement is available, we may combine 2 or more Level-2 territories to replace it. These territories must produce in sum the minimum number of fledglings for the productivity level of the replaced territory. MRC will afford each territory its designated protection level. When MRC combines 2 or more territories for this purpose, we will count them as a single territory for assessing whether we must implement the contingencies described below for population, distribution, and habitat objectives.
>
> YEARS 2012-2031
> CONTINGENCY: Y§10.3.1.2.5-2
> In the first 20 years of our HCP/NCCP, MRC will determine if either Level-1 or Level-2 owl territories fall 20% below the initial contingency trigger, or 20% below *Population Objective 1* (O§10.3.1.2-1*)*. Within deficient inventory blocks (see Table 10-7), MRC will initially provide high protection to all Level-1 territories and moderate protection to all Level-2 and Level-3 territories. In doing so, we expect owl population numbers to rebound.
>
> YEARS 2032-2071
> CONTINGENCY: Y§10.3.1.2.5-3
> During the middle 40-years of our HCP/NCCP, our concern shifts to distribution of those owl territories and growth of required habitat to support that distribution. In this time period, the contingency event remains essentially the same—a 20% drop in owl territories below *Population Objective 1* (O§10.3.1.2-1). However, our response to declines in owl territories is different than in the preceding 20 years. MRC will only increase protections for owl territories in inventory blocks that have not met (a) *Distribution Objective 1* (O§10.3.1.2-3) or (b) the *2007 Baseline Distribution* and *40-Year Habitat Requirement* (see Table 10-7 and Table 10-10). The reason for this difference in response is subtle. This contingency period overlaps the last 20 years of the first 40-year period and the first 20-years of the last 40-year period of our HCP/NCCP. In this pivotal time period, instead of assuming that declines in owl population automatically require a response of heightened protection, MRC will consider the number of owl territories and the acreage of owl habitat in each inventory block. Because MRC is seeking a more proportionate distribution of owl territories across our land, we expect some of the inventory blocks to show a decrease in owl population during the first 40 years of our HCP/NCCP.

YEARS 2072-2092

CONTINGENCY: Y§10.3.1.2.5-4

During the last 20 years of our HCP/NCCP, MRC will continue a similar course; however, in each inventory block, MRC must now meet either (a) *Distribution Objective 2* (O§10.3.1.2-4) or (b) the *2007 Baseline Distribution* and *75-Year Habitat Requirement* (see Table 10-7 and Table 10-10) As a result of our efforts to grow and protect owl habitat and to encourage owl dispersal for more proportionate distribution across the plan area, we project that by end of our HCP/NCCP term the number of Level-1 and Level-2 owl territories will increase by 20% over *Population Objective 1* (O§10.3.1.2-1).

In effect, contingency strategies provide protection equivalent to 2007 *take-avoidance* standards until the causes of decline can be determined and, if possible, corrected. If the declines cannot be corrected, *moderate* protection will extend to the end of our HCP/NCCP term. The contingency strategies also force MRC to backtrack and evaluate current population and habitat conditions against baseline conditions and targeted objectives to see when and where breakdowns began to occur. This information may help us to determine direct causes for owl population declines and propose effective responses. If contingencies occur, MRC will meet with the wildlife agencies to determine cause of declines and appropriate responses. We will include all declines and responses in our annual monitoring report.

TIME PERIOD: 2012-2092

CONTINGENCY: Y§10.3.1.2.5-1

CONTINGENCY TRIGGER

A territory designated Level-1 falls to a lower productivity level.

INTENT OF CONTINGENCY MEASURE

Ensure that MRC maintains the spotted owl population objectives for the entire term of our HCP/NCCP.

CROSS REFERENCES

Territory = northern spotted owl territory

STRATEGIC RESPONSE 1

1. Replace a Level-1 territory with another Level-1 territory.
2. In the event that a replacement Level-1 territory is not available, MRC can combine 2 or more territories that produce, in combination, at least as many fledglings as the minimum number of fledglings for a Level-1 territory; these will receive high protection.

EXAMPLE

A Level-1 territory called MD095 produces an average of 1.2 fledglings over a 10-year period. After a drop in productivity, this Level-1 territory becomes a Level-2 territory. We now have to replace MD095 with another territory producing >0.8 fledglings (the minimum number for a Level-1 territory), or combine 2 or more territories producing, in combination, >0.8 fledglings. The combined territories then receive high protection.

TIME PERIOD: 2012-2031

CONTINGENCY: Y§10.3.1.2.5-2

INITIAL CONTINGENCY TRIGGER

For 2 consecutive years, the total number of Level-1 or Level-2 owl territories falls 20% below *Population Objective 1* (O§10.3.1.2-1), i.e. there are less than **22** Level-1 or 54 Level-2 territories.

INTENT OF CONTINGENCY MEASURE

Maintain *Population Objective 1* (O§10.3.1.2-1) across MRC forests and *2007 Baseline Distribution* within individual inventory blocks.

CROSS REFERENCES

2007 Baseline Distribution (see Table 10-7)

Population Objective 1 (O§10.3.1.2-1) = 28 Level-1 and 67 Level-2 territories.

Distribution Objective 1 (O§10.3.1.2-3)—Table 10-7

STRATEGIC RESPONSE 2

1. MRC will determine which inventory blocks are not meeting their *2007 Baseline Distribution*, even if that decrease is only 1 territory.
2. Within deficient inventory blocks, MRC will provide all Level-1 territories with high protection and all Level-2 and Level-3 territories with moderate protection. We will re-check territory numbers each year and continue these contingency protections until deficient inventory blocks rebound to their *2007 Baseline Distribution* for 2 consecutive years. If necessary, MRC will maintain protections until the next contingency time period begins.
3. If after 5 years the deficient inventory blocks are still below their *2007 Baseline Distribution*, MRC will "isolate" these inventory blocks from the rest of covered lands. MRC will subtract the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in the *2007 Baseline Distribution* from the total number of Level-1 and Level-2 territories in *Population Objective 1*. This will be the *Adjusted Population Baseline*. Following is an example of such an adjustment.

   NOTE

   MRC initially establishes an objective of 28 Level-1 territories and 67 Level-2 territories. In 2015, the Albion inventory block experiences a decrease of 2 Level-1 territories; Navarro West inventory block, a decrease of 5 Level-1 territories. In 2020, 5 years after the first sign of a decline, the number of territories in Albion and Navarro West has still not rebounded to their *2007 Baseline Distribution*. To determine if future declines trigger contingency measures, MRC subtracts the baseline numbers for Level-1 territories in the Albion and Navarro West (4+11) from *Population Objective 1* (28) to get 13. A 20% decline from 13 is 10—the new *contingency trigger* for Level-1 territories. We also subtract the baseline numbers for Level-2 territories in the Albion and Navarro West (6 + 7) from *Population Objective 1* (67) to get 54. A 20% decline from 54 is 43 —the new *contingency trigger* for Level-2 territories. In this example, starting in 2020, *the contingency trigger* would then be to maintain 13 Level-1 territories and 43 Level-2 territories—outside the deficient inventory blocks.

4. MRC will manage the deficient inventory blocks separately from the rest of covered lands. This separate management policy will return the deficient inventory blocks essentially to moderate protection roughly equivalent to 2007 *take avoidance* standards. However, if there is evidence, after 5 years, that some owls in a deficient inventory block have

benefited from the increased protection, MRC will maintain high and moderate protections originally prescribed for the owl territories in that inventory block. MRC will consult with the wildlife agencies about the validity of the evidence before taking this action. Otherwise, MRC will immediately provide moderate protection to all owl territories in the deficient inventory blocks, regardless of their productivity level. We will continue this moderate protection until the deficient inventory blocks meet their *2007 Baseline Distribution* or the strategic response for years 2032-2071 takes effect. If necessary, MRC will maintain protections until the next contingency time period begins. Contingency trigger calculations after deficient inventory blocks rebound are as follows:

a. If a deficient inventory block rebounds to its *2007 Baseline Distribution*, MRC will add the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in the *2007 Baseline Distribution* to the Adjusted Population Baseline. MRC will use this Adjusted Population Baseline in calculating subsequent contingency triggers.

    a. If all the deficient inventory blocks rebound, MRC will return to the initial contingency trigger. In the above example, if Albion and Navarro West rebounded to their *2007 Baseline Distribution*, the *contingency trigger* would return to 22 Level-1 territories and 54 Level-2 territories, rather than 10 and 43 respectively.

Example Data		
	Level-1 Territories	Level-2 Territories
Population Objective 1	28	67
Albion	4	6
Navarro West	11	7
Year 2015		
Albion	1	6
Navarro West	3	9
Year 2020	No change	No change
Adjusted Population Baseline	28 - (4 + 11) = 13	67 - (6+7) = 54
Contingency Calculation	20% of 13 = 2.6 13 - 3 = 10	20% of 54 = 10.8 54 – 11 = 43
Adjusted Population Objective for Year 2020	13	43

TIME PERIOD: 2032-2071

CONTINGENCY: Y§10.3.1.2.5-3

INITIAL CONTINGENCY TRIGGER

For 2 consecutive years, the total number of Level-1 or Level-2 territories falls 20% below *Population Objective 1* (O§10.3.1.2-1), i.e. there are less than 22 Level-1 or 54 Level-2 territories.

INTENT OF CONTINGENCY MEASURE

Maintain *Population Objective 1* (O§10.3.1.2-1) across MRC forests and *Distribution Objective 1* within individual inventory blocks.

CROSS REFERENCES

2007 Baseline Distribution (see Table 10-7)

Population Objective 1 (O§10.3.1.2-1) = 28 Level-1 and 67 Level-2s

Distribution Objective 1 (O§10.3.1.2-3)—see Table 10-7

Habitat objective 1 (O§10.3.1.2-5)—see Table 10-10.

STRATEGIC RESPONSE 3

1. MRC will determine which inventory blocks are not meeting either (a) their *Distribution Objective 1* or (b) their *2007 Baseline Distribution* and *Habitat Objective 1*.
2. Within deficient inventory blocks, MRC will immediately provide all Level-1 territories with high protection and all Level-2 territories with moderate protection. In addition, we will extend moderate protection to all Level-3 territories. We will re-check territory numbers each year and continue these contingency protections until deficient inventory blocks meet (a) *Distribution Objective 1*; or (b) their *2007 Baseline Distribution* and *Habitat Objective 1*, or (c) 5 years elapse.
3. If after 5 years, the deficient inventory blocks are still not meeting (a) their *Distribution Objective 1* or *(b)* their *2007 Baseline Distribution* and *Habitat Objective 1,* MRC will "isolate" these inventory blocks from the rest of covered lands. MRC will subtract the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in *Distribution Objective 1* from the total number of Level-1 and Level-2 territories in *Population Objective 1*. This will be the *Adjusted Population Baseline*.
4. MRC will manage the deficient inventory blocks separately from the rest of covered lands. MRC will extend moderate protection to all owl territories in the deficient inventory blocks, regardless of their productivity level. We will continue this moderate protection until the deficient inventory blocks meet (a) *Distribution Objective 1*; or (b) their *2007 Baseline Distribution* and *Habitat Objective 1*; or (c) the strategic response for years 2072-2092 takes effect. However, if there is evidence, after 5 years, that some owls in a deficient inventory block have benefited from the increased protection, MRC will maintain high and moderate protections originally prescribed for the owl territories in that inventory block. MRC will consult with the wildlife agencies about the validity of the evidence before taking this action.
5. Contingency trigger calculations after deficient inventory blocks rebound are as follows:
   - If a deficient inventory block rebounds to its *Distribution Objective 1*, MRC will add the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in *Distribution Objective 1* to the Adjusted Population Baseline. MRC will use this *Adjusted Population Baseline* in calculating subsequent contingency triggers.
   - If a deficient inventory block rebounds to its *2007 Baseline Distribution* and its *Habitat Objective 1,* MRC will add the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in the *2007 Baseline Distribution* to the Adjusted Population Baseline. MRC will use this Adjusted Population Baseline in calculating subsequent contingency triggers.
   - If all the deficient inventory blocks rebound, we will return to the initial contingency trigger of 22 Level-1 or 54 Level-2 territories.

TIME PERIOD: 2072-2092

CONTINGENCY: Y§10.3.1.2.5-4

INITIAL CONTINGENCY TRIGGER

For 2 consecutive years, the total number of Level-1 or Level-2 territories falls 20% below *Population Objective 2* (O§10.3.1.2-2), i.e., there are less than 27 Level-1 or 64 Level-2 territories.

INTENT OF CONTINGENCY MEASURE

Achieve and maintain *Population Objective 2* (O§10.3.1.2-2) and *Distribution Objective 2* (O§10.3.1.2-4).

CROSS REFERENCES

2007 Baseline Distribution (see Table 10-7)

Population Objective 2 (O§10.3.1.2-2) = 34 Level-1 and 80 Level-2 territories

Distribution Objective 1 (O§10.3.1.2-3)—see Table 10-7

Habitat objective 1 (O§10.3.1.2-5)—see Table 10-10.

STRATEGIC RESPONSE 4

1. MRC will determine which inventory blocks are not meeting either (a) their *Distribution Objective 2* or (b) their *2007 Baseline Distribution* and *Habitat Objective 2*.
2. Within deficient inventory blocks, MRC will immediately provide all Level-1 territories with high protection and all Level-2 territories with moderate protection. In addition, we will extend moderate protection to all Level-3 territories. We will re-check territory numbers each year and continue these contingency protections until deficient inventory blocks meet (a) *Distribution Objective 2*; or (b) their *2007 Baseline Distribution* and *Habitat Objective 2*; or (c) 5 years elapse; or (d) the term of our HCP/NCCP ends.
3. If after 5 years, the deficient inventory blocks are still not meeting (a) their *Distribution Objective 2 or (b) their 2007 Baseline Distribution* and *Habitat Objective 2*, MRC will "isolate" these inventory blocks from the rest of covered lands. In subsequent calculations to determine whether Level-1 or Level-2 territories fall 20% below *Population Objective 2*, MRC will exclude the number of territories in these isolated inventory blocks. If additional inventory blocks experience decreases, we will follow the same procedure.
4. MRC will manage the deficient inventory blocks separately from the rest of covered lands. This separate management policy will return the deficient inventory blocks essentially to 2007 *take avoidance* standards. MRC will extend moderate protection to all owl territories in the deficient inventory blocks, regardless of their productivity level. We will continue this moderate protection until the deficient inventory blocks meet (a) *Distribution Objective 2*; or (b) their *2007 Baseline Distribution* and *Habitat Objective 2*; or (c) the term of our HCP/NCCP ends. However, if there is evidence, after 5 years, that some owls in a deficient inventory block have benefited from the increased protection, MRC will maintain high and moderate protections originally prescribed for the owl territories in that inventory block. MRC will consult with the wildlife agencies about the validity of the evidence before taking this action.
5. Contingency trigger calculations after deficient inventory blocks rebound are as follows:
   - If a deficient inventory block rebounds to its *Distribution Objective 2*, MRC will add the number of Level-1 and Level-2 territories represented by these isolated inventory blocks in *Distribution Objective 2* to the Adjusted

TIME PERIOD: 2072-2092

Population Baseline. MRC will use this Adjusted Population Baseline in calculating subsequent contingency triggers.

- If a deficient inventory block rebounds to its *2007 Baseline Distribution* and its *Habitat Objective 2*, MRC will add the number of Level-1 and Level-2 territories in the *2007 Baseline Distribution* to the *Adjusted Population Baseline* in calculating subsequent contingency triggers.
- If all the deficient inventory blocks rebound, we will return to the initial contingency trigger of 28 Level-1 or 66 Level-2 territories.

Contingencies for habitat objectives

CONTINGENCY: Y§10.3.1.2.5-5

Table 10-10 shows the required acreage of nesting/roosting habitat to meet *Habitat Objectives 1* (O§10.3.1.2-5) and *Habitat Objective 2* (O§10.3.1.2-6). This requirement is in the contingencies for *Population Objective 2* (O§10.3.1.2-2) and *Distribution Objective 2* (O§10.3.1.2-4). In defining the habitat objectives, MRC projected an increase in nesting/roosting habitat throughout the term of our HCP/NCCP. Recent research indicates the need for a mix of suitable and unsuitable habitat within each owl territory (Franklin et al. 2000). MRC projects that, 40 years after initiation of our HCP/NCCP, nesting/roosting habitat will comprise 23% of all potential habitat; 75 years after initiation, nesting/roosting will comprise 25% of all potential habitat as well as 25% of each inventory block. Several inventory blocks, of course, will likely have even more nesting/roosting habitat than this 25% minimum requirement.

Table 10-10 Potential, Actual, and Projected Spotted Owl Habitat in the Plan Area

	HCP/NCCP Implementation					
	2012	2012	2012	2012	+ 40 Years	+ 75 Years
Inventory Block	Plan Area (ac)	Potential Nesting Roosting (ac)	% of Potential Nesting Roosting	Actual Nesting/ Roosting (ac)	Habitat Objective 1 Nesting/ Roosting (ac)	Habitat Objective 2 Nesting/ Roosting (ac)
Albion	14,797	14,526	7%	6604	5116	3629[14]
Big River	33,480	33,058	16%	3852	6059	8265
Garcia	14,906	14,434	7%	2535	3072	3609
Navarro E.	30,863	30,508	15%	2367	4997	7627
Navarro W.	23,549	23,120	11%	7951	6866	5780
Noyo	19,350	19,318	9%	2156	3493	4830
Rockport	38,427	38,272	18%	7579	8574	9568
South Coast	34,281	33,446	16%	11094	9728	8362
Ukiah	3,591	2,466	1%	0	309	617
TOTAL	**213,244**	**209,148**	**100%**	**44,137**	**48,214[15]**	**52,287**

[14] In order to correct for rounding error, the amount of nesting/roosting habitat shown in Table 10-10 for the Albion tract is slightly higher than 25% at year 75.

[15] This tabulated number is slightly greater than the 23% total nesting/roosting required by year 40 (i.e. 0.23 * 209,148 = 48,104 ac); however, this will be the actual acreage MRC will use to determine if we are meeting our overall habitat objective. Using the larger number should ensure that we meet our long-term habitat objective.

To meet this final objective, MRC recognizes that some inventory blocks must produce a large amount of nesting/roosting habitat, while other inventory blocks already have more than the required amount. In order to re-distribute the owls more evenly across covered lands, we will increase nesting/roosting in inventory blocks deficient in such habitat. The amount of habitat in inventory blocks with a current surplus of nesting/roosting habitat may decline by Year 40 of our HCP/NCCP. In each case, we will manage the increases and decreases incrementally. For example, in the Navarro East inventory block, there are 2367 ac of nesting/roosting habitat at the start of HCP/NCCP implementation. Our habitat objectives require that this block will increase to 7627 ac of nesting/roosting by the end of our HCP/NCCP term. In order to manage habitat growth in Navarro East, MRC subtracts 2367 ac from 7627 ac to get 5260 ac—the required amount of new nesting/roosting acreage. Half of 5260 ac is 2630 ac of nesting/roosting habitat. In 40 years, therefore, our objective for the Navarro East is 4997 ac of nesting/roosting habitat (2367 + 2630 = 4997); in 75 years, 7627ac (4997 +2630).

Contingencies for barred owls

CONTINGENCY: Y§10.3.1.2.5-6

Barred owls are dispersing into northern California and forcing spotted owls from their territories. In fact, we indicated in section 5.2.6.3 that the number of barred owl territories MRC biologists have detected within 1 km of spotted owl territories has increased steadily from 2005-2010, namely, 1 in 2005, 4 in 2006, 6 in 2007, and 9 in 2008, 4 in 2009, 22 in 2010. Whether these barred owls will displace the spotted owls from their territories is uncertain, but likely. To date, there are no recommended practices for discouraging barred owls from invading spotted owl territories. If effective non-lethal techniques become available, MRC will implement them, whenever feasible. Otherwise, when MRC biologists locate a barred owl in a spotted owl territory, we will apply the following contingencies:

1. MRC will seek information from the wildlife agencies on (a) whether control or removal is the best option when a barred owl invades a spotted owl territory and (b) the approved method for control or removal.

2. MRC will obtain authorization from the wildlife agencies before initiating any effort to control or remove barred owls (M§13.9.1.4-7) and undertake agency-approved measures as soon as practicable.

3. MRC, upon recognizing the arrival of a barred owl in a spotted owl territory, will freeze both the productivity and protection levels of that territory until (a) the barred owl abandons or is removed from the territory or (b) a spotted owl replaces the barred owl or (c) 3 years elapse.

4. MRC will re-initiate a spotted owl productivity assessment, skipping over the years in which a barred owl occupied a spotted owl territory and commencing with the barred owl's abandonment of or removal from the territory.

5. MRC will conclude that we have done all we can to manage barred owls, if the wildlife agencies concur with us that any of these conditions pertain: (a) effective non-lethal measures are not available; (b) the wildlife agencies do not authorize measures for control; or (c) implementation of control measures is not effective.

6. MRC will, subsequent to the conditions in #5 and with the approval of the wildlife agencies, designate the Level-1 and Level-2 territories occupied by barred owls as Northern Spotted Owl Recovery Territories (NSORT).

7. MRC will
   - Retain the core area with the most nesting/roosting habitat within each recovery territory (Figure 10-6, Core Area B).
   - Retain the core area with the most foraging habitat, if there is no nesting/roosting habitat or develop habitat in the core area at the direction of the wildlife agencies.

     NOTE
     To develop habitat, MRC might, for example, reduce the density of trees to provide more openings, thin trees to provide more flyways, or thin from below to accelerate the growth of nesting/roosting habitat.

   - Maintain at least 500 ac of suitable habitat within 0.7 miles of the initial activity center (IAC) of the retained core area (Figure 10-6, Core Area B) or maintain the existing suitable habitat if it is already less than 500 ac.
   - Include all NSORT, regardless of their productivity level, in calculations to determine whether we meet the population and distribution objectives for northern spotted owls.

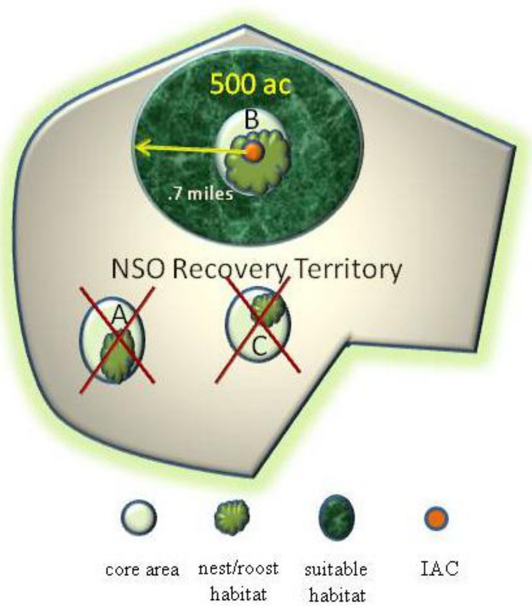


Figure 10-6 Retaining Core Area and Suitable Habitat in NSO Recovery Territory

10.3.1.3 Conservation measures

10.3.1.3.1 Conservation measures by protection level

MRC stratifies protections based on habitat and season (breeding and non-breeding). For operational purposes and by agreement between MRC and the wildlife agencies, the breeding season for northern spotted owls is February 1–August 31. Conservation measures for breeding season do not apply under the following conditions:

- Northern spotted owls in the territory are either absent or not nesting.
- Northern spotted owls in the territory have completed their nesting attempt but failed to produce a fledgling.

- Fledgling(s) in moderate or high protection areas have been out of their nest for at least 2 weeks and are capable of independent sustained flight.
- Fledgling(s) in limited protection areas are capable of independent sustained flight.
- Operations proposing "disturbance only"[16] within 1000 ft of spotted owl activity centers with moderate protections are after July 30th.

During emergencies, a vehicle can stop at any location in the plan area.

Territories with high protection

	Conservation Measures for NSO Territories with High Protection
Habitat	
C§10.3.1.3.1-1	Provide, on covered lands, a core area of at least 80 contiguous ac (32 ha) which is 500 ft (153 m) from the initial activity center and off-limits to harvest.
C§10.3.1.3.1-2	Adhere to MRC guidelines for selecting a core area in the order of priority given below: 1. Create a circular buffer around the initial activity center with a 500-ft radius. 2. Select 80 ac of contiguous nesting/roosting habitat, if available. 3. Supplement any deficiencies in the desired 80 ac with the next-best contiguous habitat. 4. Locate the habitat on same side of a topographic divide, such as a ridge, if possible.
C§10.3.1.3.1-3	Protect core areas that are within both covered lands and state parks in proportion to the amount of core area acreage on covered lands. **EXAMPLE** A core area adjoins both the plan area and Navarro River Redwoods State Park, such that 60 ac are in the plan area and 20 ac on park land. MRC will protect the 60 ac of the core area that are in the plan area.
C§10.3.1.3.1-4	Retain suitable habitat (a) within 1000 ft of the initial activity center and (b) within the extended protection area (i.e., 267 ft beyond the periphery of the core area) and ensure that any harvests maintain or increase the pre-harvest mean stand diameter (MSD).
C§10.3.1.3.1-5	Maintain at least 500 ac of suitable habitat within 0.7 miles of the activity center or maintain the existing suitable habitat if, prior to harvest, it is already less than 500 ac. **NOTE** The forester will ensure that MRC meets the minimum habitat criteria post-harvest. Additionally, the forester will confirm via air photos or past harvest plans that the habitat typing is correct and current. If there is a disagreement about the habitat typing before, during, or after harvest, the forester will meet with the disputant at the stand in question to resolve the concern. If there is still disagreement, the disputing agency will work with MRC to agree upon a sampling intensity and protocol to determine canopy cover and habitat typing of the stand.

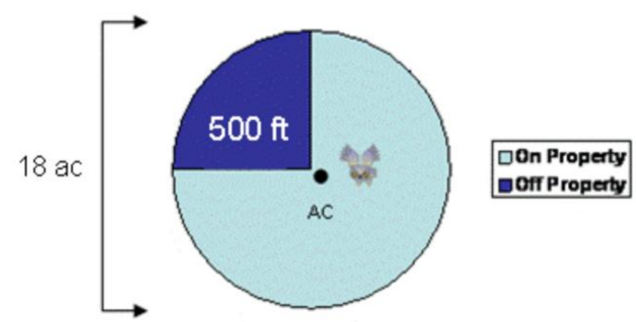
[16] Disturbance for spotted owls includes road work (excluding emergency road maintenance), road construction, blasting, log yarding, log loading, timber felling, hauling, and use of heavy equipment.

	Conservation Measures for NSO Territories with High Protection
C§10.3.1.3.1-6	Permit fire control lines for prescribed burning within a core area only with approval of the wildlife agencies.
C§10.3.1.3.1-7	Mark and retain all known nest trees of northern spotted owls and protect them, if possible, with 4 screen trees. **DEFINITION** A screen tree creates a barrier of protection (e.g., from wind) for an adjacent tree and for wildlife that might be occupying it. It must have intermingling limbs above or equal to the height of the canopy of the tree to be screened. Its tree tops must be at least half the height of the tree to be screened. **NOTE** Conservation measures C§10.3.1.3.1-7 through C§10.3.1.3.1-9 still apply when a spotted owl has abandoned its core area and moved into another core area.
C§10.3.1.3.1-8	Follow this procedure if a tree to be screened does not have at least 4 screen trees: ▪ Use 2 times the canopy spread as the distance within which to assess and retain potential screen trees. ▪ Select, as the screen tree, the tallest tree in the assessment quadrant which is, at minimum, ½ the height of the tree to be screened. **NOTE** If no trees meet this criterion, do not retain additional trees.  ▪ Select screen trees in open non-screened quadrants, if possible.
C§10.3.1.3.1-9	Permit harvesting of a screen tree only if (a) there are at least 6 screen trees; (b) felling will not damage the tree to be screened; and (c) removing the harvested tree will not damage the tree to be screened.
C§10.3.1.3.1-10	Restrict construction of new roads to locations outside of the core area.
Breeding Season	

	Conservation Measures for NSO Territories with High Protection
C§10.3.1.3.1-11	Conduct only the following operations within 1000 ft (305 m) of a current spotted owl activity center: ▪ Use of mainline haul roads and maintenance of mainline haul roads as designated in the *HCP/NCCP Atlas* (MAPS 14A-C). **NOTE** Maintenance includes actions necessary to use the roads, e.g., knocking down water bars, grading, and watering. Maintenance does not include actions that would be considered reconstruction of roads under the California Forest Practice Rules (CDF 2006, p. 14), such as changing the prism of the road. MRC will retain any trees felled for maintenance in forest adjacent to roads within the core area. ▪ Use of public roads. ▪ Use and maintenance of existing MRC roads which are at least the same distance from the current AC as a public road or mainline haul road. ▪ Use of pickups and ATVs on existing roads.
C§10.3.1.3.1-12	Permit helicopter operations, including service landings, only 2640 ft (805 m) or more from a spotted owl activity center, measured and marked according to map distance.
C§10.3.1.3.1-13	Allow a logging vehicle to stop only for safety reasons when within 1000 ft (305 m) of a nest site known to be currently active, unless the vehicle is on a mainline road.
C§10.3.1.3.1-14	Permit prescribed burning within ¼ mile of an occupied activity center only with the approval of the wildlife agencies.
C§10.3.1.3.1-15	Survey for spotted owls when operations could result in disturbance or reduction of suitable habitat (see Appendix K, *Northern Spotted Owl Data and Protocol*, section K.5.1.8).
Non-breeding Season	
C§10.3.1.3.1-16	Prohibit harvest or forest management within the core area.
C§10.3.1.3.1-17	Conduct only the following operations within the core area: ▪ Use and maintenance of existing roads. ▪ Reconstruction of any truck road only if MRC has exhausted all other alternative measures that might result in less impact. ▪ Use of cable corridors and tailholds: – Fell only trees that may hang up cable lines. – Leave all trees felled for the cable corridor on the forest floor for woody debris. – Yard logs only outside the core area. – Exclude nest or screen trees from felling. – Fell trees for cable corridors away from nest or roost trees so that no damage can occur to nest trees, screen trees, or roost trees.
C§10.3.1.3.1-18	Permit helicopter operations—including service landings—that are at least 1000 ft (305 m) from an activity center, measured and marked according to map distance.

	Conservation Measures for NSO Territories with High Protection
C§10.3.1.3.1-19	Survey for spotted owls when operations could result in reduction of suitable habitat (see Appendix K, *Northern Spotted Owl Data and Protocol*, section K.5.1.8).

