WASHINGTON STATE
FOREST PRACTICES
ADAPTIVE MANAGEMENT PROGRAM
SCIENCE CONFERENCE

Cooperative Monitoring
Evaluation & Research

Tuesday, May 8, 2018 – 9:00-4:30
OB2 Auditorium, DSHS Building
Olympia, Washington

NATURAL RESOURCES
HILARY S. FRANZ
COMMISSIONER OF PUBLIC LANDS

Washington State Forest Practice
Adaptive Management Program
Acknowledgements

A special Thank-you to all of the scientist who will be presenting at the 2018 CMER Science Conference. In addition, our sincerer gratitude to the support staff that have planned the conference proceedings.

CMER Science Conference Coordinator:
Patti Shramek

Cooperative Monitoring Evaluation and Research Committee (CMER):
Committee members, both voting and participating attendees.

CMER Co-Chairs: Doug Hooks (Washington Forest Protection Association) and Jenny Knoth (Green Crow)
CMER Coordinator: Patti Shramek

CMER Scientific Advisory Groups (SAG)
SAG attendees which includes caucus members, the public, and contractors, who are participating or have served on these committees. This list is exceptionally long.
SAG Co-Chairs:

- **ISAG:** Jason Walter, Marc Gauthier
- **LWAG:** Marc Hayes, A.J. Kroll
- **RSAG:** Joe Murray
- **SAGE:** Todd Baldwin
- **UPSAG:** Casey Hanell, Mike Maudlin
- **WetSAG:** Debbie Kay, Harry Bell

Technical Writing & Implementation Groups (Pilot - TWIGS):
Scientist & CMER/AMP staff who have provided their expertise to the following projects:
Eastside Type N Riparian Effectiveness, Westside Type F Riparian Prescription Effectiveness, Roads Effectiveness Best Management Practices, Unstable Slopes Criteria, Forested Wetland Effectiveness Project

Timber Fish and Wildlife Policy (Policy):
Caucus committee members, the public, and contractors who are participating or have served on the committee.
Policy Chair: Scott Swanson (Washington State Association of Counties)

Forest Practices Board Members:
Stephen Bernath (Chair), Lisa Janicki, Carmen Smith, Bob Guenther, Heather Ballash, Tom Laurie, Patrick Capper, Jeff Davis, Paula Swedeen, Tom Nelson, David Herrera, Brent Davies, and Noel Willet

CMER Staff:
Dave Schuett-Hames Greg Stewart, and Emily Davis,

Adaptive Management Staff:
Hans Berge, Howard Haemmerle, Teresa Miskovic, Angela Johnson, Heather Gibbs, and Patti Shramek

University of Washington Editor and Staff
Dr. Dan Vogt, Managing Editor of Independent Scientific Peer Review

Tribes:
NWIFC, UCUT, Chehalis, Colville, Hoh, Jamestown, Kalispel, Lower Elwha, Lummi, Makah, Nisqually, Nooksack, Port Gamble, Puyallup, Quileute, Quinault, Sauk-Suiattle, Shoalwater, Skokomish, Spokane, Squaxin Island, Stillaguamish, Suquamish, Swinomish, Tulalip, Upper Skagit, Yakama

Washington Conservation Caucus:
Audubon Washington, Conservation Northwest, The Mountaineers, Olympic Forest Coalition, Pacific Rivers Council, Sierra Club, Washington Environmental Council, Washington Forest Law Center and Wild Fish Conservancy.

Small Landowner Office:
Washington Farm Forestry Association, Participating Washington State Private Landowners

Large Landowner Caucus:
Washington Forest Protection Association, Participating Washington State Private Landowners

County Government:
Washington State Association of Counties

Washington State Government:
Department of Ecology, Department of Fish and Wildlife, and Department of Natural Resources

Federal Government:
National Marine Fisheries Service, US Fish and Wildlife Service, Environmental Protection Agency, US Forest Service

Without question, stakeholders have been missed in this list of acknowledgements. The science and policy decisions cannot be made without the cooperation, participation, and dedication of all stakeholders and the support of the citizens of Washington State.

