CMER FY 2008 WORK PLAN

Prepared by:

COOPERATIVE MONITORING, EVALUATION AND RESEARCH COMMITTEE

FINAL

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Comments or questions contact:

Nancy Sturhan, CMER Co-chair
(NSQQ490@dnr.wa.gov)

Sally Butts, CMER Co-chair
(Sally_Butts@fws.gov)

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1.0 INTRODUCTION

The State Forest Practices Board (FPB) adopted an adaptive management program in concurrence with the Forest and Fish Report legislation (State Forest Practices Rules WAC *222-12-045). The purpose of this program is to:

> "…provide science-based recommendations and technical information to assist the board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve resource goals and objectives."

To provide the science needed to support adaptive management, the FPB established the Cooperative Monitoring, Evaluation and Research Committee (CMER). The FPB appoints core CMER members and empowers CMER to implement research, effectiveness, and validation monitoring per guidelines set by the Forest and Fish Report (FFR). CMER is organized into a series of Scientific Advisory Groups (SAGs) that are responsible for designing and implementing the research and monitoring program. Table 1 provides a brief description of the SAGs.

Table 1. CMER Scientific Advisory Group structure.

Scientific Advisory Group	**Acronym**	Develops and oversees projects related to
Bull Trout Scientific Advisory Group	BTSAG	Bull trout biology and the FFR rules designed to maintain bull trout habitat
Instream Scientific Advisory Group	ISAG	In-channel issues, including stream typing and fish passage
Landscape-Wildlife Advisory Group	LWAG	Wildlife, including stream-associated amphibians
Riparian Scientific Advisory Group	RSAG	The FFR riparian strategy
Scientific Advisory Group-Eastside	SAGE	Issues specific to the eastside
Upland Processes Scientific Advisory Group	UPSAG	Roads, mass wasting and channel processes
Wetlands Scientific Advisory Group	WETSAG	Wetland identification and protection

The goal of the CMER work plan is to present an integrated strategy for conducting research and monitoring to provide credible scientific information to support the FFR adaptive management program. The purpose of the work plan is to inform CMER participants, policy constituents, and the interested public about CMER's activities. The plan is a living document that will be revised in response to research findings of CMER or the scientific community, changing technology, changes in policy objectives, and funding. This version supercedes the FY 2007 version of the work plan. Annual revisions to the work plan are anticipated in the future.

The remainder of the document describes the CMER research and monitoring program and CMER recommendations for the FY 2008 work plan. Section 2.0 describes the organization of the CMER research and monitoring activities and the approaches used to address research and monitoring questions relevant to FFR adaptive management. Section 3.0 describes the CMER

procedures for prioritization at the program (topic areas) level, and at the project level. Section 4.0 presents the proposed CMER FY 2008 action plan, including recommendations for project prioritization, scheduling and budget allocations. Section 5.0 provides an overview of CMER's research and monitoring program, with program and project descriptions organized by rule group.

2.0 CMER RESEARCH AND MONITORING STRATEGY

The CMER work plan consists of more than 70 projects covering a range of topics related to the FFR forest practices rules. The work plan is organized in a hierarchical format consisting of rule groups, programs, and projects.

FOREST PRACTICE RULE GROUPS

At the highest level, the CMER work plan is organized by FFR "rule groups". A rule group is a set of forest practices rules relating either to a particular resource, such as wetlands, or fish-bearing streams, or to a particular type of forest practice, such as road construction and maintenance. The eight rule groups are shown in Table 2. Although the rule group divisions are somewhat arbitrary, they provide a useful framework for the research and monitoring strategy.

Table 2. Description of the rule groups used as a framework for the CMER work plan.

Rule Group	Description	Rule Context
Type F riparian rules	Prescriptions for identification fish bearing streams and management of adjacent riparian areas	FFR Appendix B; WAC 222-30
Type N riparian rules	Prescriptions for identification of non-fish-bearing streams and management of adjacent riparian areas	FFR Appendix B WAC 222-30
Unstable Slopes	Prescriptions for identification and management of areas potentially susceptible to mass wasting/erosion processes	FFR Appendix C WAC 222-24,30
Forest Roads	Prescriptions for identification and management of erosion and runoff from forest roads	FFR Appendix D WAC 222-24
Fish Passage	Prescriptions for identification and prevention of fish-passage barriers	FFR Appendix D WAC 222-24
Pesticides	Prescriptions for application of forest chemicals	FFR Appendix E WAC 222-38
Wetland Protection	Prescriptions for the identification and management of wetlands	FFR Appendix F WAC 222-30
Wildlife	Prescriptions for protection of wildlife	

RESEARCH AND MONITORING PROGRAMS

Critical research and monitoring questions are identified at the rule group level to address information gaps related to scientific uncertainty and resource risk associated with the rules. Once the research and monitoring questions are identified, programs are developed to address them. Programs consist of one or more related projects designed to strategically address a set of

related scientific questions. Twenty-eight programs containing more than 70 projects are identified in the CMER work plan.

CMER research and monitoring programs utilize a variety of approaches that address critical questions at different spatial and temporal scales. The work plan incorporates an integrated research and monitoring approach as recommended by the Monitoring Design Team (MDT) Report (MDT, 2002); including effectiveness monitoring to evaluate prescription effectiveness at the site or landscape scale; extensive status and trend monitoring to evaluate status and trends in resource condition indicators across FFR lands; and intensive monitoring to identify causal relationships and document cumulative effects at the watershed scale. CMER also conducts rule implementation tool projects to develop, refine or validate scientific tools necessary for implementing the rule(s) or for establishing performance standards. These approaches are summarized below:

Effectiveness Monitoring. Effectiveness monitoring programs are designed to evaluate the performance of the prescriptions in achieving resource goals and objectives. Effectiveness monitoring differs from the other approaches in that it is directed at prescription effectiveness, primarily at the site-scale. These programs also may include related projects to develop research methodologies or to validate relationships between forest practices activities, input processes and resource response.

Extensive Status and Trend Monitoring. Extensive monitoring programs evaluate the current status of key watershed input processes and habitat condition indicators across FFR lands and document trends in these indicators over time as the FFR prescriptions are applied across the landscape. Extensive monitoring provides a statewide, landscape-scale assessment of the effectiveness of FFR rules to attain specific performance targets across FFR lands. Extensive monitoring is designed to provide report-card-type measures of rule effectiveness (i.e., are FFR performance targets and resource condition objectives being achieved on a landscape scale over time) that can be used to determine the degree to which progress is consistent with expectations.

Intensive Monitoring. Intensive monitoring is designed to evaluate the cumulative effects of multiple forest practices at the watershed scale. Analysis of these effects improves our understanding of causal relationships and of the effects of FFR rules on aquatic resources. Intensive monitoring integrates the effects of multiple management actions over space and through time within the water shed. Evaluation of the monitoring data requires an understanding of the effects of individual actions on a site and the interaction of those responses through the system. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how aquatic resources respond to these habitat changes. This sophisticated level of understanding of the physical and biologic systems can only be achieved with an intensive, integrated, monitoring effort. CMER has identified several potential monitoring topics and is currently scoping an intensive monitoring program.

Rule Implementation Tool Development. Rule implementation tool projects are designed to develop, refine or validate tools used to implement the forest practices rules.

1. Methodology Tool Development Projects develop, test or refine protocols, models, and guides that allow the identification and location of FFR specified management features, such

as the Last Fish Model, landslide screens, the Np/Ns break and Sensitive Sites Identification, or the achievement of specified stand conditions such as the DFC Basal Area Target.

2. Target Verification Projects consist of studies designed to verify the validity of performance targets developed during FFR negotiations that the authors identified as having a weak scientific foundation, such as the DFC basal area targets for Type F streams.

Rule implementation tools differ from research and monitoring tools, which are required to implement a specific effectiveness-monitoring program, such as Road Surface Erosion Model. Monitoring implementation tools are included with the effectiveness monitoring programs.

3.0 CMER PRIORITIES

CMER's long-term goal is to address the full range of critical questions identified in the CMER work plan, the availability of funding, time and human-resources limit the number of projects that can be developed and implemented each year. In order to focus effort and resources on the most critical issues for FFR adaptive management, CMER prioritizes proposals for research and monitoring at both the program and project levels. Establishing priorities allows CMER to pursue the most pressing research and monitoring issues in an orderly manner over time.

The first step in CMER's prioritization process was to rank the relative importance of the proposed programs in meeting FFR goals and objectives. The program prioritization strategy was to:

1. Rank effectiveness/validation monitoring and extensive status and trend monitoring programs on the basis of scientific uncertainty and risk to aquatic resources;
2. Evaluate the importance of rule implementation tool programs by consulting with DNR and then establish priorities on a project basis;
3. Defer integration of the intensive monitoring program into the CMER action plan until further scoping and coordination with other efforts occurs.

Effectiveness monitoring and extensive status and trend monitoring programs were ranked by CMER members in attendance at the December 19, 2002 CMER meeting who evaluated each program by asking two questions:

1. How certain are we of the science and/or assumptions underlying the rule?
2. How much risk is there to aquatic resources if the science or assumptions underlying the rule are incorrect?

These questions were selected as the criteria to rank programs because the need for scientific information to inform adaptive management is most critical when there is a high level of scientific uncertainty concerning the interaction between forest practices, watershed processes and aquatic resources; and where the sensitivity of the processes and aquatic resources to potential disturbance creates the greatest risk of resource impacts.

Uncertainty is a measure of confidence in the science underlying a rule, including the causal relationships providing the conceptual foundation for the prescriptions, and assumptions about prescription effectiveness and resource response when it is applied on the ground. High uncertainty (low certainty) indicates that little is known about the underlying science and the rule is likely based on assumptions that have not been validated. It may also indicate that the

prescription is untested and performance under field conditions is unknown. Low uncertainty (high certainty) indicates that the science underlying the rule is well known and accepted, or that the prescription (or similar treatment) has been evaluated under similar conditions. Risk is a measure of the potential for detrimental impacts to aquatic resources including fish, stream associated amphibians, and water quality. High risk indicates the activity covered by the prescription has a greater potential to affect aquatic resources due to its magnitude, frequency, or direct linkage to the resource. Low risk indicates the rule has less potential to affect resources.

Individual scores were averaged to obtain mean risk and uncertainty scores for each program. These were multiplied to get a combined score that was used to rank the programs (Table 3). The FFR Policy Group accepted the rankings and instructed CMER to use them as the basis for prioritizing effectiveness/validation and extensive status and trend monitoring projects.

Table 3. Rankings for effectiveness monitoring and extensive status/trend monitoring programs.

Program Title	Overall Ranking	Uncertainty		Risk	
		Mean	Rank	Mean	Rank
Effectiveness/Validation Programs					
Type N Buffer Characteristics, Integrity Function	1	4.4	1	3.9	1
Eastside Type F Desired Future Range and Target	2	4.2	2	3.8	2
Type N Amphibian Response	3	4.2	2	3.7	3
Road Basin-scale Effectiveness Monitoring	4	3.4	5	3.4	4
Type F Statewide Prescription Monitoring	5	3.2	7	3.1	6
Mass Wasting Effectiveness Monitoring	6	3.2	6	2.9	8
Eastside (BTO) Temperature	7	3.0	9	3.2	5
Wetlands Revegetation Effectiveness	8	3.5	4	2.7	11
Road Site-scale Effectiveness Monitoring	9	2.6	14	3.1	6
Hardwood Conversion	10	3.0	8	2.6	12
Wetland Mitigation	11	2.8	11	2.7	10
Fish Passage Effectiveness Monitoring	12	2.6	14	2.9	9
Wildlife Program	13	2.9	10	2.4	14
Wetland Management Zone Effectiveness Mon.	14	2.8	12	2.5	13
CMZ Effectiveness Monitoring	15	2.7	13	2.1	15
Forest Chemicals	16	2.0	16	2.1	16
Extensive Status/Trend Monitoring Programs					
Extensive Riparian Monitoring	1	3.5	2	3.5	1
Extensive Mass Wasting Monitoring	2	3.7	1	2.9	3
Extensive Fish Passage Monitoring	3	3.1	3	3.1	2

The program rankings for effectiveness/validation programs and extensive status and trend monitoring programs shown in Table 3, as well as information on the relative importance of rule implementation tool programs gleaned from consultation from DNR, were used to provide guidance to the SAGs on where to focus time and energy in project scoping and development.

The second stage of prioritization occurred at the project level in order for CMER to make recommendations to the FFR policy committee concerning scheduling and allocation of funding among the projects developed by the SAGs. Projects were prioritized based on the extent to which projects were deemed essential to inform FFR adaptive management, input from DNR on their importance in improving implementation of forest practice rules, the status of projects relative to policy decisions on adaptive management, and need to follow through and complete work already underway. CMER and the Adaptive Management Program Administrator develop each fiscal year's proposed projects based on those criteria.

4.0 FY 2008 ACTION PLAN RECOMMENDATIONS

Table 4 presents information on current and proposed CMER projects, organized by rule group. The recommended CMER budgets for projects FY 2008 have been differentiated into two tiers displayed in separate columns in Table 4. Tier 1 projects are those projects CMER is certain to implement in FY 2008. Tier 2 projects are those projects that CMER may initiate in FY 2008 but which have not yet been approved by Policy and/or CMER, and/or still involve considerable scientific or fiscal uncertainty. The FFR Policy Group will ask the Forest Practices Board (FPB) to approve all of the Tier 1 projects at its September 2007 meeting and will give the FPB a "heads up" on the Tier 2 projects. The Policy Group will propose to return to the FPB for Tier 2 approvals on a project-by-project basis if/when uncertainties are resolved and the path forward is clear. This will require coordination among CMER, Policy, and the FPB so that any needed Tier 2 project approval can be obtained at the right time: after the project and its budget are well defined, so that a recommendation can be made by Policy to the board, but before the time when work needs to begin

NOTE: See appendix A for complete budget table showing expenditures to date and future planning figures for all CMER projects described in this work plan.

Table 4 – FY 2008 CMER Projects and Budget	Tier One	Tier Two
Type N Rule Group		
Type N Experimental Buffer Treatment Project - Basalt Lithologies	$700,000	
Buffer Integrity - Shade Effectiveness	$135,000	
Eastside Type N Characterization	$60,000	
Amphibians in Intermittent Streams		$156,000
Type F Rule Group		
Type F Riparian Prescription Monitoring - Westside		$60,000
Type F Riparian Prescription Monitoring - Eastside	$195,000	
Eastside Riparian Current Condition Assessment	$260,000	$15,000
Eastside Channel Wood Characterization		$80,000
Hardwood Conversion Project	$19,520	
Extensive Monitoring Program		
Extensive Temperature Monitoring	$280,000	
Extensive Riparian Monitoring		$250,000
DFC Validation Program		
Site Class Map Validation		$60,000
Plot Width Standardization		$270,000
Bull Trout Rule Group		
Bull Trout Overlay Temperature	$173,000	
Solar Radiation/Effective Shade	$181,600	
Bull Trout Field Implementation Coordinator	$22,000	
Unstable Slopes Rule Group		
Effectiveness of Unstable Landform ID		$200,000
Mass Wasting Prescription Scale Effectiveness		$400,000
Roads Rule Group		
Road Sub-Basin Scale Effectiveness Monitoring	$200,000	
Fish Passage Rule Group		
Effectiveness of Stream Simulation Culverts		$80,000
Fish Movement & Culvert Gradient Flume Study		$300,000
Wetlands Rule Group		
Wetland Mitigation Effectiveness	$15,000	

Wetland Management Zone Effectiveness		$15,000
Wetlands GIS Data Layer		$45,000
	Tier One	**Tier Two**
Wildlife Rule Group		
RMZ Resample	$20,000	
Intensive Monitoring		
Intensive Cumulative Effects Monitoring	$100,000	
Subtotal Projects	**$2,361,120**	**$1,931,000**
Project Support		
Project Development Support	$140,000	
CMER Staff (NWIFC)	$431,000	
CMER Project Managers (DNR)	$152,000	
Program Administration		
AMP Administrator	$99,500	
Contract Specialist	$76,600	
CMER/Policy Coordinator	$45,260	
CMER Website	$13,410	
Independent Science Review Panel	$99,260	
DFC Model Update	$20,000	
AMP Data Management		$20,000
Subtotal Support and Administration	**$1,077,030**	**$20,000**
Total FY 08 Expenditures for Projects/Activities	**$3,438,150**	**$1,951,000**

5.0 RULE GROUP DESCRIPTIONS AND MONITORING STRATEGIES

This portion of the work plan presents the research and monitoring strategy for each forest practice rule group, along with a description of related programs and projects. Information on each rule group is presented separately, following a similar format. The rule summary briefly describes the intent of the rule, the rationale identifies scientific questions related to those rules, and the strategy organizes those questions into programs and task categories. The programs for each rule group organized by approach, i.e. effectiveness monitoring, extensive monitoring or rule implementation. Brief descriptions of individual projects appear within the program descriptions.

Because of the complexity of the riparian strategy, it is divided into five rule groups: the Stream Typing rule group (Type F/N delineation), the Type N rule group (non-fish-bearing streams), the Type F rule group, the Bull Trout rule group, and the Channel Migration Zone Rule Group. Sections on the remaining rule groups appear in the following order: unstable slopes, roads, fish passage, pesticides, wetland protection and wildlife rule groups. Last is a section on the intensive monitoring program, which addresses cumulative effects.

STREAM TYPING RULE GROUP

The FFR recommends adoption of rules by the forest practices board delineating waters of the state into three categories, Type S Waters, Type F waters and Type N waters. Distinguishing the upper limits of Type F (or S) waters is particularly important, because the presence or absence of fish habitat in the streams creates differences in the aquatic resources of concern, the management strategies and the prescriptions applied.

Rule Summary

Currently, stream typing is based on a complicated set of physical and beneficial use criteria according to guidance in the forest practice rules. Due to questions about the accuracy of this system, the FFR report recommends development of a statewide stream type map using a multi-parameter, field verified, GIS logistic regression model to identify the upper extent of Type F streams.

