Aquatic and Riparian Effectiveness Monitoring Program

Interagency Monitoring Program – Northwest Forest Plan Area

Steve Lanigan

2009 Annual Technical Report

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USDA Forest Service Pacific Northwest Regional Office
Bureau of Land Management Oregon State Office

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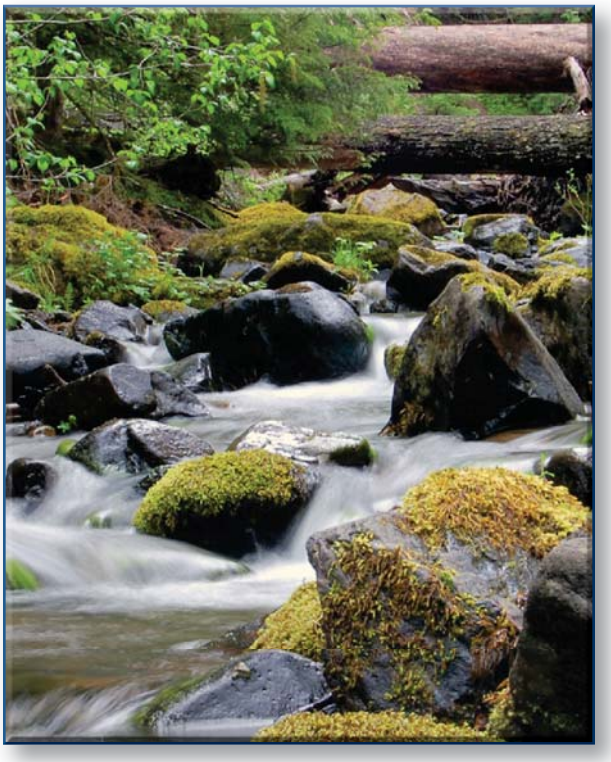
Executive Summary



Steve Lanigan

The Aquatic and Riparian Effectiveness Monitoring Program (AREMP or the monitoring program hereafter) is a "Service First" program consisting of US Forest Service (FS) and Bureau of Land Management (BLM) employees working together to evaluate if the Northwest Forest Plan's (NWFP) Aquatic Conservation Strategy is maintaining and restoring watershed condition within the NWFP area. The NWFP provides management direction for 24 million acres of federal lands in western Washington and Oregon, and northern California. Highlights of AREMP accomplishments during the 2009 fiscal year include:

Continuing to refine the decision-support models used to assess watershed condition:

- Held five workshops to refine aquatic province decision-support models used to assess watershed condition.
- Assembled GIS layers used in the decision-support models.
- Incorporated new decision-support model attributes based on the input from the province workshop participants.

Assisting local units in the use of decision-support models:

- Worked with Natural Resources staff to develop draft regional guidance for assessing aquatic species population viability in forest plan revisions.

Completing a successful field season:

- Collected stream data from 28 watersheds to measure physical and biological attributes used to assess watershed condition as part of our normal field sampling program.
- Continued our quality control program by resurveying 17 sites.
- Participated in the third year of a FS pilot regional aquatic invasive species survey program.
- Stayed within our allotted budget. The average cost to sample each watershed was $36,789.
- Used Student Conservation Association interns as a successful component of the summer field staff.

Continuing our participation in the Pacific Northwest Aquatic Monitoring Partnership (PNAMP):

- Provided final comments for a manuscript describing a side-by-side protocol comparison test for in-channel physical attributes in the John Day Basin, OR conducted during summer 2005. The manuscript is expected to be published in 2010.

- Co-authored two additional papers resulting from the John Day protocol test that discussed the difficulty of using the Rosgen stream channel classification system.

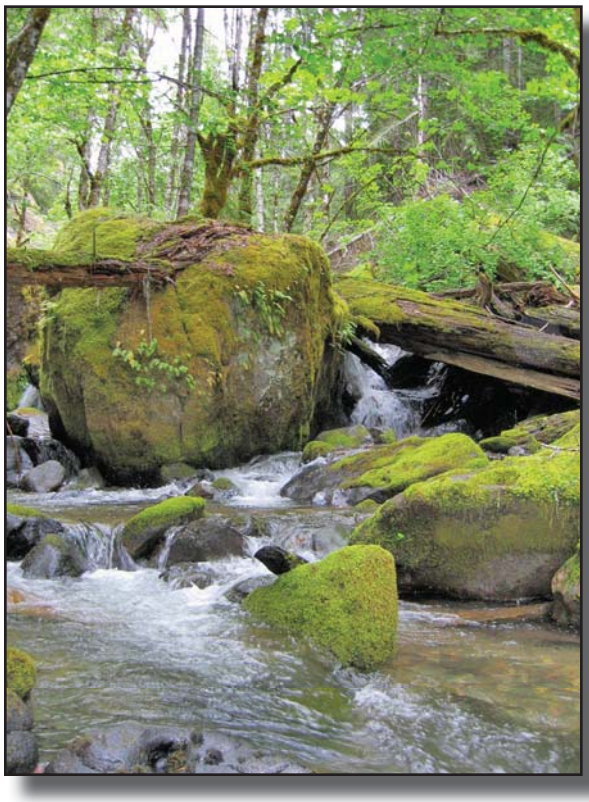
- Participated in Lower Columbia River Endangered Species Act salmon recovery area workshops where state and federal agencies are proposing to use a master sample design to determine sampling sites, establish common protocols, and share data for habitat status and trend monitoring. AREMP and Washington Department of Fish and Wildlife staff are co-leading an effort to identify ways to include remote sensing and GIS data in watershed condition assessments.