Territories with moderate protection

	Conservation Measures for NSO Territories with Moderate Protection
Habitat	
C§10.3.1.3.1-20	Adhere to MRC guidelines for selecting a core area: ▪ Select nesting/roosting habitat over foraging habitat. ▪ Select contiguous habitat over isolated habitat. ▪ Select habitat located proximal to the activity center relative to a topographic divide, such as a ridge.
C§10.3.1.3.1-21	Provide a core area of at least 18 contiguous ac (7 ha) that are *no-harvest* with a minimum distance of 500 ft (152 m) to the initial activity center.
C§10.3.1.3.1-22	Retain suitable habitat that is within the extended protection area (i.e., 500 ft beyond the periphery of the core area) prior to harvest and ensure that harvested areas maintain or increase pre-harvest mean stand diameter.
C§10.3.1.3.1-23	Mark and retain all known nest trees of northern spotted owls and protect them with screen trees (see C§10.3.1.3.1-7).
C§10.3.1.3.1-24	Permit fire control lines for prescribed burning within a core area only with the approval of the wildlife agencies.
C§10.3.1.3.1-25	Maintain at least 500 ac of suitable habitat within 0.7 miles of the activity center or maintain the existing suitable habitat if, prior to harvest, it is already less than 500 ac.
C§10.3.1.3.1-26	Protect core areas that are both on and off MRC property in proportion to the amount of acreage that is actually on MRC property. **EXAMPLE** A core area consists of a circle with a 500 ft radius. Within this 18-ac circle, 75% of the land is on covered lands. The rest of the core area is on other property. MRC will protect 0.75 * 18 or 14 ac.  MRC maintains a minimum of 14 ac (75%) of the core area
Breeding Season	

	Conservation Measures for NSO Territories with Moderate Protection
C§10.3.1.3.1-27	Conduct only the following operations within 1000 ft (305 m) of the current activity center: ▪ Use of mainline haul roads and maintenance of mainline haul roads as designated in the *HCP/NCCP Atlas* (MAPS 14A-C). **NOTE** Maintenance does not include actions that would be considered reconstruction of roads under the California Forest Practice Rules (CDF 2006, 14), such as substantial change in the prism of the road. ▪ Use of public roads. ▪ Use and maintenance of existing MRC roads that (1) are located at least the same distance from the current spotted owl activity center as a public road or mainline haul road; or (2) are existing seasonal roads ≥500 ft (152 m) from the current activity center and in use during the time the spotted owl territory has been active. **NOTE** Maintenance does not include actions that would be considered reconstruction of roads under the California Forest Practice Rules (CDF 2006, 14), such as substantial change in the prism of the road. ▪ Use of pickups and ATVs on existing roads. ▪ Use of a road if an owl pair is upgraded from limited to moderate protection and has successfully reproduced while the AC was within 500 ft (152 m) of the road. **NOTE** The assumption is that the road disturbance has not disrupted the owls since they have already reproduced.
C§10.3.1.3.1-28	Permit helicopter operations—including service landings—that are at least 2640 ft (805 m) from an activity center, measured and marked according to map distance.
C§10.3.1.3.1-29	Permit prescribed burning within ¼ mile of an occupied activity center only with the approval of the wildlife agencies.
C§10.3.1.3.1-30	Allow a logging vehicle to stop only for safety reasons when within 1000 ft (305 m) of a nest site known to be currently active, unless the vehicle is on a mainline road.
C§10.3.1.3.1-31	Retain any trees, felled for allowable maintenance, in the forest adjacent to roads within the core area.
C§10.3.1.3.1-32	Survey for spotted owls when operations could result in disturbance or reduction of suitable habitat (see Appendix K, *Northern Spotted Owl Data and Protocol*, section K.5.1.8).
Non-breeding Season	
C§10.3.1.3.1-33	Prohibit harvest or forest management within the core area.

	Conservation Measures for NSO Territories with Moderate Protection
C§10.3.1.3.1-34	Conduct only the following operations within the core area: ▪ Use of cable corridors and tailholds: – Fell only trees that may hang up cable lines. – Yard logs only outside the core area. – Exclude nest or screen trees from felling. – Leave all trees felled for the cable corridor on the forest floor for woody debris. – Fell trees for cable corridors away from nest or roost trees to limit damage to these trees ▪ Use and maintenance of existing roads.
C§10.3.1.3.1-35	Permit helicopter operations—including service landings—that are at least 1000 ft (305 m) from an activity center.
C§10.3.1.3.1-36	Survey for spotted owls when operations could result in reduction of suitable habitat (see Appendix K, *Northern Spotted Owl Data and Protocol*, section K.5.1.8).
C§10.3.1.3.1-37	Permit construction of new roads inside the core area only if MRC maintains habitat thresholds.

Territories with Limited Protection

	Conservation Measures for NSO Territories with Limited Protection
Habitat	
C§10.3.1.3.1-38	Mark and retain all known nest trees of northern spotted owls and protect them with screen trees (see C§10.3.1.3.1-7).
Breeding Season	
C§10.3.1.3.1-39	Protect a 500-ft (152-m) no-harvest buffer during the breeding season.
C§10.3.1.3.1-40	Permit helicopter operations—including service landings—that are at least 1320 ft (402 m) from an activity center.
C§10.3.1.3.1-41	Survey for spotted owls when operations could result in disturbance (see Appendix K, *Northern Spotted Owl Data and Protocol*, sections K.5.1.3 and K.5.1.9.2).

Level-4 Territories

	Conservation Measures for NSO Territories Off Property
Non-breeding Season	
C§10.3.1.3.1-42	Mark and retain all known nest trees of northern spotted owls and protect them with screen trees.
Habitat	
C§10.3.1.3.1-43	Level 4A Apply C§10.3.1.3.1-20 through C§10.3.1.3.1-37.
C§10.3.1.3.1-44	Level 4B Apply C§10.3.1.3.1-38 through C§10.3.1.3.1-41

	Conservation Measures for NSO Territories Off Property
Breeding and Non-breeding Seasons	
C§10.3.1.3.1-45	Level 4A Apply C§10.3.1.3.1-20 through C§10.3.1.3.1-37.
C§10.3.1.3.1-46	Level 4 B Apply C§10.3.1.3.1-38 through C§10.3.1.3.1-41

Level-5 Territories

	Conservation Measures for NSO Territories On/Off Property
Habitat	
C§10.3.1.3.1-47	Apply C§10.3.1.3.1-20 through C§10.3.1.3.1-37.
Breeding Season	
C§10.3.1.3.1-48	Apply C§10.3.1.3.1-20 through C§10.3.1.3.1-37.
Non-breeding Season	
C§10.3.1.3.1-49	Apply C§10.3.1.3.1-20 through C§10.3.1.3.1-37.

10.3.1.3.2 Conservation measures for mobile activity centers

DEFINITION

Mobile activity center refers to the fact that northern spotted owls generally do not use the same nest or roost in the same location in consecutive years; they move from spot to spot.

Activity centers are located within a territory. MRC will assign only 1 activity center to a territory per year, based on nest sites, number of observations, and presence of whitewash or pellets (see Appendix K, *Northern Spotted Owl Data and Protocol,* section K.5.4). We will protect up to 3 core areas established in 3 separate years for each known territory based on its productivity level. In reality, we expect this situation to be rare. In addition, we will protect the core area of each activity center, according to the protocol cited above, unless the activity center is abandoned. [17]

	Conservation Measures for Mobile Activity Centers
Territories with High or Moderate Protection	
C§10.3.1.3.2-1	Ensure that breeding season protections are always given to the most current activity center.

[17] An activity center can be abandoned while a territory remains active. A spotted owl territory covers the entire area that an owl or pair of owls defends during a breeding season.

	Conservation Measures for Mobile Activity Centers
C§10.3.1.3.2-2	Maintain a nest-site core area through at least 3 breeding seasons (Figure 10-7). **EXAMPLE** **Year 0:** Spotted owl is in nest, and initial activity center and core area is established. **Year 1:** Spotted owl is not in the core area, but the core area remains. **Year 2:** Spotted owl is not in the core area, but the core area remains. **Year 3:** Spotted owl is not in the core area, so core area is abandoned.
C§10.3.1.3.2-3	Maintain a roost site core area through at least 2 breeding seasons unless in Year 0 a spotted owl is detected 1 time only in the roost site.[18] **EXAMPLE** **Year 0:** Spotted owl is in roost site; initial activity center and core area is established. **Year 1:** Spotted owl is not in the core area, but the core area remains. **Year 2:** Spotted owl in not in core area, so core area is abandoned.[19]
Territories with Limited Protection	
C§10.3.1.3.2-4	Surround a spotted owl's most recent activity center with a 500 ft buffer during the breeding season.

Graphical representations

Figure 10-7 through Figure 10-9 graphically represents the application of the conservation measures for mobile activity centers. Figure 10-7 shows that once an owl is spotted in a nest and a core area established, MRC must protect that core area from harvest even if the owl has apparently moved on and is not spotted again in that core area for 3 years. Only at the end of the breeding season in Year 3, with no further owl sightings recorded in the interim, can MRC harvest the designated core area.

Figure 10-8 and Figure 10-9 depict 2 different scenarios for mobile activity centers. In Scenario 1, an owl moves its activity center 3 times in 3 years but still stays within the original core area. MRC does not designate a new core area based on each new activity center but protects the habitat of the originally designated core area. We do, however, apply disturbance measures to all current activity centers.

In Scenario 2, MRC establishes a core area for an owl activity center. The following year the owl moves outside this core area. MRC establishes a new core area around the new activity center, while simultaneously protecting the original core area. Another year passes and the owl again returns to the original core area. MRC extends protection to both core areas. Only if the owl "abandons" 1 or both of these core areas over the course of 4 breeding seasons (i.e., Year 0 through Year 3), can MRC harvest in the abandoned core area.

[18] To conclude that a spotted owl roosted only 1 time in Year 0, MRC must conduct at least 4 visits (4 daytime walk-ins; or 3 daytime walk-ins and 1 nocturnal survey; or 2 daytime walk-ins and 2 nocturnal surveys) with no detections after the single location. In addition, the following year (Year 1) MRC must conduct at least 4 visits (4 daytime walk-ins; or 3 daytime walk-ins and 1 nocturnal survey; or 2 daytime walk-ins and 2 nocturnal surveys) to conclude the owl has not roosted in the core area again. This means that MRC can consider the core area abandoned after the end of the breeding season in Year 2. All visits must be properly spaced to meet the survey protocol specified in Appendix K, *Northern Spotted Owl Data and Protocol*, section K.5.3.2.2).

[19] If the same spotted owl is nesting outside the core area, MRC considers the owl territory unoccupied for the year.

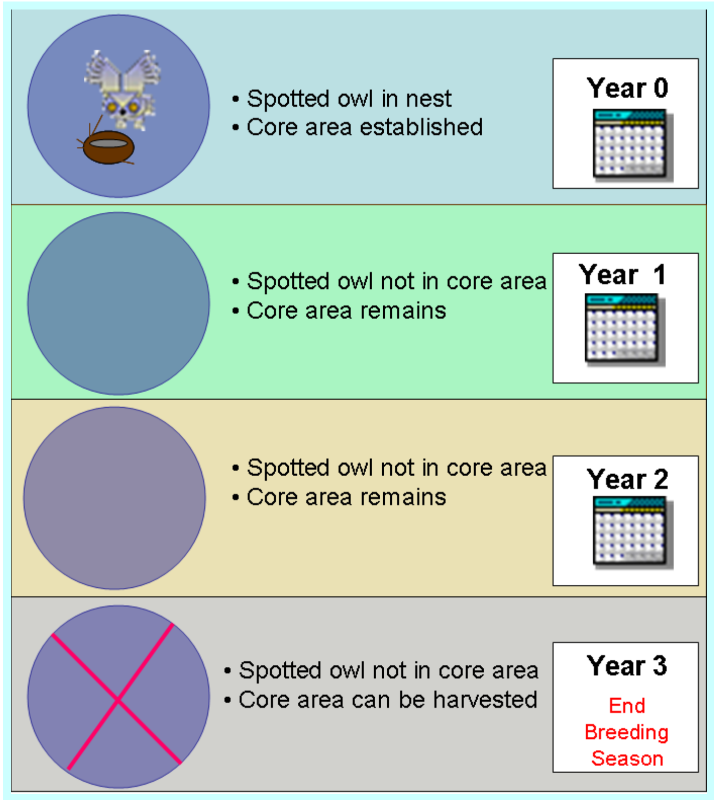


Figure 10-7 Maintaining Nest Site Core Area

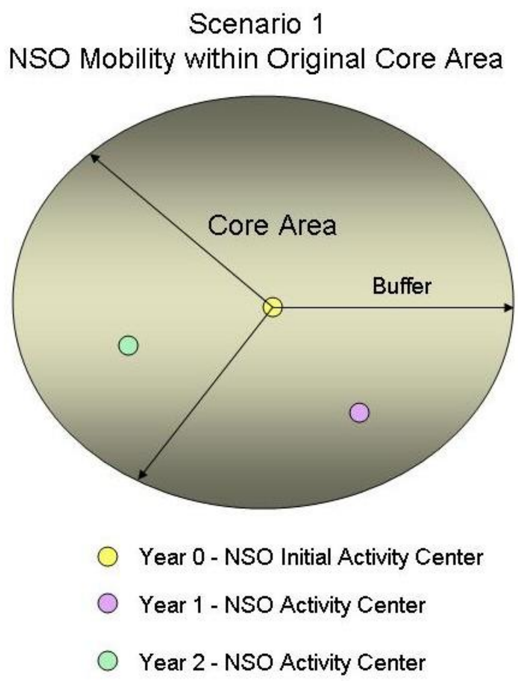


Figure 10-8 Scenario 1 - Mobile Activity Centers

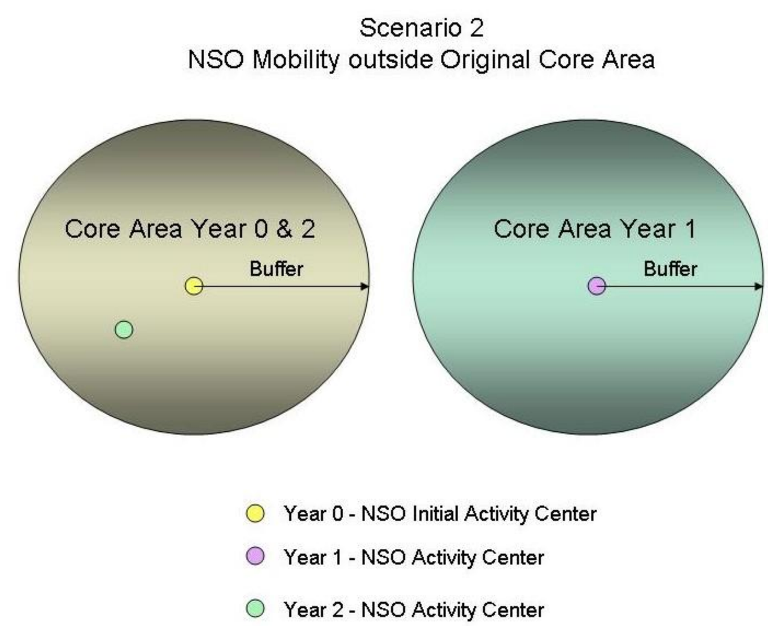


Figure 10-9 Scenario 2 - Mobile Activity Centers

10.3.1.3.3 Recovery strategy for the northern spotted owl

In September 2010, USFWS released its *2010 Draft Revised Recovery Plan for the Northern Spotted Owl*. The plan states that "Currently, the most important range-wide threats to the spotted owl are competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and uncharacteristic wildfire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbance" (USFWS 2010, 30).

In Table 10-11, each excerpt from the USFWS recovery plan is succeeded by the anticipated MRC action to comply with USFWS recommendations or incorporate them in our HCP/NCCP.

Table 10-11 USFWS Draft Recovery Criteria and MRC Response

Recovery Action 1	Establish an inter-organizational spotted owl implementation team ("Northern Spotted Owl Recovery Implementation Team") to oversee the implementation of the Recovery Plan.
MRC Action	MRC will provide expertise and information to the spotted owl implementation team as needed.
Recovery Criterion 1	Stable Population Trend: The overall population trend of spotted owls throughout the range is stable or increasing over 10 years, as measured by a statistically reliable monitoring effort.
MRC Action	MRC is providing ongoing monitoring of population trends of spotted owls in our forestlands as part of our validation monitoring efforts (M§13.9.1.4-1)

Recovery Criterion 2	Adequate Population Distribution: Spotted owl subpopulations within each province (i.e., recovery unit, excluding the Willamette Valley Province) achieve viability, as measured by the HexSim population model or some other appropriate quantitative measure.
MRC Action	MRC conservation objectives aim to achieve well-distributed owl populations (O§10.3.1.2-3 and O§10.3.1.2-4).
Recovery Criterion 3	Continued Maintenance and Recruitment of Spotted Owl Habitat: There is no net loss in nesting/roosting or foraging habitat throughout the range, as measured by effectiveness monitoring efforts or other reliable habitat monitoring programs.
MRC Action	MRC conservation objectives should result in well-distributed owl habitat across covered lands (O§10.3.1.2-5 and O§10.3.1.2-6).
Recovery Action 2	Continue annual monitoring of the population trend of spotted owls to determine if the population is decreasing, stationary, or increasing.
MRC Action	MRC will use its various demographic studies to contribute to the evaluation of spotted owl population trends ((M§13.9.1.4-1)
Recovery Action 3	Conduct occupancy inventory or predictive modeling needed to determine if Recovery Criteria 1 and 2 have been met.
MRC Action	MRC will continue to complete occupancy monitoring on our Level-1, Level-2, and strategic Level-3 owls throughout the term of the HCP/NCCP (M§13.9.1.3-1).
Recovery Action 4	Use the habitat modeling process described . . . to identify, and test the efficacy of numerous habitat conservation network scenarios at conserving spotted owl habitat. Use the results from this effort to inform decisions concerning both the possible development of a habitat conservation network and potential revisions to spotted owl critical habitat.
MRC Action	MRC will continue to use our internal habitat typing and provide results of field validation and verification of assessments to the wildlife agencies, as requested.
Recovery Action 5	In west-side forests managed for spotted owl habitat we recommend land managers implement silvicultural techniques in plantations, overstocked naturally regenerated stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery.
MRC Action	MRC is not testing habitat development methods for owls, however, we will be testing the efficiency of various silvicultural treatments in accelerating the growth of marbled murrelet habitat (M§13.9.2.2-2).
Recovery Action 10	Manage habitat-capable lands within occupied spotted owl sites across all ownerships to retain extant spotted owl pairs and resident singles.
MRC Action	MRC conservation strategy covers both spotted owl pairs and resident singles. Our strategy provides the greatest protection for spotted owls that are the most productive while extending lesser protections for non-productive owls. Retaining and increasing habitat across our forestlands should increase the spotted owl population over time.
Recovery Action 11	In all areas of Federal and non-Federal lands where pre-fire management is focused towards the development of spotted owl habitat, post-fire silvicultural modifications should concentrate on spotted owl habitat restoration and conserving spotted owl habitat elements that take the most time to develop or recover (e.g., large trees, snags, downed wood).
MRC Action	MRC has not included specific pre-fire management in our HCP/NCCP; however, our conservation strategies focus on conserving and recruiting key habitat elements that take the most time to develop or recover (such as wildlife trees, snags, and downed wood).

Recovery Action 12	Design and conduct experiments on forest stand structure to better understand relationships between spotted owl habitat, spotted owl prey, and spotted owl demographic response, and the effects of various thinning prescriptions on spotted owls.
MRC Action	MRC has proposed several validation monitoring studies to address the affect of forest structure on spotted owls, e.g., M§13.9.1.4 (Effect of Hardwood Density on Northern Spotted Owls); M§13.9.1.4-5 (Effect of Habitat on Productivity of Northern Spotted Owls); and M§13.9.1.4-4 (Effect of Harvest within 1000 ft of NSO Territories with Limited Protection). We will share the results of these studies with the wildlife agencies and other researchers.
Recovery Action 13	Standardize province-specific habitat definitions across the range of the spotted owl using a collaborative process.
MRC Action	MRC will test and verify our habitat definitions throughout the term of our HCP/NCCP. In addition, we will participate in efforts to standardize habitat definitions.
Recovery Action 14	Encourage applicants to develop Habitat Conservation Plans/Safe Harbor Agreements that are consistent with the recovery objectives.
MRC Action	MRC initiated our HCP/NCCP long before the current USFWS recovery plan was developed; however, we believe our plan is consistent with the objectives of that recovery plan.
Recovery Action 15	As appropriate and within the boundaries of our authority, the Service encourages the establishment of a work group to develop a comprehensive set of business and economic incentives that facilitate creative opportunities for non-Federal landowners to engage in management strategies consistent with the recovery objectives.
MRC Action	MRC will assist in this effort wherever possible.
Recovery Action 16	Monitor for sudden oak death and avian diseases (e.g., WNV, avian flu, Plasmodium spp.) and address as necessary.
MRC Action	MRC will continue to monitor, over the term of the HCP/NCCP, for sudden oak death through anecdotal reports of our foresters and for West Nile Virus through samples taken as part of our banding program.
Recovery Action 20	If barred owl removal is determined to be most effectively and humanely implemented through shooting of individuals, work with the State of California to modify their regulations so this important recovery activity can occur in compliance with all applicable laws.
MRC Action	MRC will control barred owls as part of its conservation strategy if the wildlife agencies concur and we can obtain appropriate permits (see contingency Y§10.3.1.2.5-6).
Recovery Action 21	Establish a technical work group of entities involved with barred owl research and management (Federal and State agencies, Tribes, timber industry, universities, and nongovernmental organizations) to coordinate actions relative to barred owl research, management, monitoring, and public outreach.
MRC Action	MRC will provide information and staff for these efforts as requested.
Recovery Action 22	Analyze existing data sets from the demographic study areas relative to the effects of barred owls on spotted owl site occupancy, reproduction, and survival.
MRC Action	MRC will provide information as requested even though our forestlands are not currently part of a demographic study area.
Recovery Action 23	Establish protocols to detect barred owls and document barred owl site status and reproduction.

MRC Action	MRC is tracking and collecting reproductive information on barred owls as they are located.
Recovery Action 24	Ensure that protocols adequately detect spotted owls in areas with barred owls.
MRC Action	MRC has updated our survey protocols (see Appendix K) to reflect additional requirements for determining if a territory is inactive in a given year. We will schedule extra surveys beyond our annual surveys if we do not detect spotted owls. Finally, we will use wildlife callers for nocturnal surveys to increase the likelihood of spotted owl detections.
Recovery Action 25	Analyze resource partitioning of sympatric barred owls and spotted owls.
MRC Action	MRC welcomes research proposals from interested academics although we currently have no monitoring programs specifically related to such efforts.
Recovery Action 26	Create and implement an outreach strategy to educate the public about the threat of barred owls to spotted owls.
MRC Action	MRC will continue to share our information on barred owls to the public as part of our stakeholder outreach.
Recovery Action 27	Expedite permitting of experimental removal of barred owls.
MRC Action	MRC will control barred owls as part of its conservation strategy if the wildlife agencies concur and we can obtain appropriate permits (see contingency Y§10.3.1.2.5-6).
Recovery Action 28	Design and implement large-scale control experiments to assess the effects of barred owl removal on spotted owl site occupancy, reproduction, and survival.
MRC Action	MRC will study the effect of barred owl removal on proximal spotted owl territories as part of our monitoring effort (M§13.9.1.4-7).
Recovery Action 29	Manage the negative effects of barred owls on spotted owls so that Recovery Criterion 1 can be met.
MRC Action	MRC will control barred owls as part of its conservation strategy if the wildlife agencies concur and we can obtain appropriate permits (see contingency Y§10.3.1.2.5-6).
Recovery Action 30	Develop mechanisms for land-owners and land-managers to support barred owl management using a collaborative process.
MRC Action	MRC will participate in this process.
Recovery Action 32	To the maximum extent practicable, maintain all of the older and more structurally complex multilayered conifer forests on Federal and non-Federal lands across the range of the spotted owl, allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These forests are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees.
MRC Action	MRC will retain all un-harvested old growth stands. We may harvest in old-growth patches already lightly harvested to accelerate the development of old growth. In addition, we will retain all individual old growth trees in the plan area along with nearby screen trees.

Recovery Action 33	Convene an expert panel to develop a comprehensive vulnerability assessment (USFWS 2009) with recommendations for land managers and stakeholders engaged in spotted owl recovery. This interdisciplinary panel should include technical expertise on spotted owl and barred owl ecology, impacts of climate change in the Pacific Northwest, and the ecology of forested ecosystems.
MRC Action	MRC will provide information or staff members to this panel as requested.
Recovery Criterion 4	Post-delisting Monitoring: To monitor the continued stability of the recovered spotted owl, a post-delisting monitoring plan has been developed and is ready for implementation with the States of Washington, Oregon, and California.
MRC Action	MRC will monitor spotted owls for the 80-year term of our HCP/NCCP even if they are delisted by the wildlife agencies.
Recovery Action 34	Develop a post-delisting monitoring plan ready for implementation with the States of Washington, Oregon, and California.
MRC Action	MRC will monitor spotted owls for the 80-year term of our HCP/NCCP even if they are delisted by the wildlife agencies.

10.3.1.4 Rationale

10.3.1.4.1 Rationale for productivity levels

Our rationale in designating protection levels based on productivity is that owls that produce the most fledglings should receive the most protection. Owls that produce fewer fledglings should receive less protection. Moreover, we increase the effectiveness of our conservation measures if we concentrate our efforts on owls that generally remain in the same stand and produce more fledglings.

To assess appropriate productivity cut-offs for owls, we first examined whether our baseline productivity was comparable to other similarly managed areas in northern California. The productivity rate of owl pairs on covered lands was 0.58 fledglings/pair from 1989 to 2007. This number compared well with other lands: Humboldt Redwood Company (HRC) 0.67 fledglings/pair;[20] Willow Creek Study Area 0.61 fledglings/pair (Franklin et al. 2010); and Simpson Timber Company, 0.63 fledglings/pair from 1992 to 2002 (Simpson Resource Company 2003). Next, we decided that our cut-off between high producers and mid-level producers should be greater than the mean fledge productivity per northern spotted owl pair (0.80 > 0.58). Using data from 1998 through 2007, MRC biologists calculated the number of owl territories producing > 0.80 fledglings each year. We used all productivity information from 1998-2007 to calculate mean productivity. The mean number of owl territories from 1998-2007 that produced a mean annual productivity > 0.80 was 29.90 with a standard error of 0.91. Research from a demographic study in Willow Creek indicated that the mean number of fledglings produced there contributed to a population trend that could not be differentiated from stationary (Franklin et al. 2002).

We based our conservation measures on the premise that northern spotted owls that receive greater protection will have greater survival rates and be able to remain productive in their territories for a longer period of time. In addition, our regional analysis of spotted owls (Appendix K, *Northern Spotted Owl Data and Protocol*, section K.4) indicates that if all Level-3

[20] John Hunter (USFWS) relayed this information to Sarah Billig (MRC) in a discussion on 2/5/2004. This number is a running average over 12 years. Until 2008, HRC lands were owned by Pacific Lumber Company (PALCO).

territories disappeared completely from our landscape and if every other landowner in Mendocino County followed the same conservation strategy (i.e., harvest within 500 ft of owls with limited protection), "empty" territories would still be within a reasonable dispersal distance for both male and female northern spotted owls (Forsman et al. 2002).

MRC is protecting 95 of the 120 territories in southern Mendocino County needed to maintain a population of northern spotted owls (USFWS 1992). This is a large portion of the regional goal even though MRC only owns approximately 28% of the timberland production zone in Mendocino County (Shih 2002).

To determine an appropriate cut-off point for the 3 productivity levels, MRC developed a frequency histogram based on baseline productivity. In our analysis, we did not count a final status of "nesting unknown" (NU) in the calculations (Figure 10-10). In Level-1 territories, owls produce > 0.8 fledglings per year; in Level 2, > 0.00 but < 0.8 fledglings per year; in Level 3, no fledglings per year. Figure 10-10 shows spotted owl territories and the mean number of fledglings produced per year as of 2007. In Figure 10-11, for NU=0, we calculated means for all territories visited in the year; for NU=omitted, we calculated means using all territories with a final nesting status for the year. Calculations for the baseline production of spotted owl territories in our HCP/NCCP use NU=omitted.

10.3.1.4.2 Rationale for increased population objective

Over the term of our HCP/NCCP, MRC will be growing additional nesting/roosting habitat, as projected by our landscape model and in line with our habitat definitions. Our rationale is that an increase in this habitat will allow for a larger owl population. In the second half of our HCP/NCCP timeline, MRC proposes increasing the population of productive owls by managing for a 20% increase in Level-1 and Level-2 territories and increasing the total number of Level-1 and Level-2 territories from 95 to 114. Table 10-7 shows that Level-1 territories will increase from 28 to 34; Level-2 territories will increase from 67 to 80.