Strategy and Rationale

The FFR report provides a clear rationale and guidance for a strategy related to the stream typing system. The FFR report indicates that the current approach to stream typing is not adequately precise, defines a modeling approach for developing a new map, and sets specifications for the accuracy of the model. It also calls for development of a field protocol for inclusion in the forest practices board manual.

The Instream Scientific Advisory Group (ISAG) has developed a single program (the stream typing program) to develop and validate a GIS based model to predict the upstream extent of fish or fish habitat (Table 5).

Table 5. Stream Typing Rule Group critical question and program.

Stream Typing Rule Group Critical Questions	Program Name	Task Type
How can the demarcation between fish- and non-fish-habitat waters be accurately identified?	Stream Typing Program	Rule Tool

Rule Implementation Tool Programs

Stream Typing Program

Purpose

The purpose of this program is to develop a statewide stream typing map, described as follows in the Forest and Fish Report:

> *"The rule to be adopted by the Forest Practices Board will include a statewide map delineating the waters of the state into three categories: Type S waters, Type F waters and Type N waters. The map is to be developed using a multi-parameter, field-verified GIS logistic regression model pursuant to the adaptive management procedures described in Appendix L. The multi-parameter model will be "habitat driven" and will use geomorphic parameters such as basin size, gradient, elevation and other indicators. Electro fishing and day or night snorkeling and other non-lethal methods may be used with appropriate state and federal permits to do research and effectiveness monitoring for the purpose of developing and testing a habitat-based model or improving the model at five year intervals."*

Strategy

ISAG has been charged with implementation of this program.

Project Descriptions

Last Fish/Habitat Prediction Model Development Project
Development and utilization of the GIS-based logistic regression fish habitat model(s) to identify and map the upstream boundary of Type F (fish-habitat) streams has been completed by DNR. This project would provide analysis to evaluate various questions about the model. The FFR Policy Group decided that additional information was not necessary at this time.

Annual/Seasonal Variability Project
A seasonal and annual variability analysis was completed Work was begun in 2000-2001 to identify last fish points and also assess sampling error. Additional field survey data were collected in 2002, 2003 and 2005 for use to complete another analysis of annual variability. In 2005 a seasonal variability study was completed and a final report was provided in spring 2006. The FFR Policy Group decided that additional information was not necessary at this time.

Last Fish/Habitat Prediction Model Field Performance Project
This project objective was to validate and assess the performance of the model predictions and future applicability. A study design was developed and accepted by CMER with an approach and methodology to investigate the performance of the model to correctly determine fish habitat across watersheds of western Washington. ISAG compiled existing field survey data and presentated this to the FFR Policy Committee Water Typing Work Group to determine the direction of further research. The FFR Policy Group decided that additional information was not necessary at this time.

TYPE N RIPARIAN PRESCRIPTIONS RULE GROUP

Type N streams are non-fish-habitat streams that either do not provide suitable habitat to support fish or do not contain fish because of a natural barrier to fish migration. Type N streams are protected under FFR for several reasons. First, they provide habitat for stream-associated amphibians (SAA) covered by the agreement. Second, water quality standards pertaining to these streams need to be met. Finally, Type N streams contribute water, nutrients, woody debris, and sediment that affect downstream fish habitat and water quality.

The Type N riparian prescriptions are designed to accomplish the following FFR resource objectives:

1. Provide cool water by maintaining shade, groundwater temperature, flow, and other watershed processes controlling stream temperature,
2. Provide complex in- and near-stream habitat by recruiting large woody debris and litter,
3. Prevent the delivery of excessive sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams, and
4. Provide conditions that sustain SAA population viability within occupied sub basins.

Rule Summary

Two buffering strategies are prescribed for Type Np streams, the clear-cut and the partial-cut strategies. The clear-cut strategy is prescribed for the west side, whereas landowners on the eastside have the flexibility to use either clear-cut or partial-cut strategies. The clear-cut strategy involves a patch buffering system where portions of the riparian stand can be clear-cut to the stream and other areas are protected with a 50-ft wide no-cut patch buffer. The patch buffer includes fixed and flexible components. Fixed components include 50-ft buffers around the sensitive sites (e.g., connected springs and seeps, Np initiation points; and stream junctions) and on both sides of the stream upstream 300-500 ft from the Type F/Type Np boundary. The flexible component allows the landowner to choose where to place the remaining buffer to bring the total buffer length to 50% of the Type-Np length. Eastside landowners have the option of using the 'partial-cut' strategy', a continuous 50 ft buffer along the length of the Type Np stream. The partial-cut buffer can be thinned, providing that the appropriate basal area and leave tree requirements are met. A 30 ft wide equipment limitation zone (ELZ) is established on all Type N streams (Np and Ns) to minimize sediment input from bank and soil disturbance. Operations within the ELZ are designed to avoid soil disturbance, and sediment delivery must be mitigated.

Strategy and Rationale

The Type N rules are based on the assumption that the riparian buffering strategies will result in aquatic conditions that meet the resource objectives and consequently achieve the three FFR performance goals. However, great uncertainty exists about these assumptions because the functional relationships between riparian management practices, riparian functions and aquatic resource response are not well studied or understood. Several major areas of uncertainty include:

1. How to identify the upper boundary of perennial flow in Type N streams,
2. How riparian stands and the inputs and functions they provide respond to management practices and the level of protection provided by the prescriptions,
3. The habitat utilization patterns of Stream Associated Amphibians and their response to riparian management practices, and
4. The effects of Type N riparian management practices on sediment, large woody debris (LWD), temperature and nutrient regimes in downstream fish-bearing streams.

The Type N riparian strategy is designed to address critical questions related to the effectiveness of the rules in achieving FFR goals and resource objectives. The critical questions, programs, task types and responsible scientific advisory group (SAG) are listed in Table 6.

Table 6. Critical questions and programs for the Type N Riparian Prescriptions Rule Group.

Critical Questions	Program Name	Task Type	SAG
How should the initiation point of Type Np streams be identified for management purposes?	Type N Delineation Program	Rule Tool	UPSAG
How do survival and growth rates of riparian leave trees change following Type Np buffer treatments? Are riparian processes and functions provided by Type Np buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, litter fall and amphibians? How do other buffers compare with the FFR Type N prescriptions in meeting resource objectives? How do the Type N riparian prescriptions affect downstream water quality and fish populations? Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives? What is the frequency and distribution of windthrow in FFR buffers on Type N and F streams? What site and habitat conditions are associated with sites with significant blowdown?	Type N Riparian Effectiveness Program	Effective-ness	RSAG
Is Stream Associated Amphibian (SAAs) population viability maintained by the Type N prescriptions?	Type N Amphibian Response	Effective-ness	LWAG
What is the current status of riparian conditions and functions in Type N streams on a statewide scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring	Extensive	RSAG
Can the methods used to identify and characterize sensitive sites be improved?	Sensitive Site Program	Rule Tool	LWAG

Effectiveness Monitoring Programs

Type N Riparian Effectiveness Program

Purpose

The purpose of this program is to evaluate the FFR Type N riparian management prescriptions, including the response of riparian vegetation, growth and mortality of buffer trees, the level of riparian functions provided, the biotic and water quality responses to the prescriptions (both within the Type N system and in downstream fish-bearing waters), and their effectiveness in achieving performance targets and meeting water quality standards.

Strategy

The effectiveness of the Type N riparian management prescription package is uncertain because there are many gaps in the scientific understanding of headwater streams, their aquatic resources, and the response of riparian stands, amphibians, water quality and downstream fish populations to different riparian management strategies. Consequently, the prescriptions are based on assumptions that have been neither thoroughly studied nor validated. This program is ranked first among the 16 CMER programs.

This program will answer critical questions about the effectiveness of both the FFR Type N riparian prescriptions and alternative riparian management prescriptions through a series of projects. Some projects are statewide in scope, while others have a regional focus due to the different Type N riparian management issues on the east or west sides of the state. Critical questions for the projects associated with this program are shown in Table 7.

Table 7. Type N Riparian Effectiveness Program.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR partial cut and patch cut Type Np buffer treatments?	Type N Riparian Effectiveness Project
Are riparian processes and functions provided by Type N buffers maintained at levels that meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, litter fall and amphibians?	Type N Riparian Effectiveness Project Type N Experimental Buffer Treatment Projects (basalt and incompetent lithologies)
How do different buffering strategies compare with the FFR Type N prescriptions in meeting resource objectives?	Type N Experimental Buffer Treatment Projects (basalt and incompetent geologies) Eastside Type N Water Quality/Downstream Effects Study
How do the Type N riparian prescriptions affect downstream water quality and fish populations?	Type N Experimental Buffer Treatment Projects (basalt and incompetent geologies) Eastside Type N Water Quality/Downstream Effects Study
What is the frequency and distribution of windthrow in FFR buffers? What site and habitat conditions are associated with sites with significant blowdown?	Windthrow Frequency, Distribution and Effects Project
What are the characteristics of eastern Washington Type N stream channels and riparian areas and how do they vary across eastern Washington?	Eastside Type N Characterization Project

Do different types of Type N channels explain the variability in the response of Type N channels to forest practices?	Eastside N Function Case Study Eastside Type N Classification Project
Are the Type N performance targets valid and meaningful measures of success in meeting resource objectives for Type N streams?	Type N Performance Target Validation Project

Westside Type N Riparian Prescriptions Effectiveness Strategy
There are two CMER projects currently underway to evaluate the effectiveness of the westside Type N riparian prescriptions. These projects utilize two different, but complementary approaches to inform adaptive management. The *Type N Buffer Characteristics, Integrity and Function Project-Westside* examines a random sample of westside Type N forest practice applications to evaluate the performance of Type N prescriptions as they are applied operationally over the range of conditions occurring in the FFR landscape. The *Type N Experimental Buffer Treatment Project (basalt lithology*) focuses on aquatic resource response to the Type N prescriptions in streams with competent lithologies in western Washington. This study utilizes a manipulative experimental design that compares the effectiveness of a range of Type N treatments (that vary in the percentage of stream length buffered) with untreated control sites. This study measures amphibian response, litter fall, temperature, downstream export of nutrients, detritus, macroinvertebrates, and sediment, and fish response).

Two additional projects that address the westside Type N riparian prescriptions are in the scoping stage. Scoping is underway on a project to evaluate the effectiveness of Type N riparian prescriptions in incompetent lithologies. This project, initially called the *Type N Experimental Buffer Treatment Project (incompetent lithology*), was intended to complement the study in basalt lithologies by using a similar design to evaluate prescription performance in more erosive lithologies. However the scope is currently being expanded to encompass riparian buffer and forest road construction issues (and trade-offs between the two) in headwater basins with soft lithologies. In addition, RSAG is beginning scoping on a project to focus on assessment of windthrow in riparian buffers.

Eastside Type N Streams Strategy
A series of projects focuses on eastern Washington Type N streams. These projects are being developed to address uncertainties about variability in Type N flow conditions, the riparian functions provided, and appropriate management strategies for eastern Washington Type N streams.

The lead-off project is a study to better document variability in the hydrology of eastside Type N channels and riparian vegetation (*Eastside Type N Characterization Project*). Scoping is done on this study and study design is scheduled for 2007. Several ideas have been suggested for studies to follow the *Eastside Type N Characterization Project*. These include a case study to examine Type N riparian functions in areas with specific management concerns (*Eastside Type N Function Case Study*), a manipulative study of the resource response to alternative eastside riparian prescriptions *(Eastside Type N Water Quality/Downstream Effects Study*) and a project to improve classification of eastside Type N stream channels for management purposes (*Eastside Type N Classification Project*). None of these projects are currently being scoped.

The *Type N Riparian Effectiveness - Eastside Project* proposed to examine a random sample of east-side Type N riparian forest practice applications to evaluate the performance of Type N prescriptions as they are applied operationally over the range of eastside Type N streams. However, this study has been placed on hold due to a lack of suitable study sites at the present time.

Implementation of these projects will provide useful information for adaptive management in Type N riparian prescriptions, including an assessment of the variability in the performance of the FFR Type N prescriptions across the FFR landscape, and intensive comparison of instream and downstream aquatic resource response to different Type N buffering strategies on both sides of the state. Once these projects are underway, it is envisioned that the Type N performance target validation project will be designed to test and refine FFR performance targets for Type N riparian prescriptions. Data on the response of buffers, the level of riparian functions provided and aquatic resource response gained from the three buffer effectiveness projects will be used to define the approach taken by the Type N performance validation project.

Project Descriptions

Type N Riparian Effectiveness Project
The Type-N FFR buffer integrity, characteristics, and function project will evaluate the effectiveness of the FFR Type-N riparian prescriptions, including survival of buffer leave trees, stand condition and trajectory over time, and changes in riparian functions including shade, LWD recruitment, and stream bank protection. The study design calls for selecting a random sample of Type N forest practices and pairing the "treatment" sites with un-harvested control sites to provide an unbiased estimate of variability for the performance of the buffers relative to the Type N performance targets. The design for this project has been approved and funded by CMER. A pilot effort is underway. Initial post-harvest sampling at 15 treatment/control pairs in the western Washington western hemlock zone strata was initiated in the fall of 2003. Post harvest low altitude photography and field measurements of canopy conditions were collected in 2004 and a preliminary analysis of the 1st year post-harvest sampling shade data has been submitted to RSAG for review. A contract for analysis of low altitude photo interpretation of mortality and stand information was terminated due to failure of the contractor to provide products. RSAG is preparing recommendations for the future direction of the project based on an assessment of the initial phase of the project. Field data on riparian stand conditions, fallen trees, LWD recruitment, shade, channel wood loading and soil disturbance from windthrown trees was collected in the summer/fall of 2006. This data is currently being analyzed. No additional data collection is scheduled until FY 2010.

Type N Experimental Buffer Treatment in Basalt Lithologies Project
This study is an experimental test of the effects of three riparian buffer strategies (compared to an unharvested control basin) on amphibian, water quality, and downstream exports of nutrients, detritus, macroinvertebrates and suspended sediment, and down stream fish populations. The study design employs four blocks, each consisted of a reference stream on each buffer treatment. Pre- and post-harvest data on variables such as amphibian populations, riparian stand characteristics, tree mortality and LWD recruitment, shade and stream temperature, litter fall, light, stream flow, water chemistry, particulate and invertebrate export and stream bank erosion have been collected during the first pre-harvest year. Downstream effects on water quality and fish populations will be assessed. In order to include amphibians, the study sites are confined to

basins with basalt or other competent lithologies. The study plan for this project has been reviewed by SRC and approved by CMER. Site selection and site set up is complete and the first year of sampling is currently underway.

Type N Experimental Buffer Study in Incompetent Lithologies
After funding the Type N Experimental Buffer Study in Basalt Lithology at the August 2005 meeting, the FFR Policy Group asked that CMER assess the feasibility of using the existing, approved study plan as the basis for conducting a study on more erosive (incompetent) lithologies in western Washington. This project is currently being scoped by members of RSAG, UPSAG and LWAG with the intent of combining the study with a larger scale evaluation of road-generated sediment and delivery to fish bearing streams.

Windthrow Frequency, Distribution and Effects Project
Preliminary results of the Type N BCIF Project indicate that windthrow mortality in Westside Type N buffers is widespread. Many land managers have observed this as well. In response to this concern, RSAG is planning on scoping a project to document the frequency and distribution of windthrow in FFR Type N buffers on the westside. A preliminary budget estimate to support this project is included in the FY 2008 budget.

DNR Type 5 Experimental Buffer Treatment Project (not included in Budget Table in appendix)
This is a cooperative project with DNR and USFS that compares the response of riparian stands, temperature, litter fall, nutrients**,** small mammals, amphibians, and downed wood to a range of buffer treatments applied in sets of small paired watersheds. CMER provided a small amount of funding for start-up costs and has used experience gained as a cooperator in this project to help design other CMER projects. Baseline data collection is complete, and post-harvest data collection on recently harvest sites is scheduled for completion in summer 2007. Data analysis has begun. No additional CMER funding is anticipated.

Eastside Type N Characterization Project

The Eastside Type N Characterization Project is the first in a series of SAGE proposed studies that will examine eastern Washington headwater streams. Other related SAGE projects include the Eastside Type N Function Study (not included in Table 4), Eastside Type N Classification Project (Table 4, line 18), and Type N Performance Target Validation Project (Table 4, line 17).

Because no single study is likely to succeed in describing the distribution of all features that affect stream function over an area as large as the forest lands of eastern Washington, the Eastside Type N Characterization Project has been conceived as a series of individual studies that will characterize stream attributes and their dependencies. Given the importance of flow as an important transport mechanism between non-fish and fish-bearing streams, SAGE has decided to study it first. Scoping for the Eastside Forest Hydrology Study of the Eastside Type N Characterization Project has been approved by CMER. The next steps will be 1) study design, 2) Independent Scientific Review Committee (ISRC) review; and 3) design finalization and implementation.

The goal of the Eastside Forest Hydrology Study is to describe the spatial and temporal distributions of physical components of Type N streams that contribute to stream function and which may be used to classify streams into groups that appear to exhibit similar characteristics and processes and which may therefore function similarly. By the time the Eastside Forest Hydrology Study is completed, the Type N Riparian Extensive study should be underway. As data from the Eastside Forest Hydrology and Riparian Extensive Studies become available, SAGE will evaluate whether the data collected meet the requirements of the Characterization Project and if additional characterization studies are required prior to research on eastside Type N stream functions.

Eastside Type N Classification Project

The Eastside Type N Classification Project has been neither scoped nor designed. The Eastside Type N Characterization Project will collectively contribute to a classification scheme for Type N streams in eastern Washington, which will group streams that appear to exhibit similar characteristics and processes and which may therefore function similarly. The study will also provide a context for interpreting channel response to management practices.

Eastside Type N Function Case Study (not included in Budget Table in appendix)

This study will identify and quantify the environmental values and functions of a sample of Type N streams in eastern Washington. Streams will be selected from the results of the Eastside Type N Classification Project. The downstream effects proposed for montoring include water quality, sediment loads, wood delivery, nutrient loads, macronutrients and more.