- Participated in Columbia Basin Fish and Wildlife Authority workshops conducted to share information about large-scale monitoring programs in the Pacific Northwest.

Steve Wilcox

Stream surveyors measured the size of wood and counted the number of wood jams throughout each surveyed stream reach.

Introduction



BLM

This report provides an account of the Aquatic and Effectiveness Monitoring Program's (AREMP) monitoring efforts in fiscal year 2009 (October 2008 - September 2009). During 2009, AREMP worked toward or accomplished several key objectives. A complete discussion of each of these accomplishments is provided in subsequent sections. Updates are also provided for budget and personnel required to accomplish the tasks assigned to the monitoring program.

The Northwest Forest Plan (NWFP), a management strategy applied to 24 million acres of federal land in the Pacific Northwest, was approved in 1994. The NWFP includes an Aquatic Conservation Strategy that requires the protection, restoration, and monitoring of aquatic ecosystems under the Plan's jurisdiction (USDA-USDI 1994).

AREMP was developed to fulfill the monitoring component of the strategy. The overall objectives of the monitoring program include:

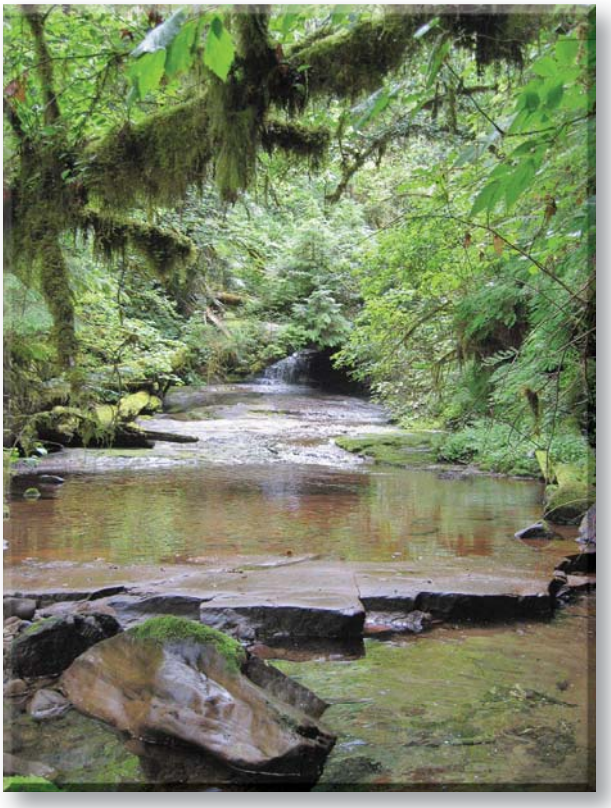
- Assessing the condition of aquatic, riparian, and upslope ecosystems;
- Developing ecosystem management decision-support models to refine indicator interpretation;
- Developing predictive models to improve the use of monitoring data;
- Providing information for adaptive management by analyzing trends in watershed condition and identifying elements that result in poor watershed condition; and
- Providing a framework for adaptive monitoring at the regional scale (Reeves et al. 2004).

Monitoring is conducted at the subwatershed scale (US Geologic Survey 6th-field hydrologic unit code [HUC]). These subwatersheds (hereafter referred to as "watersheds") are approximately 10,000-40,000 acres in size.

John Tyler

We continued our alliance with the Student Conservation Association.

Accomplishments



Sarah Moffitt

15-Year Evaluation of Watershed Condition

We continued our efforts toward producing a 15-year assessment of watershed condition status and trend, with an expected completion date of fall, 2010. We are evaluating the federal land portion of every 6th-field watershed with at least 25% federal (FS, BLM, and National Park Service (NPS)) ownership along the total length of the stream - over 1370 watersheds! Status and trend maps (Figure 1) for each aquatic province within the Plan area will be created, based on the results of the decision-support models we're developing with local specialists input (see sidebar). We'll also be examining the status and trend of watersheds with different land allocations (e.g., matrix, late-successional old growth, Congressional reserves), and watershed condition status and trend in key watersheds (where the emphasis is on restoration and protection) and focus watersheds (a FS designation for 5th-field watersheds with the highest priority for restoration).

Assembling new GIS layers

The spatial data used in the decision-support models rarely exist in a continuous uniform layer for the NWFP area. The BLM and FS maintain separate road data that must be pieced together for our analyses. All the GIS layers that are used in the decision-support models were updated and some new layers were added. Compiling data from multiple agencies and regions is problematic because of varying data standards, formats, and attributes. The new vegetation layer, Interagency Mapping and Assessment Program (IMAP) (Ohman and Gregory 2002) is now consistent over the whole NWFP area, which is an improvement over the combined Interagency vegetation Mapping Project (IVMP) and Classification and Assessment