PROGRAM CONTENTS

2018 CMER SCIENCE CONFERENCE AGENDA
Tuesday, May 8, 2018

Time	Presentation	Presenter
9:00 am to 9:15 a.m.	Welcome and Introduction	The Honorable Hilary Franz, Commissioner of Public Lands
9:15 to 9:30	Adaptive Management Program Overview	Howard Haemmerle, Department of Natural Resources
9:30 to 10:15	Deep-Seated Landslides Literature Synthesis	Dan Miller, M2 Environmental Services
10:15 to 10:45	Upslope Processes Scientific Advisory Group: Deep-Seated Landslide Research Strategy	Mike Maudlin, Nooksack Indian Tribe
10:45 - 11:00	**Break**	
11:00 to 11:45	Scoping an Extensive Riparian Monitoring Implementation Pilot Project	L. Monika Moskal and Andrew Cooke, University of Washington
11:45 to 1:00 pm	**Lunch**	
1:00 to 1:30	Hardwood Conversion Study	Kevin Ceder, Cramer Fish Sciences
1:30 to 2:00	Eastside Modeling Effectiveness	Kevin Ceder, Cramer Fish Sciences
2:00 – 2:30	Type N Experimental Buffer Treatment Study on Hard Rock Substrates: Summary of findings through two years post-harvest.	Aimee McIntyre, Washington Department of Fish and Wildlife
2:30 to 2:45	**Break**	
2:45 – 3:30	Type N Experimental Buffer Treatment Study: Investigating Change in Post-Harvest Genetic Diversity for Three Stream-Associated Amphibians	Stephen Spear, The Wilds
3:30 – 4:00	Type N Experimental Buffer Treatment Study on Hard Rock Substrates: Stream temperature and shade.	Bill Ehinger, Washington Department of Ecology
4:00 – 4:25	Van Dyke's Salamander: Summary of Literature Review Findings	Marc Hayes, Washington Department of Fish and Wildlife
4:25 – 4:30	Closing Remarks	
4:30	**Adjourn**	

COOPERATIVE MONITORING EVALUATION & RESEARCH COMMITTEE BACKGROUND

The Cooperative, Monitoring, Evaluation and Research Committee (CMER) was established by the Washington State Forest Practices Board to help evaluate the effectiveness of the Washington Forest Practices Rules. CMER is made up of members representing State agencies (Washington Departments of Natural Resources, Fish and Wildlife and Ecology), Federal agencies (U.S. Fish and Wildlife Service and National Marine Fisheries Service), Washington Tribes, Washington Counties, industrial and small forest landowners and environmental organizations.

There are currently six scientific advisory groups (SAGs) and 5 Technical Writing and Implementation Groups (TWIGs) that provide support to CMER. The SAGs and TWIGs develop scientific research and monitoring studies based on CMER direction and priority research questions from the Washington Forest Practices Board (Board) and/or Timber, Fish and Wildlife Policy Committee (Policy) pertaining to riparian and aquatic resources. These research questions evolve over time as new information is gathered and synthesized. Once studies are developed, SAGs and TWIGs bring them forward for CMER's review and approval before presentation to Policy. Most study designs and completed research and monitoring reports undergo independent scientific peer review prior to final approval. The active SAGs and TWIGs are as follows:

Landscape and Wildlife Advisory Group (LWAG)
Riparian Scientific Advisory Group (RSAG)
Scientific Advisory Group Eastside (SAGE)
Instream Scientific Advisory Group (ISAG)
Upslope Processes Scientific Advisory Group (UPSAG)
Wetlands Scientific Advisory Group (WETSAG)
Westside Type F Riparian Prescription Monitoring TWIG
Eastside Type N Riparian Effectiveness TWIG
Road Prescription-Scale Effectiveness Monitoring TWIG
Unstable Slopes Criteria Evaluation and Development TWIG
Forested Wetlands Effectiveness Study TWIG

CMER holds regular monthly meetings attended by CMER members, SAG co-chairs, and other interested parties. SAGs meet on a monthly basis.

Completed CMER research is forwarded to a Policy, also made up of members representing the stakeholder groups identified in the first paragraph. As with CMER, they meet monthly to consider CMER studies, other forest practices issues and make recommendations to the Board. The Board is an independent state agency, chaired by the Commissioner of Public Lands or designee, which sets minimum standards for forest practices.