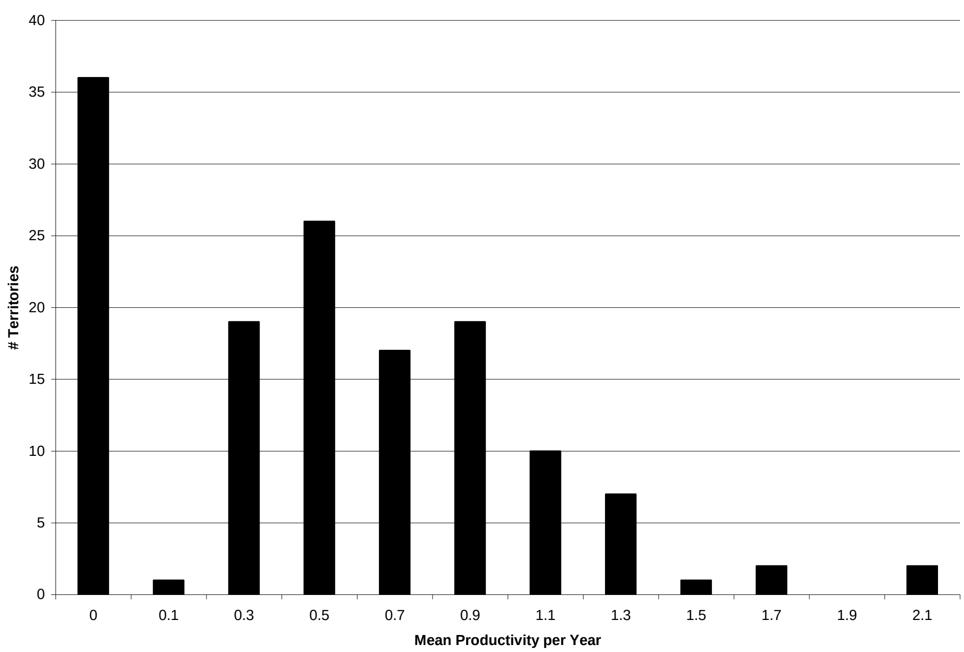


Figure 10-10 Territories with Mean Productivities per Year (1998-2007)

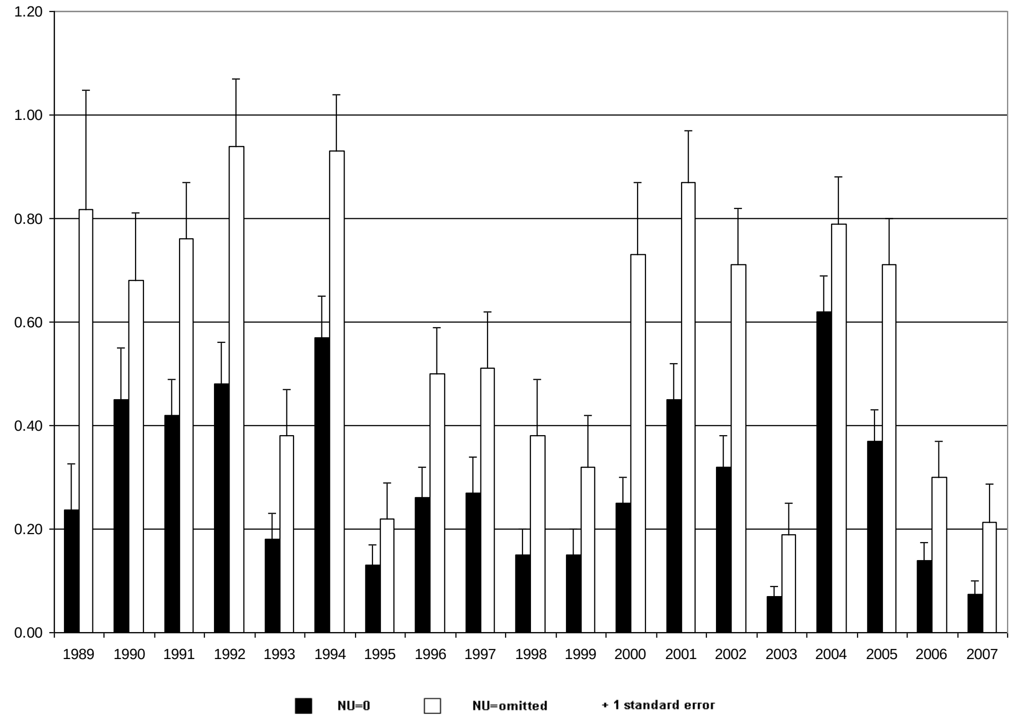


Figure 10-11 Mean Number of Fledglings per Spotted Owl Territory (1989-2007)

10.3.1.4.3 Rationale for population objective contingencies

Our baseline number of spotted owls by productivity level is a snapshot in time and does not necessarily reflect the variability of a typical spotted owl population. Spotted owl reproduction is known to vary widely over time (Franklin et al. 2002) and, even with unchanging habitat conditions, populations may change because of climatic variation (Franklin et al. 2000). In one study site, variation in fecundity was 82% between a mean of 0.2 fledglings per pair per year in bad years and 1.1 fledglings per pair per year in good years (Franklin et al. 2010).

Our productivity has varied from a low of 0.19 fledglings per territory per year to a high of 0.94 fledglings per territory per year. To assess the level of variation in owl productivity on MRC timberland, we compared productivity rates by year. Using 1998 as a starting year for assessing the number of Level-1 territories on covered lands (Table 10-12), the variation in the fewest number of Level-1s (26 in 1998 and 1999) and the mean number of Level-1s (29.9) is approximately 13% (29.9-26 = 3.9, 3.9/29.9= 0.1304). Though our fledgling productivity per territory per year also varies from the mean (0.58 fledglings per territory per year) by greater than 20%, we decided in consultation with the wildlife agencies that a 20% decline was a more appropriate cut-off than the range of variability in number of Level-1s represented by our data, i.e., 13%.

Given recent fluctuations in spotted owl productivity across the north coast of California, we believe the natural variability is greater than 13% in mean productivity. In order to allow for inherent variability in this population, we added a requirement that the number of Level-1 territories or Level-2 territories be less than 20% of the baseline during 2 consecutive years. This will restrict the likelihood that contingencies occur due to a single poor reproductive year.

Table 10-12 shows the number of Level-1 territories on all MRC land (including non-covered lands) from 1998-2007; we use the last 10 years of data to calculate running averages every year.

Table 10-12 Running Average of Level-1 Territories

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean	Standard Error
Level-1 Territories	26	26	33	33	29	29	28	33	33	29	29.70	0.96

10.3.1.4.4 Rationale for habitat objectives

In defining the habitat objectives, we projected an increase in nesting/roosting habitat throughout the term of the plan. Research (Franklin et al. 2000) indicates that owls with a mix of suitable and unsuitable habitat within their territories have greater fitness than those with a solid block of suitable or unsuitable habitat. For our 2007 baseline, MRC documented 95 productive owls in our plan area. Approximately 21% of our plan area (or potential habitat) is nesting/roosting habitat. Increasing our population of productive owls by 20% would mean there will be 114 owls in our plan area by Year 2075. To proportionally support 114 owls, we will need 25% of our forest land in nesting/roosting habitat (95:114::21:x, where x=25). Our objective within the first 40 years of our HCP/NCCP is that 23% of potential habitat will be nesting/roosting habitat and that spotted owls will re-distribute more evenly across the plan area. After 75 years, the objective is that 25% of potential habitat will be nesting/roosting habitat and that the number of owls will increase to 114. Moreover, MRC landscape models predict that, throughout the term of our HCP/NCCP, suitable habitat on covered lands will not drop below 60% and, therefore, MRC will comply with the 50-11-40 recommendation (see section 10.3.1.1.5).

10.3.1.4.5 Rationale for distribution objective contingency

In order to increase the number of productive owls and re-distribute the owl population more equally across the plan area, MRC will grow nesting/roosting habitat in inventory blocks where nesting/roosting habitat is deficient. After 40 years, 23% of the potential habitat in the plan area will be in nesting/roosting habitat; inventory blocks initially deficient in nesting/roosting habitat will show an increase in nesting/roosting acreage. By the end of our HCP/NCCP term, 25% of all inventory blocks will be nesting/roosting habitat. While MRC anticipates that owls will re-distribute more evenly across covered lands with the growth of new nesting/roosting habitat, we cannot guarantee that they will. The distribution objective contingency allows for MRC to stay out of contingency measures if an inventory block is maintaining the number of productive owls it started with and has grown the projected habitat (trending towards 25% habitat at the end of the term). Table 10-10 show actual, potential, and projected nesting/roosting habitat acres for each inventory block.

10.3.1.4.6 Rationale for limitations on non-emergency stopping

MRC recognizes that individual spotted owls may become habituated to humans as a result of monitoring techniques, i.e., walk-in monitors using live mice to assess nesting status. Often, field staff report spotted owls following them back to their trucks at the end of a status check, or showing up by the roadside immediately after they leave the truck. Unfortunately, there are currently no alternatives to mousing that allow for assessment of spotted owl occupancy, nesting status, and productivity status. We believe the best way to reduce owl habituation to humans is to limit parking near nest sites during logging operations. To accomplish this, we will allow logging vehicles to stop only for safety reasons when within 1000 ft (305 m) of a nest site known to be currently active, unless the vehicle is on a mainline road.

10.3.1.4.7 Validation of habitat typing

MRC validated nesting/roosting criteria using on-the-ground data collection from 2005. Appendix K (section K.3.2, *MRC methods for nest site evaluation*) has a description of the nest site study. We assumed that owl nests would only be found in nesting/roosting habitat. The data included tree type, size class, and canopy cover. MRC correlated data collected at each nest site to a structure class and habitat type in our landscape model. After categorizing the nest sites into habitat types (Table 10-13), we found that 61% of nest sites were identified as nesting habitat. We generally categorized the other nest sites as foraging habitat, and classified 7 sites as non-suitable. This analysis did not evaluate productivity relationships with structure class or nest site selection per se. However, since we classified the majority of our sites, we are confident that our nesting/roosting definitions include the most important factors for nesting/roosting habitat.

Table 10-13 Habitat Typing of NSO Nest Sites Surveyed in the Plan Area

Habitat Typing of NSO Nest Sites Surveyed in the Plan Area		
2005 Totals		
Structure Class	**# of Nest Sites**	**Assigned NSO Habitat**
24	15	Nesting/Roosting
23	18	Nesting/Roosting
22	20	Nesting/Roosting
21	9	Foraging
20	2	Nesting/Roosting
18	1	Foraging
17	1	Foraging
10	15	Foraging
6	2	Foraging
5	6	Non-suitable
1	1	Non-suitable

TABLE NOTE
Nest Sites (n=90)

10.3.2 Marbled murrelet

10.3.2.1 Overview

MRC conservation measures for marbled murrelets provide (1) buffers for existing timber stands in the Lower Alder Creek planning watershed that are known to have murrelet activity; (2) management alternatives specifically geared to develop and accelerate new habitat in this same area; and (3) stands outside of the Lower Alder Creek drainage with special restrictions to promote growth of murrelet habitat at an accelerated pace. Currently, Lower Alder Creek is the only location in the plan area where murrelet behavior suggests that murrelets actually occupy the area rather than just travel through it. Occupancy is important since Mendocino County has largely been a *distribution gap* for murrelet populations along the California coast.

Lower Alder Creek is a high gradient stream surrounded by steep rocky slopes with many windswept and deformed trees. Portions of Lower Alder Creek contain patches of old-growth redwood and Douglas fir that serve as habitat for marbled murrelets. Many of the mature second-growth conifers, particularly Douglas fir, are deformed from disease and storm damage; in this condition, they may contain nesting platforms suitable for marbled murrelets. Much of the potential habitat in Lower Alder Creek is atypical compared to what is commonly described as murrelet nesting habitat elsewhere in the murrelet's range (e.g., moss covered, decadent old growth trees). Unique growing conditions, rugged topography, relatively short distance to the coast, and logging limited in some areas by difficult terrain have allowed a murrelet population to persist in Lower Alder Creek over the years. Previous landowners harvested much of the old growth from Lower Alder Creek in the 1920s and 1950s; the remnant patches of old growth are typically where murrelet core areas occur. Additionally, because few murrelets have been detected outside of Lower Alder Creek in Mendocino County, this location may be one of the last remaining refuges here for the marbled murrelet.

Outside the Lower Alder Creek area, MRC has proposed protocols for murrelet surveys, as well as protections in lieu of surveys. If MRC decides not to survey an area with potential habitat trees, we must follow protection measures. In addition, MRC will not harvest any tree that has a high likelihood of being a potential habitat tree for murrelets. This is a major concession for a private landowner. In effect, we are protecting more trees than necessary.

Our HCP/NCCP will contribute to the conservation efforts for marbled murrelets in California. The core of our plan protects the existing murrelet population in the Lower Alder Creek watershed. Barring unforeseen circumstances, our protections will maintain this population and give it the opportunity to increase even more as surrounding areas produce potential murrelet habitat and nest trees. MRC will offer the wildlife agencies the chance to purchase some of these forested stands. In discussions with the wildlife agencies, we have designated 6 potential areas. Additionally, MRC will retain all trees that have a high potential to become murrelet nest trees even if our surveys indicate that a tree or stand is currently not occupied by murrelets. We believe these measures, in addition to other measures relevant to AMZ protections and high retention areas, will have a positive impact on murrelet survival in the plan area.

10.3.2.1.1 Murrelet management areas

MRC has designated the area in Lower Alder Creek where the primary effort for murrelet conservation will focus as the Lower Alder Creek Management Area (LACMA). Within LACMA are 3 regions, each with different conservation measures. Appendix L, Figure L-1 provides a map of these regions, while Figure 10-12 is a very simplified depiction. MAPS 7A-D in the *HCP/NCCP Atlas* show known occurrences of marbled murrelets in the plan area.

A. Lower Alder Creek Core Area (LACCA)—167 ac

This includes all areas within Lower Alder Creek that MRC identifies as occupied or presumed occupied by murrelets or that have Type I and Type II old-growth stands. Though we currently know of only 4 such stands, others may become part of LACCA in the future. We determined all core areas by the stand boundaries of the occupied trees. Going forward with our HCP/NCCP, we will continue to determine core areas by locating occupied trees, assigning them to a stand, and delimiting the boundaries of that stand.

Protections

MRC intends to protect existing habitat in LACCA.

B. Lower Alder Creek Habitat Area (LACHA)—471 ac

This is the area between and around occupied stands (core areas) in Lower Alder Creek. MRC believes this area has the best potential to become occupied in the future and, therefore, we are accelerating the growth of new murrelet habitat at these locations through silvicultural treatments. Additional habitat is important because murrelet decline may be due to a decline in nesting habitat

(Cooperider et al. 2000). If LACHA becomes completely occupied habitat, we will merge its designated core areas into 1 core area.

Protections
MRC intends to protect existing habitat elements in these areas and connect the "islands" of murrelet habitat through management to accelerate habitat growth.

C. Lower Alder Creek Buffer Area (LACBA)—599 ac
This area provides extra protection for LACMA from wildfires, wind throw, increased predation, and rising temperatures—all likely edge effects. The minimum width of the LACHA buffer is 300 ft.

DEFINITION	**Edge effects** are changes in ecological communities and factors at the boundaries of habitat

Protections
MRC intends to manage this area so that it can absorb surrounding impacts, such as timber harvest, and leave the interior habitat for murrelets undisturbed.

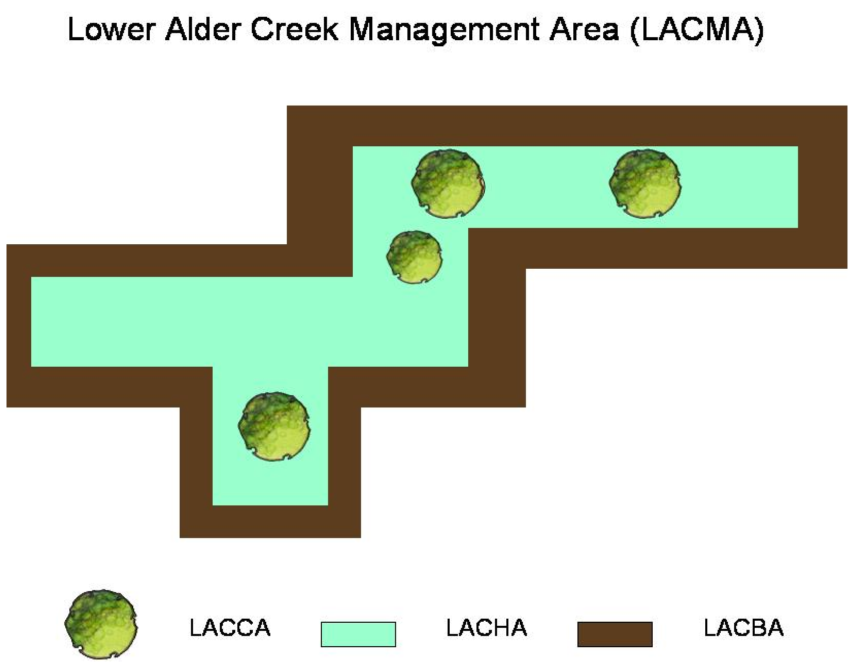


Figure 10-12 Murrelet Areas in Lower Alder Creek

10.3.2.1.2 Survey efforts

LACMA

In order to distinguish between occupied and unoccupied areas in the habitat area or buffers, MRC will survey according to the accepted protocol at the time, including any amendments by USFWS or CDFG. Within LACMA, there are 2 enhancements to the current protocol:

1. MRC will create survey stations that cover 10 ac rather than the 30 ac recommended by

the Pacific Seabird Group (PSG).[21]

2. MRC will survey for murrelet occupancy in all proposed PTHPs or other projects; surveys that indicate non-occupancy will be applicable for 2 years.

Areas outside LACMA

Section 10.3.2.3.3, explains how MRC actually locates potential murrelet habitat in areas outside LACMA. In the event potential murrelet habitat is, in fact, located, a forester can then decide whether to survey for murrelets.

- If a forester decides not to survey for murrelets in a PTHP or other project area outside LACMA, the pre-determined protections for the area must apply.
- If a forester decides to survey for murrelets, MRC must complete surveys according to the accepted protocol at the time, including any amendments by USFWS or CDFG. Surveys outside of LACMA that indicate *probable non-occupancy* will be applicable for a period of 15 years.

Radar monitoring plan

MRC will conduct radar surveys in Lower Alder Creek to determine trends in annual murrelet activity in that drainage (M§13.9.2.1-1). In addition, we will conduct 2 surveys every year on the Albion River, the Navarro River, and Greenwood Creek (M§13.9.2.1-2). For other watercourses that have a high likelihood of murrelet activity, we will survey on a rotating basis (M§13.9.2.2-3). This rotation will include annual surveys of 2 watercourses; in total, MRC will survey 10 watercourses over the course of 5 years. Although MRC will decide the rotation slots for the watercourses, we must, by agreement with the wildlife agencies, complete the rotating surveys in order to get the benefits of distinguishing primary murrelet trees from secondary murrelet trees, along with the separate protections that each will receive (see sections 10.3.2.3.5 and 10.3.2.3.6).

10.3.2.2 Biological goals and objectives

Goals and Objectives for Marbled Murrelets	
Goals	
G§10.3.2.2-1	Protect the murrelet population and its habitat in Lower Alder Creek.
G§10.3.2.2-2	Protect and increase potential murrelet habitat across the plan area.
Objectives	
O§10.3.2.2-1	Retain permanently all trees defined as primary murrelet habitat trees.
O§10.3.2.2-2	Retain permanently all sites occupied[22] by marbled murrelets.
O§10.3.2.2-3	Maintain murrelet presence in the Navarro River watershed and in drainages in which, in the future, MRC biologists detect murrelets.

[21] Survey stations of 10 ac result in a more intensive survey. To cover the recommended 30 ac requires, in effect, 3 surveys and increases the likelihood of detection if murrelets are actually in the area.

[22] According to the latest version of the marbled murrelet protocol, an occupied site is one in which "murrelets have been observed exhibiting sub-canopy behaviors, which are behaviors that occur at or below forest canopy and that strongly indicate that the site has some importance for breeding" (Mack et al. 2003, 3).

Goals and Objectives for Marbled Murrelets	
O§10.3.2.2-4	Provide opportunities for the wildlife agencies to analyze or purchase conservation easements in 6 MRC areas compatible for development of murrelet habitat and for murrelet colonization.
O§10.3.2.2-5	Maintain a stable or increasing (i.e. non-declining) number of murrelet radar detections at LACMA.

10.3.2.3 Conservation measures

The conservation measures for murrelets cover 3 distinct areas, which receive different levels of protection based on the likelihood of murrelet use.

1. LACMA
   Since murrelets continually use LACMA, MRC has a separate management policy for this area, which safeguards and benefits the existing murrelet population, as well as accelerating habitat growth.

2. Murrelet Habitat Recruitment Stands (MHRS)
   Even though LACMA is the primary location for marbled murrelets in the plan area, MRC recognizes the need to prepare for a potential catastrophe in LACMA, such as a fire or severe windstorm, which would severely damage murrelet habitat. Such preparation includes designating other potential sites encompassing potential habitat for murrelet dispersal and occupation. MRC has mapped 6 murrelet habitat areas (22 stands) because of their old-growth characteristics (O§10.3.2.2-4). These 6 areas, designated Murrelet Habitat Recruitment Stands (MHRS), are in 5 separate inventory blocks—6 stands in Big River; 6 in South Coast; 4 in Rockport; and 3 each in the Navarro West and Albion inventory blocks (see *HCP/NCCP Atlas*, MAPS 6A-C). These areas will provide habitat for potential murrelet re-colonization.

   The wildlife agencies may purchase these areas once they issue a permit to MRC. MRC will notify the wildlife agencies at least 2 years before harvesting any of these stands to allow the agencies an opportunity to analyze the value of the stands and decide whether to purchase them in order to accelerate murrelet habitat. MRC will not harvest in these stands for at least 20 years from HCP/NCCP commencement. MRC may, with the agreement of the wildlife agencies, designate different stands in the future that are dispersed across our timberland. We have focused our initial efforts on locating stands close to the coast to provide a better likelihood of murrelet occupation. The process for selecting future stands is (a) to select a stand that is either Type I or Type II old growth and (b) give priority to stands most likely to provide murrelet habitat (Table 10-15).

3. Murrelet Habitat Zones (MHZ)
   In addition to LACMA and MHRS, MRC has designated 3 Murrelet Habitat Zones (*HCP/NCCP Atlas*, MAPS 6A-C); each zone receives protection based on the likelihood that murrelets will use or occupy these areas (*HCP/NCCP Atlas*, MAPS 7A-D.)

   A. Zone 1
   This is (1) the area north of Juan Creek in the Rockport inventory block; (2) any location in the plan area that is within 5 miles (8.0 km) of the coast; (3) any

area within the Lower Alder Creek planning watershed that is within 5-10 miles of the coast and on the bottom 1/3 of a hillslope (as measured from Class I or large Class II watercourses).

B. Zone 2

This is any location in the plan area (excluding those in Zone 1) that is 5-10 mi (8-16 km) from the coast and at the bottom 1/3 of a hillslope (as measured from Class I or large Class II watercourses).

C. Zone 3

This is (1) any location in the plan area that is >10 mi (16 km) from the coast or (2) any area that is 5-10 mi (8-16 km) from the coast and at the upper 2/3 of a hillslope (as measured from Class I and large Class II watercourses).

Occupied habitat in these areas will receive the same protection as current USFWS and CDFG standards. During the breeding season, USFWS and CDFG standards include a ¼ mile disturbance buffer around occupied stands. Outside the breeding season, the standards mandate a 300 ft no-harvest buffer around occupied stands.

Other areas will receive high, moderate, or limited protection based on the likelihood that murrelets are present. MRC may assume murrelet presence or survey to determine murrelet status. If we choose not to survey, we will extend more protection to an area than it would have received had we surveyed and determined it to be unoccupied. There is, of course, a small chance that an un-surveyed area may actually contain an occupied stand and, therefore, will receive less protection than it would have if the area had been surveyed and the occupied stand uncovered. However, MRC believes that the probability of encountering murrelets in these un-surveyed areas is extremely low and the protections are adequate based on that low probability.

In addition, the conservation measures focus on 3 time-frames: general, breeding season, and non-breeding season. Table 10-14 defines these timeframes.

Table 10-14 Timeframes for Marbled Murrelet Conservation Measures

General	Breeding Season	Non-breeding Season
LACMA, Occupied Marbled Murrelet Areas, and MHRS		
Apply at all times of the year	Apply February 15-September 15	Apply outside the breeding season
All Other Covered Lands		
Apply March 15 – September 15		

10.3.2.3.1 LACMA

Lower Alder Creek Core Areas (LACCA)

	Conservation Measures for LACCA
General	
C§10.3.2.3.1-1	Prohibit forest management operations, including timber harvest and road-building.
C§10.3.2.3.1-2	Prohibit public entry into a core area, e.g., for firewood cutting or recreation.

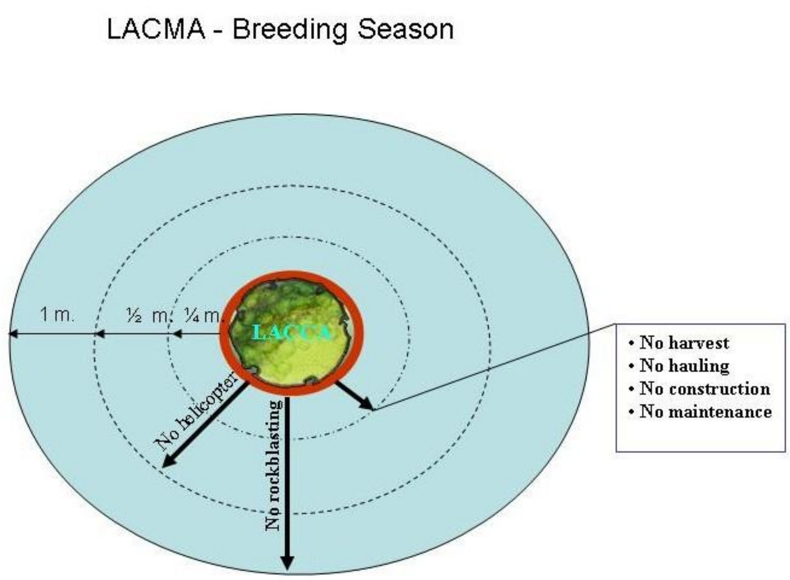


Figure 10-13 General LACMA Protections for Breeding Season

Lower Alder Creek Habitat Areas (LACHA)

	Conservation Measures for LACHA
General	
C§10.3.2.3.1-3	Conduct timber management only to create and enhance habitat for marbled murrelets.
C§10.3.2.3.1-4	Obtain approval of the wildlife agencies before submitting a PTHP for any proposed forest management in LACMA.
C§10.3.2.3.1-5	Obtain approval of the wildlife agencies before altering vegetation or maintaining roads.
C§10.3.2.3.1-6	Provide the wildlife agencies with a map of the entire project area before initiating any activity.
C§10.3.2.3.1-7	Permit fire control lines for prescribed burning within LACHA only with approval of the wildlife agencies.

	Conservation Measures for LACHA
C§10.3.2.3.1-8	Treat logging debris—between September 15th and March 24th in the 1st year following any harvest conducted in LACHA—with means approved by the wildlife agencies, such as: • Lopping slash so that a minimal amount remains as ladder fuels. • Removing felled trees < 24 in. dbh to a landing. • Cutting the top 50 ft off any felled tree > 24 in. dbh and removing this 50-ft segment to a landing. • Bucking and limbing, in the forest, any segments of tree stems remaining on the ground. • Lopping any residual slash, after the above operations have been completed, that is more than 30 in. high.
Breeding Season	
C§10.3.2.3.1-9	Conduct timber operations only if (a) an MRC survey shows that murrelets are not occupying any area within a ¼ mile of a proposed project; (b) the operations are at least a ¼ mile beyond a core area periphery; (c) the operations are at least 100 ft (23 m) away from potential habitat trees; and (d) the operations occur within the time period of 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-10	Permit vehicular traffic within ¼ mile of a core area periphery or within 100 ft of potential murrelet habitat trees for (a) maintenance and hauling on mainline routes; (b) vehicles on existing seasonal or permanent roads which are 1 ton or less; or (c) all terrain vehicles (ATVs) on existing roads.
C§10.3.2.3.1-11	Permit prescribed burning within ¼ mile of LACHA only with approval of the wildlife agencies.
C§10.3.2.3.1-12	Permit helicopter operations if they are at least ½ mile from a core area periphery and an MRC survey shows that murrelets are not occupying any area within a ½ mile of the helicopter operations.
C§10.3.2.3.1-13	Conduct blasting only if (a) it is at least 1 mi (1.6 km) from a core area periphery; (b) it is within the time period of 2 hours after sunrise to 2 hours before sunset; and (c) an MRC survey shows that murrelets are not occupying any area within 1 mile of the blasting.
C§10.3.2.3.1-14	Conduct all road maintenance as well as rock and log hauling from 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-15	Prohibit public entry, e.g., for firewood cutting or recreation.
Non-breeding Season	
C§10.3.2.3.1-16	Permit vehicular traffic within 300 ft (91 m) of a core area periphery or within 100 ft (23 m) of potential murrelet habitat trees for (a) maintenance and hauling on mainline routes; (b) vehicles on existing seasonal or permanent roads which are 1 ton or less; or (c) all terrain vehicles (ATVs) on existing roads.
C§10.3.2.3.1-17	Conduct timber operations only if (a) an MRC survey shows that murrelets are not occupying any area within 300 ft (91 m) of a proposed project; (b) the project is at least 300 ft beyond a core area periphery; (c) the operations are 100 ft (23 m) away from potential habitat trees; and (d) the operations are within the time period of 2 hours after sunrise to 2 hours before sunset.

	Conservation Measures for LACHA
C§10.3.2.3.1-18	Create a required cable corridor only if (a) an MRC survey shows that murrelets are not occupying any area within 300 ft (91 m) of the cable corridor; (b) trees are felled away from potential habitat; and (c) operations are within the time period of 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-19	Permit helicopter operations if they are at least 500 ft from a core area periphery and an MRC survey shows that murrelets are not occupying any area within 500 ft of the operations.
C§10.3.2.3.1-20	Conduct all maintenance and hauling (a) at least 300 ft (92 m) from a core area periphery and (b) within the time period of 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-21	Maintain a consistent “viewshed” for radar monitoring sites.

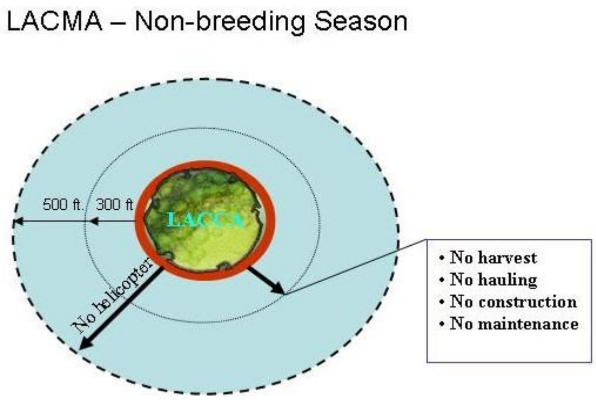


Figure 10-14 General LACMA Protections for Non-breeding Season

Lower Alder Creek Buffer Areas (LACBA)

	Conservation Measures for LACBA
General	
C§10.3.2.3.1-22	Conduct timber management only to provide buffering and protection for LACCA and LACHA.
C§10.3.2.3.1-23	Obtain approval of the wildlife agencies before submitting a PTHP for any proposed forest management in LACMA.
C§10.3.2.3.1-24	Permit fire control lines for prescribed burning within LACBA only with approval of the wildlife agencies.
C§10.3.2.3.1-25	Obtain approval of the wildlife agencies before altering vegetation or maintaining, constructing, or reconstructing roads.
C§10.3.2.3.1-26	Provide the wildlife agencies with a map of the entire project area before initiating any activity.