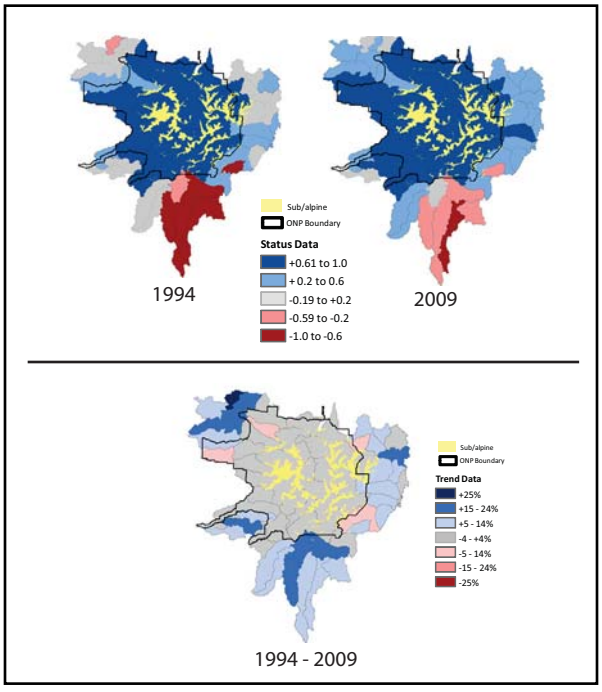


Figure 1. Watershed condition status (upper two maps) and trend (lower map) is being evaluated for federal lands within the NW Forest Plan area. These draft maps are for the Olympic aquatic province.

Watershed Condition Workshops

Steve Lanigan

Program personnel held a second round of workshops with technical specialists from FS, BLM, Pacific Northwest Research Station, Washington Department of Fish and Wildlife, Washington Department of Ecology, Washington Forest Practices Board Cooperative Monitoring, Evaluation, and Research (CMER) Committee, Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA) Fisheries, Oregon Fish and Wildlife, and California Fish and Game to further refine our six provincial watershed condition models. Specialists provided feedback on how well the output from models refined over the previous year matched up with their perspective of "on-the-ground" conditions. Further refinements were suggested and AREMP staff continued to refine the models for use in the 15-year assessment of watershed condition. Watershed condition on federal lands will be assessed in every 6th-field watershed in the Plan area that has at least 25 percent federal ownership along the stream.

with Landsat of Visable Ecological Groupings (CALVEG) used in the 10 year assessment (Gallo et al 2004). The new decision-support models required new GIS analysis methodology to be built for each province.

Assist Local Units

Forest plan revisions

AREMP and FS Regional Office staff worked together to develop draft regional guidance for assessing aquatic species population viability in forest plan revisions. The team also coordinated a science review of the draft guidance.

Provide surveying support to units for restoration efforts

For the second year in a row, we assisted the Fisheries and Hydrology staff of the Roseburg BLM district on a project to map existing channel configuration at the beginning of a restoration project so that changes could be measured through time (Figure 2). Six sites (in two watersheds) totaling approximately 6000 feet were intensively mapped in order to document the existing channel and habitat features. Mapped habitat features included different types of substrate bar classifications (distinguished from bed load material), wood (both natural and placed), exposed bedrock sheets, and information about the existing pools. In 2009, we re-surveyed the same sites to detect differences in substrate as the result of a flood event in the winter of 2008. The work took place in the fall and we utilized field crew members who stayed on after our regular field season ended.

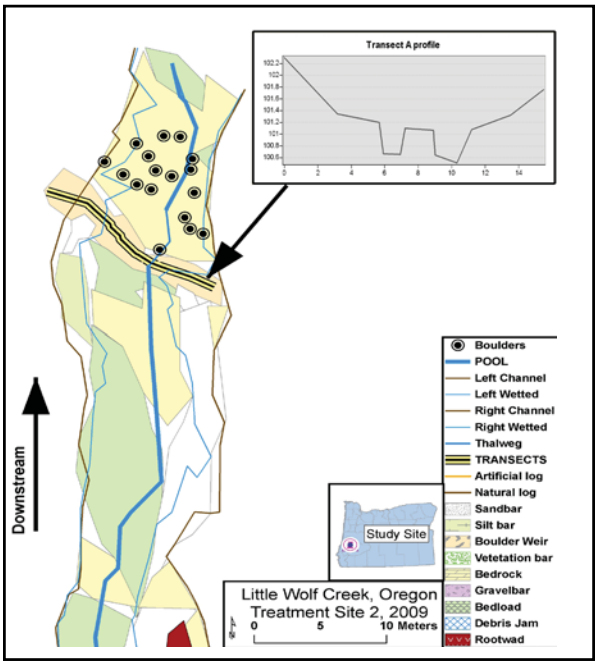


Figure 2. Detailed site maps produced by AREMP staff will be used by BLM district specialists to help plan and monitor stream channel restoration projects.

Field Sampling Accomplishments

Twenty-eight watersheds spread throughout the Plan area were sampled during 2009 (Figure 3,