Type N Performance Target Validation Project

The Type N Performance Target Validation Project has been neither scoped nor designed. It will probably consist of one or more studies designed to validate the relationships between Type N performance targets and aquatic resource response. This comparison will ensure that the performance targets provide a meaningful indication that FFR resource objectives are being achieved. In the 2007 work plan, the Eastside Type N Water Quality/Downstream Effects Study (Table 4, line 16) was subsumed into the Type N Performance Target Validation Study

Type N Amphibian Response Program

Purpose

The purpose of this program is to addresses critical questions concerning the response of SAAs to forest practices, particularly the Type N riparian prescriptions. Many uncertainties exist regarding the distribution of SAAs, their life history and habitat utilization patterns, population dynamics, effects of forest practices on SAA habitats, and the response of SAA populations to these changes. Consequently, the Type N riparian rule is based on the assumption that buffering of perennial Type N streams around 'sensitive' sites (sites thought to provide high quality SAA habitat), will maintain the viability of SAA populations. These assumptions and uncertainties have been examined and used to develop a series of sub-questions under the main critical question (Table 8).

Strategy

The restricted distribution of SAAs and the lack of information about them required the development of an amphibian response strategy that differs from that of many other rule groups. This program began with the development of tools needed to implement the Type N buffer rule for sensitive sites (i.e., SAA sensitive sites identification methods and characterization) and procedures to detect and determine the relative abundance of SAAs for monitoring purposes. During this time other projects designed to determine critical monitoring questions for some species (i.e., tailed frog literature review and meta-analysis) or answer species-specific L-1 questions were undertaken (i.e., Dunn's and Van Dyke's salamanders). Following the completion of these projects effectiveness monitoring will begin. This program is administered by LWAG. This program is ranked third among the 16 CMER programs.

The restricted distribution of SAA and uneven abundance further limited the amphibian response program. LWAG determined that an extensive monitoring project for SAAs would not provide useful information for the FFR adaptive management program and cooperation with other monitoring projects was not possible. LWAG concluded that any monitoring program must focus on those physical factors (e.g., geology) that appear to effect SAA distribution, abundance, and response to timber harvest (i.e., the Type N Experimental Buffer Treatment Project described in Section 3.1.1).

Project Descriptions

SAA Detection/Relative Abundance Methodology Project

The SAA Detection/Relative Abundance Methodology Project is designed to evaluate and develop a standard methodology for sampling SAAs in headwater forest streams. It addresses the need for a research/monitoring methodology to detect amphibians and determine their relative abundance. The most widely used methods produce high variance estimates and detection probabilities are unknown. Two project reports have been completed, Fieldwork for this project has been completed. Several manuscripts with project results are being submitted to peer-reviewed journals.

Table 8. Type N Amphibian Response Program.

Critical Questions	Project
Is SAA population viability maintained by the Type N prescriptions? Do SAAs continue to occupy and reproduce in the patch buffers? Do SAAs continue to occupy and reproduce in the ELZ only reaches? If SAAs do not continue to occupy the ELZ only reaches, do they re-occupy those reaches before the next harvest? How does SAA habitat respond to the sensitive site buffers? How does SAA habitat respond to variation in inputs, e.g. sediment, litter fall, wood? How do SAA populations respond to the Type N prescriptions over time?	SAA Detection/ Relative Abundance Methodology Project Type N Experimental Buffer Treatment
What are the common findings and inconsistencies in published studies on the effects of timber harvest on tailed frogs? What can be learned from a meta-analysis of published data and unpublished data on tailed frogs in managed forests? Are published generalizations on the relationship between parent geology and tailed frog abundance correct and consistent?	Tailed Frog Literature Review & Meta-analysis Project Tailed Frog and Parent Geology Project
What are the common findings and inconsistencies in published studies on the habitat associations of Dunn's & Van Dyke's Salamanders?	Dunn's & Van Dyke's Salamander Project
What are the effects of various levels of shade retention on the stream-breeding SAAs? Is there an optimum level of shade retention? Does territoriality in high quality habitat confound interpretation of SAA relative abundance estimates?	Buffer Integrity-Shade Effectiveness Project
What are the effects of three buffer treatments on SAAs, 2 years post-harvest?	Amphibian Recovery Project
How do stream associated amphibians utilize intermittent stream reaches at or near the origins of headwater streams?	Amphibians in Intermittent Streams Project

Tailed Frog Literature Review & Meta-analysis Project

Of the 6 FFR SAAs, the tailed frog may be the most extensively studied due to an inclusive distribution in the coastal Pacific Northwest. There are enough published studies on this species that a synthesis of those results is useful in helping LWAG develop a research and monitoring program. In addition, the published data sets, as well as several that are not published, will be the subject of a meta-analysis. That analysis may or may not support the literature review synthesis and will likely identify other factors related to tailed frog distribution and response to timber harvest that will be useful in developing LWAG's program. A draft literature review was completed in 2003. The partitioning of the two species of tailed frog required the review to be restructured to reflect that taxonomic revision . The restructured review is planned for completion in 2007,. The meta-analysis is underway and planned for completion in FY 2007. LWAG administers this project.

Tailed Frog and Parent Geology Project
Recent studies in managed forests have emphasized the relationship between parent geology, stream substrate composition, and tailed frog abundance. The general hypothesis has emerged that tailed frogs are most abundant in streams on geologies that produce hard or competent rock (volcanic basalt) vs. those that do not (marine sandstones). However, a study in Olympic National Park found that tailed frogs were abundant on both marine and volcanic parent material. These studies were largely observational and the distinction between geologies was an extrapolated finding of the results. This project would test the parent geology hypothesis throughout Washington. This project is currently on hold. LWAG administers this project.

Dunn's & Van Dyke's Salamander Project
The FFR indicates that LWD may be important for Dunn's and Van Dyke's salamanders. However, general habitat descriptions for both these species emphasize the importance of streamside rocky substrates. A literature review to determine the basis for the LWD connection to these species in the FFR was done external to CMER in 2000. The initial field phase of this project, done in cooperation with the Forest Service in 2001, was a study designed to provide additional information on the role of LWD in these species habitats. The initial field phase collected data across too few sites to complete an effective analysis, so a second phase of field data was collected in 2003. Analysis of data from both phases is being completed and an initial peer-reviewed submittal ready product will be completed in 2007.

Buffer Integrity-Shade Effectiveness Project
The effects of blow down on SAAs in Type N patch buffers are largely unknown. However, blow down is unpredictable in time and space, precluding a passive monitoring approach. One of the primary effects of blow down is a reduction in shade. This project will examine the effects of four levels of shade retention on tailed frog and torrent salamander density, body condition, and spatial distribution, water temperature, primary productivity, and macro-invertebrates. This is a cooperative project between Longview Timber Corporation and CMER. Longview Timber Corp. completed a pilot study in 2003, and initiated a broader study in 2004. The latitudinal breadth of this study was increased with a CMER-approved segment to include sites on the Olympic Peninsula. Site selection for this added segment has been completed and the first year of pre-harvest sampling occurred in FY 2006 with the second year in 2007. Treatments will be implemented during winter 2007-2008. As sampling is projected for two-years pre- and two years post-treatment, this project will extend to fiscal 2011

Amphibian Recovery Project
In 1998, the National Council for Air and Stream Improvement (NCASI) funded a study by Dr. Rhett Jackson on the effects of 3 buffer treatments on headwater streams in the Willapa Hills and Olympic Peninsula. Many of the FFR SAAs occurred on these sites. The NCASI funding covered a year of pre-treatment data and immediate post-harvest sampling. This project collected additional data, 2 years post-harvest. This project was completed in 2003. Four peer-reviewed journal articles have been published.

Amphibians in Intermittent Streams Project
This project seeks to provide an understanding of amphibian use of the intermittent segments that often occur at or near the origins of headwater streams. This project will provide information that will directly inform the placement of the required 50 ft buffer on headwater springs, which is part of current rule. This project has been scoped, the critical questions have been developed and defined, and has a fully developed study proposal that has been approved by

LWAG. The study included 3 phases: 1) an assessment of data collected under previous CMER funded projects for its applicability to the goals and objectives, 2) an analysis of the data, if any, identified in phase 1, and 3) based on the results of phases 1 or 2, additional data collection if needed. Phase 1 identified only 10 streams from one study area in western Washington with data approporiate to the project, thus LWAG determined that phase 3 would be required. The data analysis of phase 2 is underway with a projected completion data in FY 2007. Phase 3 scoping and study design has been completed and approved by LWAG, and ready for CMER review and approval. Once that is completed, release of a RFQQ will follow. LWAG will administer this project. The suggested approach will be to have a consultant(s) conduct the field sampling and members of LWAG will conduct the analysis of the data and report/manuscript writing.

Extensive Status and Trend Monitoring Programs

Extensive Type N Riparian Status and Trend Monitoring Program

Purpose

The purpose of the extensive riparian status and trend monitoring program (ERSTMP) is to provide data needed to evaluate the landscape-scale effects of implementing the FFR forest practices riparian prescriptions and to provide the data needed by the regulatory agencies to provide assurances that forest practices rules meet Clean Water Act requirements and achieve riparian resource objectives. Critical questions for the extensive Type N riparian status and trends monitoring program are shown in Table 9. This program will obtain an unbiased estimate of the distribution of stream temperature and shade, and riparian stand characteristics on Type N streams across FFR lands and provide statistically valid estimates of two riparian resource indicators, water temperature and riparian stand conditions and identify trends in these indicators over time.

Table 9. Critical questions for Type N Extensive Riparian Status & Trend Monitoring Program.

Critical Questions	Project
What is the distribution of maximum summer stream temperature and 7-day mean maximum daily water temperature on FFR lands, and how is the distribution changing over time as the FFR prescriptions are implemented?	All extensive riparian status and trends monitoring projects
What proportion of stream length on FFR lands meets water quality standards for water temperature, and how is the proportion changing over time as the FFR prescriptions are implemented?	
What are current riparian stand attributes on FFR lands, and how are stand conditions changing over time as the FFR prescriptions are implemented?	

Strategy

The extensive riparian status and trend monitoring program is stratified by region (eastside/westside) and by stream type (fish-bearing and perennial non-fish-bearing). Stratification at this coarse scale is necessary because riparian buffering strategy differs both for

Type F/S (fish-bearing) and Type Np (perennial non-fish- bearing) streams and for eastern vs. western Washington forestlands. Organizing the sampling effort into separate projects creates projects of a manageable size and allows project-specific adjustments in the sampling strategy and effort to address stratum-specific differences in variability. This program ranked first among the three CMER extensive monitoring programs.

A study design for the entire extensive riparian trend-monitoring program was developed by RSAG. ISRP review was completed in November of 2005 and RSAG is currently reviewing the comments. Further action was postponed until the results of the evaluation of air photo interpretation to characterize riparian stands were available in spring 2007. RSAG is also exploring combining this study with the eastside Type F and Eastside Type N Riparian Characterization Studies.

Rule Implementation Tool Programs

Sensitive Site Program

This program consists of two rule-tool implementation projects. The program began in 1999 and is managed by LWAG.

Purpose

The purpose of this program is to refine the descriptions of SAA sensitive sites in FFR and to estimate their importance to stream-associated amphibians.

Strategy

The strategy is to first develop a field methodology to assist forest managers in identifying sensitive sites and then characterize sensitive sites that are the most important to the FFR SAAs.

Project Descriptions

SAA Sensitive Sites Identification Methods Project

The purpose of the SAA sensitive site identification method project is to develop a practical methodology for identifying SAA sensitive sites, such as headwall seeps, side-slope seeps, and headwater springs. It is designed to answer the following critical questions:

- Are sites important to amphibians correctly identified by rule?
- Are rule-identified sites valuable for amphibians?
- Does sensitive site field identification need to be improved?

It is intended to inform the Type N riparian rule by providing a standard methodology (field guide) for field managers to identify SAA sensitive sites when designing harvest units. This project was completed in 2007. Two manuscripts have been submitted to a peer-reviewed journal and two additional manuscripts are in preparation. The project is administered by LWAG.

SAA Sensitive Sites Characterization

The purposes of this project are to document the distribution and characteristics of sensitive sites as described by the FFR rule and to verify their utilization and habitat value for SAA. It will generate information on the characteristics of sensitive sites, validate the extent to which they are utilized by amphibians, and determine if other sensitive sites exist. Information from this project

could result in changes to the sensitive area criteria in the rules to better focus buffer protection on areas important to SAA. This project was completed in 2006. One manuscript has been submitted to a peer-reviewed journal and another is in preparation. The project is administered by LWAG.

TYPE F RIPARIAN PRESCRIPTIONS RULE GROUP

The FFR report recognizes differences in riparian systems and processes between eastern (Eastside) and western (Westside) Washington. It describes the goal of the riparian strategies for Westside Type F (fish-bearing) streams as follows:

> "…Riparian silvicultural treatments and conservation measures that are designed to result in riparian conditions on growth and yield trajectories towards what are called 'desired future conditions.' As used in this report, desired future conditions are the stand conditions of a mature riparian forest, agreed to be 140 years of age (the midpoint between 80 and 200 years) and the attainment of resource objectives. …These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an endpoint of riparian stand development."

The eastern Washington riparian rules for Type F streams provide for stand conditions that: 1) vary over time within the range of historic disturbance regimes, 2) provide riparian functions needed to meet resource goals for fish, amphibians and water quality, and 3) maintain forest health by minimizing risk of catastrophic damage from insect, disease or fire.

The FFR assumes that riparian forests managed in accord with these strategies will provide adequate levels of key riparian functions (providing large woody debris, shade, and nutrients and preventing sediment input) necessary to meet FFR resource objectives for harvestable levels of salmonids, long-termviability of other covered species, and protection of water quality while maintaining a viable timber industry. These key functions are the focus of the resource objectives and performance targets established for this rule group.

Rule Summary

The Type F riparian rules prescribe riparian management zones (RMZs) that differ between the Eastside and Westside but share common characteristics. The common characteristics are RMZs equal in width to a site-potential tree height and divided into three zones: core, inner and outer. The core zone is adjacent to the stream and generally is a no harvest zone. The core is intended to protect bank stability and maintain the majority of shade and wood recruitment. The inner and outer zones extend outward from it. Prescribed harvesting is allowed under specific conditions.

Westside Type F Prescriptions

Western Washington RMZs consist of three zones, including:

1. A core zone 50 feet wide that is generally a no-harvest zone.

2. An inner zone extending from 10 to 100 feet beyond the core zone (depending on the site class and stream size) where the management objective is to place the combined core and inner zone on a trajectory to grow into the desired future condition (DFC).
3. An outer zone extending beyond the inner zone to the edge of the RMZ where timber harvest is managed to protect special sites and wildlife habitat and contribute to the overall riparian functions provided by the RMZ.

A variety of measures in the Westside Type-F riparian rules address site-specific situations, operational concerns of landowners, conversion of hardwood-dominated sites to conifer, placement of large wood, catastrophic loss from fire or wind, and alternate plans.

Eastside Type F Prescriptions

The eastern Washington Type-F riparian rules require:
1. A core 30-foot wide that is generally a no harvest zone.
2. An inner zone that is 45 to 70 feet wide (depending site class and stream size).
3. An outer zone is between 0 to 55 feet wide.

The sum of the core, inner and outer zones approximates the length of a site-potential tree, which varies with site class. Allowable harvest within the inner and outer zones is different for each of three elevation bands, referred to as timber habitat types in the rules. These elevation bands were intended to emulate variations in natural disturbance regimes, variations in species distributions, and other riparian characteristics. Guidance for selecting RMZ leave trees based on size and species are intended to move riparian stand conditions towards larger trees of fire and disease resistant species. Two temperature rules overlay the Eastside Type F riparian rule package. The first defines the amount of shade needed to meet state water-quality standards. The second (the bull trout overlay) is intended to provide the additional temperature protection required by bull trout (see Bull Trout Rule Group, below).

Strategy and Rationale

The western Washington Type F riparian rules are based upon the assumptions that:
1. The DFC basal area targets adequately describe mature riparian forest conditions.
2. The growth model used for DFC adequately projects riparian growth and mortality.
3. Some hardwood-dominated riparian stands need to be converted to conifer in order to achieve DFC.
4. Stands that meet the DFC target will provide the aquatic habitat conditions needed to provide the functions to meet the overall performance goals and resource objectives.

The eastern Washington Type F riparian rules are based upon the following assumptions:
1. The management strategies in the Type-F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2. The defined elevation bands are reasonably accurate reflections of the spatial distribution of historical disturbance regimes and species compositions
3. The management strategies will minimize risk of catastrophic events within the RMZs.
4. The management strategies will put stands on a trajectory that will provide the riparian functions needed to support harvestable populations of fish.

5. The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs of bull trout.

Uncertainties about the validity of the assumptions and the effectiveness of the rule lead to a series of critical questions and programs to address them (Table 10). The effectiveness programs include:

1. The Type F Statewide Effectiveness Monitoring Program, which addresses effectiveness of the Type F riparian rules in meeting performance targets and achieving resource objectives;
2. The Hardwood Conversion Program, which addresses uncertainty regarding strategies and prescriptions for managing hardwood dominated stands;
3. The Extensive Riparian Trend Monitoring Program, which documents status and trends of riparian conditions on Type F streams on a regional scale;
4. The DFC Validation Program, a rule tool program that addresses uncertainties regarding the validity of the west side DFC performance targets and the accuracy of DFC model that is used to project stand trajectory to age 140;
5. The Eastside Riparian Type F Program, which assesses current riparian stand and stream conditions on Type F streams across the eastside to evaluate the likelihood that the prescriptions will move stands to within the range of natural variability (forest health, riparian function, and within historic disturbance regimes). Once study sites for this study are identified, an Eastside Type F Instream Characterization Study will be developed. This study will look at multiple instream attributes that provide critical habitat for heathy fisheries and examine the relationship of this habitat to the adjacent RMZ. This study will initiate the development of eastside LWD performance targets and validate the shade-temperature relationships for eastern Washington in the forest practices rules. Scoping for this study will begin in 2007 (CMER FY08).
6. The Eastside Temperature Nomograph Program that validates the shade-temperature relationships for eastern Washington in the forest practices rules; and
7. The Bull Trout overlay temperature program, which addresses effectiveness of the eastside Type F shade requirements. This program is discussed in the Bull Trout rule group.