	Conservation Measures for LACBA
C§10.3.2.3.1-27	Treat logging debris—between September 15^{th} and March 24^{th} in the 1^{st} year following any harvest conducted in LACHA—with means approved by the wildlife agencies, such as: ▪ Removing felled trees < 24 in. dbh to a landing. ▪ Cutting the top 50 ft off any felled tree > 24 in. dbh and removing this 50-ft segment to a landing. ▪ Bucking and limbing, in the forest, any segments of tree stems remaining on the ground. ▪ Lopping any residual slash, after the above operations have been completed, that is more than 30 in. high.
C§10.3.2.3.1-28	Prohibit public entry, e.g., for firewood or recreation.
Breeding Season	
C§10.3.2.3.1-29	Conduct timber operations only if an MRC survey shows that murrelets are not occupying any area within a ¼ mile of a proposed project and the operations are (a) at least a ¼ mile beyond a core area periphery; (b) at least 100 ft (23 m) away from potential habitat trees; and (c) within the time period of 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-30	Permit vehicular traffic within ¼ mile of a core area periphery or within 100 ft of potential murrelet habitat trees for (a) maintenance and hauling on mainline routes; (b) vehicles on existing seasonal or permanent roads which are 1 ton or less; or (c) all terrain vehicles (ATVs) on existing roads.
C§10.3.2.3.1-31	Permit helicopter operations if they are at least ½ mile from a core area periphery and an MRC survey shows that murrelets are not occupying any area within a ½ mile of the helicopter operations.
C§10.3.2.3.1-32	Conduct blasting only if (a) it is at least 1 mi (1.6 km) from a core area periphery; (b) it is within the time period of 2 hours after sunrise to 2 hours before sunset; and (c) an MRC survey shows that murrelets are not occupying any area within 1 mile of the blasting.
C§10.3.2.3.1-33	Permit prescribed burning within ¼ mile of LACBA only with approval of the wildlife agencies.
C§10.3.2.3.1-34	Conduct all maintenance and hauling from 2 hours after sunrise to 2 hours before sunset.
Non-breeding Season	
C§10.3.2.3.1-35	Harvest to create a required cable corridor only if (a) an MRC survey shows that murrelets are not occupying any area within 300 ft of the cable corridor; (b) trees are felled away from potential habitat; and (c) operations are within the time period of 2 hours after sunrise to 2 hours before sunset.
C§10.3.2.3.1-36	Conduct timber operations only if (a) an MRC survey shows that murrelets are not occupying any area within 300 ft of a proposed project; (b) the project operations are at least 300 ft beyond a core area periphery; (c) the operations are at least 100 ft (23 m) away from potential habitat trees; and (d) the operations are within the time period of 2 hours after sunrise to 2 hours before sunset, unless harvest is required for a cable corridor and (i) trees are felled away from potential habitat, and (ii) operations are within the time period of 2 hours after sunrise to 2 hours before sunset.

	Conservation Measures for LACBA
C§10.3.2.3.1-37	Permit vehicular traffic within 300 ft (91 m) of a core area periphery or within 100 ft (23 m) of potential murrelet habitat trees for (a) maintenance and hauling on mainline routes; (b) vehicles on existing seasonal or permanent roads which are 1 ton or less; or (c) all terrain vehicles (ATVs) on existing roads.
C§10.3.2.3.1-38	Permit helicopter operations if they are at least 500 ft from a core area periphery and an MRC survey shows that murrelets are not occupying any area within 500 ft of the helicopter operations.
C§10.3.2.5.1-39	Conduct all maintenance and hauling only within the period from 2 hours after sunrise to 2 hours before sunset.

10.3.2.3.2 Murrelet habitat recruitment stands (MHRS)

	Conservation Measures for Murrelet Habitat Recruitment Stands (MHRS)
C§10.3.2.3.2-1	Identify and prioritize MHRS with the wildlife agencies within 2 years of HCP/NCCP approval.
C§10.3.2.3.2-2	Provide at least 2-years notice to the wildlife agencies prior to submitting a PTHP containing or adjacent to an MHRS in order to allow the wildlife agencies to analyze the MHRS and possibly purchase it at a mutually agreed upon price prior to approval of the PTHP. **NOTE** MRC may at any time identify potential murrelet habitat as a conservation easement and provide the wildlife agencies the opportunity to purchase it. If the wildlife agencies decide to purchase any potential or designated habitat, they may apply silviculture based on stand conditions and on habitat enhancement for murrelets.
C§10.3.2.3.2-3	Prohibit harvest in MHRS during the first 20 years of HCP/NCCP implementation.

Table 10-15 shows sample criteria, provided by CDFG, for prioritizing MHRS which the wildlife agencies may want to purchase during the term of our HCP/NCCP. The ranking parameter is based on acres, adjusted by a multiplier or factor. This factor reflects our preliminary assessment about the potential of such stands to grow into murrelet habitat. The wildlife agencies will evaluate actual stands as funds become available.

Table 10-15 Criteria for Prioritizing MHRS

Criteria for Prioritizing MHRS				
Scale	**Variable**	**Ranking Parameter**	**Factor**	**Rationale or Assumption**
Internal characteristics of stand				
	Availability of nest structure			
		>5 trees per acre with >5 possible permanent nest	1.4	More nest sites, more nest trees, greater value

Criteria for Prioritizing MHRS				
Scale	**Variable**	**Ranking Parameter**	**Factor**	**Rationale or Assumption**
		platforms		
		>2 trees per acre with >5 possible permanent nest platforms	1.2	Value declines as nest sites and trees decline
		>5 trees per acre with >2 but <5 possible permanent nest platforms	1.3	Value declines as nest sites and trees decline
		>2 trees per acre with >2 but <5 possible permanent nest platforms	1.1	Value declines as nest sites and trees decline
	Level of nest tree canopy			
		<10% of the canopy of potential nest trees rise above the general stand canopy	1.2	Canopy protects nests from predators and climate by reducing its exposure
		<33% of the canopy of potential nest trees rise above the general stand canopy	1	Some exposure but still substantial screening from the stand canopy
		>50% of the canopy of potential nest trees rise above the general stand canopy	0.8	Exposure reduces value
	Needs and constraints of existing stand management			
		Stand value high; no need for active management	1.4	Stand appears to already provide good nesting habitat
		High potential for constructive active management	1.3	Number of releasable trees is high; easy access for operations and little likelihood of damage
		Low potential for constructive active management	1	Number of releasable trees is low; more possibility for damage from logging.
Characteristics of stand location				
		Stand enhanced by being adjacent to reserve	1.3	• Stand size is an important descriptor of

Criteria for Prioritizing MHRS				
Scale	**Variable**	**Ranking Parameter**	**Factor**	**Rationale or Assumption**
				habitat occupancy. • Location adjacent to parks or consistent easements functionally increases the stand size.
		Stand enhanced by being adjacent to AMZ	1.2	• AMZ can act as a buffer to designated stands • Stands in a "V" confluence have essentially a double-wide AMZ on 2 sides
		Stand enhanced by being adjacent to mature stands	1.1	Locations adjacent to mature stands, which are managed to remain mature stands, can enhance the functional size of the designated stand.
		Management in adjacent stand unlikely to enhance value of murrelet habitat	1	Size of the designated stand is not enhanced by adjacent conditions.
		Management in adjacent stand inimical to murrelet use	0.5	Management in adjacent stand reduces the value of the potential habitat for murrelets, e.g., no enhancement of stand, attraction for predators, etc.
Characteristics of stand landscape				
	Zone (accounts for distance to ocean, slope position)		1.3	
		Stand located in Zone 1	1.3	Table 10-16
		Stand located in Zone 2	1.0	Table 10-16
		Stand located in Zone 3	0.7	Table 10-16
	Colonizable			Enhances metapopulation functions and spreads risks

Criteria for Prioritizing MHRS				
Scale	**Variable**	**Ranking Parameter**	**Factor**	**Rationale or Assumption**
		Stand located adjacent to occupied watersheds (but not in Alder Creek)	1.3	• Colonization (or undetected use) more likely due to proximity of murrelets • Spreads out risks (e.g., wildfire, disease, etc.)
		Stand located in or adjacent to watersheds with lands managed for murrelets or lands already meeting murrelet habitat definitions (e.g., old-growth park)	1.1	"Managed for murrelets" means active management.
		Stand located in or adjacent to watersheds with lands consistent with murrelets	1.0	"Consistent with murrelets" means passive management of mature second-growth forests (e.g., some of the parks)
		Stand not located near known occupied watersheds or watersheds with lands managed for murrelets or consistent with murrelets	0.8	Less likely to be colonized due to distance

10.3.2.3.3 Assessment for potential murrelet habitat in MHZs

MRC will assess potential murrelet habitat within and near a PTHP boundary based on (a) the zone within which the PTHP is located (Table 10-16); (b) the yarding method (e.g., helicopter yarding requires a larger area); and (c) the blasting requirements. The assessment area for murrelets will be the entire area within 800 ft (244 m) of the harvest boundary of a PTHP in Zone 1 and 400 ft (122 m) of the harvest boundary of a PTHP in Zones 2 and 3 (see Figure 10-15). In addition, MRC will assess potential murrelet habitat ½ mile from any helicopter yarding unit and 1 mile from any blasting area. We will use aerial photos and other available information to assess any areas outside the activity boundary; these assessments will include field visits to evaluate suspect areas. We will survey for murrelet trees and, depending on their location, assign a protection level or conduct further surveys. Protections will depend on the number and proximity of murrelet habitat trees.

10.3.2.3.4 Determination of potential murrelet habitat trees

MRC will designate conifer trees with these specifications as potential murrelet nest trees:

Size (dbh) Diameter must equal or exceed
- 48 in (122 cm) for redwood.
- 36 in (91 cm) for Douglas-fir.

- 36 in (91 cm) for grand fir.
- 36 in (91 cm) for Sitka spruce.
- 30 in (76 cm) for western hemlock.
- 30 in (76 cm) for all other conifers.

Habitat elements At least 1 platform that is

- Capable of retaining an egg, such as a broken top, an elevated burl, a debris accumulation, or a branch that is more than 6 in. (10 cm) in diameter and nearly horizontal (i.e., + or − 45^0 angle from horizontal).
- Within the canopy of a stand and below the highest treetop within a 300 ft radius.
- Sheltered directly above by at least 50% canopy cover.

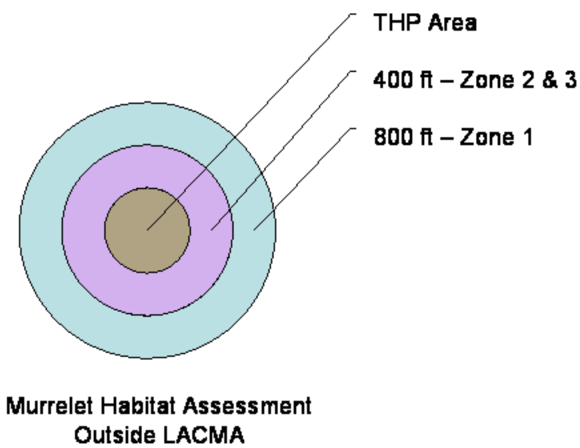


Figure 10-15 Murrelet Habitat Assessment for the MHZs

10.3.2.3.5 Primary murrelet trees

Primary murrelet trees exhibit the characteristics listed in section 10.3.2.3.4; in addition, they have at least 1 platform which is 9 in. or more in diameter.

10.3.2.3.6 Secondary murrelet trees

In order to provide a simple and conservative process for assessing potential murrelet trees, MRC established the criteria cited in section 10.3.2.3.4. Strict adherence to these criteria would retain excessive numbers of trees unlikely to harbor murrelet nests. Some potential murrelet trees have only a slight possibility that murrelets will ever use them. Secondary murrelet trees are usually second- growth conifers. As a general rule, MRC will retain all potential murrelet habitat trees. However, MRC may harvest some of these trees with 6-9 in. platforms or, at best, provide them limited protection, as long as we meet the following conditions:

- MRC does not harvest old-growth trees.
- MRC implements the required and optional portions of our radar plan for monitoring watercourses (M§13.9.2.1-2 and M§13.9.2.2-3).
- MRC does not detect murrelets within the watershed or performs a follow-up survey, with approval of the wildlife agencies, to narrow the extent of murrelet activity within the watershed.

If MRC detects 1 or more murrelets during radar monitoring, we will obtain approval of the wildlife agencies on the appropriate course of action. Moreover, we will complete more audio-visual surveys to assess whether we should treat trees with 6-9 in. platforms in an area where we detected murrelets in secondary murrelet trees. There are only 2 watercourses outside of LACMA where there have been credible radar detections of murrelet-type activity and quality murrelet habitat nearby, namely Navarro River and Russell Brook. For this reason, we will treat all potential murrelet trees in the Navarro watershed up to the eastern boundary of the Navarro West inventory block and all trees within the Russell Brook watershed as primary murrelet trees until we meet with the agencies to discuss murrelet activity there. MRC will consult with the wildlife agencies during the audio-visual surveys.

10.3.2.3.7 On-the-ground judgments and training

MRC will use their best on-the-ground assessment to identify potential murrelet trees; however, in some cases, identification may be impossible from the ground. It is difficult to identify platforms in second-growth stands. To ensure consistency in assessment, MRC will hold a training session for forest managers on the characteristics of murrelet trees and on the specifications for primary and secondary murrelet trees. We will invite the wildlife agencies to participate in our training sessions. Refresher courses and training for new forest managers will occur as needed. Our annual report will include a summary of these training sessions, along with the names of individuals attending each session.

If, in implementing this plan, MRC biologists determine that other methods or criteria should be used in assessing murrelet trees, we will obtain the approval of the wildlife agencies on any alternative measures.

10.3.2.3.8 Determination of protection levels with surveys

MRC will only implement occupied, high, or moderate protective measures for the MHZs if surveys indicate murrelets are present but not occupying a timber stand or if we decide not to survey. Based on survey results, MRC will respond in 1 of 3 ways:

1. If a survey does not detect murrelets, MRC will provide limited protection (i.e., retain the tree and all screen trees) to the identified trees.
2. If a survey detects murrelets but they are not occupying a stand, MRC will provide limited protection to the identified trees (i.e., retain the murrelet tree and all screen trees).[23]
3. If a survey detects murrelets and they are occupying a stand, MRC will apply the protection measures for occupied stands (C§10.3.2.3.11-1 through C§10.3.2.3.11-9).

On the other hand, if MRC decides not to survey either for presence or occupancy, we will apply conservation measures C§10.3.2.3.11-1through C§10.3.2.3.11-9 for high protection areas, C§10.3.2.3.12-1 through C§10.3.2.3.12-9 for moderate protection areas, and C§10.3.2.3.13-1 through C§10.3.2.3.13-2 for limited protection areas, as outlined in Table 10-16.

[23] MRC must complete surveys with positive detections according to occupancy protocol or the wildlife agencies will consider the stand occupied.

DEFINITION

High protection areas in MHZs are most likely to have murrelets.
Moderate protection areas in MHZs are somewhat likely to have murrelets.
Limited protection areas in MHZs are least likely to have murrelets.

Table 10-16 Protection Levels for Marbled Murrelet (MAMU) Habitat in the MHZs

MAMU Habitat Type	Zone 1	Zone 2	Zone 3
Type I old-growth stands	High	High	Moderate
Type II old-growth stands	High	Moderate	Moderate
> 4 primary MAMU trees each within 100 ft[a] (30 m) of another MAMU tree	High	Moderate	Moderate
> 2 primary MAMU trees each within 100 ft (30 m) of another MAMU tree	High	Moderate	Limited
2 primary MAMU trees within 100 ft (30 m) of each other	Moderate	Limited	Limited
1 primary MAMU tree or any number of secondary murrelet trees	Limited[b]	Limited	Limited

TABLE NOTES

[a] The 100-ft distance provides a means for assessing the proximity of potential habitat trees. We believe that as the number of trees that are each within 100 ft of another MAMU tree increases, the likelihood of murrelets using the trees increases.

[b] If future research indicates that marbled murrelets are using single trees for nesting in Mendocino County, MRC will provide single murrelet trees in Zone 1 with moderate protection.

10.3.2.3.9 Additional murrelet disturbance measures

In July 2006, USFWS published new guidelines for activities occurring in or near potential murrelet habitat. During murrelet breeding season, the sound level of a proposed activity determined the required disturbance buffer (USFWS, 8-14-2006-2887). USFWS distinguished 5 noise levels: low = < 70 db; moderate = 71-80 db; high = 81-90 db; very high = 91-100 db; extreme = 101-110 db. Using Table 10-17 and Table 10-18, MRC classified each logging operation into decibel levels to determine appropriate disturbance buffers for un-surveyed potential murrelet habitat and occupied murrelet habitat.

Table 10-17 Disturbance Buffers Based on Sound Levels

	Anticipated Sound Level				
	Low (<70)	Moderate (71-80 db)	High (81-90 db)	Very High (91-100)	Extreme (101-110 db)
Disturbance buffer	None	200 ft[24]	500 ft	1320 ft	1320 ft

Table 10-18 Disturbance Buffers for Various Activities[25]

Activity	Decibels	Noise Level	Buffer
Chainsaw	83	High	500 ft
Log truck	77	Moderate	200 ft
Backhoe	84	High	500 ft
Cat skidder	81	High	500 ft
Dump truck	85	High	500 ft
Log Loader	83	High	500 ft
Bulldozer	84	High	500 ft
Rock Drills and Jackhammers	97	Very High	1320 ft
Large tree felling (dominants and co-dominants)	92	Very high	1320 ft
Jake brake on truck	94	Very high	1320 ft
Yarder tower whistles	95	Very high	1320 ft

10.3.2.3.10 Occupied murrelet habitat

	Conservation Measures for Occupied Murrelet Habitat in the Murrelet Habitat Zones (MHZs)
Breeding Season	
C§10.3.2.3.10-1	Limit approaches to at least a distance of 0.25 mi (0.4 km) from identified habitat tree(s) unless it involves (a) maintenance or hauling on mainline haul routes, (b) the use of non-mainline roads if they are farther away from an identified habitat tree than the mainline road, (c) use of a vehicle ≤ 1 ton on existing seasonal or permanent roads; or (d) all terrain vehicles (ATVs) on existing trails.
C§10.3.2.3.10-2	Permit prescribed burning within ¼ mile of occupied murrelet stands only with approval of the wildlife agencies.
C§10.3.2.3.10-3	Permit fire control lines for prescribed burning within occupied murrelet stands only with approval of the wildlife agencies.
C§10.3.2.3.10-4	Permit helicopters at least 0.50 mile (0.8 km) from identified habitat trees.
C§10.3.2.3.10-5	Conduct blasting at least 1 mile (1.6 km) from identified habitat trees.

[24] The original USFWS guidelines recommend a 165-ft disturbance buffer; MRC has increased the buffer to 200 ft at the request of USFWS.

[25] MRC may consult with the wildlife agencies if we have evidence that specific equipment performing a specific job generates less noise then stated here. If the wildlife agencies agree, MRC will establish a disturbance buffer based on the criteria in
Table 10-17.

Conservation Measures for Occupied Murrelet Habitat in the Murrelet Habitat Zones (MHZs)	
C§10.3.2.3.10-6	Conduct all maintenance and hauling within 0.25 miles of identified habitat trees only from 2 hours after sunrise to 2 hours before sunset.
Non-breeding Season	
C§10.3.2.3.10-7	Conduct harvest operations and construction of new roads at least 300 ft (92 m) away from identified habitat trees.
C§10.3.2.3.10-8	Permit helicopters at least 500 ft (152 m) away from identified habitat trees.
C§10.3.2.5.10-9	Conduct all maintenance and hauling within 300 ft (92 m) of identified habitat trees only from 2 hours after sunrise to 2 hours before sunset.

10.3.2.3.11 Murrelet habitat in high protection areas

Conservation Measures for Murrelet Habitat in the Murrelet Habitat Zones (MHZs) High Protection Areas	
Breeding Season	
C§10.3.2.3.11-1	Conduct operations defined in Table 10-18 at their prescribed distance from habitat trees. **NOTE** This constraint does not apply to (a) use or maintenance of mainline roads for log hauling or (b) use of non-mainline roads that are farther from the potential habitat trees than a mainline or public road.
C§10.3.2.3.11-2	Conduct operations not defined in Table 10-18 at least 800 ft (244 m) from habitat trees. **NOTE** This constraint does not apply to (a) use or maintenance of mainline roads for log hauling or (b) use of non-mainline roads that are farther from the potential habitat trees than a mainline or public road.
C§10.3.2.3.11-3	Permit helicopters at least 0.25 mile (0.40 km) away from potential habitat trees.
C§10.3.2.3.11-4	Conduct blasting at least 1 mile (1.6 km) away from potential habitat trees.
Non-breeding Season	
C§10.3.2.3.11-5	Conduct harvests at least 100 ft (30 m) away from potential habitat trees. **NOTE** This constraint does not apply to operations where tree felling is necessary for a cable corridor.
C§10.3.2.3.11-6	Conduct harvests between 100-200 ft (61 m) from habitat trees in accordance with the following silvicultural prescriptions or obtain approval of the wildlife agencies for alternative prescriptions more suitable for a specific stand.

Buffer	Buffer Silvicultural Prescription
100-200 ft (30-60 m)	• ≥ 175 ft^2 post-management • 70% post-management canopy closure • No harvesting of existing old-growth or potential murrelet trees

Conservation Measures for Murrelet Habitat in the Murrelet Habitat Zones (MHZs) High Protection Areas	
C§10.3.2.3.11-7	Permit helicopters that are at least 300 ft (92 m) away from habitat trees or known Type I or Type II old-growth stands unless they have been surveyed according to currently accepted protocols without murrelet detections.
C§10.3.2.3.11-8	Retain all primary murrelet trees and screen trees.
C§10.3.2.3.11-9	Permit harvest of secondary murrelet trees if a ground survey determines that it is unlikely murrelets are occupying the surrounding area. **NOTE** MRC will not harvest old-growth trees under this provision.

10.3.2.3.12 Murrelet habitat in moderate protection areas

Conservation Measures for Murrelet Habitat in the Murrelet Habitat Zones (MHZs) Moderate Protection Areas	
Breeding Season	
C§10.3.2.3.12-1	Conduct operations defined in Table 10-18 at their prescribed distance from habitat trees. **NOTE** This constraint does not apply to (a) use or maintenance of mainline roads for log hauling or (b) use of non-mainline roads that are farther from the potential habitat trees than a mainline or public road.
C§10.3.2.3.12-2	Conduct operations not defined in Table 10-18 at least 400 ft (153 m) from habitat trees. **NOTE** This constraint does not apply to (a) use or maintenance of mainline roads for log hauling or (b) use of non-mainline roads that are farther from the potential habitat trees than a mainline or public road.
C§10.3.2.3.12-3	Permit helicopters at least 0.25 mile (0.40 km) away from potential habitat trees.
C§10.3.2.3.12-4	Conduct blasting at least 1 mile (1.6 km) away from habitat trees by line of sight and at least 0.5 miles (0.80 km) away by map distance.
Non-breeding Season	
C§10.3.2.3.12-5	Conduct harvests at least 75 ft (23 m) away from habitat trees unless tree felling is necessary for a cable corridor **NOTE** This constraint does not apply to operations where tree felling is necessary for a cable corridor. In these cases, MRC will leave all felled trees on the ground and will fell trees away from potential habitat trees. Additionally, MRC will make every reasonable effort to avoid felling trees within 50 ft (15 m) of potential habitat trees.

Conservation Measures for Murrelet Habitat in the Murrelet Habitat Zones (MHZs) Moderate Protection Areas	
C§10.3.2.3.12-6	Conduct harvests between 75-200 ft (22-60 m) from habitat trees in accordance with the following silvicultural prescriptions or obtain approval of the wildlife agencies for alternative prescriptions more suitable for a specific stand. **Buffer**: 200 ft (61 m) **Buffer Silvicultural Prescriptions**: • $\geq$ 175 ft^2 post-management basal area • 60% post-management canopy closure • No harvesting of existing old growth or potential murrelet trees
C§10.3.2.3.12-7	Permit helicopters at least 200 ft (61 m) away from habitat trees or known Type I or Type II old growth stands unless they have been surveyed according to currently accepted protocols without murrelet detections.
C§10.3.2.3.12-8	Retain all potential murrelet trees and screen trees.
C§10.3.2.3.12-9	Permit harvest of secondary murrelet trees if a ground survey determines that it is unlikely murrelets are occupying the surrounding area. **NOTE** MRC will not harvest old growth trees under this provision.

10.3.2.3.13 Murrelet habitat in limited protection areas

Conservation Measures for Murrelet Habitat in the Murrelet Habitat Zones (MHZs) Limited Protection Areas	
Breeding and Non-breeding Season	
C§10.3.2.3.13-1	Retain all primary murrelet habitat trees.
C§10.3.2.3.13-2	Permit harvest of secondary murrelet trees if a ground survey determines that it is unlikely murrelets are occupying the surrounding area.

10.3.2.3.14 Hendy woods state park

MRC will place a 200 ft vegetative buffer around its border with Type I old growth in Hendy Woods State Park. The silviculture will follow the buffer prescription for Type I old-growth stands (C§9.4.3.1-3). This is the only old-growth grove known to be directly adjacent to covered lands. The intent of this action is to provide additional protections for potential murrelet habitat.

10.3.2.3.15 Post termination conservation measures

MRC will maintain LACMA core areas plus connective acreage (i.e., approximately 200-300 ac) for at least 60 years from the issuance of our permit. If any MHZ becomes occupied prior to termination of the plan, MRC will retain these, unharvested, for at least 60 years from the issuance of our permit. Currently 6 areas are MHRS. In addition, MRC will retain a maximum of 200 occupied acres in the plan area for at least 60 years from the issuance of our permit.

10.3.2.3.16 Marbled murrelet recovery plan

USFWS approved the marbled murrelet recovery plan in 1997. The recovery objective is to maintain or increase the productivity of the murrelet population while minimizing threats to their survival. The highlighted text in Table 10-19 is verbatim from the USFWS recovery plan. Each excerpt is succeeded by the anticipated MRC action to comply with its recommendations or incorporate them in this HCP/NCCP.

Table 10-19 USFWS Recovery Criteria and MRC Response

USFWS Recovery Criteria and MRC Response	
Criterion 1	Establish 6 Marbled Murrelet Conservation Zones and develop landscape-level management strategies for each zone (USFWS 1997c, p. vi).
MRC Action	USFWS has yet to develop a management plan for Recovery Zone 5, the category into which all of our forestlands fall.
Criterion 2	Identify and protect terrestrial and marine habitat areas within each Marbled Murrelet Conservation Zone (USFWS 1997c, p. vi).
MRC Action	MRC will cultivate the Lower Alder Creek Management Area (LACMA) for marbled murrelet habitat (C§10.3.2.3.1-3). This area is approximately 1237 ac and has occupied stands. We have also agreed that the wildlife agencies may purchase any MHRS that could provide future habitat for marbled murrelets (C§10.3.2.3.2-2).
Criterion 3	Monitor marbled murrelet populations and habitat and survey potential breeding habitat to identify potential nesting areas (USFWS 1997c, p. vi).
MRC Action	MRC is monitoring with radar our only known murrelet population to follow trends each year in the number of detections in and around Lower Alder Creek (M§13.9.2.1-1). In addition, we will conduct surveys or provide appropriate protections for all potential breeding habitat identified during pre-harvest assessments similar to the USFWS recovery plan (10.3.2.1.2).
Criterion 4	Implement short-term actions to stabilize the murrelet population (USFWS 1997c, p. vi).
MRC Action	MRC will not harvest occupied stands in the Lower Alder Creek area. Moreover, after intensive surveys to detect any murrelet nesting, we will manage all other areas within LACMA for habitat improvement. In addition, we will retain any occupied stands outside of LACMA.
Criterion 5	Implement long-term actions to stop population decline and increase marbled murrelet population growth. (USFWS 1997c, p. vi)

USFWS Recovery Criteria and MRC Response

MRC Action	MRC will maintain and promote potential breeding habitat through various conservation measures: • Protection measures for Class I and Class II AMZ to recruit murrelet habitat. • Retention of Type I old growth and primary habitat trees, along with limited harvest within Type II old-growth stands, in order to protect and enhance late-seral value and existing habitat. • Easement protections to grow murrelet habitat.
Criterion 6	Initiate research on survey and monitoring protocols, population estimates, limiting factors, disturbance effects, and additional life history data. (USFWS 1997c, p. vii)
MRC Action	MRC will cooperate with researchers and generally provide access to our lands for scientific studies, if approach and timing of the studies is relevant and feasible.
Criterion 7	Establish a Regional West Coast Data Center.
MRC Action	MRC will provide information and data to regional efforts and respond to additional data requests from agency members, as time permits.

For Recovery Zone 5, the USFWS recovery plan states:

> The population is so small that immediate recovery efforts may not be successful at maintaining this population over time and longer term recovery efforts (e.g., developing new potential habitat) may be most important (USFWS 1997 129).

LACMA is entirely within Recovery Zone 5. MRC is managing LACMA to develop new potential murrelet habitat as well as to provide a buffer from wind and fire for existing habitat. We will maintain and promote murrelet habitat with

- Protections for Class I and Class II AMZ.
- Retention of Type I old growth and primary murrelet habitat trees.
- Limited harvest of Type II old growth.
- Easements.
- Recruitment of new murrelet trees in upland stands through the conservation measures for wildlife trees, snags, and screen trees.
- Designation of 6 Murrelet Habitat Recruitment Stands (MHRS) in 5 inventory blocks as backup in the event there is a catastrophe in LACMA.

10.3.2.4 Rationale

10.3.2.4.1 Rationale for overall approach in LACMA

MRC designed the Lower Alder Creek Murrelet Area (LACMA) to protect the population of murrelets using the Lower Alder Creek drainage. Protections focus on Type I and Type II old growth stands, as well as stands known to have been used by murrelets or stands with high potential for murrelet occupancy. These core areas are off limits to most management operations. Around these stands, we also designate a zone in which MRC may only undertake measures designed to accelerate habitat growth and value. With the required approval of the wildlife agencies, MRC can manage vegetation in these habitat areas. Finally, we will designate an area for vegetation management to buffer core and habitat areas from adjacent activities and to reduce edge effects (such as wind, solar radiation, and predation) as Chen et al. (1995) suggest.[26] This will also reduce adverse effects on the interior habitat for murrelets.

10.3.2.4.2 Rationale for protection levels

Murrelet nests are generally in old-growth stands. Fewer nests are in stands with residual old-growth trees interlaced with second growth trees. In defining a grouping of potential habitat trees, MRC uses 100 ft as the maximum distance between trees in the group. In our professional judgment, this is the distance at which large trees have enough canopy overlay to qualify as 1 clump.

10.3.2.4.3 Rationale for MHZ and associated protection levels

MRC believes murrelets are most likely to use areas within 5 miles of the coast with a higher density of large trees. Though murrelets will use an area 5-10 miles inland in lower drainages, these areas are less likely to be used than areas closer to the coast. Murrelets are least likely to use areas more than 10 miles inland and at the tops of ridges, or areas with fewer potential habitat trees. We know of no occupied murrelet behavior beyond 10 miles of the coast in Recovery Unit 5. Due to a recent discovery of 2 stands 7 and 8.5 miles inland in which murrelets were exhibiting occupancy behavior,[27] we set up an intermediate zone of 5-10 miles on the lower 1/3 of a slope. We also followed the advice of our HCP/NCCP Science Panel in defining these zones (Noss 2003, 52). However, we have not actually found an occupied stand in the plan area that was more than 5 miles from the coast; additionally, we are not aware of any detections of murrelets more than 10 miles from the coast in Mendocino County. For graphical representations, see the Marbled Murrelet Protection Zone maps in Appendix B, *HCP/NCCP Atlas* (MAPS 6A-C).