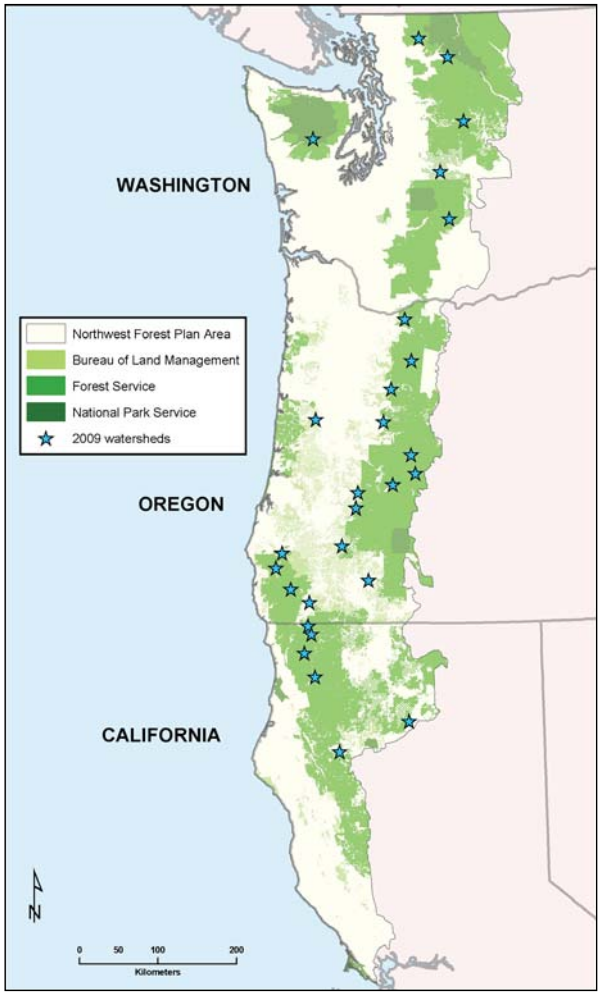


Figure 3. Map of watersheds surveyed during the 2009 field season.

Jared Blake

App. A-1). These watersheds were sequentially sampled from the subset of the 250 watersheds originally selected for monitoring the NWFP. The 250 watersheds were selected at random using a generalized random tessellation sampling design, which guarantees a spatially balanced sample (Stevens and Olsen 2003, 2004). Watersheds had to contain a minimum of 25 percent federal ownership (FS, BLM, or NPS) along the total length of the stream (1:100,000 National Hydrography Dataset stream layer) to be considered for sampling in the monitoring plan. Eighteen sites were resurveyed as part of our quality control program. During the 2009 field season, eight watersheds were dropped from the sample list for various reasons:

- Four were dropped due to inaccessibility (crews were unable get into the watershed);
- One was dropped due to access and marijuana growing concerns;
- One was dropped because the stream was too large to safely survey; and
- Two were dropped because an ownership change resulted in less then 25% of the watershed being under federal ownership.

Changes to sample effort allocation

The program historically allocated summer field efforts to three types of surveys: 1)initial, 2) quality control, and 3) trend. Initial surveys are conducted at sites that have not been surveyed before are used to determine watershed status. These surveys were 59 % to 77 % between 2002 and 2007. The quality control (QC) surveys are within year resurveys of randomly selected sites; the information is used to assess the measurement differences between crews. These surveys were 12 % to 21 % of the sites surveyed between 2002 and 2007. The trend surveys are a subset of the quality control surveys from the previous year and were intended to determine trend prior to the program resurveying all sites. These surveys were 5 % to 14 % of the sites surveyed between 2002 and 2007.

For the 2009 field season the program changed the allocation of sample effort across the different types of surveys. The trend surveys were dropped completely and the quality control surveys were scaled backed considerably due to the following:

1. Statisticians at Oregon State University examining our data determined that having more time (years) between measurements – as opposed to less time – is more powerful in detecting changes in the environment.

2. After conferring with statisticians and monitoring experts, we concluded that the existing dataset of quality control surveys was sufficiently large to assess the measurement differences between crews.

3. Finally, by taking the same amount of effort (sites) dedicated to the quality control and trend surveys and using it to conduct initial surveys, we were able to get within two watersheds of finishing the initial 250 watersheds. Once the initial 250 watersheds are surveyed, the program can begin the resurvey

Jonathan Frech

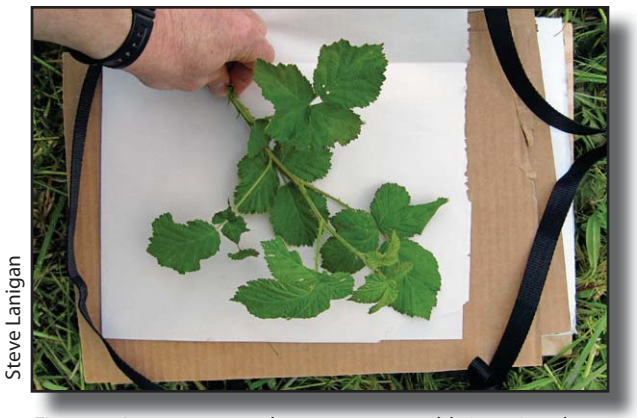
work for detecting change on the landscape, i.e., "start over." As a result of these shifts in effort allocation, the field crews surveyed 171 new sites in 28 new watersheds.

Protocol changes

There were two changes to the field sampling protocol this year:

1. We added a plant press protocol for preserving potential terrestrial and aquatic invasive plant specimens in the field (Figure 4)

2. The program formalized the use of back-sight measurements when moving the total station survey equipment. This means the crews now measure the distance and direction (with the total station) to the previous point rather than using an external check mechanism to make sure the move between occupied points was executed correctly.



Steve Lanigan

Figure 4. A press was used to preserve possible invasive plants for later taxomonic verification.

Quality assessment program

The monitoring program's Quality Assessment Program (QAP) included several components. Training and written protocols were used to ensure field personnel understand what and how to collect the data. Established methods and tools to search for errors in the data were key to capturing and correcting errors. The data manager served the key role of inspecting data for errors (both correctable and non-correctable) and

Sarah Moffitt

relayed mistakes back to the field crews to prevent further errors in data collection. The data manager was also responsible for inspection of calculated attributes (summarized raw data) for outlying errors. Quality assessment information was also used to identify needed improvements in protocol training for the next field season.