Table 10. Critical questions and programs for the Type F Riparian Prescriptions Rule Group.

Type F Riparian Prescriptions Rule Group Critical Questions	Program Name	Task Type	SAG
Does the DFC model adequately project stand basal area growth to age 140? Do the basal area targets, adequately describe mature riparian forest conditions?	DFC Validation Program	Rule Tool	RSAG
Are the Type F riparian rules effective in meeting the performance targets, resource objectives, and overall performance goals of FFR?	Type F Statewide Effectiveness Monitoring Program BTO Temperature Program	Effective-ness	RSAG BTSAG
Where and how should hardwood conversion projects be conducted, and what are the ecological outcomes?	Hardwood Conversion Program	Effective-ness	RSAG

What is the current range of conditions for eastside riparian stands and streams? Will application of the prescriptions result in stands that achieve eastside FFR objectives (forest health, riparian function and historic disturbance regimes)? What are appropriate LWD performance targets?	Eastside Type F Riparian Program	Rule Tool	SAGE
Can the shade/temperature relationships in the eastside temperature nomograph be refined?	Eastside Type F Riparian Program	Rule Tool	SAGE
What is the current status of riparian conditions and functions in Type F streams on a regional scale, and how are conditions changing over time?	Extensive Riparian Trend Monitoring Program (Type F)	Extensive	RSAG
How do aquatic organisms respond to changes in habitat and water quality associated with changes in riparian inputs and functions?	Aquatic Habitat Biotic Response	Intensive	RSAG

Effectiveness Monitoring Programs

Type F Statewide Prescription Monitoring Program

Purpose

The purpose of this program is to undertake research and monitoring to evaluate the effectiveness of the FFR Type F riparian prescriptions, compare and evaluate alternative Type F buffer treatments, and to validate the Type F performance targets. The program is designed to address scientific uncertainty about the prescriptions for type F streams, including:

1. The survival of buffer trees and rates of buffer tree mortality from windthrow, disease, insects and other factors,
2. Post-harvest changes in conifer-dominated westside RMZs, and whether westside stands will remain on trajectory to achieve DFC performance targets,
3. Post-harvest changes in conifer-dominated eastside RMZs, and whether eastside riparian stands will remain within desired ranges and
4. Uncertainty about the level of riparian functions provided by riparian stands produced by FFR Type F prescriptions, and whether or not FFR resource objectives and performance targets will be achieved.
5. The efficacy of alternative buffer designs in providing riparian functions and meeting resource objectives and performance targets.
6. The validity of various performance targets.

Strategy

Implementation of the Type F statewide prescription-monitoring program was identified as a priority by CMER in the January 2003 program ranking process. The program is designed to answer a series of critical questions that will reduce scientific uncertainty concerning the effectiveness of the Type F prescriptions and the response of riparian stands, functions and aquatic resources to riparian management practices. Table 11 lists the critical questions and the projects that address them. This program is ranked fifth among the 16 CMER programs.

Table 11. Type F Statewide Prescription Monitoring Program critical questions and projects.

Critical Questions	Project
How do the survival and growth rates of riparian leave trees change following the FFR Type F buffer treatments?	Type F Riparian Prescription Monitoring Projects (Eastside and Westside)
Do stands in Type F RMZs remain on trajectory to DFC (west side) or within desired ranges (east side)?	
Do riparian functions meet FFR resource objectives and performance targets for shade, stream temperature, LWD recruitment, and litter fall following application of the riparian Type F prescriptions?	
Would alternative approaches to the FFR Type F prescriptions be more effective in meeting FFR resource objectives and performance targets, while reducing costs or increasing flexibility for landowners?	Type F Experimental Buffer Treatment Project
Are the Type F performance targets valid and meaningful measures of success in meeting resource objectives?	Type F Performance Target Validation Project

The program is being implemented in stages. The Type F riparian prescription monitoring projects will be the first to be implemented, because the greatest uncertainties concern the effectiveness of the current FFR Type F prescriptions. The original study design for Type F riparian prescription called for a passive design that involved random sampling of Type F Forest Practice Applications to determine the effectiveness of the prescriptions as they are applied operationally across the range of conditions on FFR lands paired with untreated control sites. The proposal was to sample the east and west sides as separate strata. However, the Bull Trout Overlay temperature study demonstrated the great expense and difficulty in finding suitable treatment and control sites in eastern Washington. Consequently, the decision was made to utilize the BTO sites and study design for additional eastside riparian prescription monitoring in order to save money, expedite implementation of the project, and provide an integrated package of results for the adaptive management process. This will be accomplished by collecting additional data on changes in vegetation, buffer integrity and LWD recruitment at the BTO temperature study sites. Westside Type F riparian prescription effectiveness monitoring will be implemented as in the original study design. Depending on the results of these projects, experiment buffer treatment projects may be implemented to test the effectiveness of alternative buffer designs. Finally, the response of aquatic organisms and resources to different levels of riparian inputs and functions needs to be examined to determine if the Type F performance targets are valid and meaningful measures (Type F Performance Target Validation Project).

Project Descriptions

Type F Riparian Prescription Monitoring Project- Westside
In January of 2003, CMER approved the N/F Riparian Prescription Monitoring study design, which included a study design for monitoring the effectiveness of the Type F riparian prescriptions. RSAG is planning to begin implementing the westside Type F prescription effectiveness component in the spring of 2008. RSAG intends to develop an implementation plan in the winter of 2007. Site selection will begin in winter/spring of 2007/08.

Type F Riparian Prescription Monitoring Project- Eastside
RSAG, in conjunction with BTSAG and SAGE, developed a proposal to conduct eastside Type F effectiveness monitoring at the paired treatment-control sites used for the Bull Trout Overlay

temperature study. This project involves collecting additional information on buffer tree integrity/survival and changes in stand conditions and LWD recruitment to augment the BTO project data on temperature and canopy closure. In the spring of 2006 SAGE and RSAG held an integration meeting and identified how this project would be integrated with SAGE's Type F projects. CMER approved the integration strategy and gave the go-ahead to implement this study. Post-harvest sampling was conducted at four sites in 2006. Post-harvest sampling will continue over a several year period due to the staggered harvest schedule of the sites.

Type F Experimental Buffer Treatment Project
The Experimental Type F Buffer Treatment Project has been neither scoped nor designed. This project design, particularly the identification of appropriate alternative prescriptions for testing, will be based on the results of the Type F riparian prescription-monitoring project.

Type F Performance Target Validation Project
This project has been neither scoped nor designed.

Hardwood Conversion Program

Purpose

The purpose of this program is to inform the FFR strategy for addressing hardwood riparian stands that are the legacy of past timber harvest practices. Many riparian stands that were formerly conifer dominated are currently dominated by hardwoods as a result of past logging practices. These hardwood stands probably will not achieve DFC without active intervention. Large uncertainties are associated with the identification of sites where conversion is an appropriate management strategy, the cost and effectiveness of different silviculture techniques, and the trade-offs between short-term effects and long-term benefits. This program is ranked tenth among the 16 CMER programs.

Strategy

Table 12 presents the critical questions and projects of the Hardwood Conversion Program. The program began by implementing an initial project (the Hardwood Conversion Project) to provide information for the FFR Policy Committee on the effectiveness of hardwood conversion treatments, and the economic costs and benefits of hardwood conversion, through a series of case studies. In response to comments on the study design, a component to examine stream temperature response was added to the project.

In the spring of 2005, another project was initiated in response to a request from the Small Forest Landowners Advisory Committee working on a small landowner hardwood conversion template. This group requested information on the effect of hardwood conversion on stream temperature as a function of buffer width and stream length treated. In response to this request, WDOE submitted a proposal to CMER for the hardwood conversion water temperature modeling project. The project was carried out and is described below under "WDOE Temperature Modeling Project".

RSAG is contemplating other projects to address specific aspects of hardwood conversion, such as studies to determine how to identify sites where hardwood conversion is an appropriate management strategy, and to assess the distribution and characteristics of hardwood-dominated riparian stands on FFR lands.

Table 12. Hardwood Conversion Program critical questions and projects.

Critical Questions	Project
How effective are different hardwood conversion treatments in re-establishing conifers in hardwood-dominated riparian stands?	Hardwood Conversion Project
Is hardwood conversion in riparian stands operationally feasible and what are the economic costs and benefits of the hardwood conversion treatments?	
What effects do hardwood conversion treatments in riparian stands have on shade, stream temperature and LWD recruitment?	
What is the effect of hardwood conversion practices on stream temperature as a function of buffer width and length of stream treated?	WDOE Water Temperature Modeling Project

Project Descriptions

Hardwood Conversion Project
The Hardwood Conversion Project is a series of case studies at eight sites. Each site consists of landowner designed and implemented site-specific harvests of hardwood trees in riparian buffers. In each case, harvest is followed by replanting of conifers. Pre-harvest vegetation and stream temperature monitoring is completed. Harvest has occurred at all sites except one, and post-harvest monitoring is being implemented. In 2007/8 it is anticipated that 1st year post-harvest data collection will be completed at all sites, and 2nd and 3rd year post harvest data collection will occur at several sites. The economic component of the study will be implemented in 2007/8. Pre and post harvest stream temperature data have been collected at all sites. A review draft report on the stream temperature monitoring is scheduled to be submitted to CMER in 2007. Additional data may be collected at one site in summer of 2007 to better understand anomalous results from that site.

WDOE Temperature Modeling Project
This study used an existing stream temperature model and an existing shade model to explore the relative effect on stream temperature of different hardwood conversion strategies. The management strategies that were evaluated include a one-sided harvest with a continuous 30 ft buffer with treated stream lengths ranging from 500-1500 feet. A sensitivity analysis was performed on a range of stream conditions (width, flow, gradient, groundwater, and hyporheic flow). A draft report was completed in 2006 and was reviewed by CMER. The report was completed in 2007 and submitted to the Small Forest Landowner Advisory Group who had requested the study.

Extensive Status and Trend Monitoring Programs

Extensive Type F Riparian Status and Trend Monitoring Program

Purpose

The purpose of the extensive riparian status and trend monitoring program (ERSTMP) is to provide data needed to evaluate the landscape-scale effects of implementing the FFR forest practices riparian prescriptions and to provide the data needed by the regulatory agencies to

provide assurances that forest practices rules meet Clean Water Act requirements and achieve riparian resource objectives. Critical questions for the Type F extensive riparian status and trend monitoring program are shown in Table 13. This program will obtain an unbiased estimate of the distribution of stream temperature and shade, and riparian stand characteristics on Type F streams across FFR lands. It will provide statistically valid estimates of two riparian resource indicators, water temperature and riparian stand conditions, for streams across FFR lands and identify trends in these indicators over time.

Strategy

The Type F extensive riparian status and trend monitoring program is organized into separate projects by region (eastside/westside). Stratification at this coarse scale is necessary because riparian buffering strategy differs both for Type F/S (fish-bearing) and Type Np (perennial non-fish- bearing) streams and for eastern vs. western Washington forestlands. Organizing the sampling effort into separate projects creates projects of a manageable size and allows project-specific adjustments in the sampling strategy and effort to address stratum-specific differences in variability. This program ranked first among the three CMER extensive monitoring programs.

A study design for the entire suite of extensive riparian trend-monitoring projects was developed by RSAG. ISRP review was completed in November of 2005. Site selection requires accurate information on the location and typing of streams. The new western Washington stream-type map and the revised eastern Washington stream type map are now available. The order in which the extensive riparian projects are implemented will depend on funding, availability of accurate stream typing information and coordination with the SAGE riparian current condition assessment project. RSAG anticipates initiating sampling of at least one stratum in the summer of 2007.

Table 13. Extensive Riparian Status & Trend Monitoring Program (ERSTMP) critical questions.

Critical Questions	Project
What is the distribution of maximum summer stream temperature and 7-day mean maximum daily water temperature on FFR lands, and how is the distribution changing over time as the FFR prescriptions are implemented?	All extensive riparian status and trends monitoring projects
What proportion of stream length on FFR lands meets water quality standards for water temperature, and how is the proportion changing over time as the FFR prescriptions are implemented?	
What are current riparian stand attributes on FFR lands, and how are stand conditions changing over time as the FFR prescriptions are implemented?	
What proportion of westside Type F/S stream length on FFR lands meet DFC basal area performance targets, and how is the proportion changing over time as the FFR prescriptions are implemented?	Westside Type F/S
What proportion of eastside Type F/S stream length on FFR lands are within the eastside basal area ranges, and how is the proportion changing over time as the FFR prescriptions are implemented?	Eastside Type F/S

Project Descriptions

Eastside Type F/S Riparian Extensive Monitoring Project

A plan is currently being developed to integrate site selection and sampling of the Eastside Type F/S riparian extensive monitoring project with the Eastside Riparian Current Condition Assessment project. Implementation of this integrated sampling effort is planned for spring and summer of 2007.

Rule Implementation Tool Programs

Type F DFC Validation Program

The program is being administered by RSAG, and is designed to address uncertainties about the DFC approach, including uncertainties about: 1) how well the current targets reflect mature unmanaged riparian conditions for conifer and mixed stands, 2) how accurately the DFC model predicts growth of riparian stands to age 140, 3) what sort of habitat conditions will be provided by mature riparian stands, and 4) how young stands of different composition and density develop as they mature.

Purpose

The purpose of this program is to validate the DFC approach for management of western Washington, conifer-dominated riparian stands on fish bearing streams, including the DFC performance targets and the DFC model.

Strategy

This program consists of several projects designed to answer a series of critical questions (Table 14). DFC target validation has been identified as a high priority issue. To manage conifer and mixed riparian stands to achieve functions associated with mature stands, the DFC approach requires stand targets that reflect mature stand conditions, and a model that can accurately predict the trajectory of young stands to maturity.

Table 14. Type F DFC Validation Program critical questions and issues.

Critical Questions	Projects
Do the DFC targets accurately reflect stand conditions for mature, unmanaged conifer-dominated west side riparian stands?	DFC Target Validation Project DFC Plot Width Standardization Project
How are the westside Type F riparian prescriptions being applied by landowners? What is the effect of various prescription options and constraints on current harvest and projected future basal area?	DFC-FPA Analysis
What is the accuracy of the DNR site class maps in riparian areas, and what factors influence map accuracy?	DFC Site Class Map Validation Project
Does the DFC growth and mortality model accurately predict the trajectory of west side conifer-dominated riparian stands to age 140?	DFC Trajectory Model Validation Project
What aquatic habitat conditions are associated with mature west side riparian stands?	DFC-Aquatic Habitat Project
How do mature stand structures develop from younger stands in a variety of stand compositions	Pathways of Riparian Stand Development to Maturity Project

and densities?	
What growth trajectories and successional pathways are characteristic of hardwood-dominated riparian stands?	Red Alder Growth and Yield Model Project

Validation of the DFC performance targets is a high priority. Work on the DFC target validation project began in 2000, and the project results were transmitted to FFR policy in March of 2005. In response to this document, the FFR policy Committee requested that CMER undertake three additional tasks. One task was to conduct scoping for a project to standardize the width of the plots used in the DFC study to address concerns raised in the ISRP review (DFC Plot Width Standardization Project). Another task was to undertake a study to determine how the westside Type F Prescriptions are being applied by landowners and to evaluate how the different prescription options and constraints influence the amount of timber available for harvest and projected future basal area (the DFC-FPA Analysis). A third task was to undertake preparation of a scoping document to identify and evaluate potential approaches for validating the accuracy of the DNR site class maps in riparian areas (DFC Site Class Map Validation Project).

Validation of the DFC model is another important issue being addressed by this program. Development of a study to quantify the growth and dynamics of riparian buffers created by implementation of DFC rule was put on hold while RSAG waited to assess the feasibility of the regional riparian stand growth-mortality cooperative effort to address this issue in a cost-effective manner. The DFC-Aquatic Habitat Project is a lower priority issue, consequently scoping on this project has not begun. The Pathways of Riparian Stand Development to Maturity Project is an outgrowth of the DFC target validation project, based on the realization that many young low density stands of mixed composition are not likely to achieve DFC without some form of intervention, and that a better understanding of the development of such stands is needed to identify appropriate management approaches.

Project Descriptions

DFC Target Validation Project
The purpose of this project is to collect data on stand characteristics from a random sample of mature unmanaged conifer-dominated riparian stands in western Washington; compare basal area per acre from the sample with the current DFC targets; and evaluate alternative parameters for characterizing DFC. This project has been completed. The results are available in a CMER document entitled *Validation of the western Washington Desired Future Conditions (DFC) performance targets in the Washington State Forest Practices Rules with data from unmanaged, conifer-dominated riparian stands*". The results were transmitted to the FFR Policy Committee for consideration in the summer of 2005.

DFC Plot Width Standardization Project
In response to the DFC Target Validation Project described above, the FFR Policy Group requested that CMER undertake several additional tasks including scoping a follow-up sampling effort to standardize the width of the plots used in the DFC study to address concerns raised in the ISRP review. RSAG completed scoping in the spring of 2006. A scoping paper with options for follow-up sampling was approved by CMER and presented to FFR policy in the summer of 2006.

DFC-FPA Analysis

A second request from the FFR Policy Group was to undertake a study to determine how the westside Type F Prescriptions are being applied by landowners and to evaluate the effect of various prescription options and constraints on timber available for current harvest and on projected future basal area. The FFR Policy Group provided funding to CMER staff to complete an office (desktop) analysis of a random set of FPAs and to conduct a field verification project on a sub-sample of those FPAs. A draft report on the desktop analysis was presented to RSAG in December of 2005. Data collection for the field verification project occurred in the winter of 2006 and a draft report was submitted to RSAG in the spring of 2006. Later in 2006, CMER approved a contract to finalize the "desktop analysis", " field check" and "model and manual" reports, along with a document that synthesized findings from each of the documents. This work will was completed in, 2007.