Table 10-20 Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010)

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
1976	Russian Gulch State Park	05/09/1976	2	unknown	Paton and Ralph 1988	Ground
1988	East of town of Mendocino	11/16/1988	2	0.6	Paton and Ralph 1988	Ground
1994	Lower Alder Creek (4 survey stations, surveyed 24 times)	06/04/1994 06/11/1994 06/18/1994 06/25/1994 07/02/1994 07/08/1994 07/09/1994	486 (mean per survey = 20)	2.2-4.2	MRC	Ground

[26] The size of LACMA (1237 ac) is fairly large and fits into the recommendation of Chen et al (1995) to retain larger forest patches.
[27] This information came in an e-mail from Scott Fullerton (Campbell Group) to Sarah Billig (MRC) on 2/23/06.

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
		07/22/1994 07/28/1994				
1994	Lower Wages Creek	07/27/1994	2	1.67	Georgia Pacific, Ambrose 1998	Ground
1994	Upper Lower North Fork, 10 mile	08/03/1994	approx. 6	2.8	Georgia Pacific, Ambrose 1998	Ground
1995	Lower Alder Creek (4 survey stations, surveyed a total of 19 times)	05/31/1995 06/07/1995 06/21/1995 07/19/1995 07/26/1995	167 (mean per survey = 8.7)	2.2-4.2	MRC	Ground
1995	Admiral Standley	07/14/1995	2	9.0	Georgia Pacific, Ambrose 1998	Ground
1995	Lower Greenwood Creek	05/25/1995 05/26/1995 06/10/1995 06/24/1995	5 (mean per survey = 1.0)	< 1.0	Louisiana Pacific	Ground
1995	Miller Pond	07/29/1995	2	2.7	Georgia Pacific, Ambrose 1998	Ground
1996	Wages Creek, near Westport	07/24/1996	2	1.5	Georgia Pacific, Ambrose 1998	Ground
1996	Lower Alder Creek	06/14/1996 06/27/1996 07/19/1996	130 (mean per survey = 21.6)	2.2-4.2	MRC	Ground
1997	Skunk Creek	07/29/1997	2	9.75	Georgia Pacific, Ambrose 1998	Ground
1997	Lower Alder Creek	05/16/1997 06/05/1997 07/02/1997	286 (mean per survey = 22)	2.2-4.2	MRC	Ground

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
		07/09/1997 07/23/1997 07/30/1997 08/06/1997				
1998	Lower Alder Creek	05/13/1998 05/20/1998 05/27/1998 06/03/1998 06/09/1998	46 (mean per survey = 9.2)	2.2-4.2	MRC	Ground
1999	Lower Alder Creek	08/03/1999 08/04/1999	8 (mean per survey = 4)	2.2-4.2	MRC	Radar
1999	Lower Greenwood Creek	07/18/1999 07/19/1999 07/27/1999 07/29/1999 07/31/1999	7 (mean per survey = 1.4)	0.5	MRC	Radar
1999	Stewart's Point	07/21/1999	16	3	E. Burkett survey information	Ground
1999	Stewart's Point	07/21/1999	20	2	E. Burkett survey information	Ground
2000	Mouth of the Albion	07/05/2000 07/28/2000 07/30/2000	0	0.5	MRC	Ground
2000	Mouth of the Albion	07/04/2000 07/05/2000 07/28/2000 07/30/2000	13 (mean per survey = 3.3)	0.5	MRC	Radar
2000	Navarro Head	06/28/2000 06/29/2000 07/27/2000	6 (mean per survey = 2.0)	0.5	MRC	Ground
2000	Lower Navarro River	07/29/2000	24	1.1	MRC	Radar
2000	Lower Alder Creek	07/01/2000 07/02/2000 07/23/2000 07/25/2000	120 (mean per survey = 30)	2.2-4.2	MRC	Radar
2000	Greenwood Creek	06/30/2000	30	0.5	MRC	Radar

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
		07/06/2000 07/24/2000 07/26/2000	(mean per survey = 7.5)			
2001	Lower Albion River	06/30/2001 07/01/2001 07/30/2001	6 (mean per survey = 2)	1.1	MRC	Radar
2001	Lower Alder Creek	07/02/2001 07/03/2001 07/31/2001	69 (mean per survey = 7.7)	2.2-4.2	MRC	Ground and Radar
2001	Navarro River, along 128	06/22/2001	5	4.2	MRC	Radar
2001	Navarro River, along 128	06/21/2001	5	1.1	MRC	Radar
2001	Lower Greenwood/Morrison (1 survey, radar detection)	07/05/2001	1	4.7	MRC	Radar
2002	Lower Albion River	07/04/2002 07/30/2002 07/31/2002	3 (mean per survey = 1)	2.9	MRC	Radar
2002	Lower Alder Creek	07/01/2002	11	2.2	MRC	Radar
2002	Lower Elk Creek	07/05/2002 07/22/2002 07/29/2002	2 (mean per survey = 0.67)	0.6	MRC	Radar
2002	Lower Greenwood Creek	07/02/2002 07/21/2002 07/29/2002	0	5	MRC	Radar
2002	Navarro River, along 128	07/03/2002	6	1.1	MRC	Radar
2002	Navarro River, along 128	07/31/2002	0	4.2	MRC	Radar
2002	Navarro River, along 128	07/07/2002	2	7.3	MRC	Radar
2002	Lower Alder Creek	07/10/2002 07/11/2002 07/17/2002 07/26/2002 07/30/2002	8 (mean per survey =1.6)	4.2	MRC	Radar
2002	West Brushy (in lower Alder Creek)	04/30/2002 07/01/2002 07/08/2002 07/30/2002	120 (mean per survey date = 30)	3.8	MRC	Ground
2002	Lower Alder Creek	4/30/2002 07/01/2002 07/08/2002 07/10/2002 07/12/2002 07/17/2002	12 (mean per survey = 1.7)	2.2	MRC	Ground
2002	Lower Alder Creek, near mouth	07/01/2002	23	1.4	MRC	Ground

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
2003	Lower Alder Creek, mouth	07/23/2003 07/28/2003	67 (mean per survey = 33.5)	1.0	MRC	Radar
2003	Lower Alder Creek, rock quarry	07/24/2003 07/29/2003	11 (mean per survey = 5.5)	2.8	MRC	Radar
2003	West Brushy (in Lower Alder Creek)	07/22/2003 07/25/2003	4 (mean per survey = 2)	4.2	MRC	Radar
2003	Irish Gulch	04/26/2003 06/06/2003 06/24/2003 07/14/2003 07/28/2003	5 (mean per survey = 1), distant detections	2.5	MRC	Ground
2003	Lower Alder Creek	07/01/2003	23	2.8	MRC	Ground
2003	Lower Alder Creek	07/29/2003	53	2.7	MRC	Ground
2003	Lower Alder Creek (near mouth)	07/23/2003	5	1.7	MRC	Ground
2003	Lower Alder Creek	07/24/2003	52	2.9	MRC	Ground
2003	West Brushy (in Lower Alder Creek	05/06/2003 06/06/2003 07/03/2003 07/17/2003 07/25/2003	43 (mean per survey date = 8.6)	4.2	MRC	Ground
2003	Horsetail (Hawthorne Timber lands)	Unknown	unknown	7.0	Fullerton, e-mail 02/23/06	Ground
2003	Gulch 16 (Hawthorne Timber lands)	Unknown	unknown	8.5	Fullerton, e-mail 02/23/06	Ground
2004	Lower Alder Creek (near mouth)	07/20/2004 07/22/2004	50 (mean per survey = 25)	1.7	MRC	Radar
2004	Lower Alder Creek (rock quarry)	07/21/2004 07/23/2004	24 (mean per survey = 12)	2.8	MRC	Radar
2004	Irish Gulch	07/23/2004	3	2.5	MRC	Ground[28]
2004	West Brushy (in Lower Alder Creek)	07/24/2004 07/25/2004	1 (mean per survey = 0.5)	4.2	MRC	Radar
2005	Lower Alder Creek (mouth)	07/17/2005 07/21/2005	50 (mean per survey = 25)	1.7	MRC	Radar
2005	Lower Alder Creek (rock quarry)	07/18/2005 07/22/2005	4 (mean per survey = 2)	2.5	MRC	Radar
2005	West Brushy (in Lower Alder Creek)	07/19/2005 07/20/2005	1 (mean per survey = 0.5)	4.2	MRC	Radar

[28] The detections at this survey station actually came from the Lower Alder Creek drainage and were not attributed to this particular project area but rather to the LACMA area.

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
2005	Big River	07/21/2005 07/23/2005	2	5.9	Stacy Martinelli, CDFG	Ground
2007	Lower Alder Creek (mouth)	06/27/2007 07/04/2007 07/11/2007 07/27/2007 07/31/2007	57 (mean per survey = 11.4)	0.5	MRC	Radar
2007	Lower Alder creek (west of rock quarry)	07/17/2007 07/24/2007 07/25/2007 07/26/2007 07/30/2007	13 (mean per survey = 2.8)	1.7	MRC	Radar
2008	Lower Alder Creek (mouth)	07/15/2008 07/18/2008 07/25/2008 07/28/2008 08/01/2008 08/07/2008	192 (mean per survey = 38.4)	0.5	MRC	Radar
2008	Lower Alder Creek (west of rock quarry)	07/09/2008 07/16/2008 07/27/2008 07/29/2008 08/03/2008	2 (mean per survey = 0.4)	1.7	MRC	Radar
2008	Russell Brook A[29]	05/07/2008 07/10/2008	13 (mean per survey = 6.5)	16.3	MRC	Radar
2008	Russell Brook B[28]	06/20/2008 07/17/2008 07/24/2008	2 (mean per survey = 0.67)	17.5	MRC	Radar
2008	North Fork Garcia River	06/18/2008	3	6.5	MRC	Radar
2008	Navarro River, along 128	06/11/2008	2	1.1	MRC	Radar
2008	Marsh Gulch	07/25/2008	1	1.6	MRC	Ground
2009	Lower Alder Creek (mouth)	07/25/2009 07/28/2009 07/30/2009	165 (mean per survey = 55)	0.5	MRC	Radar
2009	Lower Alder Creek (west of rock quarry)	07/21/2009 07/24/2009 07/26/2009 07/27/2009	36 (mean per survey = 9)	1.7	MRC	Radar
2009	Owl Creek (above Alder Creek)	07/18/2009 07/06/2009	4 (mean per survey = 2)	2.0	MRC	Ground

[29] Note these surveys include only "murrelet-type" detections. The detections in Russell Brook were never verified as actual murrelets, based on factors such as flight speed and time of detection as well as observations from biologists on the ground. It was presumed that these detections were more likely band-tailed pigeons than actual murrelets. However, they were classified as "murrelet-type" detections.

Murrelet Detections: Mendocino County (1976-2005) and MRC (1998-2010						
Year	**Location**	**Dates**	**Total Annual Detections**	**Miles Inland**	**Source**	**Survey Type**
2010	Lower Alder Creek (mouth)	07/20/2010 07/23/2010 07/08/2010 07/16/2010 07/05/2010 07/29/2010 07/26/2010	318 (mean per survey = 45.4)	0.5	MRC	Radar
2010	Lower Alder Creek (west of rock quarry)	07/21/2010 07/22/2010 07/14/2010 07/30/2010 07/23/2010 07/28/2010	73 (mean per survey = 12.2)	1.7	MRC	Radar

MRC protection levels provide protection less than current occupancy standards. These protections will apply when MRC is able to find the requisite number of potential habitat trees nearby. In each case, we provide protections that are greater than if the area had been surveyed and determined to be absent of murrelets. We believe the vast majority of these stands do not have murrelets present; MRC conducted over 250 surveys outside of Alder Creek since 1994 with ground detections only on the Greenwood Creek watershed in 1995. There was also ground detection on Navarro Head in 2000 by surveyors associated with MRC; however, the detected location was not in the plan area. Within our HCP/NCCP Atlas, MAPS 6A-C show our murrelet survey stations and pinpoint our detections. Therefore, if these areas remain un-surveyed, they are likely to receive greater protection than they would under standard protection measures, i.e., no specific protections for absent areas with potential habitat.

10.3.2.4.4 Rationale for additional protection around old-growth

Type I and Type II old-growth stands are the most likely places for murrelet detections outside of the coastal zone. MRC will protect these stands with its old-growth conservation strategy. This strategy provides the greatest protection in zones where trees are densest.

10.3.2.4.5 Rationale for murrelet habitat tree criteria

MRC has based its criteria for murrelet habitat trees on our knowledge of known nest trees within northern California. Size minimums were from measured nest trees in California. According to a summary of dbh of murrelet nest trees in California presented in Carey et al. (2003), mean dbh of murrelet nest trees is 121 in. (308 cm) with a range of 54 in. (139 cm) to 210 in. (533 cm). The MRC minimum size for potential habitat trees is less than the minimum dbh of all measured nest trees in California. Selection of potential tree species includes those in which murrelets have been known to nest, with the exception of red alder. Probably the most important attribute of a potential habitat tree is the presence of platforms with a diameter large enough to hold a murrelet egg (Carey et al. 2003). In California, as Table 10-21 shows, murrelet nests have been located on branches ranging from 6.3-14.6 in., with a mean value of 9.7 in. (24.3 cm). We chose to be conservative and use a minimum of 6 in. (10 cm). Despite the fact that the science panel did not recommend using the amount of cover above the nest as a criterion, MRC chose to include it in describing nest sites (Table 10-21) because of its common acceptance. A study in Oregon, for example, indicated that nest trees had more canopy cover than randomly selected trees (Nelson and Wilson 2002). The mean cover above nests in California was 87% (Nelson 1997). By using a canopy cover less than the mean for potential murrelet trees, we are allowing more trees to be called potential murrelet trees. This is a conservative approach; it ensures that even trees that may be outside the typical range for murrelet nest trees are still counted as potential trees. Finally, MRC chose to accept the advice of our HCP/NCCP science panel (Noss et al. 2003) that murrelet platforms should be horizontal and + or – 45 degrees, in order to retain a murrelet egg.

Rationale for primary and secondary murrelet tree criteria
While MRC and the wildlife agencies agree that murrelets are more likely to use trees with larger nest platforms, MRC has also categorized a class of secondary murrelet trees. These trees will receive disturbance and habitat protection as shown in Table 10-16. Unlike primary murrelet trees, MRC may harvest secondary murrelet trees if we have met radar and ground survey requirements.

Table 10-21 Characteristics of Murrelet Nest Trees in the Pacific Northwest

Nest Tree Characteristics	California	Oregon	Washington
Tree Species	Coast Redwood (9) Douglas Fir (4) Western Hemlock (1) *n* = 14	Douglas Fir (32) Western Hemlock (11) Sitka Spruce (1) Western Red Cedar (1) *n* = 45	Douglas Fir (3) Western Hemlock (3) *n* = 6
Tree diameter (in.)	121.5 ± 16.4 54.7 - 209.8 14	64.8 ± 3.1 29.9 - 109.8 45	58.9 ± 7.3 34.8 - 86.6 6
Tree height (ft)	239.8 ± 9.2 160.1 - 283.8 14	201.8 ± 6.6 118.1 - 279.2 45	188.3 ± 12.1 148.0 - 213.3 5
Nest branch height (ft)	153.9 ± 10.2 104.0 - 221.5 14	137.5 ± 7.2 44.6 - 245.4 44	111.2 ± 18.0 65.9 - 173.6 6
Branch diameter at nest (in.)	9.7 ± 1.2 6.3 - 14.6 6	13.3 ± 1.5 3.9 - 24.8 12	11.6 ± 3.0 4.2 - 18.1 4
Branch crown position (%)	64.3 ± 3.3 50.0 - 91.0 14	67.8 ± 2.6 26.0 - 98.0 44	63.4 ± 7.7 41.0 - 82.0 5
Nest platform length (in.)	9.6 ± 1.5 3.7 -16.5 10	21.8 ± 2.8 3.0 - 98.4 44	12.1 ± 2.8 3.9 - 22.4 6
Nest platform width (in.)	7.8 ± 1.6 2.6 - 20.0 10	10.6 ± 0.7 2.8 - 20.8 44	9.8 ± 1.9 3.9 - 15.4 6
Percent moss on platform	42.2 ± 14.7 0 - 100.0 12	89.5 ± 2.7 50.0 - 100.0 31	58.0 ± 19.8 5.0 - 100.0 5
Moss depth on platform (in.)	0.5 ± 0.3 0 - 3.2 12	1.9 ± 0.16 0 - 4.7 43	0.6 ± 0.3 0 - 1.4 5
Percent cover above nest	87.1 ± 7.9 5.0 - 100.0 13	78.1 ± 3.3 5.0 - 100.0 41	89.2 ± 4.4 70.0 - 100.0 6

TABLE NOTES
Data source: USFWS 1997c.
Data reported as mean ± SE, range, and sample size

10.3.3 Point Arena mountain beaver (PAMB)

10.3.3.1 Overview

MRC conservation measures for the Point Arena mountain beaver

- Provide 2007 take-avoidance protections to existing burrow systems.
- Survey for new burrow systems.
- Protect un-surveyed habitat.
- Encourage new habitat for mountain beavers through timber harvest.

In creating opportunities for new colonization of mountain beavers, our measures promote the survival of this species.

For operational purposes and by agreement between MRC and the wildlife agencies, the breeding season for Point Arena mountain beaver is December 1–June 30. The assumption behind our conservation measures is that disturbance is most critical during the breeding season, when MRC applies disturbance measures. MRC may still use existing roads at any time for maintenance, hauling, or administration, without a required survey or buffer.

MRC will also implement specific conservation measures for the Point Arena mountain beaver. Our HCP/NCCP assessment area for the Point Arena mountain beaver is 5 miles inland from the Pacific Ocean, extending from a point 2 miles north of Bridgeport Landing to a point 5 miles south of the town of Point Arena (*HCP/NCCP Information* Atlas, MAP 21). The distribution of the Point Arena mountain beaver on MRC covered lands is not likely to extend beyond this area.

If MRC adds land to the plan area, we will expand the assessment area of the Point Arena mountain beaver to include all areas that USFWS considers within the potential range of this species.

10.3.3.1.1 PAMB surveys

Prior to conducting covered activities, MRC will follow the procedures delineated in Appendix M, *Point Arena Mountain Beaver Protocol*. We will map the distribution of any potential habitat of mountain beaver in the assessment area as we conduct surveys. If we have met our objective for protected burrow systems (O10.3.3.2-1) and our surveys determine that a burrow system is inactive, we will obtain the approval of the wildlife agencies to designate the burrow system as such and release its area from all conservation measures. We will survey for burrows within

- 100 ft of above-ground noise generating equipment, i.e., mechanical equipment that contacts the ground and causes ground vibrations while felling, yarding, removing downed wood, and burning.
- 200 ft of habitat modification.
- 400 ft of habitat removal.
- 500 ft of mechanical equipment that contacts the ground and causes severe ground vibrations.

10.3.3.2 Biological goals and objectives

Goal and Objectives for Point Arena Mountain Beaver	
Goal	
G§10.3.3.2-1	Maintain or increase the population of Point Arena mountain beaver by increasing the amount and quality of their current habitat in the plan area.

Goal and Objectives for Point Arena Mountain Beaver	
Objective	
O§10.3.3.2-1	Maintain or enhance at least 85% of the known burrow systems of Point Arena mountain beaver in the plan area (i.e., 12 of 14).[30]
O§10.3.3.2-2	Create at least 1 site of potential habitat for each active burrow system when harvest occurs within the assessment area for Point Arena Mountain Beaver.

10.3.3.2.1 Potential habitat

DEFINITION

Suitable habitat for the Point Arena mountain beaver includes coastal scrub, the edges of conifer forest, and riparian plant communities where there is a cool climate, adequate soil drainage, and many small herbaceous and woody plants.

In order to create habitat to address O§10.3.3.2-2, MRC will
- Assess after harvest whether a managed area meets the habitat description.
- Review the new habitat for burrow systems for 5 years following timber harvest.

Prior to harvest operations, MRC will also assess whether a burrow system is a candidate for adaptive management. Our effectiveness monitoring will address whether a particular timber harvest can create expansion habitat for Point Arena mountain beaver burrow systems (M§13.9.3.1-2). It will evaluate if creating habitat proximal to existing burrow systems is successful. If the evaluation indicates that is successful, MRC may harvest adjacent to existing burrow systems under validation monitoring (M§13.9.3.2-2).

10.3.3.3 Conservation measures

The assumption behind our conservation measures is that disturbance is most critical during the breeding season. The conservation measures, therefore, focus on 3 time-frames: general, breeding season, and non-breeding season. Table 10-22 defines these timeframes.

Table 10-22 Timeframes for PAMB Conservation Measures

General	Breeding Season	Non-breeding Season
Apply at all times of the year	Apply December 1-June 30	Apply outside the breeding season

Conservation Measures for Point Arena Mountain Beavers (PAMB)	
General	
C§10.3.3.3-1	Prohibit timber operations (including felling, yarding, and construction of firelines) in any contiguous habitat area that is within 200 ft of active PAMB burrows or un-surveyed suitable PAMB habitat. **NOTE** Patches of habitat are contiguous only if they are less than 50 ft apart.

[30] MRC and the wildlife agencies recognize that some of these PAMB burrow systems may eventually become overgrown with vegetation and, consequently, unoccupied. For this reason, we are committed to maintain or enhance at least 85% of the PAMB burrow systems in our baseline distribution.

	Conservation Measures for Point Arena Mountain Beavers (PAMB)
C§10.3.3.3-2	Prohibit road construction in any contiguous habitat area that is within 400 ft of active PAMB burrows or un-surveyed suitable PAMB habitat.
C§10.3.3.3-3	Prohibit salvage operations within 100 ft of known existing PAMB burrow systems.
C§10.3.3.3-4	Prohibit foot traffic that might cause burrow collapse within 25 ft of active PAMB burrow systems or un-surveyed potential PAMB habitat. **ALLOWABLE USE** MRC staff may enter the bounds of an active burrow system or un-surveyed potential habitat when surveying for burrows or conducting HCP/NCCP monitoring.
C§10.3.3.3-5	Fell trees away from un-surveyed potential PAMB habitat or active PAMB burrow systems, unless the wildlife agencies approve an alternative treatment within adaptive management.
C§10.3.3.3-6	Construct or reconstruct roads to maintain or enhance hydrologic conditions in the vicinity of PAMB burrow systems. **NOTE** MRC will only modify local hydrology with the approval of the wildlife agencies.
C§10.3.3.3-7	Prohibit construction of permanent barriers, including fences and permanent openings greater than 50 ft (15 m), which might disrupt dispersal or movement between occupied PAMB colonies.
C§10.3.3.3-8	Conduct rodent control, including trapping, at least 500 ft (152.5 m) away from active PAMB burrows or un-surveyed potential PAMB habitat.
C§10.3.3.3-9	Conduct outdoor rodent control within PAMB assessment areas only with individuals approved as PAMB surveyors.
C§10.3.3.3-10	Restrain domestic dogs on a 6-ft leash in areas containing PAMB burrow systems or un-surveyed potential PAMB habitat.
C§10.3.3.3-11	Conduct blasting at least 500 ft (152.5 m) away from an active PAMB burrow or un-surveyed potential PAMB habitat.
C§10.3.3.3-12	Conduct prescribed burning at least 100 ft away from an active PAMB burrow or un-surveyed potential PAMB habitat.
Breeding Season	
C§10.3.3.3-13	Conduct the following operations (resulting in severe ground disturbance) at least 500 ft (152.5 m) away from an active PAMB burrow or un-surveyed potential PAMB habitat: ▪ Use of heavy equipment off roads. ▪ Tractor yarding. ▪ Operation of log landings. ▪ Loading log trucks. ▪ Use of rock pits.

	Conservation Measures for Point Arena Mountain Beavers (PAMB)
C§10.3.3.3-14	Conduct the following operations (resulting in above-ground noise and ground vibration) at least 100 ft (30.5 m) from an active PAMB burrow system or un-surveyed potential PAMB habitat: ▪ Use and maintenance of existing roads for log hauling. ▪ Chainsaw brushing or thinning of non-commercial trees. ▪ Felling commercial trees. ▪ Cable yarding. ▪ Helicopter yarding. ▪ Use of motorized vehicles. ▪ Limbing and bucking. ▪ Maintenance and re-fueling of heavy equipment. ▪ Construction or re-construction of roads. **ALLOWABLE USE** MRC may yard logs in un-surveyed potential PAMB habitat and occupied PAMB habitat as long as the logs are fully suspended above the habitat. Yarding must occur between 1 hour after sunrise and 1 hour prior to sunset.
C§10.3.3.3-15	Permit the following operations at all times no matter what the distance from active PAMB burrow systems or un-surveyed potential PAMB habitat: ▪ Use of mainline roads for log hauling and maintenance of mainline roads as designated by various maps in the HCP/NCCP Atlas. **NOTE** Maintenance includes actions necessary to use the roads, e.g., knocking down waterbars, grading, and watering. Maintenance does not include actions considered reconstruction of roads under the California Forest Practice Rules (CDF 2006, 14), such as changing the prism of the road. MRC must retain any trees felled for maintenance in forest adjacent to burrow systems or un-surveyed potential habitat. ▪ Use of public roads. ▪ Use and maintenance of MRC roads which are at least the same distance from a current active PAMB burrow as a public road or mainline haul road. ▪ Use of pickups and ATVs on roads.
Non-breeding Season	
C§10.3.3.3-16	Conduct the following operations (resulting in severe ground disturbance) at least 100 ft (30.5 m) away from an active PAMB burrow or un-surveyed potential PAMB habitat: ▪ Use of heavy equipment off roads. ▪ Tractor yarding. ▪ Operation of log landings. ▪ Loading log trucks. ▪ Use of rock pits. **ALLOWABLE USE** MRC may schedule these operations within 100 ft (30.5 m) of a known burrow system with prior approval of the wildlife agencies (M§13.9.3.2-2).

	Conservation Measures for Point Arena Mountain Beavers (PAMB)
C§10.3.3.3-17	Conduct the following operations (resulting in above-ground noise and ground vibration) at least 50 ft from an active PAMB burrow system or un-surveyed potential PAMB habitat: ▪ Chainsaw brushing or thinning of non-commercial trees. ▪ Felling commercial trees. ▪ Cable yarding. ▪ Helicopter yarding. ▪ Use of motorized vehicles. ▪ Limbing and bucking. ▪ Maintenance and re-fueling of heavy equipment. ▪ Construction or re-construction of roads. **ALLOWABLE USE** MRC may yard logs in un-surveyed potential PAMB habitat and occupied PAMB habitat as long as the logs are fully suspended above the habitat. Yarding must occur between 1 hour after sunrise and 1 hour prior to sunset.
C§10.3.3.3-18	Permit the following operations at all times no matter what the distance from active PAMB burrow systems or un-surveyed potential PAMB habitat: ▪ Use of mainline roads for log hauling and maintenance of mainline roads as designated by various maps in the HCP/NCCP Atlas. **NOTE** Maintenance includes actions necessary to use the roads, e.g., knocking down waterbars, grading, and watering. Maintenance does not include actions considered reconstruction of roads under the California Forest Practice Rules (CDF 2006, 14), such as changing the prism of the road. MRC must retain any trees felled for maintenance in forest adjacent to burrow systems or un-surveyed potential habitat. ▪ Use of public roads. ▪ Use and maintenance of MRC roads which are at least the same distance from a current active PAMB burrow as a public road or mainline haul road. ▪ Use of pickups and ATVs on roads.

10.3.3.3.2 Point Arena mountain beaver recovery plan

USFWS completed the Point Arena mountain beaver recovery plan in 1998 (USFWS 1998a). The recovery objective is to provide criteria and actions that could result in de-listing the Point Arena mountain beaver. The following highlighted text summarizes points from the USFWS recovery plan (USFWS 1998a, iv-v). Each excerpt is succeeded by the anticipated MRC action to comply with its recommendations or incorporate them in our HCP/NCCP.

Criterion 1	Protect known populations.
MRC Action	MRC will provide protective buffers around occupied and un-surveyed potential habitat. We may employ adaptive management within some of these buffers, with the approval of the wildlife agencies.
Criterion 2	Protect suitable habitat, buffers, and corridors.

MRC Action	MRC will provide protective buffers around occupied and un-surveyed potential habitat. We may employ adaptive management within some of these buffers, with the approval of the wildlife agencies. As part of our validation monitoring, MRC will review harvests within buffers to determine if they provide additional suitable habitat for Point Arena mountain beavers.
Criterion 3	Develop management plans and guidelines.
MRC Action	MRC will generally follow USFWS no-take guidelines. Our conservation goal is to maintain the current existing population and habitat of Point Arena mountain beavers on covered lands. In addition, MRC will create new habitat over the term of our HCP/NCCP with timber harvest and experimental approaches.
Criterion 4	Gather biological and ecological data necessary for conservation of the subspecies.
MRC Action	MRC will study the habitat of Point Arena mountain beavers through our validation monitoring program, including how to create habitat through timber harvest. Moreover, MRC welcomes research proposals related to this species within our forestlands.
Criterion 5	Determine feasibility of, and need for, relocation.
MRC Action	MRC will cooperate with relocation plans if they fit within the management guidelines of our HCP/NCCP.
Criterion 6	Monitor existing populations and survey for new ones.
MRC Action	MRC will monitor the spatial extent of our existing populations every 5 years. Surveys for new sites will occur as part of PTHP process.
Criterion 7	Establish an outreach program.
MRC Action	MRC considers this outside the scope of our current plan.

10.3.3.4 Rationale

Our conservation measures protect Point Arena mountain beavers from the negative effects of timber harvest. MRC does not expect “take” to result from any of these conservation measures. In fact, we expect an increase in potentially suitable habitat for mountain beavers over the course of our HCP/NCCP. We have designed monitoring and adaptive management programs (M§13.9.3.1-1 and M§13.9.3.1-2; M§13.9.3.2-1 and M§13.9.3.2-2) to study the relationship between timber harvests and mountain beaver viability. In addition, we will continue to monitor existing burrow systems to better understand the population and dynamics of mountain beavers on our land. Research suggests that timber harvest may provide colonization opportunities for mountain beavers once the harvest is concluded (Hooven 1973, Neal and Borrecco 1981). If we can create suitable habitat from timber harvest, we expect our HCP/NCCP to protect existing colonies of Point Arena mountain beavers in the plan area and also to provide opportunities for colonization of new burrow systems there.

Chapter 11

Conservation Measures for Rare Plants

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11 CONSERVATION MEASURES FOR RARE PLANTS

11.1 Introduction

Anything you do to a forest—including "hands off" management—may result in benefit to some species and harm to others. Therefore, drawing a boundary around a rare plant population within a forest will not necessarily guarantee its survival; it may still "wink out." Protecting rare plants is particularly problematic in a working forest, where forest management is primarily focused on growing and harvesting certain species of trees. Forest management involves roads, heavy equipment, logging crews, environmental changes, and many other factors that can threaten rare plants. Also, a complete picture of which plants inhabit a particular forest and where they are located takes considerable effort to develop. Nevertheless, MRC is committed to conserving rare plants on our land.