The current Washington Forest Practices Rules were implemented in 1999 and formally adopted in 2001. On June 5, 2006, the Rules pertaining to riparian and aquatic resources were recognized in a federally approved Habitat Conservation Plan for a 50-year term. The Washington Forest Practices Habitat Conservation Plan includes approximately 9.3 million acres of non-federal, non-tribal forest land in Washington that falls within the jurisdiction of the Washington Forest Practices Rules and Washington Forest Practices Act.

RELEVANT WEBSITES

Washington State Department of Natural Resources: https://www.dnr.wa.gov/

Forest Practices Adaptive Management Program (CMER): https://www.dnr.wa.gov/programs-and-services/forest-practices/adaptive-management

Forest Practices Division: https://www.dnr.wa.gov/programs-and-services/forest-practices

Forest Practices Habitat Conservation Plan: https://www.dnr.wa.gov/programs-and-services/forest-practices/forest-practices-habitat-conservation-plan

Washington State Department of Fish and Wildlife: https://wdfw.wa.gov/

Washington State Department of Ecology: https://ecology.wa.gov/

Washington Forest Protection Association: http://www.wfpa.org/

Washington Farm Forestry Association: https://www.wafarmforestry.com/

Northwest Indian Fisheries Commission: https://nwifc.org/

Upper Columbia United Tribes: http://www.ucut.org/

Columbia River Inter-Tribal Fish Commission: http://www.critfc.org/

Washington State Association of Counties: http://wsac.org/

Washington Forest Law Center: http://www.wflc.org/

U.S. Fish and Wildlife Service – Pacific Region: https://www.fws.gov/pacific/

National Marine Fisheries Service – Northwest Regional Office: http://www.nwr.noaa.gov/

REFRESHMENT/SNACK/LUNCH OPTIONS

OB2 Cafeteria, Service Level
Sandwiches, soups, salad bar, grill items, and daily specials.

Natural Resources Building (NRB) Cafeteria, Lobby Level, Building Adjacent to OB2
Sandwiches, soups, salad bar, grill items, and daily specials.

Meconi's Italian Subs - Corner of Union Avenue and Capitol Way South
Sub sandwiches, salads, and soups.

Wagner's European Bakery - Near Corner of Union Avenue and Capitol Way South
Sandwiches, soups, salads, and bakery goods.

Subway - Near Corner of Union Avenue and Capitol Way South
Sub sandwiches, salads, and wraps.

ABSTRACTS

ADAPTIVE MANAGEMENT PROGRAM
OVERVIEW

FOREST PRACTICES ADAPTIVE MANAGEMENT PROGRAM: STRUCTURE, RESEARCH AND MONITORING PROGRAM, AND ACTIVITIES

Presenter: Howard Haemmerle, Adaptive Management Program Project Manager, Department of Natural Resources

The 1999 Forests and Fish Report recommended an adaptive management program to address the effectiveness of the forest practices prescriptions in meeting resource objectives. The 1999 Legislature referenced the 1999 Forests and Fish Report in the Salmon Recovery Bill (Engrossed Substitute House Bill 2091), which directed the Forest Practices Board to adopt rules that were consistent with the recommendations of the Forests and Fish Report. Pursuant to that direction, the Forest Practices Board adopted an adaptive management program, a systematic approach for improving resource management by learning from management outcomes.

The primary objective of the Adaptive Management Program (AMP) is to provide science-based recommendations to assist the Forest Practices Board in determining if and when it is necessary to adjust rules and guidance for aquatic resources to achieve resource goals and objectives. Additionally, the Forest Practices Habitat Conservation Plan relies upon the AMP to oversee a rigorous science-based program to ensure the state is meeting its obligations under the Endangered Species Act (ESA), Clean Water Act (CWA), and ESHB 2091. Three important outcomes are desired in the AMP including providing certainty of change as needed to protect targeted resources, predictability and stability of changes to rules, and quality controls to study designs and interpreted results.

Two committees serve the Forest Practices Board in the AMP: a Policy committee and the Cooperative Monitoring, Evaluation, and Research (CMER) committee. Each committee operates in a consensus framework and is represented by nine stakeholder caucuses. The Policy committee is charged with making recommendations to the Board after consideration of findings from CMER research. CMER is the science arm of the AMP and is charged with overseeing research that informs rules and or guidance.