DFC Site Class Map Validation Project
The third request from FFR Policy Group was to prepare a scoping document that identifies and evaluates approaches for validating the accuracy of the DNR site class maps in riparian areas CMER staff prepared a scoping document that was approved by CMER and presented to FFR policy in the summer of 2006.

DFC Trajectory Model Validation Project
This project will assess the accuracy of the DFC model in predicting riparian stand growth and trajectory from harvest age to the DFC target (age 140). This project will be designed to validate the DFC model as a tool to predict trajectory to the DFC target for both conifer-dominated and mixed stands.

DFC-Aquatic Habitat Project
The purpose of this project is to determine the range of aquatic habitat associated with mature (DFC) riparian forest conditions. This study has been neither scoped nor designed. RSAG does not plan to begin scoping on this project at this time.

Pathways of Riparian Stand Development to Maturity Project (not included in Budget Table in appendix)
The purpose of this project is to determine the development sequence of younger stands of various compositions and densities to mature stands. The study is intended to inform management of uneven-aged stands and those of low density or mixed composition. This study has been neither scoped nor designed. RSAG does not plan to begin scoping on this project at this time..

Red Alder Growth and Yield Model Project (not included in Budget Table in appendix)
The purpose of this project was to develop a growth and yield model for red alder. Existing models either did not include red alder amongst the species simulated or use equations that are based on too few field data. In this project, cooperators from across the PNW have contributed existing data that was compiled and cleaned at the UW Stand Management Cooperative. A growth and yield model for red alder will be developed from these data in a second phase of the project. Red alder is a dominant component of many riparian forests and although the model is not specific to riparian areas it will provide better information on the growth dynamics of these riparian stands than is currently available. CMER has contributed project development funds to this cooperative effort. This project is currently underway. In the fall of 2006, CMER received a request from the Washington Hardwood Commission to fund additional sampling at some

existing sites. This request was approved by the FFR policy committee and the work occurred in the winter of 2007. This project was funded from project development funds.

Eastside Riparian Type F Program

Purpose

The purpose of the eastside riparian Type F program is to validate the eastside Type F riparian prescriptions. The eastside riparian strategy is designed to achieve three management objectives:

1. To create dynamic riparian stands and riparian processes that emulate those provided by natural riparian disturbance regimes,
2. To create healthy and sustainable riparian stand conditions and,
3. To create riparian stands that provide riparian functions necessary for the protection and recovery of salmonids and aquatic amphibian species.

The Forest Practices Rules describe the management strategy as follows:

> *"For eastside forests, riparian management is intended to provide stand conditions that vary over time. It is designed to mimic eastside disturbance regimes within a range that meets functional conditions and maintains general forest health. These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an end of riparian stand development"* (WFPB, 2001).

The Eastern Washington Type F riparian rules are based on the following assumptions:

1) The management strategies in the Type F rules will put stands in the RMZ on a trajectory that is within the range of natural variability.
2) The defined elevation bands are reasonably accurate reflections of the special distribution of historical disturbance regimes and species composition.
3) The management strategies will minimize risk of catastrophic events
4) The management strategies will put stands on a trajectory that will provide riparian functions needed to support harvestable populations of fish.
5) The temperature overlays are necessary to provide stream temperatures that meet the state water quality standards and the needs for bull trout.

Strategy

Uncertainties about the validity of the assumptions and the effectiveness of the rule led to two critical questions and programs to address them. The critical questions to address first are:

1) What is the desired range of conditions for eastside riparian stands and what are the appropriate LWD performance targets?
2) Can the shade/temperature relationships in the eastside temperature nomograph be refined?

Project Descriptions

SAGE has developed the following projects to address these critical questions:

Eastside Disturbance Regime Literature Review Project

A literature review titled *A Review and Synthesis of Available Information on Riparian Disturbance Regimes in Eastern Washington* was produced to gain an understanding of what disturbance regimes existed in the past and how they affected riparian forests. This will help

determine whether we can apply these past conditions to present riparian stands and meet the Desired Future Conditions for riparian function. This document was reviewed by SAGE, CMER and SRC, and approved by CMER. The project is complete.

Eastside LWD Literature Review Project
A literature review titled *Review of the Available Literature Related to Wood Loading Dynamics in and around Streams in Eastern Washington Forests* was undertaken to help gain an understanding of the dynamics of functional stream wood and to a lesser degree the linkage between the level of LWD recruitment and the health of aquatic habitat. Addressing the uncertainty will require additional information on the relationship of LWD recruitment and habitat function. There is uncertainty about the response of aquatic habitat to different types or levels of LWD input and loading, and how much LWD riparian buffers need to produce. This document has been reviewed by SAGE, CMER and SRC, and the project is complete.

Eastside Temperature Nomograph Project
The Eastside Temperature Nomograph Project developed an Eastern Washington-specific nomograph using existing data and identified gaps for future study. The study identified site characteristics necessary to produce a better predictive model of stream temperatures in eastern Washington. The report was reviewed by SAGE and CMER and was not accepted as an approved project because technical shortcomings were identified. The document was retired to the file with comments noted. The data used in the analysis have been obtained and archived for potential future use and analysis. Further work on the eastside temperature nomograph project has been put on hold pending the results of an evaluation by WDOE of the approach for achieving water quality criteria, which will determine if the nomograph will be needed.

Eastside Riparian Current Condition Assessment Project
Eastern Washington has a wide range of climatic conditions, elevations, forest types, riparian zones, and management history. Riparian health/function information over this range of conditions is limited. An assessment, or baseline study, of current riparian forest stands is needed to determine whether they are meeting required functions for fish habitat and whether they fit into the historical disturbance regime and/or current disturbance regime. This will also help to develop targets to accomplish prescription assessment/evaluation. A scoping document was developed by SAGE, and CMER subsequently approved project development and site selection. The study plan for this project was reviewed by ISRP. Coordinated site selection with the riparian extensive monitoring project is occurring. Data collection has begun and will continue through FY 2008.

Eastside Type F Instream Characterization Project
Fish bearing streams in Eastern Washington exhibit a wide range of characteristics and management histories. An assessment, or baseline study, of current stream conditions and characteristics will help determine whether they are meeting required functions for fish habitat. This will also help to develop targets to accomplish prescription assessment/evaluation. Scoping for this project will begin in 2007. The study is on a trajectory for implementation in fiscal year 2008.

BULL TROUT RULE GROUP

Bull Trout are listed under ESA as threatened throughout their range in Washington. A factor contributing to their "threatened" status is the degradation of habitat, especially increasing

stream temperatures. Bull Trout temperature require cooler stream temperatures than do other salmonids. The bull trout habitat overlay is a map that is intended to show the distribution of known and potentially suitable bull trout habitat in eastern Washington.

Rule Summary

Specific riparian timber harvest prescriptions apply to Type F streams located within the bull trout habitat overlay area. When a timber harvest unit is located within the overlay, "all available shade" must be retained within 75 feet of the bankfull width or channel migration zone, whichever is greater. When outside of the overlay, prescriptions fall under the standard shade rule, which can allow for harvest of a portion of shade trees within the 75 feet, depending on elevation and canopy cover existing prior to harvest. The standard shade rule, which was designed to meet earlier state water quality temperature standards, is hypothesized to be inadequate to meet bull trout water temperature requirements.

Strategy and Rationale

Problems arose during implementation of the bull trout overlay. Because knowledge of the current and potential distribution of the species is imprecise, large areas of forestland in eastern Washington are included within the bull trout overlay. Some included areas may never have been occupied by bull trout and may not have the potential to support bull trout in the future. In these areas, the riparian zones bordering these streams are placed under inappropriate restrictions that may result in riparian conditions that do not meet the intent of the Eastside riparian strategy. Site-specific data on bull trout presence/absence or habitat conditions would help to identify areas that should be added to or removed from the bull trout overlay.

The Bull Trout "All Available Shade" Rule is based on the following assumptions:

1. Shade and water temperature are more at risk in eastern Washington than in western Washington because of the potential for more shade removal within the eastside RMZ prescriptions and warmer eastside air temperatures.
2. The water temperature criteria within the current (prior to 2004) water quality standards (and nomograph) are too warm to meet the optimal cold water temperature needs of bull trout.
3. A primary factor contributing to bull trout decline is habitat degradation, especially as it relates to stream temperature. Past forest practices, including shade removal, have been a contributing factor. Therefore with restoration of habitat and the consequential reduction in stream temperatures, bull trout should rebound in those habitats.
4. Historically when habitats were more optimal, watersheds were more extensively occupied by bull trout, including all life history strategies such as resident and migratory (i.e. fluvial and adfluvial).
5. The "all available shade" rule should provide more shade and water temperature protection than the standard eastside prescriptions.
6. The densiometer methodology can adequately measure and determine "all available shade".
7. All shade affecting stream temperature comes from within 75 feet of the stream.

The following list of uncertainties apply to the bull trout "all available shade rule"

1. Actual bull trout temperature requirements.

2. Accuracy of the bull trout habitat overlay in identifying habitat potentially suitable for bull trout.
3. The characteristics of "unsuitable" bull trout habitat are poorly defined.
4. The effectiveness of the densiometer methodology for determining effective shade, especially "all available shade" is not fully understood.
5. The meaning of "all available shade" is unclear.

The strategy for the bull trout rule group is intended to answer a set of critical questions that address these uncertainties (Table 15). Two programs are proposed to address these questions.

Table 15. Critical questions and programs for the Bull Trout Rule Group.

Bull Trout Rule Group Critical Questions	Program Name	Task Type
Are both the standard eastside prescriptions and the "all available shade" rule effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature? Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule? Are FFR riparian prescriptions effective at protecting groundwater flow and temperature?	BTO Temperature Program	Effective-ness
How can habitat suitable for bull trout be identified?	Bull Trout Habitat Identification Program	Rule Tool

The Bull Trout Overlay Temperature Program is designed to address the effectiveness of FFR rules on shade and stream temperatures in bull trout habitat, as well as other eastside fish habitat. The Bull Trout Habitat Identification Program is intended to help in identifying bull trout habitat for management purposes. All programs are administered by BTSAG.

Effectiveness Monitoring Programs

Bull Trout Overlay Temperature Program

Purpose

This program addresses the effectiveness of eastside FFR rules in protecting and maintaining shade and cool stream temperature, both within and outside of the bull trout habitat overlay.

Strategy

The Bull Trout Temperature Overlay (BTO) Program consists of three projects that address the critical questions in Table 16. The projects are designed to complement and build upon each other by first determining the effectiveness of both eastside riparian prescriptions ("all available shade" [BTO]; and standard shade rules) on shade, solar energy, and stream temperature. Conceptual models are also being developed to determine potential forest practices effects on groundwater and stream temperature. This program is ranked seventh among the 16 CMER programs.

Table 16. BTO Temperature Program critical questions.

Critical Questions	Projects
Are both the standard eastside shade rules and the "all available shade" rule effective in protecting shade and stream temperature and in meeting the water quality standards? Are there differences between the standard eastside rules and the "BTO all available shade" rules in the amount of shade provided and their effect on stream temperature?	BTO Temperature (Eastside Riparian Shade/Temperature Effectiveness) Project
Is "all available shade" actually achieved with the densiometer methodology under the BTO shade rule?	Solar Radiation/Effective Shade Project
Does timber harvest affect the temperature of groundwater entering streams?	Groundwater Conceptual Model Project

Project Descriptions

BTO Temperature (Eastside Riparian Shade/Temperature) Project
The BTO Temperature Project is designed to evaluate the effectiveness of both the "all available shade" rule and the standard Eastside riparian prescriptions in meeting FFR resource objectives, and to determine if a difference exists between shade and stream temperature provided by the BTO "all available shade" prescriptions and the standard FFR shade requirements. This field study is administered by BTSAG and is currently in both the pre- and post-harvest data collection stages. The staggered timing of data collection for pre- and post-harvest is dependent upon specific harvest schedules for the various study sites. This study is combined with the Solar Radiation /Effective Shade Project.

Solar Radiation/Effective Shade Project
The Solar Radiation/Effective Shade Project is designed to evaluate whether "all available shade" is actually achieved under the BTO shade rule. This study is being done in conjunction with the BTO Temperature (Eastside Riparian Shade/Temperature Effectiveness Study). As stated above, the field study is currently in both the pre- and post-harvest data collection stages. The staggered timing of data collection for pre- and post-harvest is dependent upon specific harvest schedules for the various study sites

Groundwater Conceptual Model Project
The Groundwater Conceptual Model Project was designed to investigate the potential impacts of timber harvest on groundwater temperatures, which subsequently could have the potential to discharge to streams and thereby affect the temperature regime of fish habitat. A draft literature review has been completed. However, the draft conceptual model developed from the original contract did not meet the expectations or objectives described by the BTSAG to identify areas that might be highly susceptible to groundwater heating after timber harvest. Staff from CMER and USFWS were able to make additional progress on development of the intended conceptual models; however, due to limited staffing availability and higher priorities, that progress has not yet reached completion. BTSAG is in the process of assessing the next steps needed to complete the original objectives for this project.

Groundwater Research Studies
These projects have been neither scoped nor designed. Future groundwater studies are pending results from development and assessment of the groundwater conceptual model.

Rule Implementation Tool Programs

Bull Trout Habitat Identification Program

This program is administered by BTSAG and consists of three projects.

Project Descriptions

Bull Trout Presence/Absence Protocols
Sampling efficiency models for detecting bull trout have been developed that are part of the development of presence/absence protocols. Two papers were finalized and approved by CMER, relating to sampling efficiency models: (1) Development of Bull Trout Sampling Efficiency Models, by Thurow et al., March 2004; and (2) Analysis of Movement Patterns of Stream-Dwelling Salmonids in Response to Three Survey Methods, by Peterson et al., July 2003. The results of these papers provide valuable information towards understanding the probability of detection and associated effort needed to survey for bull trout presence under various habitat conditions. The information contained in these papers help to inform us on aspects related to a bull trout field protocol, but additional work would be needed to achieve the program goal of a bull trout field protocol. The two CMER reports and the "Six Questions Leading to a Forest and Fish Policy Adaptive Management Recommendation to the Forest Practices Board" have been forwarded to Policy. Policy has accepted the reports and reported that no further action or work was needed at this time.

Bull Trout Habitat Prediction Models
This project was designed to develop bull trout habitat suitability models, which would help in identifying those areas on the bull trout habitat overlay which might actually be "unsuitable" for supporting bull trout. According to the forest practices rules, if areas were found to be "unsuitable" for potentially supporting bull trout, those areas could be exempt from the requirements of the "all available shade" rules. To date, preliminary draft models have been developed, but found to be too coarse for forest practices purposes. One report from this project was finalized and approved by CMER, entitled: Models to Predict Suitable Habitat for Juvenile Bull Trout in Washington State, by Dunham and Chandler, July 2001. This report provided valuable information pertaining to habitat suitability for juvenile bull trout. However, the study only resulted in setting up a preliminary model, which was too coarse of a screen for determining what would represent "unsuitable bull trout habitat" within forested lands. Predictive models tend to be more appropriate for determining "suitable" habitat rather than "unsuitable" habitat. Additional work would be needed to incorporate additional variables, resulting in a finer screen for determining what might be "suitable" or "unsuitable" habitat. It is likely, however, that a model would not be adequate by itself to determine habitat suitability; additional field surveys would probably be needed on a site-by-site basis. The CMER report and the "Six Questions Leading to a Forest and Fish Policy Adaptive Management Recommendation to the Forest Practices Board" have been forwarded to Policy. Policy has accepted the report and decided that no further action or work was needed at the time.

Other Related Research
Yakima River Radiotelemetry (not included in Budget Table in appendix)

This project is designed to evaluate the migratory patterns of adult bull trout and to identify their distribution and habitat preferences in the Yakima River watershed. The information gained from this project will inform bull trout presence/absence protocols and habitat prediction models.. The draft final report from this project is currently in the review process.

CHANNEL MIGRATION ZONE RULE GROUP

Rule Summary

The channel migration zone (CMZ) is an area within a river or stream valley where the active channel is prone to move laterally. The intent of the CMZ rule is to maintain riparian forest functions (e.g. woody debris recruitment, bank reinforcement, shade, and litter) along migrating channels. No timber harvest, salvage, or road construction (except for road crossings) is allowed within CMZs without an alternate plan that specifies the conditions which will provide equal and overall effective protection of public resources as described in the rules and the Forest Practices Act.

Strategy and Rationale

The strategy for the CMZ rule group is intended to answer a set of critical questions that address uncertainties concerning CMZ delineation and effectiveness (Table 17). The overall strategy is to assess the delineation methods for CMZs.

Table 17. Critical questions and programs for the CMZ Rule Group.

Channel Migration Zone Rule Group Critical Questions	Program Name	Task Type
What field/map criteria allow consistent, repeatable delineation of the CMZ lateral boundaries ("edge")?	CMZ Delineation Program	Rule Tool
Will the physical processes that drive channel migration change appreciably due to the application of FFR rules?	CMZ Validation Program	Intensive

The first question arises from the need to identify and delineate the CMZ so that the prescriptions can be implemented as intended. The rule assumes that the CMZ can be identified and the extent of the channel migration zone can be and will be consistently delineated by landowners. This assumption has high uncertainty because although many CMZs are relatively easy to recognize their boundaries are difficult to define in the field. Incorrect delineation of the CMZ edge results in incorrect placement of the adjacent RMZ, making it potentially vulnerable to channel disturbance.

The second question addresses the future patterns of channel migration. The CMZ rule is based on the assumption that the area subject to channel migration during the last 100 years is the same area that will be subject to channel migration during the next 100 years. A high level of uncertainty exists for this assumption because changes in land-use and other factors (i.e. in channel wood, sediment and flow) during the next 100 years could change the frequency of channel avulsion (the most common form of channel migration in forested conditions).

Rule Implementation Tool Programs

CMZ Delineation Program

Purpose

The purpose of the CMZ program is to assess the available methods and criteria for accurately identifying and delineating CMZs.