Chapter 11 describes the key elements of rare plant conservation for our HCP/NCCP, including how to

- Define conservation goals and objectives for covered rare plants.
- Select rare plant species covered under the plan.
- Survey for covered plants in accordance with CDFG guidelines.
- Create management categories for conservation objectives and measures.
- Assign covered species to the appropriate management category.
- Focus protections on management categories, groups of species, or individual species.

Included in this chapter are discussions on the intent behind key conservation measures, such as buffer width, buffer management, limits of take, and translocation.

Comprehensive long-term monitoring and adaptive management are a key part of the conservation strategy for covered rare plants described in Chapter 13, *Monitoring and Adaptive Management,* section 13.10. MRC will use long-term monitoring to evaluate the effectiveness of our conservation measures. If monitoring shows that we are not meeting our conservation objectives, MRC may obtain approval from the wildlife agencies to change our conservation measures. Adaptive management is the process of implementing conservation measures, monitoring results, and adjusting conservation measures based on those results.

11.1.1 Defining basic terms

DEFINITION

Occurrence is a location where a plant is found; an occurrence can consist of a single individual or a group of individuals, which may include several sub-groups.[1]

Recovery is reduction of threats and attainment of individual numbers and geographic range to the extent that listing as threatened or endangered is no longer warranted.

Translocation is the transfer of live plants or plant parts (seeds, cuttings, rhizomes, etc.) from one location to another, in order to establish them and promote reproduction.

[1] Single occurrences are, by definition, separated from the nearest occurrence(s) by ¼ mile or more (CDFG 2005). An occurrence may or may not be equivalent to a biological population. MRC does not define our monitoring and management units with ¼ mile delimiters.

Take for plants, in a general sense, means the loss of individuals through direct or indirect means.[2]

Management category is an element in an ordered scale that characterizes the management objectives and protections MRC will apply to an area or a covered rare plant.

11.2 Biological goals and objectives

Goals and Objectives for Covered Rare Plants	
Goals	
G§11.2-1	Conserve the natural communities, habitats, and occurrences of covered rare plant species found in the plan area.
G§11.2-2	Contribute to the recovery of covered rare plant species in the plan area that are listed as *threatened* or *endangered* by CDFG or USFWS.
G§11.2-3	Manage and conserve rare plant species that are not listed as *threatened* or *endangered* so that listing remains unnecessary.
Objectives	
Management Category 1 (MC1)	
O§11.2-1	Maintain all covered rare plant occurrences in the plan area at stable-to-increasing[3] levels of abundance and distribution (i.e., occurrence trend is stable-to-increasing).
O§11.2-2	Avoid[4] or minimize[5] mortality of individual plants.
O§11.2-3	Minimize direct and indirect adverse impacts to occurrences, such as ground disturbances, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-4	Retain existing site conditions of importance to covered rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil structure, soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 2 (MC2)	
O§11.2-5	Maintain a stable-to-increasing number of occurrences in each inventory block where the covered species is known (i.e., species trend is stable-to-increasing).
O§11.2-6	Maintain, on average, stable-to-increasing levels of abundance and distribution for the covered species throughout its range in the plan area (i.e., species trend is stable-to-increasing).
O§11.2-7	Minimize[4] mortality of individual plants.

[2] See section 1.7.1.
[3] Definitions for trend conditions (i.e., *stable, increasing*, and *decreasing)* must be species-specific and will be a component of the protocols for effectiveness monitoring (Chapter 13). In general, definitions will incorporate parameters for self-sustainability, such as area occupied by the rare plant species, number or cover of rare plants in the occurrence, and measures of viability like seed production.
[4] *Avoid*, in this context, means zero take.
[5] *Minimize*, in this context, means the lowest number permitted, as described in the conservation measures under "standard limits of take."

Goals and Objectives for Covered Rare Plants	
O§11.2-8	Reduce direct and indirect adverse impacts, such as ground disturbances, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-9	Minimize changes in site conditions of importance to rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil structure, soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 3 (MC3)	
O§11.2-10	Maintain stable-to-increasing levels of abundance and distribution within all inventory blocks where the covered species is found (i.e., species trend is stable-to-increasing).
O§11.2-11	Reduce mortality of individual rare plants, as feasible.
O§11.2-12	Reduce, as feasible, direct and indirect adverse impacts, such as ground disturbance, accelerated erosion, accelerated sedimentation, fuel spills, slash deposition, and increases in number or cover of invasive pest plants.
O§11.2-13	Minimize, as feasible, changes in site conditions of importance to rare plants, such as microclimatic factors (sun/shade levels, humidity); soil factors (soil moisture regime, soil compaction level); local hydrology; ground disturbance levels; and plant species composition of the community and habitat.
Management Category 4 (MC4)	
O§11.2-14	Maintain number and size of occurrences in the plan area so that the species continues to qualify for its current S rank or an S rank that denotes greater abundance (see section 11.5.1).
O§11.2-15	Reduce mortality of individual rare plants, as feasible.
O§11.2-16	Maintain stable-to-increasing occurrences in the plan area, mainly through community-based conservation measures.

11.3 Summary of the Conservation Strategy for Rare Plants

MRC will conserve all covered rare plant species through community-based conservation measures, category-based conservation measures, or a combination of both. We will implement *species-specific* conservation measures supported by relevant biological information (see section 11.8).

11.3.1 Community-based measures

MRC will implement community-based conservation measures on all of our covered lands. Community-based measures will be the primary means of conservation for covered rare plants known or expected mainly in areas where covered activities rarely take place. These communities and habitats include

- Closed-cone forest (including pygmy and Bishop pine forests, see *HCP/NCCP Atlas,* MAPS 8A-C).
- Some permanent wetlands (marshes, bogs, fens).
- Rocky outcrops, including serpentine.

- Oak woodlands.

If covered activities must be carried out in these communities, MRC will avoid or minimize their effects on these areas, and, where applicable, implement categorical conservation measures for any affected rare plant occurrence.

11.3.2 Category-based measures

Category-based measures will be the primary means of conservation for covered rare plants known or expected in areas where covered activities will take place on a regular basis. Figure 11-1 provides a flowchart for the implementation of a category-based conservation strategy for covered rare plants. Unless specified otherwise, the processes are ongoing for the 80-year period of the HCP/NCCP.

11.3.2.1 Survey results

Using survey guidelines recommended by CDFG (2009), MRC will survey areas where covered activities, such as a PTHP, could affect covered rare plants. Prior to any field operations, we will submit to the wildlife agencies, along with a PTHP, the results of the surveys using a standard report format included in the *MRC Rare Plant Survey Handbook* (2007). MRC will file documentation of covered rare plant locations detected during rare plant surveys with the CNDDB (see section 11.5).

11.3.2.2 Core occurrences

DEFINITION	The **core occurrence area** is the portion of a CNDDB occurrence that is a continuous grouping subject to covered activities.

The core occurrence area may include all or part of a CNDDB occurrence (see section 11.5). A CNDDB occurrence may extend beyond MRC land or into an area not subject to covered activities; those portions of the CNDDB occurrence are not included in the core occurrence area. In the field, MRC will define the core occurrence area as one or more convex polygons that encompass all individuals. We will initially identify and mark core occurrence areas during rare plant surveys. Prior to timber harvesting or other covered activities, we will install permanent markers as specified in the conservation measures for each management category. Anticipating the possibility that markers may be damaged or removed, we will use global positioning system (GPS) data to define a core occurrence area in the event marker relocation is required. To protect the viability of individuals located on the outer margin of the core occurrence area, we will establish and mark the outer limits of the core occurrence area at least 5 ft from any visible plant parts, such as branches and surface roots. Before each stand entry, as a component of monitoring, we will check the limits and markers of the core occurrence area and adjust limits and marker locations, if needed, to encompass the current limits of the core occurrence area. More information on the identification and marking of the core occurrence area is in the *MRC Rare Plant Survey Handbook* (2007) and in section 13.10.

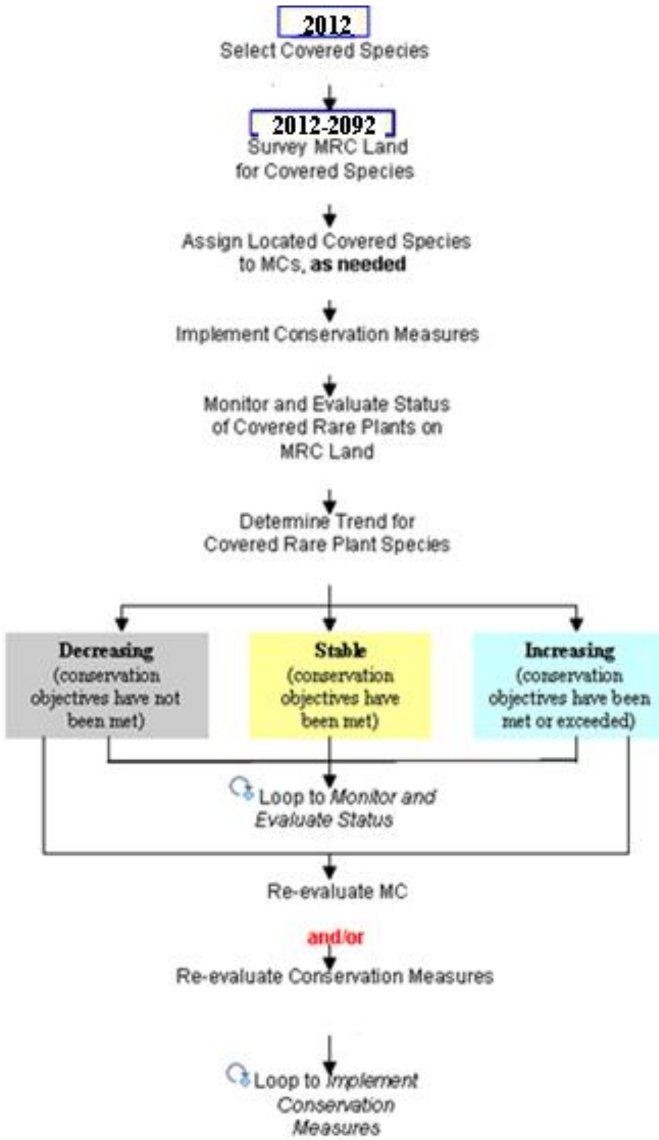

Figure 11-1 Flowchart of Category-based Conservation Strategy

11.3.2.3 Assigning management categories

If MRC detects occurrences of covered rare plants in areas where covered activities could affect them, we will implement appropriate conservation measures. To determine which category-based conservation measures should apply, MRC will assign covered rare plants to 1 of 4 management categories, based primarily on their statewide rarity and threat level and modified by characteristics of species biology, statewide distribution, occurrence size, occurrence location, and the biological and conservation significance of the occurrences in the plan area. We will assign management categories only to covered rare plants found on our land. Plants in Management Category 1 (MC1) receive the highest levels of protection and restriction; they are closely monitored. Plants in Management Category 4 (MC4) receive the lowest levels of protection and restriction; they are monitored only if warranted, as determined through adaptive management.

11.3.2.4 Objectives for management categories

MRC intends proposed conservation measures to achieve the objectives for a species in its management category. Conservation measures

- Define, mark, and protect the core occurrence area and buffer area.
- Manage invasive plants within the core occurrence area and buffer area.
- Provide for incidental take, variances to the standard take provisions, and translocation.

If we do not meet our objectives or conditions warrant, MRC may change conservation measures through adaptive management. Adaptive management for covered rare plants will be an interactive, long-term process that includes (1) monitoring and targeted studies, (2) evaluation of the effectiveness of conservation measures based on monitoring results, and (3) warranted adjustments in conservation measures. Chapter 13, *Monitoring and Adaptive Management*, provides details on compliance and effectiveness monitoring of rare plants (section 13.10.3); an explanation of targeted studies to fill in any information gaps on rare plant species (section 13.10.2.2); and the implementation process for adaptive management (section 13.10.4).

11.4 Survey methodology

MRC will conduct surveys for covered rare plants that adhere to CDFG (2009) guidelines for botanical surveys. All surveyors will also follow the guidance in the *MRC Rare Plant Survey Handbook* (2007*)*. Botanists, biologists, or foresters employed or contracted by MRC will conduct the rare plant surveys. MRC will provide special training to foresters and biologists who will conduct rare plant surveys. We will invite wildlife agency personnel who have direct involvement in covered rare plant issues and in our HCP/NCCP to attend the training. Training will include instruction on use of the *MRC Rare Plant Survey Handbook*; rare plant field identification skills; use of field survey forms to document occurrences; and report preparation. During surveys, all surveyors will use local reference collections (e.g., Mendocino College of the Redwoods Herbarium) and reference populations; they will consult with recognized experts to verify rare plant identifications. When covered activities are proposed for pygmy forest, chaparral, most perennial wetlands (lakes, marshes, bogs, and fens), and serpentine areas (including rocky outcrops as well as all serpentine-influenced communities and habitats), professional botanists with North Coast experience will complete or supervise rare plant surveys. Detection and identification of some rare plants within these communities and habitats require the special skills and experience of a professional botanist.

11.4.1 Key elements of the CDFG rare plant survey guidelines

Following is a summary of the key elements of the CDFG rare plant survey guidelines, along with a brief notation on MRC compliance:

- **Timing**
  Surveys must be conducted at a seasonally appropriate time of year when rare plants can be detected and are in identifiable condition; usually this will be during the flowering season.

  NOTE
  MRC will make more than 1 visit to encompass the flowering periods of potentially occurring covered plants in each PTHP area where suitable habitat exists. Chapter 6, *Covered Plant Species,* addresses habitat requirements.

- **Floristic surveys**
  Surveys must be floristic in nature, which requires that plants observed during the rare plant survey be identified to the taxonomic category (e.g., species, genus, or family) necessary to determine whether they are rare plants. An acceptable floristic survey may include a plant list containing some plants that are identified only to genus, if those plants are in genera or families that do not include any covered rare plants. The wildlife agencies will consider floristic surveys acceptable even if they do not include every non-covered species found in the survey area.

- **Documentation**
  Proper documentation for a newly detected occurrence of a rare plant includes a voucher specimen (unless this might jeopardize the occurrence's continued existence); photograph of the plant and its habitat; map of the rare plant occurrence; estimate of the number of individuals or area occupied; and submission of a *Field Survey Form* to CNDDB. In revisiting previously documented occurrences, the surveyor will also complete and submit a *Field Survey Form* to CNDDB.

  NOTE
  MRC will deposit voucher specimens in a California herbarium associated with an *academic institution* (see *MRC Rare Plant Survey Handbook*).

- **Knowledge and experience of the surveyor**
  Persons familiar with plants in the local area as well as with knowledge of plant taxonomy and experience in conducting floristic surveys should conduct the rare plant surveys.

- **Reporting**
  MRC will submit results of rare plant surveys in a standardized format. We will either include these results with a PTHP submittal or amend the results to an approved PTHP. If we amend the survey to an approved PTHP, CDFG will have 15 days to review the survey results before MRC commences operations. During operations, the standard conservation measures for covered rare plants will apply. MRC will submit a CNDDB *Field Survey Form* for each newly detected occurrence and for re-visits to previously known occurrences. We will include a Field Survey Form in the rare plant survey report except for incidental discoveries, such as a casual detection of a rare plant outside the context of a survey. For incidental discoveries, MRC will prepare a *Field Survey Form* and include GIS information (see section 11.4.3).

  NOTE
  MRC will notify USFWS in the event a surveyor discovers a federally listed plant.

Detailed steps for fulfilling the requirements of the CDFG rare plant survey guidelines, including the key elements summarized above, are included in the *MRC Rare Plant Survey Handbook*.

11.4.2 Frequency and conditions of rare plant surveys

MRC will survey[6] the plan area for rare plants at least 2 times during the term of the HCP/NCCP; certain conditions may trigger additional surveys (11.4.2.1). In any event, MRC expects rare plant surveys to detect the majority of rare plant occurrences that persist on covered lands, where timber harvest has been the predominant land use for up to 100 years. We acknowledge that, on occasion, a rare plant occurrence may not be detected, and, as a result, may be affected by

[6] *Survey* includes all visits within 1 year needed to locate and identify covered rare plants in an area where a covered activity will take place; typically, MRC will complete a survey within a single calendar year.

covered activities. Our HCP/NCCP requires that we conserve all covered rare plant species, as well as their communities and habitats. We anticipate meeting this goal by protecting the majority of the covered rare plant occurrences found on our land. Within a 3-year window prior to the start of any proposed covered activity, MRC will conduct rare plant surveys.

Throughout the term of our HCP/NCCP, the wildlife agencies may re-survey any location in the plan area where MRC-sponsored rare plant surveys have been completed. If re-surveys by the wildlife agencies find a significant number of rare plant occurrences undetected during the MRC-sponsored rare plant surveys, MRC and the wildlife agencies will re-evaluate the frequencies of the rare plant surveys required by the HCP/NCCP and modify those schedules if warranted (see section 13.2.2.2)

11.4.2.1 PTHP areas

Rare plant surveys in PTHP areas will follow these guidelines:

- Conduct 2 surveys (one prior to each of the first 2 entries into a stand) once the HCP/NCCP has been approved; stand entry is defined as entry for tractor (or other ground-disturbing) site preparation, ground-disturbing vegetation management, and timber harvest.

  NOTE
  CDFG will accept surveys conducted during the interim period between the approval of the Planning Agreement and the approval of the HCP/NCCP as 1 of the 2 required surveys, if they are conducted and reported in compliance with the CDFG rare plant survey guidelines (CDFG 2009).

- Conduct 1 additional survey if
  - A PTHP area shows a change in absolute tree canopy cover (meaning cover of trees ≥ 30 ft tall) of 40% or more (e.g., a change from 10% to 50% or a change from 20% to 60%) since the previous rare plant survey.

    NOTE
    Change in tree cover triggers an additional survey because it results in environmental changes that may provide new habitat for rare plants unable to survive under the original conditions.

  - A PTHP area shows the presence of species, recorded in earlier surveys, that CDFG previously did not consider rare.

11.4.2.2 Activities not related to PTHPs

This sub-section covers the frequency and conditions of rare plant surveys for activities not related to a PTHP, e.g., rock pit expansion and ground-disturbance outside PTHP areas. The discussion excludes roads and landing activities, covered in subsection 11.4.2.3.

- Conduct 1 survey in areas where completion of a proposed covered activity will result in long-term or permanent loss of suitable habitat for rare plants due to on-going disturbance.

  EXAMPLE
  For rock pit expansion, MRC will only conduct 1 survey because this type of disturbance is long-term and precludes recovery. We will implement conservation measures for any covered rare plants found during this survey. The 1-survey standard is consistent with development projects throughout California that result in long-term or permanent loss of suitable habitat for rare plants.

- Conduct 2 surveys in areas where disturbance from proposed covered activities is temporary, meaning recovery of habitat suitable for rare plants is possible within the timeframe of our HCP/NCCP.

  NOTE
  MRC will conduct the 2nd survey the next time we propose covered activities for the area if more than 10 years have elapsed.

11.4.2.3 Roads and landings

The frequency and conditions for rare plant surveys in areas with proposed covered activities for roads and landings are as follows:

- **New roads and landings**
  - Survey all routes of proposed new roads and landings 1 time.
  - Monitor all new roads and landings 1 time during the first growing season after construction of new roads or landings to specifically detect covered rare plants that may appear in response to disturbance.

    NOTE
    This is not a second rare plant survey.

- **Reconstructed roads and landings**
  - Survey roads and landings 1 time if MRC has not used them for covered activities within 5-10 years and did not previously survey them.

    NOTE
    5-10 years is long enough for habitat recovery to occur, so MRC will conduct a rare plant survey before opening the road or using the landing. MRC will not survey roads and landings if covered activities have occurred in 4 years or less because such activities would have eliminated any rare plants, making habitat recovery unlikely in that time frame.
  - Survey roads and landings 1 time if MRC has not used them for covered activities for more than 10 years, even if they previously surveyed them.

- **Regular road maintenance**
  MRC will not survey for rare plants prior to routine road maintenance that typically occurs more frequently than once in 5 years (e.g., grading, waterbar installation, minor bank slough removal, road bank vegetation brushing, non-crossing culvert replacement, or existing crossing maintenance).

11.4.3 Tracking rare plant surveys

MRC will track the history of survey coverage using GIS technology. We will create a survey frequency overlay for our land, showing the number of rare plant surveys that have been completed for each PTHP area. Each mapped PTHP area will be linked to a spreadsheet that includes basic information, such as

- Survey date.
- Surveyor.
- Target list of covered species.
- Occurrences of covered species found.
- Tree canopy cover.
- Reference to rare plant survey reports for the PTHP.
- Indication of whether previous surveys met CDFG guidelines.

MRC will also use GIS tracking for rare plant occurrences detected outside the context of a rare plant survey, i.e., *incidental discoveries*, and provide this information annually to the wildlife agencies as part of compliance monitoring.

11.4.4 Rare plant surveys vs. monitoring

Rare plant surveys are distinct from monitoring. Rare plant occurrences detected during surveys (and *incidental discoveries* made during the course of other activities) will be part of the MRC monitoring program, as appropriate. Monitoring protocols will require revisiting some rare plant occurrences on a regular basis over the term of our HCP/NCCP. Chapter 13 (M§13.10.3-1) outlines the effectiveness monitoring program for status and trend of covered rare plants.

11.5 Management Categories for Covered Rare Plant Species

MRC will assign to each covered rare plant species found on our land a management category based primarily on its statewide rarity and threat status, as denoted by its S rank (section 11.5.1) and associated threat code. Additional factors that may modify this status are

- Likelihood of impacts to the covered species or its habitat from covered activities.
- Species sensitivity to disturbance.
- Viability of the species, as expressed by size and area of its occurrences throughout its California range.
- Geographic range of the species, meaning occurrences in the plan area that represent range limits or that are disjunct from the central or main geographic distribution.
- Distribution in the plan area, including overall range and number of occurrences.
- Documented trend in the plan area.

11.5.1 Use of S ranks in assigning management categories

The S rank is a measure of statewide abundance and, inversely, of rarity. MRC will use the most current S rank when assigning covered species to a management category. There are several reasons for using the S rank as the primary factor in assigning management categories. S ranks have been assigned to all special-status plants (state and federal listing status apply only to a few), and provide a more fine-grained evaluation of status than the conservation categories of *CNPS Inventory*. S ranks are part of the element[7] ranking system used by the nationwide natural heritage network (NatureServe 2004), which includes CNDDB (Bittman 2001). The natural heritage system of element ranking includes G or global (total distribution) ranks and S or statewide ranks of relative rarity and threat. The S ranks for California species are assigned by CNDDB,[8] using the general guidelines shown in Table 11-1 (CDFG 2010). Usually a species is ranked on the more restrictive criteria. For example, a species with S1 values for a number of element occurrences and S2 values for a number of individuals and an inhabited area would be ranked S1. Appendix R, *Plant Rankings*, provides complete definitions of G and S ranks. Special characteristics of species biology and distribution, as well as occurrence characteristics (e.g., size, viability, extant vs. extirpated), may modify S rank assignments (NatureServe 2004).

[7] The word element, in this context, means a rare plant, animal, or natural community.
[8] Phone conversation between Ann Howald (Garcia and Associates) and R. Bittman (CDFG) on October 20, 2004

Table 11-1 Criteria for S Ranks for California Species

State Rank	Number of Element Occurrences	Number of Individuals	Area Inhabited (acres)	Comments
S1	< 6	< 1000	< 2000	Assign threat codes 1-3, if possible.
S2	6 ≥ 20	1000 ≥ 3000	2000 ≥ 10,000	Assign threat codes 1-3, if possible.
S3	21 ≥ 80	3001 ≥ 10,000	> 10,000 – 50,000	Assign threat codes 1-3, if possible.
S4	> 80	> 10,000	> 50,000	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5				Secure - Common, widespread, and abundant in the state.

In the element ranking system, the S1, S2, and S3 ranks are usually accompanied by a threat code (CDFG 2005). CNDDB botanists assign a threat code if the necessary information is available (Table 11-2).

Table 11-2 CNDDB Threat Codes

Code	Threat Level
1	Seriously endangered in California
2	Fairly endangered in California
3	Not very endangered in California

S ranks and their threat codes are subject to change if new information becomes known; however, status reviews are conducted on an as-needed basis only—usually in response to a request for review.[9] MRC can request status reviews of covered species if (1) occurrence numbers have changed significantly on our land or elsewhere in California; or (2) threat conditions have changed significantly. Prior to a request for a status review, we will submit to CNDDB adequate scientific data on the status of occurrences on our land, including information on occurrence size, habitat quality, viability estimates, data on threats, and other relevant information collected during monitoring. This data may be in various formats acceptable to CNDDB, such as the CNDDB *Field Survey Form* accompanied by maps or digital data with locations of occurrences. CNDDB staff responds to requests for status review as soon as they are received, within staffing capabilities.[10] Under our HCP/NCCP, CDFG will complete status reviews within 60 days unless CDFG informs MRC that staffing limitations mandate a longer review period. CDFG will inform MRC in writing of status changes that affect the base rank of covered species as soon as these changes have been entered into the database.

Although the criteria for assigning S ranks are explicit, information quality and information gaps can affect the ability of CNDDB botanists to assign an appropriate S rank. MRC will take a conservative approach with the following S ranks:

- Covered species with S ranks consisting of a range (e.g., S2-S3).

[9] Email to Ann Howald, Garcia and Associates, from R. Bittman, CDFG, on October 20, 2004.
[10] Email to Ann Howald, Garcia and Associates, from R. Bittman, CDFG, on October 20, 2004.

- Covered species with no assigned S rank due to poor information (S?).
- Covered species with an historic S rank (SH), meaning that the species or occurrence has not been seen for 20 years or more, but suitable habitat still exists (CDFG 2005).

A conservative approach means that, for a covered species with an atypical S rank, MRC will review the occurrence data and assign a base management category that affords the highest level of protection supported by the data. For example, MRC will assign a species with an S rank of S2-S3 to a management category consistent with an S rank of S2. Likewise, we will assign a species with an SH rank to a management category based on the number of recently verified (non-historic) occurrences. For example, we would assign an SH species with 12 occurrences, of which only 1 has been verified in the last 20 years, to a management category of S1 which has a range of 1-6 occurrences. Assignments of base management categories are subject to modification for all species (section 11.5.2.1), whether their S ranks are typical or atypical.

11.5.2 Assigning covered rare plant species to management categories

Assignment of a covered rare plant species to the appropriate management category requires knowledge of the specific characteristics of occurrences of that species in the plan area, such as location and size. Consequently, MRC will only assign covered species with at least 1 known occurrence on our land to management categories. While we could assign covered species with no known occurrences on our land to a *preliminary* management category based on current S rank and threat code, we have not done so for our HCP/NCCP because these assignments would be subject to constant change and would not influence the implementation of conservation measures.

MRC will periodically review the management category assignments for all covered rare plant species. In the review process, MRC will consider changes in S rank, changes in taxonomy, new monitoring information from the plan area, surveys conducted throughout the range of the species in California, and studies on the biology and ecology of the species. MRC and the wildlife agencies have agreed upon the initial management category assignments in our HCP/NCCP through a consensus process in which all parties evaluated the same data and applied the same criteria. During the term of our HCP/NCCP, these assignments may change after consultation with the wildlife agencies.

11.5.2.1 Modifiers for management categories

MRC and the wildlife agencies will apply 6 modifiers, listed below, in assigning a covered rare plant to a management category. These modifiers take into account important characteristics unaccounted for by S ranks alone. We will apply the modifiers in order of perceived significance. Modifiers, if applicable, can upgrade or downgrade the management category of a species by 1 level only; the exception is the second modifier, *communities and habitats in the plan area*. If none of the modifiers apply, MRC will assign a species to a management category based on its current S rank. The modifying factors are as follows:

1. **Sensitivity to disturbance**

   Species that are tolerant of, or dependent upon, disturbance to assure their long-term survival, such as early successional species and “fire-followers,” will be downgraded 1 level. Observations from North Coast timberlands and other evidence indicate that these species often can successfully co-exist over the long-term in actively harvested timberlands; they may actually benefit from some types of logging disturbance (Berg and Bittman 1988, Pickart et al. 1991, Hiss and Pickart 1992, Jirak 2001, Doell 2004). MRC will use targeted studies to learn more about the life cycles of these species and their long-term responses to timber harvesting, and to modify category-based conservation measures or develop species-specific conservation measures, if warranted. Species that are known or suspected to be intolerant of disturbance, based on observations, published sources, and other relevant information, will be upgraded 1 level.

2. Communities and habitats in the plan area

Species whose base management category is 2 or 3 (derived from S rank alone) will be transferred to Management Category 4 if all of the following conditions apply:

a. They are found solely or primarily in communities and habitats where covered activities are expected to occur infrequently: pygmy forest; closed-cone pine forest; true chaparral (Holland 1986); permanent wetlands, such as lakes, marshes, bogs, and fens; on rocky outcrops, including serpentine; and in serpentine-influenced communities, such as serpentine grasslands, serpentine seeps, etc.
b. They are common within the communities and habitats where they occur.
c. They include occurrences that are found on land whose management goals include the protection of natural resources such as rare plants (e.g., state parks, county parks, and public and private preserves).

MRC will protect these species primarily through community-based conservation measures, as called for in the NCCPA.

3. Viability

Long-term survival of a rare plant occurrence is less likely if the occurrence consists of a low number of individuals or is restricted to a small area. Either of these circumstances makes the occurrence more susceptible to random, unpredictable changes (stochastic events) capable of eliminating the entire occurrence (Gilpin and Soule 1986). In addition, small populations, especially if they are isolated, are more subject to loss of genetic diversity from inbreeding and other causes, which can result in reduced viability (Falk and Holsinger 1991). Species consisting mainly of occurrences of a low number of individuals or covering a small area will be more vulnerable to loss of entire occurrences and to a downward status trend. To compensate for this inherent vulnerability, the management category of these species will be upgraded 1 level.

4. Geographic range

Peripheral populations, which are those at the geographic limit of a species range or disjunct from its main or central area of distribution, are accorded special evolutionary and conservation significance (Leppig 2006). Lammi et al. (1999) state that small peripheral populations can be genetically as viable as larger populations; therefore, they have significant evolutionary and conservation value. The long-term survival of a species may depend on its peripheral populations, which may contain unique genotypes that are more capable of surviving under changing environmental conditions or that lead to future speciation (Lesica and Allendorf 1995, Nielsen et al. 2001). When a species is subject to a dramatic reduction in range (i.e., more than 75%), peripheral populations survive more frequently than do core populations, according to Channell and Lomolino (2000). In recognition of the potential significance of peripheral populations, the management category of a covered species will be upgraded 1 level if any of its occurrences in the plan area defines a range limit for the species (e.g., *Pleuropogon hooverianus)*, or is disjunct from the main or central distribution by more than 100 miles (e.g., *Juncus supiniformis*, if ever found in the plan area).