CMER's comprehensive "Work Plan" includes over ninety projects, sorted by forest practice rule group and type of program (rule tool, effectiveness monitoring, extensive monitoring, and intensive monitoring). Projects in the CMER Work Plan were initially derived from the 1999 Forest & Fish Report and have subsequently been revised by the Forest Practices Board. CMER research and is designed to answer critical questions related to AMP objectives and performance targets.
Currently, the AMP oversees 22 projects that are in various stages of progress. Eight of the 22 projects are active research projects, 7 are moving into the implementation phase, and 5 are in the scoping or study design development phase.

NOTES

DEEP-SEATED LANDSLIDES LITERATURE SYNTHESIS

Presenter: Dan Miller, M2 Environmental

The diversity and complexity of deep-seated landslides can be overwhelming: they span a huge range in size, they create features that can persist for millennia, and they behave in unexpected ways so that hazard assessments can involve drilling expensive bore holes, laboratory testing for material properties, and detailed computer analyses. People involved with forest practices in Washington must deal with them – a lot – and typically without the resources for a full-fledged geotechnical assessment. A primary goal, stated in FFR Schedule L-1, is "no increase over background rates from harvest on a landscape scale on high risk sites". The "landscape scale" context is difficult to clarify in practice, and the consequences of under-estimating hazards posed by even a single landslide can be disastrous, as we were reminded on March 22, 2014.

In December 2015, DNR distributed an RFQQ for a "focused literature review and synthesis to update CMER on research assessing the effect of forest practices on groundwater recharge areas and deep-seated landslides in glacial materials". Following completion of that review in June 2016, additional questions were raised regarding non-glacial deep-seated landslides, motivating a second literature review. This review was completed in July 2017. These reviews included a synthesis of what was found, with focus on specific questions posed by UPSAG. Based on these findings, the synthesis was also to identify gaps in current knowledge and make recommendations for future research.

In reviewing the literature, we found:

- Many case studies of deep-seated landslides, including geotechnical reports by DNR and WSDOT.
- Many studies examining material properties and describing geotechnical landslide models.
- Many empirical studies analyzing data on rates of evapotranspiration and soil-water budgets.
- Very few publications examining effects of timber harvest on deep-seated landslides.

Collectively we have a wealth of experience dealing with deep-seated landslides: UPSAG compiled several hundred geotechnical reviews and memos for this review. However, the degree to which this experience aids in accurate assessment of forest-practice influences on deep-seated-landslide activity is not apparent from the reports, or from any published literature. The paucity of studies directly applicable to the issues of concern meant that it was necessary to draw inferences by relating observations and results across multiple types of inquiry. To do this, the following steps proved useful: 1) Establish context. How many landslides are there? How many are active? 2) Identify potential features and processes common across all deep-seated landslides. 3) Identify interactions by which forest practices affect these processes. 4) Identify potential consequences of those interactions. 5) To guide research, identify observations to verify if those interactions and expected consequences occur.

Given that each landslide is unique, commonalities can seem hard to find, but the large literature of case studies suggests a basic conceptual model for explaining and anticipating landslide behavior.

1) Deep-seated landslides involve movement above a distinct shear zone. Material in this shear zone is typically finer grained, less permeable, and weaker than adjacent material above and below. The shear zone, thereby, acts to isolate the landslide mass both mechanically and hydrologically.
2) Material in the shear zone lacks cohesion. Displacement of the landslide body involves frictional resistance to movement across the shear zone. Frictional resistance is reduced by pore water pressure. Pore-water pressure is proportional to depth of saturation in the landslide body.
3) When pore pressures reduce frictional resistance below some threshold value dependent on landslide geometry, the landslide moves.

Even though every landslide presents complexities not addressed by this model, it provides a framework for steps 3 through 5; all to be discussed in this presentation.

NOTES

UPSLOPE PROCESSES SCIENTIFIC ADVISORY GROUP: DEEP-SEATED LANDSLIDE RESEARCH STRATEGY

Presenter: Mike Maudlin, Nooksack Tribe

In response to the deep-seated Hazel landslide near Oso, Washington (March 2014), the Washington Forest Practices Board requested the Timber, Fish and Wildlife Policy Committee to review current Washington State forest practices rules for timber harvest activities that may affect deep-seated landslides and to develop recommendations for future research into this topic. In response to this request, the Cooperative Monitoring, Evaluation and Research (CMER) Committee via the Upslope Processes Scientific Advisory Group (UPSAG) developed a research strategy that seeks to address questions related to forest practices effects on the stability of landslides in different geologic settings, changes in groundwater recharge in deep-seated landslides, the potential for reactivation of dormant deep-seated landslides, and the run-out potential for deep-seated landslides.