Strategy

This program will develop materials and procedures to aid field managers in the consistent and accurate delineation of CMZs. It consists of two projects. The first would provide a screening tool to locate areas with potential CMZs, and the second would provide a methodology to accurately delineate their boundaries once located. The program is not being actively developed because of its low ranking in the CMER priority list. The program is being administered by UPSAG.

Project Descriptions

CMZ Screen and Aerial Photograph Catalog Project and CMZ Boundary Identification Criteria Project

The need for these two projects, which were outlined in the 2005 Work Plan, was resolved with the recent revision of the Board Manual for CMZs (i.e. Section 2). No further CMER work on these topics is proposed.

Consistency and Accuracy of CMZ Boundary Delineations (not included in Budget Table)

The recent development of revised CMZ delineation guidelines (i.e. Board Manual Section 2) leaves open questions as to whether new methods result in accurate and consistent CMZ delineations. Although this project has not yet been scoped because of the low priority of the CMZ program, it would likely involve field evaluation of a sample of CMZ delineations. .

UNSTABLE SLOPES RULE GROUP

Rule Summary

The FFR goal for unstable-slopes management is to prevent forest practices from increasing or accelerating mass wasting (landslides) beyond the naturally occurring rate. The intent of the rule is to protect water quality and aquatic habitat by minimizing sediment delivery from forest management-related increases in mass wasting.

The FFR default protective measure for unstable slopes is avoidance. The rule strategy begins with definition of unstable landforms and the identification of unstable slopes. The strategy then is either to avoid the area or conduct a risk evaluation through the SEPA process. The rule strategy relies on the ability of forest managers and regulators to recognize and mitigate for unstable slopes within the forest practice application (FPA) and approval process. If forest practices are planned on potentially unstable slopes, the FPA application process includes a SEPA review. The correct identification and assessment of unstable slopes is achieved by the rules defining unstable landforms at a statewide level and DNR regions defining regional unstable landforms using local knowledge. As further protection, a specific FFR rule relates to timber harvest on the groundwater recharge areas of deep-seated landslides in glacial sediments.

Strategy and Rationale

Table 18 presents critical questions for the unstable slopes rule group and identifies a series of programs to address them. The strategy is to immediately implement an unstable-landform identification program to address the first two critical questions, and then to design and implement mass wasting effectiveness monitoring and validation programs to assess the effectiveness of landform recognition and mitigation at various scales. All effectiveness, extensive and intensive tasks are administered by UPSAG; rule tools are administered by DNR in collaboration with UPSAG.

Table 18. Critical questions and programs for the Unstable Slopes Rule Group.

Unstable Slopes Rule Group Critical Questions	Program Name	Task Type
What screening tools can be developed to assist in the identification of potentially unstable landforms that minimize the omission of potentially unstable landforms?	Unstable Landform Identification Program	Rule Tool
Does harvesting of the recharge area of a glacial deep-seated landslide promote its instability?	Glacial Deep-Seated Landslides Program	Rule Tool
Are unstable landforms being correctly and uniformly identified and evaluated for potential hazard?	Mass Wasting Effectiveness Monitoring Program	Effective-ness
What is the natural (background) rate of landsliding on managed forest lands?		
Are the FFR unstable-landform rules reducing the rate of management-induced landsliding at the landscape scale?		
Are the mass wasting prescriptions and mitigation measures effective in preventing landslides from roads and harvest units?		
What levels of cumulative sediment inputs are harmful to aquatic resources at the basin scale?	Mass Wasting Validation Program	Intensive

Effectiveness Monitoring Programs

Mass Wasting Effectiveness Monitoring Program

Purpose

The purpose of this program is to assess the degree to which implementation of the FFR rules is preventing or avoiding an increase in landsliding beyond natural background levels. The rules assume that:

1. The administrative process of identifying, reviewing, and regulating forest practices on potentially unstable slopes will maintain a naturally-occurring rate of mass wasting following forest practices.
2. Implementation of the unstable slopes prescriptions will achieve the Schedule L-1 Resource Objectives of clean water and substrate, and maintain channel-forming processes.
3. Implementation of the unstable slopes prescriptions will meet FFR landscape-scale targets (there are no site-scale targets).

Strategy

The Mass Wasting Effectiveness Program will address the critical question that defines the program: “Are the mass-wasting prescriptions effective in meeting the performance targets?”

The strategy is to 1) evaluate the effectiveness of identifying unstable slopes for applying prescriptions (avoidance or mitigation), and then 2) to evaluate effectiveness at two scales, the landscape scale (extensive monitoring) and the site scale (prescription effectiveness monitoring). Landscape-scale monitoring will evaluate trends in the number and volume (or area) of landslides over time using landslide inventory methods similar to those of watershed analysis. Site-scale or prescription level monitoring will use a "post-mortem" analysis on a sample of recent landslides on forestlands to determine if and how management actions were responsible for triggering the landslide. This will include landslides associated with roads, harvest, and/or leave areas (e.g., windthrow-triggered). The protocol for prescription-scale monitoring was developed during FY 2007. UPSAG will coordinate the two scales of monitoring by conducting prescription level "post-mortem" evaluations within watersheds evaluated in the landscape-scale monitoring. This will allow for interpretation of results across multiple scales; i.e., how does the effectiveness (or ineffectiveness) of specific prescriptions contribute to the total effect of landslides at the landscape scale? There are currently two competing and/or complementary study designs for extensive monitoring for mass wasting under consideration by UPSAG. Evaluation of these designs from current and planned pilot projects is expected to be completed by the end of 2007. Table 19 lists critical questions identified for the Mass Wasting Effectiveness Monitoring Program and the associated projects.

Table 19. Mass Wasting Effectiveness Monitoring Program critical questions.

Critical Questions	Project
Are unstable landforms being accurately and consistently identified in the field?	Effectiveness of Unstable Landform Identification Project
Are forest practices preventing or avoiding an increase in landsliding beyond natural rates of mass wasting?	Mass Wasting Landscape-Scale Effectiveness Monitoring Project
What field protocols will be used for assessing the causal mechanism of landslides at the site scale?	Mass Wasting Prescription-Scale Effectiveness Monitoring Protocol Development Project
Are unstable slope rule strategies failing to prevent landslides, and if so, how?	Mass Wasting Prescription-Scale Effectiveness Monitoring Project
Does wind-throw on mass-wasting buffers (leave areas) increase mass wasting?	Mass Wasting Buffer Integrity and Wind-throw Assessment Project

Project Descriptions

Effectiveness of Unstable Landform Identification Project

Considerable variability and bias exists between investigators when determining hazard areas associated with unstable (e.g., high-risk) landforms. The extent of this variability and/or bias, and the degree of influence it has on accurately identifying hazards in the field are unknown. This study will test the extent of accuracy and bias in slope hazard identification, specifically:

1) Are unstable slopes currently being uniformly recognized?
2) Are some unstable slopes currently going unrecognized?
3) Is the hazard of unstable slopes being correctly and uniformly recognized?

This study will provide recommended improvements to reduce variability related to proper hazard identification and assessment. This project is ranked as "urgent" and scoping is currently underway.

Mass Wasting Landscape-Scale Effectiveness Monitoring Project
This project will be designed to evaluate trends in the number and volume (or area) of landslides over time at the watershed scale using landslide inventory methods similar to those of watershed analysis. In broad terms, the trend monitoring will include sites that sample statewide variability in the factors that control landslide occurrence. These sites will consist of tracts containing both FFR-regulated lands and other forest lands under no or less extensive management (representative of natural or background conditions). Landslide rates and volume fluxes from both will be compared. Data to infer status and trends will consist of an inventory of landslides using data collected through the Landslide Hazard Zonation Project, complemented with aerial photography, terrain, topographic, forest cover, and road network maps. The current status will be assessed using existing data; monitoring for trends will require collection of additional data over time for each site. Based on recent research, it is unlikely that sufficient time has passed since the implementation of the new rule package to be able to detect a change. As such, UPSAG is recommending that effectiveness monitoring of landscape-scale mass wasting prescriptions be implemented no sooner than 2010. In the 2007-2009 time period, UPSAG will work to better understand how to isolate mass wasting trend in response to the Forests and Fish Rules from the dynamic noise of the natural system. These efforts may include a literature survey, a workshop, and similar studies that explore the statistical potential of different sampling schemes. This information will be used by UPSAG to decide whether and how to proceed with project scoping.

Mass Wasting Prescription-Scale Monitoring Protocol Development Project
The protocol for prescription scale monitoring must be developed prior to the implementation of the monitoring. This protocol will provide researchers with the tool needed to do site assessments in a rigorous, standardized method, should a large storm event (e.g., the 1996 storm) occur prior to the implementation of the prescription (site-scale) monitoring program. UPSAG developed the protocol "in-house" in FY2007, with assistance from a contracted editor.

Mass Wasting Prescription-Scale Effectiveness Monitoring Project
This project will be designed to conduct prescription-scale monitoring of landslides in FFR-compliant units to determine the degree to which management actions were responsible for triggering the landslide. This study will include landslides associated with roads, harvest, and leave areas, to determine the effectiveness of the current management strategies (typically avoidance) on preventing landslides. This project will help validate the effectiveness-monitoring project (and vice versa). Implementation of this project will follow development of the protocol (see previous project). The schedule for implementing the project is uncertain, because it is contingent on a storm event of sufficient magnitude to act as a potential trigger for mass wasting events over a large area. When such an event occurs, the project will need to be implemented on short notice. The study design is currently in the Independent Scientific Peer Review process.

Mass Wasting Buffer Integrity and Windthrow Assessment Project
This project will be designed to test the effect of windthrow in mass wasting leave areas on overall landslide rates. There is a school of thought that suggests that mass wasting leave areas are especially prone to windthrow. If that is true, then mass wasting leave areas would be counter-productive for reducing sediment load to streams. There has been no action on this project.

Rule Implementation Tool Programs

Unstable Landform Identification Program

Purpose

The purpose of the unstable landform identification program is to provide a set of screening tools to identify forested areas containing potentially unstable slopes to focus field verification activities on potential problem areas and thereby improve our ability to avoid them.

Strategy

This program consists of five projects that provide statewide information on the distribution of unstable landforms. The management strategy for regulating forest practices on unstable slopes consists primarily of an administrative process for identifying and reviewing forest practices on potentially unstable slopes. The main elements include defining and screening unstable slopes and improvements to the State Environmental Protection Act (SEPA) process. The success of the management strategy for unstable slopes is dependent on early recognition of potentially unstable slopes by forest managers in order to avoid or mitigate the hazards posed by them. The projects in this program are specifically referenced in the FFR as necessary for implementing forest practices that meet resource objectives.

Several projects are underway or completed and it is anticipated that the rule tools will be completely developed by 2008. Because the projects are developing screening tools which are used for information only and not as a regulatory hammer, we do not anticipate that program results will require Policy Committee action. The program is administered by UPSAG.

Project Descriptions

Shallow Rapid Landslide Screen for GIS Projects
The first phase of this project developed a GIS-based screen of modeled slope stability based on DEM topography for the Westside. This project was completed in 2001 and released as TFW report 118. The modeled slope stability map is available on the DNR Forest Practices web site. A second phase was proposed to identify topographic model(s) appropriate for similar mapping on the Eastside. This phase is on hold while the Landslide Hazard Zonation (LHZ) Project is being conducted. Should the LHZ project not complete mapping of the Eastside, the Eastside GIS screen could be used to create a complete coverage. The Westside screen becomes one component of the LHZ project in areas where the landslide hazard zonation will be completed.

Technical Guidelines for Geotechnical Reports Project
This project develops technical guidelines for geotechnical reports used in the SEPA review process. The guidelines will include identification of appropriate analytical tools and techniques appropriate for different projects and at different scales. This project is on hold while UPSAG tends to other priorities.

Regional Unstable Landforms Identification Project
This completed project provided a coordinator to work with TFW cooperators within each DNR region in order to identify unstable landforms that do not meet the present statewide landform descriptions. The project also serves as an interim screen for deep-seated landslides by identifying lithologies that promote deep-seated landslides; however, it is not intended to map them. The results of this project will be incorporated into the LHZ project.

Landform Hazard Classification System and Mapping Protocols Project
This project developed a statewide standard for assigning hazard to unstable slopes. It was completed in 2004 and was incorporated into the Landslide Hazard Zonation Project.

Landslide Hazard Zonation Project
This is a multi-phase project. A completed phase has collected and compiled all Watershed Analysis information on unstable landforms and other information on landslides and unstable slopes and placed this information in a GIS database. Additionally, Landform Hazard Classification System & Mapping Protocols Project has (1) developed a statewide standard for assigning hazard to unstable slopes and (2) completed unfinished mass wasting assessments in partially completed Watershed Analyses. The active and ongoing last phase is mapping landslides and landforms to provide consistent identification and evaluation of unstable landforms in high priority areas that are not covered by Watershed Analyses and are within FFR jurisdiction. Continued work on this project in FY2007 is contingent upon review and approval of funding by the FFR Policy Committee.

Glacial Deep-seated Landslide Program

Purpose

The purpose of the Glacial Deep-seated Landside Program is to develop a tool for assessing the failure potential of deep-seated landslides in glacial sediments resulting from changes in groundwater hydrology during and after timber harvest in the landslide recharge area.

Strategy

This program consists of two projects that are designed to develop and test an analytical model for assessing recharge impacts of timber harvest. The approach is to first develop an analytical procedure to estimate the increased recharge that may result from harvest. The second project expands this procedure into a model that incorporates site-specific conditions. The projects are administered by UPSAG.

Project Descriptions

Model Evapo-Transpiration in Deep-Seated Landslide Recharge Areas Proj.
This completed project developed an analytical model for assessing the evapo-transpiration changes resulting from timber harvest. The model is intended to be applied to timber harvest within the recharge area of deep-seated landslides in glacial sediments. The model has been developed but was not directly validated and refined because of insufficient field data. We anticipate implementing a validation/refinement study as a second phase when the appropriate field data become available . Further work in this vein is on hold until the scoping project described below is complete, and Policy has chosen a pathway for research into this topic.

Method to Assess Vulnerability of Deep-Seated Landslides to Timber Harvest
This multiphase project will integrate the existing analytical model with site-specific slope stability analysis to develop a site-specific assessment methodology that determines the potential for failure of deep-seated landslides subject to harvest in the recharge area. We anticipate two phases: Phase 1 will integrate the evapo-transpiration model with a soil moisture/recharge/slope stability model and Phase 2 will field test the model. As the validation for the model has not yet been conducted, UPSAG is recommending that this project be placed on-hold until the evapo-transpiration model can be validated.

Scoping groundwater recharge approaches, requested by Policy
At the budget retreat in March, 2006, Policy requested that UPSAG investigate pathways to evaluate the effects of harvest in groundwater recharge areas on deep-seated landslides. UPSAG designed the study plan, developed the contract language, and selected a contractor to carry out this work. The results were delivered to UPSAG in the summer of 2007 (FY08). UPSAG will bring the study and recommendations to CMER and Policy in the fall, 2007. This study is intended to reveal the most fruitful avenues of study to develop methods for evaluating the effects of timber harvest in recharge areas on movement of deep-seated landslides. These studies would then have to evaluated for prioritization within the CMER work plan.

ROADS RULE GROUP

Rule Summary

The intent of the rules for roads is to protect water quality and riparian/aquatic habitat by minimizing sediment delivery to Type S, F, and N waters and changes in hillslope and stream hydrology due to roads. Fish passage at road crossing structures is treated as a separate rule group. The road rules protect water quality and riparian/aquatic habitats through prescriptions and road Best Management Practices (BMPs). Implementation of these prescriptions through road maintenance and abandonment plans (RMAP) is intended to minimize road-surface sediment production and the hydrologic connection between the road system and the stream network. The road rules specify prescriptions for road construction, maintenance and abandonment, landings, and stream-crossing structures. In addition, the Board Manual identifies BMPs for roads and landings. The rules required RMAPs for all forest roads to be developed by 2006 for large forest landowners, and timed with timber harvest activity for small forest landowners.

Strategy and Rationale

The basic assumptions of the road rules are

1. Implementation of road prescriptions will result in achieving FFR performance goals and resource objectives, including:
    a. Meeting water quality standards,
    b. Providing clean water and substrate, and maintaining channel forming processes by minimizing the delivery of management-induced coarse and fine sediment to streams by protecting stream-bank integrity, providing vegetative filtering, protecting unstable slopes, and preventing the routing of sediment to streams,

c. Maintaining surface and groundwater hydrologic regimes (magnitude, frequency, timing, and routing of stream flow). This will be accomplished by disconnecting road drainage from the stream network, preventing increases in peak flows causing scour, and maintaining the hydrologic continuity of wetlands.

2. Assessment and planning using RMAPs is the best method to assure effective implementation of BMPs and this will achieve the above objectives.
3. Roads differ in their degree and importance of impact to the resources of concern, and we can identify and prioritize roadwork based on these differences.
4. Appropriately identified standard BMPs are effective at achieving functional objectives.

Assessment of the rules leads to five critical questions. Three monitoring and validation programs are proposed to address these critical questions (Table 20). The monitoring strategy is based on CMER's experience with road sediment problems and BMPs and on the data from numerous Watershed Analyses used to develop the FFR road performance targets for sediments. The effectiveness-monitoring strategy includes both a site-scale program and a basin-scale program. Validation of the road performance targets, which is more complex and time-consuming, will come later. This approach will first inform the uncertainties about BMP effectiveness and their ability to meet FFR targets. If BMPs are ineffective, validation monitoring is unwarranted. If BMPs are proving to be effective, then validating the performance targets should begin (do we have the right target?).

Table 20. Critical questions and programs for the Roads Rule Group.

Roads Rule Group Critical Questions	Program Name	Task Type
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions that are covered under the Mass Wasting Rule Group).	Road Basin-Scale Effectiveness Monitoring Program	Effective-ness
Does the RMAP process correctly identify priority fixes (see Section 2.9)?	Roads Prescription (Site-Scale) Effectiveness Monitoring Program	
Are road prescriptions effective at meeting site-scale performance targets for sediment and water? (Exclusive of mass wasting prescriptions, which are covered in the Mass Wasting Rule Group section).		
Have the correct performance targets for sediment delivery and connectivity been identified?	Roads Validation Program and Cumulative Sediment Effects.	Intensive
What levels of cumulative sediment inputs are harmful to the resource at the basin scale? (Validation of road sediment targets).		