Results from QAP analyses were written up in a Quality Assessment Program report (Moyer, 2009 draft). We found that field attributes differed in the ability to detect current status, trend, or both. As a result, recommendations for how to proceed with each attribute were made in the report. For example, some attributes such as dissolved oxygen cannot be measured consistently by different crews and are therefore recommended to be dropped from the field surveys. Other attributes, such as gradient, were measured precisely so no change was recommended for this protocol.

Precision of measurements and the sensitivity to changes in the environment are important factors in considering whether to keep or drop an attribute. Another component of equal importance is to consider is the need for the information as it relates to determining watershed condition (AREMP's primary goal). During 2010 an extensive review will be undertaken that considers both the quality of the data collected and the utility of the information in assessing watershed condition.

Trend analysis

During the fall of 2008 we undertook an analysis project with statisticians at Oregon State University to explore our ability to detect trends based on the field attributes. This project incorporated the

2002 – 2007 field data. The primary objective was to explore the amount of change that individual attributes would need make in order to detect that change given the variation in the attribute (both variation in measurements and the environment). A preliminary draft of this analysis was released in fall of 2009. Results indicated that (as quoted from Gaeuman and Steven 2010):

- "…Current sampling design and level of effort are potentially sufficient to allow detection of relatively small monotonic trends in at least some important AREMP metrics with good power (≥ 80 %) sometime during the second decade of monitoring.

- A second and related observation emerging from this work is that power to detect trend can heavily depend on the choice of analysis parameter.

- This work also confirms that the rotating panel design provides a better basis for trend detection than the single visit design.

- Finally, this analysis supports the claim that given existing resources, probably little is to be gained in reallocating sampling effort to arrange an incremental increase in the number of watersheds surveyed."

Shade measurements

AREMP staff continued a partnership with FS and BLM hydrologists to expand the spatial extent of a "rapid shade model" developed for stream shade assessments. The model was originally developed for the Siskiyou National Forest. AREMP survey crews collected stream shade measurements in 28 sampled watersheds (Figure 5).

Additional data was collected during the 2009 field season and will again be collected in 2010. These data will be used to validate the model for use throughout the NWFP area. When the model validation is complete, AREMP will use the model results in watershed condition assessments. Other uses of the model include developing water quality recovery plans and identifying areas that may need vegetation treatments and stream restoration projects.

Jared Blake

Figure 5. A solar pathfinder was used to measure shade at stream survey transects.

Safety

We continued our emphasis on safety by again providing all field employees with a 2-day wilderness first aid course, epi-pen and blood borne pathogen training, and drivers education training,. Everyone also got top-of-the-line wading gear, water bottles, and sunglasses. Safety concerns and advice were discussed during "dock talks" prior to crews leaving on each field trip. We used a variety of communication devices (radios programmed to each administrative unit, cell phones, and satellite phones) to stay in contact with all field crews. We also contacted local law enforcement officials before we entered a watershed to find out about any known hazaards.

Aquatic invasive species surveys

AREMP staff participated in the third year of a pilot regional survey effort to locate aquatic invasive species on federal lands.(Figure 6). Protocols developed by Oregon State University Sea Grant College Program personnel were used to survey for 23 aquatic plants and animals identified as threats to Northwest watersheds. Among the key species included were; New Zealand mudsnails, zebra mussels, quagga mussels, yellow flag iris, knotweed, hydrilla, Chinese mitten crabs, and four species of nonnative crayfish.

Samanthan Seabrook-Sturgis

Figure 6. Crews looked for aquatic invasive species throughout sampled stream reaches

In-the-field training on species identification, data collection, and reporting were provided to AREMP field coordinators and field crews by personnel from the Oregon State University Sea Grant Program. The field protocols added using a plant press to collect suspected invasive plants. Field crews encountered and verified three species of concern (ringed crayfish, Himalayan blackberry, and Japanese knotweed).

A report providing more details about our 2009 aquatic invasive species program (Andersen and Lanigan, 2009) is posted at: http://www.reo.gov/monitoring/reports/watershed-reports-publications.shtml

Pete Gruendike gave a presentation about our aquatic invasive species monitoring program at the 2009 Oregon Chapter of the American Fisheries Society. Hank Lavigne presented a poster about our invasive species disinfection protocol at the same meeting. Steve Lanigan participated in the "First Symposium of National Investigation on Invasive Plants in Taiwan" (Figure 7)

Steve Lanigan

Figure 7. The AREMP team leader, Steve Lanigan, was a featured speaker at the "First Symposium of National Investigation on Invasive Plants in Taiwan," held in Taipei, Taiwan. He described AREMP's success in incorporating invasive species surveys into an ongoing monitoring program, decontamination prolocols, and the benefits of the FS and BLM working together on the common goal of identifying invasive species

Pacific Northwest Aquatic Monitoring Partnership

Support continued for the cooperative monitoring efforts between state, federal, and tribal agencies within Washington, Oregon, California, and Idaho – known as the Pacific Northwest Aquatic Monitoring Partnership (PNAMP). AREMP staff participated in the following activities.

Inter-agency side-by-side protocol test

The Watershed Workgroup continued its efforts to prepare a manuscript describing the results of an inter-agency side-by-by-side protocol test. Data were collected during summer 2005 in the John Day Basin (eastern-central Oregon).