The research strategy draws largely from previous projects UPSAG has scoped and completed, with the addition of several projects identified in two literature reviews that were conducted in support of the strategy development. The research strategy includes descriptions of potential projects, identifies their respective priorities, timelines, and estimated costs; sequencing relative to each other; and describes the relationship between projects and their associated critical questions from the CMER Work Plan or identified by the Policy Committee. Implementation of the Strategy is expected to be a long-term process that refines our understanding of how forestry-related land use activities affect the stability of deep-seated landslides through time, and inform guidance for landslide assessment and management.

NOTES

SCOPING AN EXTENSIVE RIPARIAN MONITORING IMPLEMENTATION PILOT PROJECT

Presenters: L. Monika Moskal and Andrew Cooke, University of Washington

From 2015 to 2017, the Precision Forestry Cooperative at the University of Washington School of Environmental and Forest Sciences undertook the Extensive Riparian Vegetation Monitoring – Remote Sensing Pilot Study to look at the effectiveness of using remote sensing methods as the basis for monitoring the status and trends of riparian stands on private lands in Washington State. This Pilot Study took place in the Mashel Watershed in the Cascade Mountains of Pierce County. The Pilot Study demonstrated that remote sensing should be a primary component of monitoring efforts for the State going forward. However, because there are significant differences in the species composition and physical structure of different types of forest in the State, it is likely that the statistical models for estimating riparian metrics developed in the Mashel are not as accurate in other forest types. Thus, different models are required for different types of forest as part of a statewide monitoring effort in order to maximize accuracy. Understanding of how many models are necessary to capture the diversity of the riparian forest in WA State is necessary and a scoping project was undertaken to provide recommendations on where the next stage of the project could take place to capture the WA forest diversity as well as recommend how to modify the fieldwork and modeling efforts. The scoping project found that the most current lidar can be prioritized (unless modeling the most different forest type is of greater importance) this would suggest the usage of 2018 lidar. Best locations based on these criteria are along the Pacific coast or in the Blue Mountains. We also recommend lidar prior to 2015 not be used. Moreover, the fieldwork should happen no later than 2020 or 2021 respectively, to minimize the time lag between the datasets. Unfortunately, the lidar availability analysis and forest type analysis do not agree about where the best location for the next round of the project is. If finding the forest type with the greatest difference from the Mashel is the priority, then the work should happen in eastern Washington. Based on the amount of timber production on private and state lands on the Eastside, a watershed in the Northeast Zone is probably the most interesting. If multiple watersheds can be studied, it would make sense to work on the Eastside and the Coast. We also recommend some adjustments in the type of field data collected and metrics derived from the lidar. Neither the lidar nor the imagery approaches to estimate Large Woody Debris and Species were successful in the Pilot Study both can be excluded from the field protocol. Finally, because Leaf Area Index (LAI) may be useful for estimating stream shading, it may be desirable to add an LAI metric in future stages of this project.

NOTES

HARDWOOD CONVERSION STUDY

Presenter: Kevin Ceder, Cramer Fish Sciences

In this presentation we examine silvicultural effectiveness--planted conifer height growth, survival, competition with brush and volunteer hardwoods, and compliance with WAC stocking requirements—and an economic feasibility—measured by residual value. Height growth of planted conifers increases as stands develop, and it tends to be higher in trees with their leader above the competing brush or when species are matched to the site. Survival of planted conifers decreases over time, yet Sitka spruce, where it was planted, and trees with their leaders above the competing brush exhibited survival rates higher than other species or suppressed trees. Because of the nature of the case studies, it is not possible to firmly establish a causative relationship between the regeneration practices employed by landowners and growth and survival findings. However, there was a correlation between investment in regeneration practices and silvicultural performance. It is still unclear if the sites have met WAC stocking requirements for hardwood conversions because trees have not reached the diameters needed to evaluate stocking under the WAC. However, based on performance to-date, it appears unlikely that most sites will achieve adequate stocking. Hardwood conversion treatments, including harvest and regeneration, were economically feasible at all case study sites.