5. Distribution in the plan area

Species that have a base management category of 2 or 3 and that are widely distributed in the plan area (i.e., in 4 or more inventory blocks), will be downgraded 1 level. Species whose base management category is 2 or 3 and that are narrowly distributed in the plan area (i.e., in a single inventory block), will be upgraded 1 level. This modifier will not apply to species with S ranks of S1.1, S1.2 and S1.3, in recognition of their overall rarity. If an occurrence extends into 2 inventory blocks, MRC will count the occurrence in only 1 of the blocks.

6. Documented trend in the plan area

MRC will determine trend for all covered rare plant species with 1 or more occurrences in the plan area. For our HCP/NCCP, the trend for a covered species will be based only on the occurrences of that species found in the plan area. The trend condition for each species will be evaluated as *increasing*, *stable*, or *decreasing*. Definitions for these trend conditions will be species-specific and will use factors that indicate likelihood of long-term survival, such as number of occurrences, occurrence size, occurrence area, reproductive capacity, and other factors. MRC will develop definitions for species-specific trend conditions and determine trend as information becomes available from monitoring results and other sources. Chapter 13 (section 13.10.2.1) includes an example of definitions for trend conditions for a covered plant species. When MRC has accumulated enough monitoring data to determine trend, we will use trend as a modifying factor during the periodic reviews of management category assignments that are part of HCP/NCCP implementation. If MRC and the wildlife agencies determine that the documented trend for a species is *increasing*, MRC will downgrade the management category 1 level. If the trend is *stable*, we will not modify the management category. If the trend is *decreasing*, we will upgrade the management category 1 level.

Table 11-13 shows the criteria for assigning covered rare plants to management categories. Table 11-14 lists the management categories for the covered rare plant species currently known in the plan area.

Table 11-3 Process for Assigning Management Categories (MC)

Process for Assigning Management Categories (MC)			
MC	**Protection Level**	**S Rank and Threat Code[a]**	**Modifying Factors [b]**
1	Highest level of concern and conservation effort	S1.1 S1.2 S1.3	**Sensitivity to disturbance** • If life history suggests that the species is an early successional species or is tolerant of disturbance (e.g., *Astragalus agnicidus*, *Sidalcea malachroides*),

Process for Assigning Management Categories (MC)			
MC	**Protection Level**	**S Rank and Threat Code[a]**	**Modifying Factors [b]**
			transfer to MC2 unless the species is known from only 1 occurrence in the plan area. Otherwise, assign species to MC1. **Trend** • If there is an increasing trend, change the category to MC2. • If there is a decreasing or stable trend, maintain the category as MC1.
2	Intermediate level of concern and conservation effort	S2.1 S2.2 S3.1	**Communities and habitats in the plan area** • If the species (1) is found solely or primarily in a community or a habitat type where covered activities are unlikely to occur, (2) is common within the communities and habitats where it occurs, and (3) includes populations that are protected on public lands, transfer to MC4. Otherwise, review modifier below. **Viability** • If the typical number of individuals per occurrence, for the species throughout its range, is fewer than 100 (e.g., *Boschniakia hookeri, Lilium maritimum*), or the reproductive rate of the species is known to be low, transfer to MC1. Otherwise, review next bullet. • If the typical area occupied by a single occurrence, for the species throughout its range, is less than 1/10 of an acre (e.g., *Boschniakia hookeri, Lilium maritimum*), transfer to MC1. Otherwise, review modifier below. **Geographic range** • If any MRC occurrence defines a range limit for the species (e.g., *Pleuropogon hooverianus*), transfer to MC1. Otherwise, review next bullet. • If any MRC occurrence is disjunct (separated from) other occurrences of the species by a distance greater than 100 miles (e.g., *Juncus supiniformis*), transfer to MC1. Otherwise, review modifier below. **Distribution in the plan area** • If occurrences are found in only 1 inventory block, transfer to MC1. Otherwise, review next bullet. • If occurrences are found in 4 or more inventory blocks, transfer to MC3. Otherwise, review modifiers below. **Sensitivity to disturbance** • If life history data demonstrates or strongly suggests

Process for Assigning Management Categories (MC)			
MC	**Protection Level**	**S Rank and Threat Code**[a]	**Modifying Factors** [b]
			that the species is intolerant of disturbance (e.g., *Lilium maritimum*), transfer to MC1. Otherwise, review next bullet. • If life history data demonstrates or strongly suggests that the species is an early successional species or is tolerant of disturbance, transfer to MC3. Otherwise, assign species to MC2. **Trend** • If there is an increasing trend, change the category to MC3. • If there is a decreasing trend, change the category to MC1. • If there is a stable trend, maintain the category as MC2.
3	Lower level of concern and conservation effort	S2.3 S3.2 S3.3	**Communities and habitats in the plan area** • If the species (1) is found solely or primarily in a community or a habitat type where covered activities are unlikely to occur, (2) is common within the communities and habitats where it occurs, and (3) includes populations that are protected on public lands, transfer to MC4. Otherwise, review modifier below. **Viability** • If the typical number of individuals per occurrence, for the species throughout its range is fewer than 100 (e.g., *Boschniakia hookeri*, *Lilium maritimum*), or the reproductive rate of the species is known to be low, transfer to MC2. Otherwise, review next bullet. • If the typical area occupied by a single occurrence, for the species throughout its range is less than 1/10 of an acre (e.g., *Boschniakia hookeri*, *Lilium maritimum*), transfer to MC2. Otherwise, review modifier below. **Geographic range** • If any MRC occurrence defines a range limit for the species (e.g., *Pleuropogon hooverianus*), transfer to MC2. Otherwise, review next bullet. • If any MRC occurrence is separated from other occurrences of the species by more than 100 miles, transfer to MC2. Otherwise, review modifier below. **Distribution in the plan area** • If occurrences are found in only 1 inventory block, transfer to MC2. Otherwise, review next bullet.

Process for Assigning Management Categories (MC)			
MC	**Protection Level**	**S Rank and Threat Code**[a]	**Modifying Factors** [b]
			• If occurrences are found in 4 or more inventory blocks, transfer to MC4. Otherwise, review modifier below. **Sensitivity to disturbance** • If life history data demonstrates or strongly suggests that the species is intolerant of disturbance (e.g., *Lilium maritimum*), transfer to MC2. Otherwise, review next bullet. • If life history data demonstrates or strongly suggests that the species is an early successional species or is tolerant of disturbance, transfer to MC4. Otherwise, assign species to MC3. **Trend** • If there is an increasing trend, change the category to MC4. • If there is a decreasing trend, change the category to MC2. • If there is a stable trend, maintain the category as MC3.
4	Minimal concern and conservation effort	S4 S5	**Trend** • If there is a decreasing trend, change the category to MC3.

TABLE NOTES

[a]

- If no threat code is given, assign the species based on a threat code of 1.
- If the S rank consists of a range, assign the species based on the higher rarity status (e.g., a species with S2-S3 would be assigned based on S2).
- If an S rank has not been given because all or most occurrences are historic (SH?—meaning that records are old and status has not been determined for more than 20 years), assign the species to the management category that is consistent with the number of non-historic occurrences.

[b] Modifying factors are listed in order from most important to least important. If modifying factors apply, each species will be downgraded or upgraded by no more than one management category level, with the exception of species with S ranks of 2.1 and 2.2 that qualify for downgrading to MC4 under the criterion *Communities and habitats in the plan area* (section 11.5.2.1 #2).

[c] Monitoring will track the condition of MC4 species. If the status of an MC4 species declines, MRC will consider changes in conservation measures.

Table 11-4 Management Categories (MC) for Rare Plants in the Plan Area

Management Categories (MC) for Rare Plants in the Plan Area			
Common Name ***Scientific Name***	**S Rank**	**MC**	**Rationale**
Humboldt milk-vetch *Astragalus agnicidus*	S1.1	Not assigned	MC is not assigned because species-specific measures will be implemented (see section 11.8.2). Species is known to be early successional and tolerant of disturbance (Berg and Bittman 1988; Jirak 2001). MRC occurrences were found in 6 inventory blocks (Big River, Garcia, Navarro East, Noyo, Rockport, and South Coast).
small groundcone *Kopsiopsis hookeri*	S1-S2	1	Use S1.1 as base rank (threat level not determined). Base MC1is unchanged because no modifiers apply.
pygmy cypress *Hesperocyparis pygmaea*	S2.2	4	Downgrade to MC4 because species is found primarily in pygmy forest, where it is common. Species is protected at several state parks where management is directed toward natural resource preservation. Covered activities will be infrequent within a very small area of pygmy forest.
swamp harebell *Campanula californica*	S3.2	3	Base rank of MC3 is unchanged because no modifiers apply. Species is only present in 2 inventory blocks of the plan area (South Coast and Garcia).
Oregon goldthread *Coptis laciniata*	S3.2	2	Upgrade to MC2 because the typical number of individuals per occurrence throughout the species' range is usually fewer than 100.
coast lily *Lilium maritimum*	S2.1	1	Upgrade to MC 1 because occurrences typically are small in area and number of individuals. Additional information (not used as modifier) is that the species is sensitive to soil compaction and tolerant of reduction in canopy cover. Species is only present in 2 inventory blocks of the plan area (Garcia and South Coast).
Bolander's beach pine *Pinus contorta* ssp. *bolanderi*	S3.2	4	Downgrade to MC 4 because species is found primarily in pygmy forest, where it is common. Species is protected at several state parks where management is directed toward natural resource preservation. Covered activities will be infrequent, if at all, in pygmy forest and a minimal area will be affected.
white-flowered rein orchid *Piperia candida*	S3.2	2	Upgrade to MC2 because the number of individuals per occurrence throughout the species' range is low and the species is

Management Categories (MC) for Rare Plants in the Plan Area			
Common Name ***Scientific Name***	**S Rank**	**MC**	**Rationale**
			intolerant of disturbance.
North Coast semaphore grass *Pleuropogon hooverianus*	S1.1	1	Species has the highest statewide levels of rarity and threat. No modifiers apply. MRC occurrences represent the eastern limit of the species' range. Species is only present in 1 inventory block of the plan area (Ukiah).
maple-leaved checkerbloom *Sidalcea malachroides*	S3-S4.2	4	Downgrade to MC 4. Species is somewhat tolerant of disturbance. Species is present in 5 inventory blocks of the plan area (Albion, Garcia, Rockport, Navarro West, and South Coast).
long-beard lichen *Usnea longissima*	S4.2	Not assigned	MC has not been assigned because species-specific measures will be implemented (see section 11.8.1). Observations (Doell 2004) indicate this lichen is tolerant of disturbances related to timber harvesting. MRC occurrences found in 7 inventory blocks (Albion, Big River, Garcia, Navarro West, Navarro East, Rockport, and South Coast). Occurrences often characterized by 1 or few *source* trees, that retain this lichen over the long-term, and few-to-many *sink* trees,[11] with transient lichen presence (Peterson 2005).

11.6 Conservation Measures for Covered Rare Plants

This section describes the conservation measures, organized by management category, which MRC will implement for covered rare plant species found in the plan area. In the case of long-beard lichen and Humboldt milk-vetch, MRC has not assigned a management category because species-specific measures apply.

As indicated by the criteria in Table 11-3, the rarest and most threatened covered rare plant species are assigned to Management Category 1. These are afforded the highest level of protection, meaning that conservation measures place greater restrictions on covered activities and that covered species are managed more actively. Covered rare plant species assigned to Management Category 2 are somewhat more abundant and are less threatened than those assigned to Management Category 1; they receive an intermediate level of protection. Covered rare plant species assigned to Management Category 3, while still considered rare, are more abundant and widespread than species assigned to Management Category 2. Since these species have moderate-to-low threat levels, they receive less protection than those in Management Categories 1 and 2. Management Category 4 species are plants that are even more abundant and widespread than those in Management Categories 1-3; they are minimally threatened by covered activities. Species-based conservation measures for these species are minimal; however, MRC will implement community-based conservation measures to protect these plants. Our intention is that

[11] Refer to section 11.8.1 for a brief explanation of the terms *source* and *sink* trees.

proposed conservation measures be adequate to meet the objectives for each species within its management category (section 11.5).

MRC will implement *species-specific* conservation measures when necessary and when supported by scientific information. In contrast to measures for species assigned to management categories, species-specific measures are tailored to meet the precise needs of individual species. At present, MRC is proposing species-specific conservation measures only for long-beard lichen (section 11.8.1) and Humboldt milk-vetch (section 11.8.2). MRC and the wildlife agencies may periodically review any conservation measure and modify it, if conditions warrant a change.

11.7 Categorical Conservation Measures for Rare Plants

11.7.1 Conservation measures for management category 1 (MC1)

MRC assigns the rarest and most threatened plant species to Management Category 1. This affords the plant species the highest level of protection in that the conservation measures place greater restrictions on covered activities and manage the covered species more intensely.

	Standard Conservation Measures for Management Category 1
Communications	
C§11.7.1-1	Instruct all field personnel working in the vicinity of covered species occurrences, particularly operators of heavy equipment and those who apply pesticides, to comply with conservation measures, especially in locations with activity restrictions for core occurrence areas and buffers.
Core Occurrence Area	
C§11.7.1-2	Install a marking system that will persist throughout the term of the HCP/NCCP to designate environmentally sensitive areas along roads, such as core occurrences areas.
C§11.7.1-3	Mark the boundaries of a core occurrence area at regular intervals with painted t-posts, with stakes and colored flags, with clearly visible marks on retained trees, or with other means, so that the occurrence boundary maintains its integrity and is easily identifiable during activity and monitoring periods.
C§11.7.1-4	Mark the outer limits of the core occurrence area at least 5 ft beyond any visible parts (e.g., branches, surface roots) of a covered rare plant; use GPS data, as required, to define the core occurrence and ensure relocation if markers are damaged or removed.
C§11.7.1-5	Mark groups of plants within a core occurrence area, using methods described above, to facilitate avoidance and monitoring.
C§11.7.1-6	Restrict operations to use of existing truck roads, landings, and rock pits, as well as any activities intended to conserve rare plants, such as weed control.
C§11.7.1-7	Avoid all activities, including those outside the core occurrence and buffer areas, which result in significant alterations in surface water hydrologic conditions within the core occurrence area and adversely affect covered rare plants.

	Standard Conservation Measures for Management Category 1
C§11.7.1-8	Fell trees, only for safety purposes, into a core occurrence area but do not harvest them. **NOTE** If this need arises, MRC will notify the wildlife agencies before felling occurs. The wildlife agencies have 15 working days to respond before MRC can proceed with the planned felling operations.
C§11.7.1-9	Avoid using site preparation within designated core areas unless the wildlife agencies concur.
C§11.7.1-10	Avoid piling slash within designated core areas.
Buffer Width	
C§11.7.1-11	Ensure that the buffer width is 150 ft for forested sites (subject to timber harvest and other covered activities) and 50 ft for all other sites. **NOTE** MRC can reduce the buffer width—while still providing adequate protection—because of factors such as topographic characteristics (e.g., north slope situation); silvicultural practices (e.g., single tree selection); or adjacent stand conditions (e.g., uneven-aged management). Such reduction requires MRC to obtain the approval of the wildlife agencies.
C§11.7.1-12	Mark the outer edge of the buffer area with colored flagging or its equivalent, before covered activities begin; flagging must be clearly visible throughout the period when covered activities are taking place.
Buffer Management during Timber Operations	
C§11.7.1-13	Use only non-ground-disturbing types of site preparation (e.g., chainsaw brush cutting).
C§11.7.1-14	Use silviculture that results in cover approximately equivalent to that found in the core occurrence area with the harvest at least meeting the basal area and canopy requirements (derived from Class I and Large Class II AMZ, inner and middle bands). **NOTE** MRC will obtain the approval of the wildlife agencies on exceptions for early successional species and others that prefer open conditions.
C§11.7.1-15	Retain the approximate spatial and species mix and size distribution of tree species (conifers and hardwoods) found in the local area.
C§11.7.1-16	Fell trees away from a core occurrence area, whenever possible.
C§11.7.1-17	Treat the buffer area as an ELZ, allowing for use of existing roads, landings, and rock pits.
C§11.7.1-18	Avoid significantly altering surface water hydrologic conditions in ways that could adversely affect covered rare plants.

Standard Conservation Measures for Management Category 1	
Invasive Pest Plant Management[12]	
C§11.7.1-19	Control[13] invasive pest plants within 50 ft[14] of all covered rare plant individuals, using methods that are feasible and effective, and that minimize impacts to non-target species, during both the 1st and 2nd years following covered activities.
Take Provisions	
C§11.7.1-20	Avoid or minimize take to the maximum degree feasible.
C§11.7.1-21	Permit take only if required for normal operations.
C§11.7.1-22	Permit take only for occurrences > 250 individuals[15], except for roads, landings, and rock pits (see below).
C§11.7.1-23	Describe in project documents (e.g., PTHPs) the amount of take anticipated from covered activities.
C§11.7.1-24	Restrict activities causing take to the period between seed set and the breaking of dormancy, if feasible.
C§11.7.1-25	Consult with the wildlife agencies, if normal operations require higher take limits than those specified in C§11.7.1-26 and C§11.7.1-29.
Take for Roads, Landings, and Rock Pits	
C§11.7.1-26	Permit take of covered rare plant individuals growing in previously established roads, landings, and rock pits, if avoidance is infeasible, and adhere to the following limits: ▪ For occurrences < 250 individuals, take of up to 2% of the individuals within a single occurrence, per each single- or multiple-year project. ▪ For occurrences of 251-500 individuals, take of up to 5% of the individuals within a single occurrence, per each single- or multiple-year project. ▪ For occurrences > 500 individuals, take of up to 10% of the individuals within a single occurrence, per each single- or multiple-year project. **NOTE** Feasible minimization includes: (1) minimizing grading of roadbed and roadsides; (2) running logging trucks and other equipment in tire tracks only; (3) enforcing seasonal restrictions; and (4) applying other restrictions.

[12] Invasive pest plants, which MRC will control, include those species listed by Cal-IPC (2006) and the CDFA (2004) that pose a significant risk to rare plants in the plan area. At a minimum, these include: yellow star-thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*), jubata grass (*Cortaderia jubata*), Scotch broom (*Cytissus scoparius*), French broom (*Genista monspessulana*), and Harding grass (*Phalaris aquatica*). MRC will undertake control of additional species of invasive pest plants if they interfere, demonstrably, with the survival or reproduction of covered rare plants.

[13] *Control*, with regard to invasive pest plant management, means kill, eliminate, or remove to the maximum degree possible.

[14] This is based on a "take-avoidance" distance of 50 ft cited in the MRC Planning Agreement (2003).

[15] Definition of *individual* varies with growth form of the species, and will be defined accordingly; for spreading clonal species, area may be used as a surrogate, for example, a take limit of 2% would allow take of plants within an area equivalent to 2% of the total area occupied by the species.

	Standard Conservation Measures for Management Category 1
C§11.7.1-27	Spread soil from road berms (which need to be removed for proper road drainage and on which rare plants are growing) in roadside areas that MRC will manage as EEZs for a minimum of 2 years. **NOTE** If these sites are not colonized by rare plants within 2 years, MRC will remove EEZ restrictions. If these sites are colonized by rare plants within 2 years, MRC will continue to manage them as EEZs as long as the rare plants persist in those locations.
C§11.7.1-28	Donate, for scientific purposes and whenever possible, any rare plant that is incidentally taken and not used in translocation; this includes collecting and preserving voucher specimens, as well as salvaging live plants and seeds for researchers, seed banks, or botanic gardens. **NOTE** If MRC gets no willing takers for a specific species, we will advise the wildlife agencies and no longer make donations of that species unless the wildlife agencies identify a recipient.
Take for All Other Covered Activities	
C§11.7.1-29	Permit take, in the case of occurrences > 250 individuals, as follows: ▪ Take of up to 2% of the individuals within a single occurrence, per stand entry, for PTHPs. ▪ Take of up to 2% of the individuals within a single occurrence, per year, for other activities, without approval of the wildlife agencies.
Variances	
C§11.7.1-30	Seek approval in writing from the wildlife agencies if requesting changes to core area management, buffer management, or buffer width; include the variances in a PTHP subject to public comment.
C§11.7.1-31	Ensure that requested variances are consistent with the objectives of the conservation strategy.
Translocation	
Non-compensatory[16]	
C§11.7.1-32	Notify the wildlife agencies when MRC will perform a non-compensatory translocation.
C§11.7.1-33	Mark and map the location of the translocation in the field.
C§11.7.1-34	Describe in writing the result of the translocation for the wildlife agencies.
Compensatory translocation[17]	
C§11.7.1-35	Obtain approval from the wildlife agencies before implementing.

[16] A non-compensatory translocation (a) is not mitigation; (b) is permitted on a voluntary basis when take does not exceed standard levels; (c) does not require approval from the wildlife agencies; (d) is opportunity-driven and conducted on an ad hoc basis; (e) does not require an experimental approach; (f) is intended only to expand the area occupied by the rare plant within an occurrence or to increase the number of subgroups within an occurrence, not to establish new occurrences; and (g) uses as propagules only plants that are unavoidably taken.

[17] A compensatory translocation (a) is an allowed form of mitigation when take exceeds standard levels; (b) requires approval from the wildlife agencies; (c) requires an experimental approach; and (d) may be used to establish new occurrences or to expand an existing occurrence.

	Standard Conservation Measures for Management Category 1
C§11.7.1-36	Mark and map the location of the translocation in the field.
C§11.7.1-37	Provide thorough written documentation of methods, results, and conclusions for the wildlife agencies.

11.7.1.1 Intent of the buffer

A buffer minimizes the impact of covered activities on a core occurrence area by creating a zone of protection around it where MRC will maintain habitat conditions favorable to the rare plant. These conditions include microclimatic factors, such as humidity, temperature, and solar radiation; hydrology and soil characteristics; and populations of beneficial mycorrhizal fungi and potential pollinators. In addition, buffers limit disturbances from covered activities, such as soil compaction and vegetation removal. For early successional species that prefer more open conditions, silviculture within the buffer may aim for a canopy cover that is approximately equivalent to that found within the core occurrence area, rather than one meeting the basal area and canopy requirements of, say, inner and middle bands of Class I and Large Class II AMZ.

MRC and the wildlife agencies have based the size of buffer widths specified in our HCP/NCCP on their best professional judgment. In the case of rare plant occurrences, there is no standard for buffer widths in managed timberland. MRC will examine the effectiveness of buffer width and buffer management through targeted studies described in Chapter 13 (section 13.10.2.2).

11.7.1.2 Intent of take provisions

The conservation measures for species in Management Category 1 avoid incidental take to the maximum degree feasible.[18] If avoidance or minimization measures prevented MRC from using existing roads or accessing PTHP areas, the take provisions would be infeasible. The wildlife agencies have not established quantitative standards for take limits for rare plants. The limits of take described in the conservation measures prohibit take in all circumstances unless take is essential for normal operations, such as road and landing use. When MRC cannot avoid take, we must limit it to the smallest possible number of individual plants by restricting essential activities. In all cases, the conservation objectives for MC1 species strive to maintain every occurrence in the plan area at stable-to-increasing levels of abundance and distribution. In the event that MRC must exceed the limits of take, the wildlife agencies must approve higher take limits. Even if MRC receives such approval, the wildlife agencies may still require compensatory measures, such as habitat improvements or translocations. MRC will select the most effective compensatory measures with the approval of the wildlife agencies.

Limits of take that allow for a loss of up to 2% of individuals (or up to 10% for roads, landings, and rock pits) within an occurrence per year do not imply that a 2% loss each year is permissible. Over the 80-year term of the HCP/NCCP, most of the plan area will only be subject to impact for a few years. The limits of take defined in this plan are flexible enough to accommodate covered activities that may take place in 2 or more successive years. MRC will typically complete stand entries for timber harvest in a single year; harvests will occur on a rotation of 20 years or more. Occurrences in PTHP areas in which there has been incidental take, therefore, will have 20 years or more of recovery time between timber harvests. Apart from timber harvests, we cannot predict the number of consecutive years to complete other covered activities, but this will typically be 1-3

[18] MRC defines *feasible* as capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

years. Pre- and post-harvest monitoring, discussed in Chapter 13 (M§13.10.3-1), will track the status and trend of covered rare plants over the term of our HCP/NCCP. If monitoring determines that MRC is not meeting our conservation objectives or that conservation measures are more restrictive than required to achieve those objectives, MRC and the wildlife agencies may reconsider take provisions through adaptive management.

Our HCP/NCCP does not permit take for occurrences of fewer than 250 individuals, with the exception of essential operations on roads, landings, and rock pits. This restriction, which applies to Management Categories 1 through 3, encourages self-sustainability for small occurrences. Small occurrences are more susceptible to losses from random, unpredictable circumstances, as well as from anthropogenic disturbances. Researchers have used Minimum Viable Population (MVP) analyses, based on mathematical models, to calculate the minimum number of individuals that a population must maintain to survive over the long-term (Gilpin and Soule 1986). There are no MVP analyses for any of the rare plants covered under our HCP/NCCP; such analyses are unlikely in the near future due to the time and expense required for data collection. As Gilpin and Soule (1986) discuss, estimating MVPs is complex and there is no “magic number” that is universally applicable to all species. The proposed standard of 250 individuals, however, is a reasonable starting point, given the other protections provided by our HCP/NCCP. This standard is subject, as well, to modification through adaptive management.

If MRC anticipates that a covered activity will result in take, we will calculate the standard take limits prior to implementation of the covered activity. The standard take limits are the maximum number of individuals that MRC can take without special permission from the wildlife agencies. In our calculation, we will use the total number of individuals within the core occurrence area, as counted or estimated during the most recent rare plant survey or monitoring census conducted prior to the submission of a PTHP. MRC will report the calculated take limit in a PTHP, along with an estimate of the maximum number of individuals we expect to take after full implementation of avoidance and minimization measures. If the expected take exceeds the standard take limits, MRC will request from the wildlife agencies a variance in the standard take limits. If the wildlife agencies grant the variance, MRC will implement mitigation as compensation for exceeding the standard take limits.

11.7.1.3 Intent of translocation

Translocation is the movement of plant propagules (e.g., seeds, bulbs, stems, etc.) from one place to another in order to establish a new self-sustaining group of plants (Howald 1996). Our HCP/NCCP authorizes translocation for covered rare plant species, including species listed by both federal and state agencies. Generally, the wildlife agencies discourage translocations as a means of mitigating project impacts since the documented rate of success is low (Fiedler 1991, Falk et al. 1996). Nevertheless, translocation, along with the avoidance and minimization measures in our HCP/NCCP, may be an appropriate conservation measure in some circumstances. Even low rates of success with source propagules authorized for take can minimize waste, yield important knowledge, and improve distribution and abundance.

For our HCP/NCCP, the wildlife agencies are authorizing both non-compensatory and compensatory translocations. For a specific PTHP, plants will be subject to incidental take; the number of plants which MRC takes must be within standard take limits. This is an example of a non-compensatory translocation. If the number of plants which MRC takes is within standard take limits, there is no required compensation. Moreover, the applicable conservation measures do not require MRC to translocate any of the plants that were part of take. Under these circumstances, however, translocation represents a potential opportunity to reduce the overall loss of plants from the occurrence. Non-compensatory translocations are voluntary; MRC can make a decision on an ad hoc basis. MRC can choose to use non-compensatory translocations to increase the number of plants or the area occupied by plants within the affected occurrence, but not to “experiment” with establishing a new occurrence elsewhere.

When MRC requests higher-than-standard take limits and the wildlife agencies give project-specific approval, MRC can implement compensatory translocation. Under these circumstances, MRC would conduct translocations as controlled experiments and provide complete written documentation to the wildlife agencies of our methods, results, and conclusions. Compensatory translocations could increase the number of plants or the area occupied by plants within the affected occurrence; it could also establish a new occurrence in an area previously unoccupied by the covered rare plant species. Translocation of rare plants removed as a result of a covered activity, such as road maintenance, reduces “waste” of the species.

11.7.2 Conservation measures for management category 2 (MC2)

MRC assigns plant species to Management Category 2 that are more abundant and less threatened than those in Management Category 1 (Table 11-3). In Management Category 2, plant species receive an intermediate level of protection.

	Standard Conservation Measures for Management Category 2
Communications	
C§11.7.2-1	Instruct all field personnel working in the vicinity of covered species occurrences, particularly operators of heavy equipment and those who apply pesticides, about complying with conservation measures, especially in locations with activity restrictions for core occurrence areas and buffers.
Core Occurrence Area	
C§11.7.2-2	Install a marking system along roads to designate environmentally sensitive areas, such as core occurrences areas; ensure the system persists throughout the period when the HCP/NCCP is in effect.
C§11.7.2-3	Mark the boundaries of a core occurrence area at regular intervals with painted t-posts, with stakes and colored flags, with clearly visible marks on retained trees, or with other means, so that the occurrence boundary maintains its integrity and is easily identifiable during activity and monitoring periods.
C§11.7.2-4	Mark the outer limits of the core occurrence area at least 5 ft beyond any visible parts (e.g., branches, surface roots) of a covered rare plant; use GPS data, as required, to define the core occurrence and ensure relocation if markers are damaged or removed.
C§11.7.2-5	Mark groups of plants within a core occurrence area, using methods described in C§11.7.2-4, to facilitate avoidance and monitoring.
C§11.7.2-6	Avoid using site preparation within designated core areas unless the wildlife agencies concur.
C§11.7.2-7	Avoid piling slash within designated core areas.
Buffer Width	
C§11.7.2-8	Ensure that the buffer width is 50 ft.