The data analysis of the protocol test was led by Dr. Brett Roper (USDA Forest Service National Monitoring Coordinator). A document was submitted for publication and AREMP staff co-authors, Steve Lanigan and Chris Moyer, responded to reviewer comments as part of the publication process. We expect to have the manuscript published in 2010.

The John Day protocol test yielded a rich dataset that allowed for the exploration of inter-crew consistency in measuring attributes used in the Rosgen stream classification system (Rosgen 1996). One of our staff, Chris Moyer, was co-author on a paper (Roper et al. 2008) that examined the differences between crew measurements and the impacts those differences have on constantly classifying stream channel types with the Rosgen system. Generally, the conclusion is that a small difference between two measurements can have a profound impact on the results of the classification system results. Rosgen was given the opportunity to respond (Rosgen 2009) to the findings of the Roper et al. (2008) article and Buffington et al. (2009) is the response to Rosgen's counter arguments.

Status and trend watershed/stream integrated monitoring program

We participated in Lower Columbia River Endangered Species Act salmon recovery area workshops where state and federal agencies are proposing to use a master sample design to determine sampling sites, establish common protocols, and share data for habitat status and trend monitoring. The goal is, within 10 years, to create an integrated, interagency aquatic status and trend monitoring program to provide annual, statistically valid data on a set of agreed-upon stream, riparian, and upslope indicators of the condition of aquatic/riparian resources across the Pacific Northwest at statewide and finer scales of spatial resolution. AREMP and Washington Department of Fish and Wildlife staff are co-leading an effort to identify ways to include remote sensing and GIS data in watershed condition assessments.

We participated in Columbia Basin Fish and Wildlife Authority workshops conducted to share information about large-scale monitoring programs in the Pacific Northwest.

Program Updates

Fiscal year 2009 budget

During the 2009 field season, the program employed 26 persons directly tied to the summer field work; five personnel were core staff (permanent and term employees) and the balance were summer-seasonal employees and Student Conservation Association interns.

It cost $6131 to sample each site. This cost was derived from taking our total budget and dividing by the number of sites sampled, and included sampling trend sites and QA/QC sites as well as overhead and other non-field related costs. The cost to sample a watershed (based on sampling an average of 6 sites in each watershed) was $36,789.

Jared Blake

Heidi Andersen

Kirsten Gallo

Pete Gruendike

Hank LaVigne

Steve Lanigan

Staffing update

We welcomed the arrival of Heidi Andersen as our Lead Field Coordinator. Heidi recently finished her M.S. in Fisheries Science at Oregon State University (Andersen 2008) and was in the FS Student Career Experience Program (SCEP).

Our aquatic ecologist, Kirsten Gallo, left for a promotion with the National Park Service as the Program Manager of the Chihuahuan Desert Network, which is a natural resources inventory and monitoring network covering 6 national parks: Amistad National Recreation Area, Big Bend NP, Carlsbad Caverns NP, Fort Davis National Historic Site, Guadeloupe Mountains NP, and White Sands National Monument.

Our two field coordinators, Pete Gruendike and Hank LaVigne, also left for other jobs at the end of the field season. We are now looking at options for restructuring our staff and filling positions as quickly as possible.

AREMP Summer employment information is posted at http://www.reo.gov/monitoring/employment/index.shtml.

Student Conservation Association interns

Four Student Conservation Association interns were hired as crew members during the 2009 field season. Compared to hiring GS-0404-05 Biological Science Technicians, there was a $56,000 cost savings to the program. We continued to collect high quality data and provided valuable work experience to the interns. Five of the GS-grade employees we hired in 2009 were formerly SCA interns: one was hired as a crew leader and another four were hired as crew members. Overall, this was a very successful partnership and one we plan to continue in 2010.

Steve Lanigan

SCA interns enjoyed working in liquid sunshine..

Annual watershed reports and data available on program website

To facilitate the use of field and GIS data by local area managers, the program continues to place the annual Watershed Reports and associated data onto the monitoring program's web site. Data from 2002 to 2006 are now available on the website. Data from the 2007-2009 field seasons will be available on the site in 2010. The current web page will be updated to show links to the reports and data. At the writing of this document, the reports and data will be posted at http://www.reo.gov/monitoring/reports/watershed/aremp/aremp.htm (this is subject to change depending on constraints of the website). Summarized data, rather than individual measurement data, are posted on the web; however measurement data are available by contacting AREMP's data manager, who will provide any requested information.

Data requests

The monitoring program data manager provided data from our field surveys to local management units, Oregon Department of Fish and Wildlife, and other state and federal offices.

- Summary water temperature data were sent to the Forest Service Region 5 Water Quality Monitoring program.
- Coastal cutthroat trout data was sent to the Coastal Cutthroat Trout Interagency Committee.
- Eel River water temperature data were sent to the Mendocino NF.
- Diatom and macro-invertebrate data were sent to Rhithron Associates Inc.
- Substrate and wood data were sent to Oregon State University Department of Fish and Wildlife for analysis of splash dam locations.
- Calculated survey attributes, water temperature data, and watershed model scores were sent to the Columbia Basin Fish and Wildlife Authority.
- Methow River water temperature data were sent to Wild Fish Conservancy.
- Reach survey attributes for the Siletz and Alsea Rivers were sent to the Drinking Water Protection Program at Oregon Department of Environmental Quality.
- Calculated reach survey data for Elk Creek were sent to Coos Bay BLM.
- Other, non-specific data requests were directed to the AREMP data download website; http://www.reo.gov/monitoring/reports/watershed/aremp/aremp.htm

Literature Cited and Program Publications

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Key Presentations

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Gruendike, P. 2009. Invasive Species Monitoring. Oregon Chapter of American Fisheries Society Meeting.