NOTES

EASTSIDE MODELING EFFECTIVENES PROJECT

Presenter: Kevin Ceder, Cramer Fish Sciences

In this presentation we examine current Eastern Washington riparian zone stand conditions in the context of Phase 1 of the Eastern Washington Riparian Assessment (EWRAP), eligibility of riparian zone stands for harvest under eastside Type F riparian management prescriptions of the Forest Practices Rules, and responses of riparian zone stands to management. Currently, riparian zone stocking is generally low across all timber habitat types with decreases in stocking moving away from streams. Inner riparian zone harvest is limited in most of the study sites because basal area does not meet stocking requirements, shade does not meet criteria, the site falls within the Bull Trout Overlay, or a combination of these. Based on growth simulations with the Forest Vegetation Simulator (FVS) model, eligibility limitations persist through time with basal area or shade not increasing above criteria for harvest. After harvest in inner and outer riparian management zones, growth increases relative to thinning intensity—outer zones have a larger increase than inner zones—and is comparable between timber habitat types. Based on rating systems from Hessburg *et al.* (1999), moderate and high susceptibility to insects and disease is reduced even at low levels of management with larger reductions in ponderosa pine timber habitat type sites compared to mixed conifer sites. Flame lengths, as predicted by the Fire and Fuels Extension (FFE) for FVS, decrease with management with larger decreases in outer zones where thinning intensity is higher.

NOTES

TYPE N EXPERIMENTAL BUFFER TREATMENT STUDY ON HARD ROCK SUBSTRATES: SUMMARY OF FINDINGS THROUGH TWO YEARS POST HARVEST

Presenter: Aimee McIntyre, Washington Department of Fish and Wildlife

Type N Experimental Buffer Treatment Study is a landscape-level experiment designed to evaluate the effectiveness of the current riparian management zone (RMZ) rules for non-fish-bearing (Type N) streams on hard rock lithologies in western Washington. The experimental units, which consisted of 17 non-fish-bearing basins structured in a Before-After Control-Impact (BACI) design, included six reference (unharvested) basins and 11 basins in which one of three harvest treatments was applied: two-sided 50-ft riparian buffer along the entire perennial Type N length (100%; N = 4), two-sided 50-ft wide buffer along ≥50% (consistent with current Forest Practices rules [FP]; N = 3), and no buffer (0%; N = 4). We evaluated the magnitude and direction (positive or negative) of change for riparian-related inputs, and instream and downstream components, which included Forests and Fish-designated species of stream-associated amphibians. We collected pre-harvest data from 2006 through 2008 and post-harvest data from 2009 into 2011. In the two years post-harvest, the 100% buffer was the most effective in maintaining pre-harvest conditions, the FP was intermediate, and the 0% treatment was least effective compared to reference sites. The collective effects of timber harvest, both in terms of statistical significance and magnitude, were most apparent in the 0% treatment. The direction and magnitude of changes for the 100% and FP treatments did not differ statistically for some metrics (e.g., large wood recruitment, wood cover and loading, water temperature, discharge and Coastal Tailed Frog density), but did for others (e.g., tree mortality, riparian cover, and detritus export). The results of this study inform the efficacy of current Forest Practices rules, including how landowners can continue to harvest wood resources while protecting important headwater habitats and associated species.

NOTES

TYPE N EXPERIMENTAL BUFFER TREATMENT STUDY: INVESTIGATING CHANGE IN POST-HARVEST GENETIC DIVERSITY FOR THREE STREAM-ASSOCIATED AMPHIBIANS