Effectiveness Monitoring Programs

Roads Sub-basin Scale Effectiveness Monitoring Program

Purpose

The purpose of the roads sub-basin scale effectiveness-monitoring program is to determine the degree to which road prescriptions are effective at meeting performance targets for surface erosion sediment and water established at the sub-basin scale.

Strategy

The effectiveness-monitoring program for roads is planned for two scales: 1) monitoring at the sub-basin scale and, 2) monitoring at the site scale. FFR established performance targets at the sub-basin scale. At the sub-basin scale, road monitoring assesses the effectiveness of the rules at meeting the FFR performance targets for sediment and hydrologic connectivity across ownerships and regions of the state. Because the rules provide a 15-year window for implementation of RMAP upgrades, this program is long-term and results will provide a periodic evaluation of the trend and the trajectory toward meeting the performance targets by 2016. This program is ranked fourth among the 16 CMER programs.

The road sub-basin scale effectiveness-monitoring program currently consists of three projects that are related to critical questions in Table 21. Two projects revise and validate the analytical model to estimate road-surface erosion (WARSEM) that is used in the monitoring program to estimate sediment contributions and connectivity from selected road segments and road systems.

Table 21. Road Sub-basin Scale Effectiveness Monitoring Program critical questions.

Critical Program Questions	Projects
Are road prescriptions effective at meeting sub-basin scale performance targets for sediment and water?	Road Sub-Basin-Scale Effectiveness Monitoring Project
Are field or analytical methods needed to support the monitoring program?	Road Surface Erosion Model Update Project
How accurate is the road surface erosion model in predicting average road sediment from run-off at the site scale?	Road Surface Erosion Model Validation/ Refinement project

Project Descriptions

Road Surface Erosion Model Update Project

The road surface erosion model within the Surface Erosion Module of the Washington Forest Practices Board Manual on Standard Methodology for Conducting Watershed Analysis (version 4.0, November 1997) is an empirically derived model widely used for estimating surface erosion and sediment delivery to streams from forest roads. The primary purpose of this project is to refine and adapt the model for use in forest road monitoring and an assessment method. Revisions include standardizing input variables and developing repeatable application protocols. This project also includes development, testing, and refinement of standardized protocols for field application of the revised road surface erosion model for use at the site and road segment scale. This project was completed in 2003 and produced the WAshington State Road Surface Erosion Model (WARSEM).

Road Sub-Basin-Scale Effectiveness Monitoring Project

The main purpose of this project is to provide data that can be used to assess the degree to which sub-basin scale performance targets, and therefore resource objectives, are being met throughout the state. It will also characterize the extent of road conditions that reduce surface erosion (e.g. improved surfacing, reduced runoff to streams). Data collected at the sub-basin scale will determine the status and assess trends of key indicators of road connectivity and using WARSEM sediment delivery through time. It does not address performance targets for road performance relative to mass wasting erosion processes, which are more readily evaluated through other monitoring projects. Forest road systems in randomly selected sample areas that are proportionately distributed statewide in areas under FFR rules, independent of ownership, will be monitored. Small forest landowner properties are included in the study whenever they fall within the sampling blocks. Data will be collected to determine the degree to which roads meet established performance targets and the strength of the relationship between those reported measures and the percent of sample area under implemented RMAPs. Because road monitoring at the sub-basin scale is expected to extend through the15-year road rule implementation period, this piece will be put in place before model validation and performance target validation. The study design has completed ISRP review and been approved by CMER. Site selection is underway and a contractor has been selected. Field training, testing and initial data collection on 14 sites was completed in FY07. Field data collection is scheduled to continue in FY08.

Road Surface Erosion Model Validation/Refinement Project
WARSEM is based on a range of empirically derived data available in 2003. This project would measure sediment from selected Washington road sites to evaluate the accuracy of modeled sediment delivery rates. This study could be designed to also evaluate the effectiveness of individual sediment control strategies, such as sediment traps, silt fences or enhanced cutslope vegetation. Scoping and design are not anticipated before 2010.

Roads Site-Scale Effectiveness Monitoring Program

Site-scale effectiveness monitoring provides more insight into the effectiveness of individual road prescriptions than does sub-basin-scale monitoring program. Because the time-table for forest landowners to implement FFR prescriptions is tied to RMAPs, it is beneficial to design monitoring that accounts for this context. The site-scale subprogram requires the development of site-specific road performance measures (based on prescription objectives), the testing of site-level effectiveness using RMAP-implemented areas as a sampling stratum, and the development of field protocols for site-scale performance measures. The road site-scale effectiveness monitoring program will inform the rules at several levels by determining the degree to which strategies are achieving resource objectives at the site scale, assessing the need to modify individual RMAPs to achieve resource objectives, and assessing the need to modify guidelines and rules for road maintenance and abandonment planning.

Purpose

The dual purposes of the roads site-scale effectiveness monitoring project are to (1) determine the degree to which maintenance activities within RMAPs have been appropriately identified, and (2) assess the effectiveness of specific best management practices (BMP) in meeting their intended objective(s).

Strategy

As described in Table 22, an important issue related to road effectiveness monitoring is the degree to which maintenance activities targeted in the RMAP assessments are appropriately

identified and prioritized based on rule language to fix the "worst first." Monitoring this aspect of the prescription strategy for roads is important because individual or collective prescriptions that are effective in meeting resource protection goals, if not applied to the right locations may not achieve resource objectives, and yet still incur cost to the landowner. Equally important is the assessment of the degree to which BMPs are effective in meeting their stated objective of either reducing sediment delivery or disconnecting roads from typed surface water. This program is ranked ninth among the 16 CMER programs. We anticipate that the results of these studies will inform the FFR adaptive management process about the effectiveness of RMAP rules in achieving the FFR goals. Should RMAPs prove to be ineffective, Policy may have to revisit the rule to refine its requirements and application.

Table 22. Road Site-Scale Prescription Effectiveness Monitoring Program.

Critical Program Questions	Projects
Are RMAP scheduled activities identified and prioritized appropriately?	Effectiveness of RMAP Fixes Project
Are road prescriptions effective at meeting site-scale performance targets for sediment and water?	Road Site-Scale Effectiveness Monitoring Project

Project Descriptions

Effectiveness of RMAP Fixes Project
The primary purpose of this project is to evaluate the degree to which RMAP road repairs have been appropriately identified and implemented. The project is envisioned to follow the completion of the Road Sub-Basin-Scale Effectiveness Monitoring (for surface erosion and connectivity issues) and Mass Wasting Site-scale Effectiveness Monitoring projects (for road instability issues), so that results of these studies can be used to refine the list of treatments to be investigated and inform a sampling design for the RMAP project described here. This project would determine the extent to which identified road problems were located in areas where RMAP repairs had been implemented and attempt to determine why site scale benefits were not achieved. No action is anticipated on this project in FY2007, but initiation may occur in.

Road Site-Scale Effectiveness Monitoring Project
The concept for implementing this study has changed since the 2006 work plan. Rather than doing a separate study, we intend to investigate the effectiveness of site-scale road treatments as a component of the site-scale mass wasting study, which is presently being scoped within the mass wasting program. The objectives of monitoring of forest roads at the prescription scale are to: (1) evaluate the effectiveness of road prescriptions in meeting site-scale road stability performance targets, and (2) identify sensitive situations where prescriptions are not effective. Prescriptions to be investigated will likely include those designed to remove or reinforce unstable road material and/or provide effective water control and stream passage.

FISH PASSAGE RULE GROUP

In FFR Schedule L-2, the fish passage functional objective states: "maintain or restore passage for fish in all life stages and provide for the passage of some woody debris by building and maintaining roads with adequate stream crossings." The performance target for access barriers is to: "eliminate road-related access barriers over the time-frame for road management plans." FFR

Schedules L-1 and L-2 state the effectiveness monitoring and research objective as: "test the effectiveness of fish passage prescriptions at restoring and maintaining passage."

Rule Summary

Fish passage blockages at road crossing structures are to be addressed as part of the road maintenance and abandonment plan (RMAP) process. Road crossing structures will be inventoried and evaluated, and those acting as fish barriers are to be prioritized as to amount of potential fish-bearing stream affected. Those structures that do not provide fish passage must be repaired or replaced within 15 years, typically on a "worst-first" basis. WDFW's hydraulic code rules, the associated barrier-assessment manual, and DNR's forest practices rules apply to crossing structures on forest roads.

Strategy and Rationale

Critical questions were developed through an analysis of the FFR rules during which the assumptions and uncertainties underlying the rule were identified. From these uncertainties, two critical questions were derived (Table 23). The fish passage rule is based on the following assumptions:

1. Achieving the objective of no fish barriers is critical for recovery of depressed stocks and the health of fish at all life stages.
2. Implementation of the rules will result in achieving the objective to maintain or provide passage for fish in all life stages and to provide for the passage of woody debris likely to be encountered.
3. Assessment, prioritization, and implementation of RMAPs will achieve the objectives in a timely manner.
4. Current stream crossing replacement standards are adequate to address fish and all life history stages.
5. Hydraulic code criteria are effective at achieving resource objectives.
6. Fish species and all life history stage distributions can be characterized statewide.
7. Performance targets can be developed for fish at all life history stages.
8. Stream simulation methods provide passage for fish (definition WAC 222-16-010) and all life history stages.

Table 23. Critical questions and programs for the Fish Passage Rule Group. All effectiveness and extensive tasks are administered by ISAG.

Fish Passage Rule Group Critical Questions	Program Name	Task Type
Are the corrective measures effective in restoring fish passage for fish at all life history stages?	Fish Passage Effectiveness/ Validation Monitoring Program	Effective-ness
What is the current status of fish passage on a regional scale, and how are conditions changing over time?	Extensive Fish Passage Monitoring Program	Extensive

Effectiveness Monitoring Programs

Fish Passage Effectiveness/Validation Monitoring Program

Purpose

The Fish Passage Effectiveness/Validation Monitoring Program will validate the assumptions and test the effectiveness of the Forest Practices Rules in providing passage at road crossings for fish (as defined by WAC 222-16-010) at all life history stages (Table 24).

There are a number of questions concerning the adequacy of current fish passage design methods, existing fish passage criteria, and the definition of a fish passage barrier. This is particularly true for passing 'all species and life stages' as required in the Forest and Fish Rules. Some of these questions are applicable to high gradient headwater streams where only resident fish species are present, a particular area of interest for ISAG because adequate information on these streams is sorely lacking. The primary purpose of the Fish Passage Effectiveness/Validation Monitoring Program is to address key scientific uncertainty surrounding fish passage in headwater streams.

Table 24. Fish Passage Effectiveness/Validation Monitoring Program.

Critical Questions
Are the corrective measures effective in restoring fish passage for all life history stages?
Are stream crossing structures installed in steeper headwater streams creating the conditions they were designed to create? Are these conditions passing fish as intended?
Are our assumptions about fish movement and fish passage in headwater streams correct? Are the solutions (existing tools) we are implementing working to provide fish passage as needed?

Strategy

The Fish Passage Effectiveness/Validation Monitoring Program is composed of three principal elements: (1) fish movement capability, (2) fish life history and movement ecology, and (3) road crossing structure designs that provide fish passage (barrier solutions).

Extensive Status and Trend Monitoring Programs

Extensive Fish Passage Trend Monitoring Program

Purpose

The Monitoring Design Team defines extensive monitoring as a population-scale assessment of the effectiveness of the FFR rules in attaining forest practice related performance targets across FFR lands (Monitoring Design Team, 2002). The implied FFR performance target for fish passage based upon the requirements for Road Maintenance and Abandonment Plans (RMAP's) is to eliminate fish blockages on FFR regulated lands. This program will be designed to evaluate status and trends in fish passage conditions at forest road crossings.

Strategy

ISAG has completed an extensive fish passage monitoring design. However, due to expense and limitations of scope, implementation of the design is delayed indefinitely. Additionally, DNR compiles RMAPs progress report for the state legislature on an annual basis. ISAG is also exploring the possible use of some stream crossing data collected by UPSAG for their Road Sub-basin Scale Effectiveness Monitoring project.

Project Descriptions

Extensive Fish Passage Trend Monitoring Project

A study design for fish passage trend monitoring was developed using guidelines consistent with the Forests and Fish Report, and supplied by ISAG. The contractor (WDFW) reviewed possible monitoring approaches and presented a recommended study design and methodology to ISAG for review. Any future consideration of an Extensive Fish Passage Trend Monitoring project will require a full re-evaluation of the completed study design. In order to explore possible cost savings, ISAG will assess stream-crossing data collected by UPSAG's Roads Sub-basin Scale Effectiveness Monitoring project, and evaluate whether or not that data can be used to report on some aspect of status and trends for extensive fish passage.

PESTICIDES RULE GROUP

The objectives of the pesticides rule group is to manage pesticide use to achieve water quality standards, meet label requirements, and avoid harm to riparian vegetation. In the context of the forest practices rules, pesticide means "any insecticide, herbicide, fungicide or rodenticide, but does not include nontoxic repellents or other forest chemicals."

Rule Summary

The pesticide rules include a series of regulations that cover: 1) aerial application of pesticides, 2) ground application of pesticides with power equipment, and 3) hand application of pesticides. The rules for aerial application of pesticides prescribe a setback (offset) to prevent application of pesticides within the core and inner zones of Type F and S streams, or the wetland management zone (WMZ) of Type A or B wetlands. In these cases the offset is from the outer edge of the inner zone or the WMZ. Offsets are also prescribed for flowing Type N streams and Type B wetlands < 5 acres, however in these cases the offsets are measured from the edge of the bankfull channel or wetland. The offset distances vary depending on water type, the type of nozzle used, and wind conditions at the time of application. Separate guidelines govern ground application of pesticides with power equipment and hand equipment within RMZs and WMZs.

Strategy and Rationale

The main assumption is that the pesticide rules will be effective in achieving the objectives of meeting water quality standards, label requirements and preventing damage to vegetation in RMZs and WMZs. A level of uncertainty exists for the aerial application of pesticides because of the potential difficulties caused by terrain and wind conditions. A single critical question has been developed, with a corresponding effectiveness program (Table 25).

Table 25. Critical questions and programs for the Pesticides Rule Group.

Pesticides Rule Group Critical Questions	Program Name	Task Type
Do the pesticide rules protect water quality and vegetation within the core and inner zones of Type S and F RMZs or the WMZs of Type A or B wetlands?	Forest Chemicals Program	Effective-ness

Effectiveness Monitoring Programs

Forest Chemicals Program

Purpose

The purpose of this program is to address uncertainty concerning the effectiveness of the chemical application rules in protecting water quality and vegetation in riparian and wetland buffers. Alterative strategies with lower costs will also be considered.

Strategy

The program is under RSAG. This program is ranked last among the 16 CMER programs. Scoping has not occurred and no projects have been identified.

WETLAND PROTECTION RULE GROUP

Wetland adaptive management goals are identified in the FFR report as:

> "The goal … is to clarify the mapping of wetlands and provide for an assessment of the functions of associated wetlands. This is intended to include an assessment of the functions served by forested wetlands and the potential impacts of harvest activities in forested wetlands. The assessment may include the determination of harvest activities that cannot be adequately mitigated or recovered. Where such assessments suggest that changes in forest practices are required, this Appendix is intended to provide the mechanism for the consideration of additional rules for the protection of such wetlands."

The intent of the wetland rules is to achieve no net loss of wetland function (water quality, water quantity, fish and wildlife habitat, and timber production) by avoiding, minimizing, or preventing sediment delivery and hydrologic disruption from roads, timber harvest, and timber yarding; and by providing wetland buffers. The main strategy is to use forest and fish rules, adaptive management, and watershed analyses as the primary vehicles for implementing wetland BMPs and the evaluation of rule effectiveness.

Rule Summary

The forest practices rules classify wetlands into two categories. Type A wetlands include non-forested wetlands with an area greater than 0.5 acres or forested and non-forested bogs having an area greater than 0.25 acres. Type B wetlands include non-forested wetlands with an area greater than 0.25 acres. Landowners are required to inventory and map wetlands greater than 0.1 acre as part of an FPA for timber harvest or road construction. Wetland management zones (WMZ) are prescribed for all Type A and Type B wetlands greater than 0.5 acres. The WMZs have variable widths based on the wetland type and area; harvest is allowed within the maximum width WMZ. The specific leave tree requirements within WMZs differ for eastern and western Washington.

The use of ground based harvesting equipment is restricted within WMZs. Harvest methods are limited to low impact harvest or cable systems within forested wetlands and landowners are encouraged to leave a portion of the wildlife reserve tree requirement within the wetland. Additional rules apply to road construction to address no net loss of wetland function. The preferred option is to prevent impacts by locating roads outside of wetlands, however where this is not possible, the guidelines seek to minimize and mitigate impacts.

Strategy and Rationale

The wetland rules are based on the following assumptions:

1. Implementation of the wetland prescriptions will result in no net loss of wetland functions over a timber rotation, assuming that some wetland functions may be reduced until the mid-point of a timber rotation cycle.
2. Assessment and planning in watershed analysis and implementation of forest practices rules will achieve the stated resource objectives.
3. Appropriately identified, standard BMPs are effective at achieving resource objectives.
4. Forested wetlands will successfully regenerate following timber harvest.

Several uncertainties exist about the validity of these assumptions. The wetland functions listed in the rules are limited and significant uncertainty exists regarding the adequacy of the rules in meeting the resource objectives of the FFR report. The degree to which current rules related to road construction for wetland mitigation will achieve the "no net loss of wetland function" policy is unclear because no objective performance measures are available for determining:

1. The range of wetland functions affected by road construction, harvest, or
2. Net loss or gain of these functions over time.

These assumptions and uncertainties guided development of critical questions and research and monitoring programs to address them (Table 26).