Lanigan, S.H. 2009. Lessons learned conducting aquatic invasive species surveys. The first symposium of national investigation on invasive plants in Taiwan. National Taiwan University. Taipei, Taiwan.

LaVigne, H. 2009. Invasive species disinfection protocol of the Aquatic and Riparian Effectiveness Monitoring Program. Oregon Chapter of American Fisheries Society Meeting poster.

Morgan Garay

Acknowledgments

The Aquatic and Riparian Effectiveness Monitoring Program is an interagency effort resulting from the contributions of the FS, BLM, National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NOAA-NMFS), US Fish and Wildlife Service, NPS, California Indian Forestry and Fire Management Council, Northwest Indian Fisheries Commission, Intertribal Timber Council, and US Army Corps of Engineers. Funding was provided by FS Region 6 and Region 5, BLM Oregon State Office, NOAA-NMFS, and EPA.

The program benefited greatly from contributions from Gordie Reeves, Kelly Burnett, Phil Larsen, and Brett Roper.

The following BLM Oregon State Office personell provided support to AREMP: Kelly Coleman, Layne Gaylord and Carissa Readye helped hire crews and process personnel actions. Terri Deis assisted with payroll adjustments. Pam Sterling of the BLM Oregon State Office (OSO) processed the Student Conservation Association agreement. Mike Hamel provided valuable InDesign tips.

Sam Chan and Tania Siemens of the Oregon State University Oregon Sea Grant Extension, Robyn Draheim of Portland State University Center for Lakes and Reservoirs, and Jeff Uebel (R6-FS) provided training, support and guidance in the implementation of the invasive species monitoring protocol. Doug DeGross of Watershed Sciences, Inc. provided amphibian capture and identification training for the field crews.

Margie Witt, Beth Snyder, and Eddy Nelson all of the Siulsaw National Forest provided excellent support for both hand-held and vehicle radios; purchasing help and guidance; and fleet help and support, respectively. Bev Rhode of the Siuslaw National Forest was instrumental in overcoming logistics with field going laptop computers.

Bill Powers of the FS National Resources Information Systems provided advice on future direction for data collection and storage mechanisms.

Peter Eldred coordinated compiling and analyzing GIS and remote sensing data. Mark Isley handled data processing and database management. Benny Manriquez handled timesheets for the program during the field season. Justina Billings completed travel reimbursements for the field season. Steve Wilcox developed the field maps for the crews and assisted with the layout of this report.

Jerry Freilich of the Olympic National Park and Erik Taylor and Dan Dammann of the Roseburg BLM provided support and guidance for the logistics of field crews.

Heidi Andersen, Peter Gruendike and Hank LaVigne handled field crew coordination. Summer field staff included Kim Beedle, Jared Blake, Michelle Coffron, Wendy Crouse, Jonathon Frech, Andrew Janos, Caryn Johanson, Morgan Garay, Forrest Kaye, Beth Kroiz, Emily Lang, Jeff Metzger, Sarah Moffitt, Aaron Payne, Brent Priz, Samantha Sea-brook Sturgis, John Speece, John Tyler, Adam Webster, and Cassie Whiteside.

Sean Gordon, Kirsten Gallo, Steve Lanigan, and Peter Eldred coordinated provincial watershed condition workshops. Participants included: Jeff Dose – Umpqua NF, Marc Wilcox – Deschutes NF, Johann Hogovorst – Willamette NF, Becky Flitcroft – PNW, Bob Ruediger – Salem BLM, Ivars Steinbloom – Mt Hood NF, Ruth Tracy – Gifford Pinchot NF,

Dave Fuller – BLM California State Office, Juan de la Fuente - Klamath NF, Gregg Bousfield – Klamath NF, Christine Mai – Shasta Trinity NF, Don "Flick" Flickenger – NOAA, Robin Mowery– Mendocino NF, Sam Gygli - Mendocino NF, Erica Helton – Mendocino NF, Julie Perrochet – Klamath NF, Angie Bell – Klamath NF, Scott Downie – CFG, Joseph Furnish – R5 RO, Cameron Thomas – Wenatchee NF, Pierre Dawson – Wenatchee NF, Dick Miller – CMER, Bob Cusimono – WDOE, Kirk Krueger – WDFW, Peter Kiffney – NOAA Fisheries, Bob Metzger – Olympic NF, Robin Stoddard – Olympic NF, Bill Shelmerdine – Olympic NF, Al Doelker – BLM, Kami Ellingson – Siuslaw NF, Gordie Reeves – PNW, Kelly Burnett – PNW, Alan Herlihy – OSU/ EPA, and Phil Kaufmann – EPA.

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Report layout by Steve Lanigan. and Steve Wilcox.

Shawne Mohoric

AREMP 2009 summer crew members.