Presenter: Stephen Spear, The Wilds

Genetic monitoring provides a complementary approach to demographic monitoring, and can provide additional information on a population's response to disturbance. For instance, genetic monitoring can identify rapid declines in population size and non-random mating that may lead to future inbreeding depression. As part of the Type N Experimental Buffer Treatment Study, we assessed the genetic response of three stream-associated amphibian species (Coastal Tailed Frog, Cope's Giant Salamander, and Coastal Giant Salamander) before and after clearcut timber harvest of small headwater basins in three riparian buffer treatments (the current Washington State Forest Practices riparian leave-tree buffer [FP treatment], a more extensive buffer [100% treatment], and no buffer [0% treatment]) to an unharvested reference. We used several metrics to characterize levels of genetic diversity before and after harvest. These included number of full siblings, allelic diversity, heterozygosity, inbreeding coefficient, and heterozygosity excess bottleneck tests. We compared changes in genetic diversity across one generation (7-8 years post-harvest. We also identified genetic clusters across study sites to determine the role of gene flow in the observed genetic response. Overall, we found little evidence for a change in genetic diversity as a result of riparian buffer treatments. No significant treatment effects were observed between the pre- and post-harvest periods for Coastal Tailed Frogs. Cope's Giant Salamander also lacked evidence of significant treatment effects. We observed a significant ($p = 0.03$) treatment effect for the change in number of unique full sibling families of Coastal Giant Salamanders, which was driven by the observed decrease (-24.0) within the 100% treatment. We observed a significant change in inbreeding coefficient for Coastal Giant Salamanders ($p = 0.05$) that resulted from a decrease in both the 100% treatment (-0.17; $p = 0.02$) and the 0% (-0.16; $p = 0.03$) relative to the reference. Both Coastal Tailed Frogs and Coastal Giant Salamanders had high levels of gene flow among sites. Cope's Giant Salamander has much more restricted levels of gene flow, although there was genetic connectivity among nearby sites. Therefore, it is likely that movement in and out of experimental sites affected the levels of genetic diversity and reduced the ability to detect site-level effects, as genetic populations were more extensive than a single stream basin. Although we do not see evidence of a change in genetic diversity due to clearcut timber harvest and alternative riparian buffer treatments, we caution that increased sample size and additional sampling across future generations may be necessary to detect a trend, as simulations have demonstrated that steady declines are often not detected until several generations post-decline.

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TYPE N EXPERIMENTAL BUFFER TREATMENT ON HARD ROCK SUBSTRATES: STREAM TEMPERATURE AND SHADE

Presenter: William Ehinger – Washington State Department of Ecology

We measured changes in riparian canopy closure and stream temperature after clear-cut harvest leaving one of three riparian buffer treatments; 50-ft buffer along 100% of the perennial Type N channel (100%), 50-ft buffer along at least 50% of the perennial channel -(current Forest Practices rules, FP), and unbuffered (0%). Mean canopy closure decreased all three buffer treatments from >90% pre-harvest to a minimum four years post-harvest of 82%, 54%, and 8% in the 100%, FP, and 0% buffer treatments, respectively. Canopy closure began increasing in the fifth post-harvest year and by the ninth post-harvest year was 86%, 75%, and 59% in the 100%, FP, and 0% buffer treatments, respectively. Summer stream temperatures increased at all sites post-harvest, but was greatest in the 0% treatment in the summer immediately after harvest with mean monthly increases exceeding 3.0°C at some sites. Higher summer stream temperatures were still evident nine years post-harvest at three of the four 100% sites, two of three FP sites, and all four 0% sites.

NOTES

VAN DYKE'S SALAMANDER:
SUMMARY OF LITERATRUE REVIEW FINDINGS

Presenter: Marc Hayes – Washington Department of Fish and Wildlife

The Van Dyke's salamander (*Plethodon vandykei*) is one of seven stream-associated amphibian species designated in the Forests and Fish agreement, and the only westside species CMER has not evaluated. It is an endemic restricted to the Olympics, South Cascades and Willapa Hills of Washington State. A terrestrial species, Van Dyke's salamander has no free-living larval stage. Nonetheless, it requires moisture and cool conditions thought to rank it among the species most sensitive to climate change. In at least some regions, it may rely on downed wood for cover during periods of surface activity, as well as locations for oviposition. Some researchers have concluded that clearcutting may have the potential to eliminate terrestrial salamander populations in regions where large downed wood is the primary source of seasonal shelter and oviposition sites. One study done in the Olympics in the late 1990s on 40 sites addressing six forest conditions seemed to support that suggestion. In that study, the Van Dyke's salamander was found only on 10 of the 17 sites categorized as either old-growth (n = 11) or old-growth buffers (n = 6), and undetected on 23 second-growth sites. Conversely, Van Dyke's salamander was found on 11 of 19 sites in a 2013 study conducted exclusively in second-growth. In this presentation, we explore the basis of apparently conflicting patterns of occurrence and comment on features of Van Dyke's salamander life history important to the further study of the species as it relates to forest management.

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