Table 26. Critical questions and programs for the Wetlands Rule Group.

Wetlands Rule Group Critical Questions	Program Name	Task Type
Are forested wetlands regenerating sufficiently to maintain wetland functions?	Wetlands Revegetation Effectiveness Program	Effectiveness
Are road construction activities, harvest and harvest methods adequately mitigated to achieve no net-loss of wetland functions?	Wetland Mitigation Program	Effectiveness
Are current WMZs effective in providing adequate levels of LWD?	WMZ Effectiveness Monitoring Program	Effectiveness
Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids?		
Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect		

temperatures in connected streams?		
Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?		
How should wetlands be classified and mapped for management purposes?	Wetland Tools Program	Rule Tool

The approach of the wetlands rule strategy is to establish, through a comprehensive literature review, the current scientific basis for evaluating wetland functional relationships for salmonids, covered species and water quality and quantity. The literature review will be followed by development of tools to map wetland locations (GIS Layer) and describe wetland functions (hydrogeomorphic classification system). Specific effectiveness/validation studies will be developed to answer questions about the effects of rule implementation at the landscape and site scales. All effectiveness tasks are administered by WETSAG; rule tools are administered by DNR in collaboration with WETSAG.

Effectiveness Monitoring Programs

Forested Wetlands Effectiveness Program

Purpose
This program addresses uncertainty concerning the net loss of hydrologic function, water quality, and recovery capacity of forested wetlands following timber harvest.

Strategy
This program consists of four projects (Table 27). Schedule L-1 of the FFR states a key performance target for wetlands is "no net loss in the hydrologic functions of wetlands". Schedule L-2 H.9 directs the testing of the performance target from L-1 through research to "assess the hydrologic functions of forested wetlands, the effects of harvesting on stream flows and the effectiveness of prescriptions in meeting wetland targets." Among the list of issues is the evaluation of the regeneration and recovery capacity of forested wetlands. A literature review and synthesis of forested wetlands was performed to identify current understanding of forested wetland functions and regeneration capabilities in the Pacific Northwest. The review and synthesis also identified informational gaps that will be used to identify further research considerations. A pilot project to evaluate methods for determining reforestation in forested wetlands was recently completed. A full scale study is not planned at this time. Future studies of wetland and stream temperature interactions and hydrologic connectivity will further explore wetland functions and impacts associated with timber harvest. This program is ranked eighth among the 16 CMER programs.

Table 27. Forested Wetlands Effectiveness Program

Critical Questions	Project
What is currently known about regeneration in forested	Forested Wetlands Literature

wetlands in the Pacific Northwest?	Review & Workshop project
What are the information gaps?	
What is currently known about affects of timber harvest on forested wetland functions?	
What are the current methods of evaluating regeneration in forested wetlands?	Statewide Forested Wetland Regeneration Pilot & Project
How successfully are they being implemented?	
What results are landowners experiencing?	
What kind of guidance can be given to landowners to best ensure regeneration of forested wetlands?	
How does the post-harvest stand composition compare to pre-harvest condition?	
How are forested wetland functions affected by timber harvest?	
Does timber harvest in forested wetlands affect water temperature sufficiently to negatively affect stream temperatures in connected streams?	Wetland/Stream Water Temperature Interactions Project
Does timber harvest in forested wetlands alter hydrology sufficiently to affect wetland functions?	Wetland Hydrology Connectivity Project

Project Descriptions

Forested Wetlands Literature Review and Workshop Project
This project has been completed. It has undergone CMER and SRC review. The paper and workshop proceedings are available on-line and through CMER. The paper concludes there are considerable data gaps in the scientific literature related to the functions of forested wetlands in the Pacific Northwest, particularly related to 'covered resources' such as fish and amphibians.

Statewide Forested Wetland Regeneration Pilot and Project
The pilot project has been completed, the report, reviewed by CMER, and available on-line and through CMER. Based on the pilot study, it was concluded that the full-scale project should not be pursued at this time. The study objective to determine methodologies to assess the regeneration of forested wetlands was not sufficiently answered by the pilot. Improved mapping and tracking of forest practices operations would better support a full study in the future.

Wetland/Stream Water Temperature Interactions Project
This project will be scoped in the second half of FY2008.

Wetland Hydrologic Connectivity Project

This project has been neither scoped nor designed. This project is not scheduled to begin until 2009.

Wetland Mitigation Program

Purpose
Current forest practice rules require replacement or restoration for filling of more than 0.5 acre of a wetland to recover lost wetland functions. Currently no information is available on the effectiveness of, or compliance with, these mitigation requirements.

Strategy
To address the performance target of "no net loss of hydrologic functions of wetlands", Schedule L-2 H.8 sets a goal to determine "wetland size and function requiring mitigation sequencing to achieve targets". This program will evaluate several critical questions (Table 28), including whether mitigation activities are successful in achieving their stated goals and objectives by replacing lost wetland functions caused by wetland filling. This information can then be used to recommend any needed changes to the current process of wetland mitigation. This program is ranked eleventh among the 16 CMER programs.

Table 28. Wetlands Mitigation Program

Critical Questions	Project
Is wetland mitigation being performed when required by the forest practice rules? (compliance issue that WetSAG will not be addressing unless directed by Policy)	Wetland Mitigation Effectiveness Project
Are wetland mitigation projects achieving their stated goals and objectives?	
Are wetland mitigation projects replacing lost wetland functions?	
What functions are not being replaced?	

Project Descriptions

Wetland Mitigation Effectiveness Project
It became evident during the early scoping phase of this project that sample sites and background information were going to be difficult to obtain. The mitigation effectiveness project will begin scoping in the spring of FY 2007.

Wetland Management Zone Effectiveness Monitoring Program
Purpose
This program will be designed to assess the effectiveness of Wetland Management Zones in meeting FFR resource objectives and performance targets. The wetland management zone rules are based on a number of assumptions, including:

1. Meeting the wetland performance targets will achieve the functional objectives.

2. Certain BMPs work better than others.
3. We can determine how effective BMPs are (to a generalized degree). We can standardize how we measure and document this effectiveness.
4. Reaching BMP objectives at the site scale (i.e., avoiding road fill in wetlands) will aggregate to meeting sub-basin and watershed scale functional objectives.

These uncertainties form the basis for the critical questions (Table 29) that the program will be designed to address.

Strategy
This program is ranked fourteenth among the 16 CMER programs. This project has been discussed at WetSAG. Further exploration of the second critical question will have to occur before a strategy to answer it can be developed.

Table 29. Wetland Management Zone Effectiveness Monitoring Program.

Critical Questions	Project
Are current WMZs effective in providing adequate levels of LWD?	Wetland Management Zone Effectiveness Monitoring Project
Are current rule-defined wetland functions adequate to meet or exceed water quality standards, support the long-term viability of covered species, and support harvestable levels of salmonids?	

Project Descriptions
Wetland Management Zone Effectiveness Monitoring Project
This project has been neither scoped nor designed. This project is not scheduled to begin until 2010.

Extensive Status and Trend Monitoring Programs

Extensive Wetlands Trend Monitoring Program

Purpose
The wetlands extensive monitoring program will assess the status and trends of forested wetlands harvested under FFR rules.

Strategy
The full scale project may require that the wetland database project be complete (see the project description under rule tools). The wetlands database project is not scheduled to begin until late 2006. However, WETSAG is scoping the potential to coordinate with the Extensive Riparian Monitoring Study to gather preliminary information.

Project Descriptions

Extensive Wetlands Trend Monitoring Project
Scoping to develop a strategy to coordinate with the Extensive Riparian Monitoring Study is ongoing. Implementation of this coordinated study is scheduled to begin in FY 2007. A full scale, wetland-specific project is currently proposed to begin in 2009 or 2010.

Rule Implementation Tool Programs

Wetland Mapping Tool Program
This program consists of two projects and is administered by WetSAG in coordination with DNR.

Purpose
The purpose of the Wetland Tool Program is to develop mapping tools that will be used to define and locate wetlands throughout the State to facilitate research in wetlands.

Strategy
This program consists of two projects. The first project is phased and will develop a GIS layer mapping tool that DNR will administer. This layer will include all types of wetlands under a standardized classification system. The development of later phases of the mapping layer will involve the investigation of a hydro-geomorphic classification system for wetlands. The second project involves the development of an integration or overlay tool that will be used to integrate WetSAG's research needs with other proposed CMER research in order to increase efficiency.

Project Descriptions
DNR GIS Wetlands Data Layer Project
The first phase of the mapping layer will combine existing databases into one database layer and create an adjustable platform that will allow the database to be modified. A subject matter expert (SME) will coordinate with DNR's cartography department to create an accurate, state-wide map of all wetlands under one classification system. The second phase will recommend how the database will be updated. The recommendations may include frequent updates with data submitted by landowners using the same process that currently exists for updates to the stream typing layer. The first phase has been scoped and approved by CMER. It awaits approval by FFR Policy and the Board. Scoping of phase 2 has been post-poned pending input from Policy.

Hydro-geomorphic Wetland Classification System Project
Scoping of future phases for the data layer (above) may involve gathering information on hydrogeomorphic classification systems and incorporating improved remote sensing to map wetlands. Based on the results of the scoping, this project may be incorporated in the development of the data layer described above or developed independently beginning in 2008.

Overlay Project (not included in Budget Table in appendix)
This project will develop a system that will facilitate cooperation between WetSAG and other SAGs when wetlands are encountered while conducting other research, to increase efficiencies among SAGs and projects. The other purpose of this project is to develop technical guidelines to identify wetlands for foresters and other SAGs. This project may also involve a workshop for DNR, CMER, foresters and landowners to detail the products developed.

WILDLIFE RULE GROUP

CMER has funded a number of wildlife research projects since the late 1980s. These projects have addressed general multi-species and statewide issues, as well as species-specific concerns about the effects of forest practices. Although the FFR agreement is focused on water quality, fish, and SAAs, both the Policy Committee and CMER acknowledge that wildlife issues are important and need attention. Consequently CMER is currently funding additional sampling and analyses of a study that examines wildlife use of two streamside buffer designs. However, because CMER's focus is currently on FFR priorities, the only funding available for additional wildlife projects is from the State general fund.

Rule Summary

Forest practice rules directed at wildlife conservation take two approaches: 1) general statewide requirements, and 2) species-specific strategies. In addition, FFR rules may benefit wildlife through the retention or enhancement of habitat, such as riparian buffers, upland management areas, landslide hazard zonation, etc. The only general statewide rule specifically directed at wildlife conservation is the provisions for wildlife reserve tree management (WAC 222-30-020[11]). Specifications for the retention of wildlife reserve trees, green recruitment trees, and down logs are provided for both eastern and western Washington. Species-specific forest practice rules are closely tied to state and federal endangered and threatened species programs. Habitat of listed species is defined as critical habitat (state) and any proposed forest practice activity in critical habitat becomes a Class-IV Special forest practice under SEPA (WAC 222-10-040), requiring consultation, evaluation, an environmental impact statement, and mitigation. There are currently 10 species for which these rules apply, e.g., the bald eagle (*Haliaeetus leucocephalus*), grizzly bear (*Ursus arctos*), northern spotted owl (*Strix occidentalis*), and marbled murrelet (*Brachyramphus marmoratus*).

A species-specific approach that avoids direct rule making has been endorsed by the Forest Practices Board. This approach is the development and adoption of management plans or the specification of "voluntary" guidelines. The federal listing of the lynx (*Lynx canadensis*) prompted the state and a few large private landowners in northeastern Washington to develop and adopt a lynx management plan. The state listing of the western gray squirrel (*Sciurus griseus*) resulted in landowners agreeing to apply forest practice guidelines developed by the Washington Department of Fish and Wildlife in areas known to contain the species. These rules and associated guidelines are very complex. Each species generates specific definitions of habitats, specific monitoring methods, and specific provisions for protection of sites that vary with the species needs. In addition, the Forest Practices Board often adopts rule options that allow landowners to develop species-specific management plans.

Strategy and Rationale

The Landscape and Wildlife Advisory Group (LWAG) has been developing an overall wildlife work plan for several years. However, focused plan development for wildlife issues other than those associated with FFR were delayed until the FFR work plan is completed. Nonetheless, LWAG continues to work on the broader work plan as time allows. To date, LWAG has identified a number of programs that contain several issues, each with critical questions (Table 30). This rule group is administered by the Landscape and Wildlife Advisory Group (LWAG).

Effectiveness Monitoring Programs

Wildlife Program

Purpose

The purpose of this program is to 1) determine the species of wildlife that use managed forests, 2) estimate habitat conditions associated with wildlife use of managed forests, 3) assess the efficacy of regulations designed to provide habitat for wildlife in managed forests, and 4) identify emerging forestry-wildlife issues and develop research projects that address those issues.

Strategy

With the current emphasis of CMER on the FFR adaptive management program, there is little opportunity to fund projects on other wildlife. LWAG has identified and prioritized several wildlife issues that need attention. The highest priority project (RMZ Resample) had a great deal of overlap with many of FFR Schedule L-1 questions and this is the only wildlife project funded at this time. This program is ranked thirteenth among the 16 CMER programs.

Project Descriptions

RMZ Study Resample Project
In 1990, CMER funded an experimental study to examine the effects of two buffer configurations (state regulations and "smart buffers") on birds, small mammals and amphibians. The study produced 2 years of pre- and post-harvest data and a final report that was completed in 2000. The results were species specific and equivocal and raised numerous questions about the long-term response of wildlife to the treatments. Since the smart buffer was similar to the FFR buffer for Type F streams and more than five years had elapsed since the last sampling the RMZ, the resample project was initiated in FY 2003 to complete another 2 years of sampling to document changes over time. The study will provide additional data on riparian conditions and some SAAs. The final report was completed in 2006 and, once CMER review is complete, will be reviewed by ISPR in 2007. Final report incorporating comments is expected in 2008. This project is administered by LWAG.

Ponderosa Pine Habitat (not in FFR budget)
A number of bird species are thought to be closely associated with mature Ponderosa pine forest. Currently, Ponderosa pine forests occur along a gradient from dense stands of Douglas-fir and grand fir with a few large remnant pines to low density open stands composed almost exclusively of large diameter pine. This project would examine the abundance of birds along this gradient on the east slope of the Cascade Mountains. No activity for this project will take place in 2006.

Other Wildlife Programs/Projects (not in FFR budget)
Due to the overriding importance of the FFR adaptive management program, funds for the Wildlife Program from CMER are limited and confined to the State General Fund. Due to these circumstances, none of the other programs in Table 30 have been developed into projects.

Table 30. Wildlife Rule Group issues (in order of priority) and critical questions.

Wildlife Rule Group Critical Questions	Program	Task Type
What are the values of snags retained in upland management units and RMZs?	Effectivenes s of snags	Effective-

Is there a threshold response by wildlife to snag density? What are the fates of wildlife reserve trees (WRT) and green recruitment trees (GRT) in managed forests? What are the most-effective ways of retaining and replacing snags?	for wildlife	ness Validation
What are the effects of variation in stand establishment practices, herbicides, thinning, fertilization, and rotation lengths on vegetation and wildlife? Does the concept of the steady-state shifting mosaic apply and how does that process effect wildlife?	Conifer management effects on wildlife	Validation Effective-ness
What role do RMZs, UMAs, and other forest patches play in maintaining species and providing structural and vegetative characteristics thought to be important to wildlife? What are the functions of large legacy trees (snags, down wood, high stumps) as compared to the smaller complements produced in intensively managed forests? What are the roles and fates of special sites (e.g., rock outcrops, cliffs, talus slopes, isolated small wetlands, etc.) in managed forests?	Legacy features and their effect on wildlife	Effective-ness Validation
What are the movement patterns, processes, and distances of amphibians in managed forests? Do amphibians persist in refugia following timber harvest or is subsequent occupancy related to movements from other areas? How quickly do amphibians re-colonize areas, particularly habitat outside the stream network? What is the role of ponds created by beaver, slumps, rotational failures, road ditches, and sediment traps, and off-channel habitats in the distribution and abundance of still-water breeding amphibians?	Amphibian movement and distribution effectiveness monitoring	Effective-ness
What is the status and trends of bats in managed forests?	Forest Bats	Extensive
What is the role of WRTs and GRTs in bat ecology? What are the relationships between forest management and bat foraging and roosting?	Forest Bats	Effective-ness
What is the relationship between the abundance and productivity of wildlife and gradients in the composition and structure of ponderosa pine stands?	Ponderosa Pine Habitat	Effective-ness
What are the effects of forest practices on the western gray squirrel and oviposition sites of egg-laying reptiles? What is the role of isolated oak trees and small patches of oaks? What are the appropriate management approaches to maintaining and restoring oak woodlands at stand and landscape levels?	Oak woodland Habitat	Effective-ness

INTENSIVE WATERSHED-SCALE MONITORING TO ASSESS CUMULATIVE EFFECTS

Strategy and Rationale

Intensive monitoring is watershed-scale research designed to evaluate the cumulative effects of multiple forest practices and to provide information that will improve our understanding of causal relationships and the biological effects of FFR on aquatic resources. The evaluation of cumulative effects of multiple management actions on a system requires an understanding of

how individual actions influence a site and how those responses propagate through the system. This understanding will enable the evaluation of the effectiveness of management practices applied at multiple locations over time. This sophisticated level of understanding can only be achieved with an intensive, integrated, monitoring effort. Evaluating biological responses is similarly complicated, requiring an understanding of how various management actions interact to affect habitat conditions and how system biology responds to these habitat changes. This program was identified in the MDT report as an essential component of an integrated monitoring program. CMER is in the process of scoping its intensive monitoring needs. A draft scoping paper that identifies potential objectives and critical questions has been prepared by CMER staff. Cumulative effects of forest practices from changes in fine sediment input and LWD have been tentatively identified as issues meriting further scoping. Contacts with outside programs with similar interests in intensive monitoring (such as the State's Intensively Monitored Watersheds Program) are being pursued to identify opportunities for collaboration. A draft scoping document for a fine sediment cumulative effects study is under review by CMER.