	Standard Conservation Measures for Management Category 2
	NOTE MRC can reduce the buffer width—if still providing adequate protection—because of factors such as topographic characteristics (e.g., north slope situation); silvicultural practices (e.g., single tree selection); or adjacent stand conditions (e.g., uneven-aged management). Such reduction requires approval of the wildlife agencies.
C§11.7.2-9	Mark the outer edge of the buffer area with colored flagging or its equivalent before covered activities begin; flagging must be clearly visible throughout the period when covered activities are taking place.
Core Area Management during Timber Operations	
C§11.7.2-10	Ensure that post-harvest stands meet the basal area and canopy requirements of the inner and middle bands of Class I and Large Class II AMZs. **NOTE** MRC will obtain approval of the wildlife agencies on early successional species and others that prefer open conditions.
C§11.7.2-11	Retain the approximate distribution of conifers and hardwoods found in the core occurrence area.
C§11.7.2-12	Fell trees away from the core occurrence area, whenever possible.
C§11.7.2-13	Treat a core occurrence area as an ELZ, allowing for use of existing roads, landings, and rock pits.
C§11.7.2-14	Avoid significantly altering surface water hydrologic conditions in ways that could adversely affect covered rare plants.
Buffer Management during Timber Operations	
C§11.7.2-15	Ensure that post-harvest stands meet the basal area and canopy requirements of the inner and middle bands of Class I and Large Class II AMZs. **NOTE** MRC will obtain approval of the wildlife agencies on early successional species and others that prefer open conditions.
C§11.7.2-16	Retain the approximate distribution of trees (conifers and hardwoods) found in the local area.
C§11.7.2-17	Fell trees away from a core occurrence area, whenever possible.
C§11.7.2-18	Treat the buffer area as an ELZ, allowing for use of existing roads, landings, and rock pits.
C§11.7.2-19	Avoid significantly altering surface water hydrologic conditions in ways that could adversely affect covered rare plants.
C§11.7.2-20	Prepare sites without creating ground disturbances.
Invasive Pest Plant Management	
C§11.7.2-21	Control invasive pest plants within 50 ft of all covered rare plant individuals, using methods that are feasible and effective, and that minimize impacts to non-target species, during both the 1st and 2nd years following covered activities.
Take Provisions	
C§11.7.2-22	Avoid or minimize take to the maximum degree feasible.
C§11.7.2-23	Permit take only if required for normal operations.

	Standard Conservation Measures for Management Category 2
C§11.7.2-24	Permit take only for occurrences > 250 individuals, [14] except for roads, landings, and rock pits (see C§11.7.2-28).
C§11.7.2-25	Describe in project documents (e.g., PTHPs) the amount of take anticipated from covered activities.
C§11.7.2-26	Restrict activities causing take to the period between seed set and the breaking of dormancy, if feasible.
C§11.7.2-27	Consult with the wildlife agencies, if normal operations require higher take limits than those specified in C§11.7.2-28 and C§11.7.2-31.
Take for Roads, Landings, and Rock Pits	
C§11.7.2-28	Permit take of covered rare plant individuals growing in previously established roads, landings, and rock pits, if avoidance is infeasible, and adhere to the following limits: ▪ For occurrences < 250 individuals, take of up to 5% of the individuals within a single occurrence, per each single- or multiple-year project. ▪ For occurrences > 250 individuals, take of up to 10% of the individuals within a single occurrence, per each single- or multiple-year project. **NOTE** Feasible minimization includes: (1) minimizing grading of roadbed and roadsides; (2) running logging trucks and other equipment in tire tracks only; (3) enforcing seasonal restrictions; and (4) applying other restrictions.
C§11.7.2-29	Spread soil from road berms (which need to be removed for proper road drainage and on which rare plants are growing) in roadside areas that MRC will manage as EEZs for a minimum of 2 years. **NOTE** If these sites are not colonized by rare plants within 2 years, MRC will remove EEZ restrictions. If these sites are colonized by rare plants within 2 years, MRC will continue to manage them as EEZs as long as the rare plants persist in those locations.
C§11.7.2-30	Donate, for scientific purposes and whenever possible, any rare plant that is incidentally taken and not used in translocation; this includes collecting and preserving voucher specimens, and salvaging live plants and seeds for researchers, seed banks, or botanic gardens. **NOTE** If MRC gets no willing takers for a specific species, we will advise the wildlife agencies and no longer make donations of that species unless the wildlife agencies identify a recipient.
Take for All Other Covered Activities	
C§11.7.2-31	Permit take, in the case of occurrences > 250 individuals, as follows: ▪ Take of up to 5% of the individuals within a single occurrence, per stand entry, for PTHPs. ▪ Take of up to 5% of the individuals within a single occurrence, per year, for other activities, without approval of the wildlife agencies.
Variances	

	Standard Conservation Measures for Management Category 2
C§11.7.2-32	Seek approval in writing from the wildlife agencies if requesting changes to core area management, buffer management, or buffer width; include the variances in a PTHP subject to public comment.
C§11.7.2-33	Ensure that requested variances are consistent with the objectives of the conservation strategy.
Translocation	
Non-compensatory	
C§11.7.2-34	Notify the wildlife agencies when MRC will perform a non-compensatory translocation.
C§11.7.2-35	Mark and map the location of the translocation in the field.
C§11.7.2-36	Describe in writing the result of the translocation for the wildlife agencies.
Compensatory translocation	
C§11.7.2-37	Obtain approval from the wildlife agencies before implementing.
C§11.7.2-38	Mark and map the location of the translocation in the field.
C§11.7.2-39	Provide thorough written documentation of methods, results, and conclusions for the wildlife agencies.

11.7.2.1 Intent of take provisions

The take provisions for species in Management Category 2 avoid incidental take to the maximum degree feasible. In the conservation measures, limits of take prohibit take unless it is essential for normal operations. The overall intent is to achieve the conservation objectives for Management Category 2. If operations in the field require higher take limits, MRC must seek approval from the wildlife agencies.

Limits of take that allow for a loss of up to 5% of individuals (or up to 10% for roads, landings, and rock pits) within an occurrence per year do not imply that a 5% loss each year is permissible. Over the 80-year term of our HCP/NCCP, most of the plan area will only be subject to impact for a few years. The limits of take defined in this plan are flexible enough to accommodate covered activities that may take place in 2 or more successive years. MRC will typically complete stand entries for timber harvest in a single year; harvests will occur on a rotation of 20 years or more. Occurrences in PTHP areas in which there has been incidental take, therefore, will have 20 years or more of recovery time between timber harvests. Apart from timber harvests, we cannot predict the number of consecutive years to complete other covered activities, but this will typically be 1-3 years. Pre- and post-harvest monitoring, discussed in Chapter 13 (M§13.10.3-1), will track the status and trend of covered rare plants over the term of our HCP/NCCP. If monitoring determines that MRC is not meeting our conservation objectives or that conservation measures are more restrictive than required to achieve those objectives, MRC and the wildlife agencies may reconsider take provisions through adaptive management.

11.7.3 Conservation measures for management category 3 (MC3)

MRC assigns plant species to Management Category 3 that, while still considered rare, are more abundant and widespread and less threatened than those in Management Category 2. In Management Category 3, plant species receive less protection than species in either Management Category 1 or Management Category 2.

Standard Conservation Measures for Management Category 3	
Communications	
C§11.7.3-1	Instruct all field personnel working in the vicinity of covered species occurrences, particularly operators of heavy equipment and those who apply pesticides, about complying with conservation measures, especially in locations with activity restrictions for core occurrence areas and buffers.
Core Occurrence Area	
C§11.7.3-2	Mark the boundaries of a core occurrence area at regular intervals with painted t-posts, with stakes and colored flags, with clearly visible marks on retained trees, or with other means, so that the occurrence boundary maintains its integrity and is easily identifiable during activity and monitoring periods.
C§11.7.3-3	Mark the outer limits of the core occurrence area at least 5 ft beyond any visible parts (e.g., branches, surface roots) of a covered rare plant; use GPS data, as required, to define the core occurrence and ensure relocation if markers are damaged or removed.
C§11.7.3-4	Limit losses of individual covered rare plants as feasible.
C§11.7.3-5	Treat a core occurrence area as an ELZ, allowing for use of existing roads, landings, and rock pits.
C§11.7.3-6	Minimize significant alterations to surface water hydrologic conditions that could adversely affect covered rare plants.
C§11.7.3-7	Minimize disturbance from site preparation and slash piles.
Buffer Width	
C§11.7.3-8	Ensure that the buffer width is 50 ft. **NOTE** MRC can reduce the buffer width—if still providing adequate protection—because of factors such as topographic characteristics (e.g., north slope situation); silvicultural practices (e.g., single tree selection); or adjacent stand conditions (e.g., uneven-aged management). Such reduction requires approval of the wildlife agencies.
C§11.7.3-9	Mark the outer edge of the buffer area with colored flagging or its equivalent, before covered activities begin; flagging must be clearly visible throughout the period when covered activities are taking place.
Core Management during Timber Operations	
C§11.7.3-10	Fell trees away from the core occurrence area, whenever possible.
C§11.7.3-11	Minimize direct impacts, where feasible, by felling trees away from plants and by not skidding on plants.
Buffer Management during Timber Operations	
C§11.7.3-12	Fell trees away from a core occurrence area.
C§11.7.3-13	Treat the buffer area as an ELZ.
C§11.7.3-14	Minimize significant alterations to surface water hydrologic conditions that could adversely affect covered rare plants.
Invasive Pest Plant Management	

	Standard Conservation Measures for Management Category 3
C§11.7.3-15	Control invasive pest plants within 25 ft of all covered rare plant individuals, using methods that are feasible and effective and that minimize impacts to non-target species, during the first year following covered activities.
Take Provisions	
C§11.7.3-16	Avoid or minimize take to the maximum degree feasible.
C§11.7.3-17	Permit take only if required for normal operations.
C§11.7.3-18	Permit take only for occurrences > 250 individuals, except for roads, landings, and rock pits (see C§11.7.3-22).
C§11.7.3-19	Describe in project documents (e.g., PTHPs) the amount of take anticipated from covered activities.
C§11.7.3-20	Restrict activities causing take to the period between seed set and the breaking of dormancy, if feasible.
C§11.7.3-21	Consult with the wildlife agencies, if normal operations require higher take limits than those specified in C§11.7.3-25.
Take for Roads, Landings, and Rock Pits	
C§11.7.3-22	Permit take of covered rare plant individuals growing in previously established roads, landings, and rock pits, if avoidance is infeasible. **NOTE** Feasible avoidance includes: (1) minimizing grading of roadbed and roadsides; (2) running logging trucks and other equipment in tire tracks only; and (3) other feasible restrictions.
C§11.7.3-23	Spread soil from road berms (which need to be removed for proper road drainage and on which rare plants are growing) in roadside areas that MRC will manage as EEZs for a minimum of 2 years. **NOTE** If these sites are not colonized by rare plants within 2 years, MRC will remove EEZ restrictions. If these sites are colonized by rare plants within 2 years, MRC will continue to manage them as EEZs as long as the rare plants persist in those locations.
C§11.7.3-24	Donate, for scientific purposes and whenever possible, any rare plant that is incidentally taken and not used in translocation; this includes collecting and preserving voucher specimens, and salvaging live plants and seeds for researchers, seed banks, or botanic gardens. **NOTE** If MRC gets no willing takers for a specific species, we will advise the wildlife agencies and no longer make donations of that species unless the wildlife agencies identify a recipient.
Take for All Other Covered Activities	
C§11.7.3-25	Permit take, in the case of occurrences > 250 individuals, as follows: ▪ Take of up to 10% of the individuals within a single occurrence, per stand entry, for PTHPs. ▪ Take of up to 10% of the individuals within a single occurrence, per year, for other activities, without approval of the wildlife agencies.
Variances	

	Standard Conservation Measures for Management Category 3
C§11.7.3-26	Seek approval in writing from the wildlife agencies if requesting changes to core area management, buffer management, or buffer width; include the variances in a PTHP subject to public comment.
C§11.7.3-27	Ensure that requested variances are consistent with the objectives of the conservation strategy.
Translocation	
Non-compensatory	
C§11.7.3-28	Notify the wildlife agencies when MRC will perform a non-compensatory translocation.
C§11.7.3-29	Mark and map the location of the translocation in the field.
C§11.7.3-30	Describe in writing the result of the translocation for the wildlife agencies.
Compensatory translocation	
C§11.7.3-31	Obtain approval from the wildlife agencies before implementing.
C§11.7.3-32	Mark and map the location of the translocation in the field.
C§11.7.3-33	Provide thorough written documentation of methods, results, and conclusions for the wildlife agencies.

11.7.3.1 Intent of the take provisions

The take provisions for species in Management Category 3 minimize incidental take, while allowing normal timber harvest operations and other covered activities to proceed with minimal or no restrictions. For existing roads, landings, and rock pits, take is permitted as long as MRC implements feasible avoidance measures and continues to achieve the objectives for MC3 species. If operations in the field require higher take limits, MRC must seek approval from the wildlife agencies.

Limits of take that allow for a loss of up to 10% of individuals within an occurrence per year do not imply that a 10% loss each year is permissible. Over the 80-year term of our HCP/NCCP, most of the plan area will only be subject to impact for a few years. The limits of take defined in our plan are flexible enough to accommodate covered activities that may take place in 2 or more successive years. MRC will typically complete stand entries for timber harvest in a single year; harvests will occur on a rotation of 20 years or more. Occurrences in PTHP areas in which there has been incidental take, therefore, will have 20 years or more of recovery time between timber harvests. Apart from timber harvests, we cannot predict the number of consecutive years to complete other covered activities, but this will typically be 1-3 years. Pre- and post-harvest monitoring, discussed in Chapter 13 (M§13.10.3-1), will track the status and trend of covered rare plants over the term of our HCP/NCCP. If monitoring determines that MRC is not meeting our conservation objectives or that conservation measures are more restrictive than required to achieve those objectives, MRC and the wildlife agencies may reconsider take provisions through adaptive management.

11.7.4 Conservation measures for management category 4 (MC4)

Species that qualify for Management Category 4 are covered species that, locally, are relatively widespread or common; some are in communities where MRC will limit covered activities both in area and frequency. MRC created this management category to accommodate 3 types of covered species.

Type 1
These are species which CDFG and CNPS may downgrade during the term of our HCP/NCCP. As MRC conducts more plant surveys in compliance with our HCP/NCCP, we expect to detect new occurrences of covered species. As a result, CDFG and CNPS may downgrade the conservation status of some covered species. In 2006, for example, CNPS and CNDDB botanists conducted a status review of maple-leaved checkerbloom (*Sidalcea malachroides*). Subsequently, they downgraded its status from S3.2 to S4.2. While our HCP/NCCP was still in draft format at that time, MRC changed the management category of maple-leaved checkerbloom from MC2 to MC4.

Type 2
These species (a) are found in communities and habitats in the plan area where covered activities will occur rarely; (b) are relatively common within these communities and habitats; and (c) have sizeable protected populations elsewhere on land whose management goals include the protection of natural resources such as rare plants (e.g., state parks, county parks, and public and private preserves). Examples of this second type are pygmy cypress (*Callitropsis pygmaea*) and Bolander's beach pine (*Pinus contorta* ssp. *bolanderi*). These covered species are relatively common within the pygmy forest community where, in the plan area, there are no timber harvests and minimal road construction. In addition, these species are protected in several locations on land where natural resource conservation is a priority, such as Jug Handle State Reserve, Van Damme State Park, Salt Point State Park, and the Hans Jenny Pygmy Forest Reserve (managed by The Nature Conservancy and the University of California). MRC will protect species such as pygmy cypress and Bolander's beach pine primarily through community-based conservation measures, following the stated goals of the NCCPA.

Type 3
These species have a ranking of S4 or S5 which CNPS and CNDDB botanists may never adjust during the term of our HCP/NCCP.

By including these types of covered species in a management category, MRC expects to provide a level of conservation and monitoring that will ensure their long-term persistence in the plan area.

	Standard Conservation Measures for Management Category 4
Communications	
C§11.7.4-1	Instruct all field personnel working in the vicinity of covered species occurrences, particularly operators of heavy equipment and those who apply pesticides, to comply with conservation measures.
Core Occurrence Area	

	Standard Conservation Measures for Management Category 4
C§11.7.4-2	Mark the boundaries of a core occurrence area at regular intervals with painted t-posts, with stakes and colored flags, with clearly visible marks on retained trees, or with other means, so that the occurrence boundary maintains its integrity and is easily identifiable during activity and monitoring periods.
C§11.7.4-3	Mark the outer limits of the core occurrence area at least 5 ft beyond any visible parts (e.g., branches, surface roots) of a covered rare plant; use GPS data, as required, to define the core occurrence and ensure relocation if markers are damaged or removed.
C§11.7.4-4	Avoid impacts to individual covered rare plants to the degree necessary to meet conservation objectives.
Limits of Take	
C§11.7.4-5	Ensure that the number of individuals lost through incidental take is low enough so that a covered rare plant species qualifies for its current S rank or a higher S rank.

11.7.4.1 Intent of the take provisions

There are no specified take limits for species in Management Category 4. Nevertheless, the number of individuals lost through incidental take must be low enough to ensure that the covered species continues to qualify for its current S rank or a higher S rank (indicating a greater number of occurrences), and that some occurrences maintain a stable-to-increasing level in the plan area. Species in this category are relatively widespread and common; MRC protects them through community-based conservation measures. If monitoring demonstrates MRC is not meeting our conservation objectives, the wildlife agencies may require specific take limits and additional conservation measures through adaptive management.

11.8 Conservation Measures for Specific Species

Currently, MRC only has enough data to create species-specific measures for 2 covered plants: long-beard lichen (*Usnea longissima*) and Humboldt milk-vetch (*Astragalus agnicidus*). In the future, we may collect additional information to create, with the approval of the wildlife agencies, species-specific measures for additional covered plants.

11.8.1 Conservation measures for long-beard lichen

DEFINITION

A **source tree** is a dominant, co-dominant, or pre-dominant tree that contains large amounts of long-beard lichen in the canopy and provides propagules for dispersal.

MRC is proposing species-specific conservation measures for long-beard lichen; as a result, we have not assigned this species to a management category. For species like long-beard lichen, species-specific measures will provide a more consistent level of conservation over the long-term than is achievable through the standard conservation measures. Since 2000, many new locations for long-beard lichen in California have been documented (CNDDB 2006). The December 2005 review proposal (Peterson 2005) recommends CNDDB rankings of G5.1 and S4.2 and a CRPR-compatible rank of 4. Appendix R, *Plant Rankings*, includes an explanation of G and S ranks in

CNDDB, as well as CRPR ranks. If CNDDB staff adopts the rank recommended by the California Lichen Society (CALS), long-beard lichen may not be eligible for protection under CEQA.

The CALS status review proposal (Peterson 2005) points out that there are more than 200 occurrences of long-beard lichen in Humboldt County and in Mendocino County, where most of the California populations are known. The Sonoma County occurrences probably constitute the southern limit of this lichen's range in California and, very likely, in North America. Long-beard lichen populations in other parts of the United States and in Europe have declined in recent years, possibly because of air pollution (Brodo et al. 2001). In light of these factors, MRC will conserve long-beard lichen on our land, regardless of whether it qualifies for future protection under CEQA.

For long-beard lichen, occurrence size typically depends on the number of trees inhabited by this epiphytic lichen, which lives on the surface of forest trees, not by the number of lichen individuals. Determining the number of lichen individuals would require dismantling the organism to count the number of thalli in each occurrence. Estimates of cover are also impractical. According to data from Pacific Lumber Company land in Humboldt County (Peterson 2005), long-beard lichen populations may have a "source and sink" distribution pattern. Source trees contain visibly large amounts of long-beard lichen in the canopy; these sites persist over the long-term and provide lichen fragments that colonize new trees (Keon and Muir 2002). Sink trees, which are smaller and located in the understory, likely result from lichen fragments which source trees emit during high wind events; these sink tree populations are mainly transient. Dispersal of fragments is the main form of reproduction for long-beard lichen (Keon and Muir 2002).

A recent study in the Oregon Coast Range by Keon and Muir (2002) examined the growth of long-beard lichen in 4 types of suitable habitat. Studies of habitat characteristics in sites currently occupied by long-beard lichen shaped the definition of suitable habitat. Researchers placed transplants of long-beard lichen in apparently suitable habitat based on predictive modeling. Long-beard lichen grew in all 4 habitat types; growth was greatest in habitats predicted to be least suitable, which were characterized by south to southwest-facing slopes in clear cuts or in stands less than 10 years old. Keon and Muir (2002) noted that long-beard lichen fragments typically travel less than 16 ft (5 m) from their source locations and concluded that dispersal limitations may play a greater role than the availability of suitable habitat in determining the distribution of long-beard lichen in the Oregon Coast Range. To conserve long-beard lichen in timber management areas, Keon and Muir recommend retaining old stands of trees with "significant populations" of long-beard lichen as source locations capable of inoculating other trees.

In the plan area, MRC foresters have documented long-beard lichen from 15 occurrences; future surveys are likely to uncover additional occurrences. Most of these long-beard lichen occurrences exhibit the source and sink distribution pattern observed in other parts of the Pacific Northwest (Peterson 2005, Keon and Muir 2002).

MRC intends the conservation measures for long-beard lichen to (a) conserve the species throughout its range in the plan area; (b) conserve some source and sink complexes; and (c) provide unoccupied habitat suitable for future colonization. We will focus conservation measures on protecting the source trees inhabited by this lichen and retaining other trees that lichen might colonize.

	Standard Conservation Measures for Long-beard Lichen
C§11.8.1-1	Train foresters and rare plant surveyors in the field to recognize pendant lichens that may be long-beard lichen.
C§11.8.1-2	Search for, identify, and document long-beard lichen source and sink trees during rare plant surveys in PTHP areas.
C§11.8.1-3	Protect up to 10 source trees in any PTHP area. **EXAMPLES** ▪ If the PTHP area has 7 source trees, MRC will protect all 7. ▪ If the PTHP area has 25 source trees, MRC will protect 10 of the 25.
C§11.8.1-4	Prevent the cutting or trimming of protected sources trees, except to ensure the safety of workers.
C§11.8.1-5	Maintain screen trees in the vicinity of source trees to buffer them from wind-throw and other threats and to provide an opportunity for the dispersal of long-beard lichen. **NOTE** If feasible, MRC will select screen trees that are within the dispersal range for long-beard lichen, i.e., < 16 ft (5 m) from a source tree, and whose retention will not cause source trees to be heavily shaded.
C§11.8.1-6	Protect old-growth trees and snags[19] and limit harvest in AMZs to provide potential habitat for new occurrences of long-beard lichen.
C§11.8.1-7	Test lichen samples, whenever possible, to determine their identity, using tests recommended by lichenologists.
C§11.8.1-8	Monitor for the presence or absence of long-beard lichen throughout the term of the HCP/NCCP during preparatory fieldwork for PTHP submissions.

11.8.2 Conservation measures for Humboldt milk-vetch

Humboldt milk-vetch is a suffrutescent, perennial member of the pea family, Fabaceae (Hickman 1993). The species is fairly short-lived with an estimated life span of 5 to 10 years (Bencie 1997). Like so many members of the Fabaceae, reproductive success is dependent on some level of disturbance. Botanist R.C. Barneby, the taxon author, surmised that "disturbance of the highly competitive climax woodland and the sudden weedy abundance of *A. agnicidus* are related phenomena" (Barneby 1957). Greenhouse and germination experiments conducted by Pickart and others (1992) have confirmed Humboldt milk-vetch plants have a low tolerance for shade as well as a dependency on both scarification and stratification prior to germination. A CDFG query of the California Natural Diversity Database (CNDDB) revealed that all reported occurrences of Humboldt milk-vetch are associated, in some manner, with timber harvest activities (CDFG 2006).

MRC is proposing species-specific conservation measures for Humboldt milk-vetch; as a result, we have not assigned this species to a management category. Initially we decided that inclusion into Management Category 2 was appropriate for this species due to its early successional behavior and tolerance to disturbance. However, during the drafting of our HCP/NCCP, it became

[19] See section 9.2.1 for a definition of snags and 9.4.1.2 for a definition of old growth.

apparent that some of the conservation measures for MC2 are so restrictive that we would be unable to meet both the biological objectives for covered rare plants and the intent of the take provisions.

MRC intends the conservation measures for Humboldt milk-vetch to (a) conserve the species throughout its range in the plan area and (b) conserve habitat for localized seed banking.

	Standard Conservation Measures for Humboldt Milk-vetch
Communications	
C§11.8.2-1	Instruct all field personnel working in the vicinity of covered species occurrences, particularly operators of heavy equipment and those who apply pesticides, about complying with conservation measures, especially in locations with activity restrictions for core occurrence areas and buffers.
Core Occurrence Area	
C§11.8.2-2	Mark the boundaries of a core occurrence area at regular intervals with painted t-posts, with stakes and colored flags, with clearly visible marks on retained trees, or with other means, so that the occurrence boundary maintains its integrity and is easily identifiable during activity and monitoring periods.
C§11.8.2-3	Mark the outer limits of the core occurrence area at least 5 ft beyond any visible parts (e.g., branches, surface roots) of a covered rare plant; use GPS data, as required, to define the core occurrence and ensure relocation if markers are damaged or removed.
C§11.8.2-4	Mark groups of plants within a core occurrence area, using methods described above, to facilitate avoidance and monitoring.
C§11.8.2-5	Avoid using site preparation within designated core areas unless the wildlife agencies concur.
C§11.8.2-6	Avoid piling slash within designated core areas.
Core Area Management during Timber Operations	
C§11.8.2-7	Fell trees away from core occurrence areas, whenever possible, in order to create the least direct disturbance to individual plants.
C§11.8.2-8	Establish an ELZ within a 25 ft radius of a core occurrence area's periphery.
C§11.8.2-9	Allow the use of existing roads, skid trails, landings, and rock pits within the ELZ surrounding the core occurrence area.
C§11.8.2-10	Limit road maintenance within the ELZ to grading of running surfaces and creation of drainage structures as specified in Chapter 8, Appendix E, or the Forest Practice Rules.
C§11.8.2-11	Transport spoils from the ELZ no farther than 100 ft from the plant population unless safety or operational needs require otherwise.

	Standard Conservation Measures for Humboldt Milk-vetch
C§11.8.2-12	Deposit spoils from the ELZ preferably on the outside edge of the road where impacts from traffic and grading are limited or, if necessary, across the road surface or on a turnout or landing.
C§11.8.2-13	Permit roadside brushing and road day-lighting within the ELZ.
C§11.8.2-14	Conduct road maintenance and other covered activities, if feasible, between seed-set in the fall and breaking of dormancy in the spring.
C§11.8.2-15	Do not allow direct ignition or pile burning within the ELZ unless the wildlife agencies concur.
C§11.8.2-16	Do not plant trees within a designated core area.
C§11.8.2-17	Avoid significantly altering surface water hydrologic conditions in ways that could adversely affect covered rare plants.
Invasive Pest Plant Management	
C§11.8.2-18	Control invasive pest plants within 100 ft of a designated core area, using methods that are feasible and effective and that minimize impacts to non-target species, during both the 1st and 2nd years following covered activities.
Take Provisions	
C§11.8.2-19	Avoid or minimize take to the maximum degree feasible.
C§11.8.2-20	Permit take only if required for normal operations.
C§11.8.2-21	Describe in project documents (e.g., PTHPs) the amount of take anticipated from covered activities.
C§11.8.2-22	Restrict activities causing take to the period between seed set and the breaking of dormancy, if feasible.
C§11.8.2-23	Consult with the wildlife agencies, if normal operations require higher take limits than those specified in C§11.8.2-24 and C§11.8.2-28.
Take for Roads, Landings, and Rock Pits	
C§11.8.2-24	Permit take of Humboldt milk-vetch individuals growing in previously established roads, landings, and rock pits, if avoidance is infeasible, and adhere to the following limits: ▪ For occurrences > 100 reproductive individuals, take of up to 15% of the individuals within a single occurrence, per each single- or multiple-year project. ▪ For occurrences < 100 reproductive individuals, take of up to 10% of the individuals within a single occurrence, per each single- or multiple-year project. **NOTE** Feasible avoidance includes: (1) minimizing grading of roadbed and roadsides; (2) running logging trucks and other equipment in tire tracks only; and (3) other feasible restrictions.

	Standard Conservation Measures for Humboldt Milk-vetch
C§11.8.2-25	Seek approval of the wildlife agencies prior to commencement of operations if anticipated take exceeds permitted levels.
C§11.8.2-26	Spread soil from road berms (which need to be removed for proper road drainage and on which rare plants are growing) in roadside areas that MRC will manage as EEZs for a minimum of 2 years. **NOTE** If these sites are not colonized by rare plants within 2 years, MRC will remove EEZ restrictions. If these sites are colonized by rare plants within 2 years, MRC will continue to manage them as EEZs as long as the rare plants persist in those locations.
C§11.8.2-27	Donate, for scientific purposes and whenever possible, a sampling of Humboldt milk-vetch that is incidentally taken and not used in translocation; this includes collecting and preserving voucher specimens, and salvaging live plants and seeds for researchers, seed banks, or botanic gardens. **NOTE** If MRC gets no willing takers for a specific species, we will advise the wildlife agencies and no longer make donations of that species unless the wildlife agencies identify a recipient.
Take for All Other Covered Activities	
C§11.8.2-28	Permit take, in the case of occurrences > 100 reproductive individuals, as follows: ▪ Take of up to 5% of the individuals within a single occurrence, per stand entry, for PTHPs. ▪ Take of up to 5% of the individuals within a single occurrence, per year, for other activities, without approval of the wildlife agencies.
Variances	
C§11.8.2-29	Seek approval in writing from the wildlife agencies if requesting changes to core area management, buffer management, or buffer width; include the variances in a PTHP subject to public comment.
C§11.8.2-30	Ensure that requested variances are consistent with the objectives of the conservation strategy.
Translocation	
Non-compensatory	
C§11.8.2-31	Notify the wildlife agencies when MRC will perform a non-compensatory translocation.
C§11.8.2-32	Mark and map the location of the translocation in the field.
C§11.8.2-33	Describe in writing the result of the translocation for the wildlife agencies.
Compensatory translocation	
C§11.8.2-34	Obtain approval from the wildlife agencies before implementing.
C§11.8.2-35	Mark and map the location of the translocation in the field.
C§11.8.2-36	Provide thorough written documentation of methods, results, and conclusions for the wildlife agencies.

11.8.2.1 Intent of take provisions

The take provisions for Humboldt milk-vetch should minimize incidental take, while allowing normal timber harvest operations to proceed without unreasonable constraints. Conservation measures for this species prohibit take in all circumstances except for those essential for normal operations. Our overall intent is to achieve the conservation objectives for MC2. If MRC requires higher take limits, the wildlife agencies must approve them.

Limits of take that allow the loss of up to 5% (up to 15% for roads, landings, and rock pits) of individuals within an occurrence per year do not imply that a 5% loss each year is permissible. Over the 80-year term of the HCP/NCCP, most of the plan area will only be subject to impact for a few years. The limits of take defined in this plan are flexible enough to accommodate covered activities that may take place in 2 or more successive years. MRC will typically complete stand entries for timber harvest in a single year; harvests will occur on a rotation of 20 years or more. Occurrences in PTHP areas in which there has been incidental take, therefore, will have 20 years or more of recovery time between timber harvests. Apart from timber harvests, we cannot predict the number of consecutive years to complete other covered activities, but this will typically be 1-3 years. Pre- and post-harvest monitoring, discussed in Chapter 13 (M§13.10.3-1), will track the status and trend of covered rare plants over the term of our HCP/NCCP. If monitoring determines that MRC is not meeting our conservation objectives or that conservation measures are more restrictive than required to achieve those objectives, MRC and the wildlife agencies may reconsider take provisions through adaptive management.