Appendix A - Watersheds Surveyed in 2009

*Appendix A. Watersheds surveyed in 2009 as initial surveys with the number of sites surveyed in each watershed. Note: QA/QC sites were where a second independent crew returned to sample the same reach to determine variability in our measurements.(denoted by *).*

State	Province	Local Unit	6th Field HUC	6th Field HUC Name	Creek Code	County	Number of Sites
CA	Klamath Siskiyou	Klamath NF	180102090204	South Fork Indian Creek	CASFI	Siskiyou	8*
CA	Klamath Siskiyou	Klamath NF	180102090603	Jackass Creek	CAJAK	Klamath	6
CA	Klamath Siskiyou	Klamath NF	180102090703	Somes Creek	CASOM	Siskiyou	6
CA	Klamath Siskiyou	Shasta-Trinity NF	180102120304	Gurley Gulch	CAGUR	Trinity	6
CA	Klamath Siskiyou	Shasta-Trinity NF	180200031202	Potem Creek	CAPTM	Shasta	6
CA	Klamath Siskiyou	Siskiyou NF	177003110104	Dunn Creek	CADUN	Del Norte	8*
OR	Coast Range	Salem Blm	171002050104	Upper South Fork Of Alsea River	ORSFA	Benton	10
OR	Coast Range	Siskiyou NF	171003050104	Elk Creek	OREKC	Coos	6*
OR	Franciscan	Rogue River NF	171003110804	Florence Creek	ORFLO	Josephine	5
OR	Franciscan	Siskiyou NF	171003100801	Rogue/Illahe	ORILL	Curry	6
OR	High Cascades	Deschutes NF	170703010207	Browns Creek	ORBWN	Deschutes	8
OR	Klamath Siskiyou	Medford Blm	171003070812	Little Butte/Lick	ORLIK	Jackson	5
OR	Klamath Siskiyou	Medford Blm	171003110504	Mc Mullin Creek	ORMCM	Josephine	8
OR	Klamath Siskiyou	Roseburg Blm	171003020504	Stouts Creek	ORSTO	Douglas	6
OR	Western Cascades	Mt Hood NF	170800010506	Middle Bull Run River	ORBUL	Multnomah	8*
OR	Western Cascades	Eugene Blm	170900060608	Owl Creek	OROWL	Linn	5
OR	Western Cascades	Mt Hood NF	170900110401	Pot Creek	ORPOT	Clackamas	6
OR	Western Cascades	Roseburg Blm	171003010903	Pass Creek	ORPAS	Douglas	7*
OR	Western Cascades	Umpqua NF	171003010708	Blitzen Facial	ORBZF	Douglas	6
OR	Western Cascades	Willamette NF	170900010202	Upper Hills Creek	ORHIL	Lane	7
OR	Western Cascades	Willamette NF	170900040302	South Fork Mckenzie River / Elk Creek	ORSFM	Lane	9*
OR	Western Cascades	Willamette NF	170900050401	Detroit Reservoir/Kinney Creek	ORKIN	Linn	4
WA	Northern Cascades	Wenatchee NF	170200110302	Upper Nason Creek	WANAS	Chelan	8*
WA	Northern Cascades	Wenatchee NF	170300020303	North Fork Tieton River	WANTI	Yakima	10*
WA	Northern Cascades	Mt. Baker-Snoqualmie NF	171100050604	Middle Cascade River	WAMCR	Skagit	6
WA	Northern Cascades	Mt. Baker-Snoqualmie NF	171100050806	Lower Baker Lake	WALBL	Whatcom	7*
WA	Olympic	Olympic NP	171001020305	Graves Creek	WAGRV	Jefferson	5
WA	Western Cascades	Mt. Baker-Snoqualmie NF	171100130104	Upper Green River/Twin Camp Creek	WAUGN	King	7

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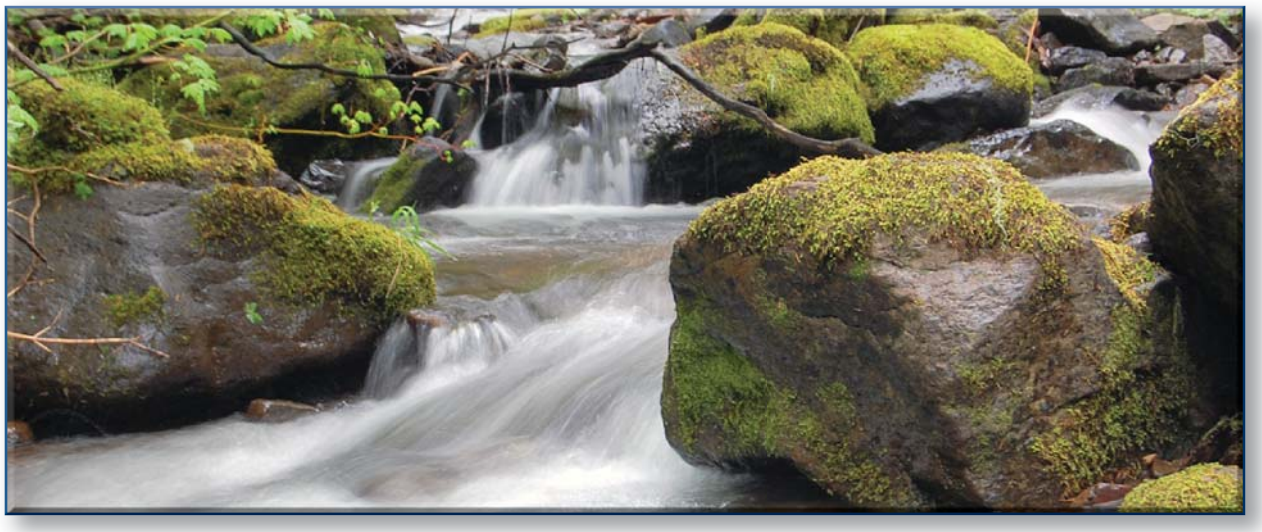

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