



Aquatic and Riparian Effectiveness Monitoring Program



Interagency Monitoring Program – Northwest Forest Plan Area



2017 Annual Report

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Introduction



The Aquatic and Riparian Effectiveness Monitoring Program (AREMP) is a "Service First" program consisting of USDA Forest Service (FS) and USDI Bureau of Land Management (BLM) employees working together to monitor the effectiveness of the Northwest Forest Plan's (NWFP) Aquatic Conservation Strategy and the BLM's Western Oregon Resource Management Plans (WO RMPs) in maintaining and restoring watershed condition within the NWFP area. The NWFP and WO RMPs provide management direction for 24 million acres of federal lands in western Washington and Oregon, and northern California (fig. 1). The purpose of this report is to highlight AREMP's monitoring efforts and support to local units in fiscal year 2017.

Accomplishments



20-Year Report on Watershed Condition

The NWFP monitoring programs produce formal reports on a 5-year cycle, with the latest reports covering the period of 2009-2013. AREMP completed this report in 2015, but an additional review of the new methods used held up publication until November 2017. The final report is now available on TreeSearch: <https://www.fs.usda.gov/treesearch/pubs/55231>.

Along with delivery of the 20-year report, AREMP prepared a documented dataset of the data that went into the report as GIS layers and data tables.

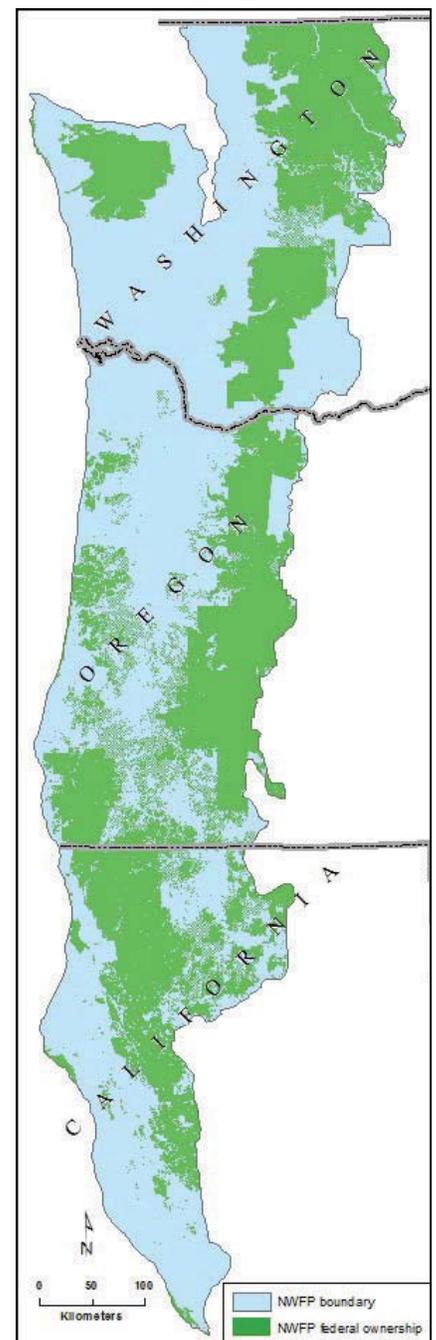


Figure 1. Northwest Forest Plan (NWFP) area and federal lands being evaluated for watershed condition (downloadable from <https://reo.gov>).

25-Year Report on Watershed Condition

Planning for the 25-year report continued with help from Rebecca Flitcroft (Forest Service PNW Research Station) and Jason Dunham (US Geological Survey). The AREMP planning group met with USFS and BLM regional fish and hydrology program leads in August to review initial plans and solicit ideas for the next report.

Additional support is being provided by staff from Dunham's research group, including Nathan Chelgren (ecologist), who is helping to test new statistical methods (hierarchical Bayesian analysis) and David Hockman-Wert (biologist), who will be providing GIS support when GIS analyst Peter Eldred retires in early 2018.

NWFP Science Synthesis

Stephanie Miller (former team lead) and Sean Gordon (research associate) participated as co-authors on a chapter on aquatic and riparian species and ecosystems for the NW Forest Plan Science Synthesis report, led by the U.S. Forest Service Pacific Northwest and Pacific Southwest Research Stations. AREMP assessment results were incorporated into the report, which is intended to inform the revision of land management plans (forest plans) for 17 national forests within the Northwest Forest Plan (NWFP) area. The target for release is June 2018. Details can be found at: <https://www.fs.fed.us/pnw/research/science-synthesis/>.

Status and Trend Sampling

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 to 40,000 acres in size.

One hundred and forty three stream sites within 25 watersheds spread throughout the NWFP area were sampled during 2017 (fig. 2). 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 (Reeves et. al. 2004, Stevens and Olsen 2003, 2004). Twelve sites were resurveyed as part of our quality control program. Three watersheds could not be surveyed due to active wildfires. These watersheds will be added to the 2018 sites.



Figure 2. Map of the watersheds surveyed during the 2017 field season

We made the following changes to the 2017 field sampling protocol to make our sampling more cost effective and time efficient:

- We collect eDNA samples for all sites.
- All data collection is done using Samsung (Android) tablets with Microsoft Excel form

LiDAR

AREMP staff investigated the potential of aircraft-based remote sensing using laser technologies (LiDAR) to better map streams and roads, key components in our upslope-riparian assessment. Staff reviewed the available data, the literature, and contacted those with experience in the USFS and BLM. A fundamental limitation for AREMP use is the lack of complete coverage for the NWFP area. A second challenge is time it takes to extract roads and streams from the lidar data. Agency staff have been able to partially automate the generation of streams, but many manual edits are still needed, particularly where roads cross streams (lidar does not see culverts), and a way to estimate stream initiation points is needed. Although one published study claimed a high level of success in automating the extraction of roads from lidar data (Sherba et al. 2014), agency staff have not been able to replicate these results, so manual digitizing is still the most effective approach. The Colville National Forest (NE Washington) embarked on a large scale lidar roads digitization project and has digitized over one million acres at the approximate rate of 150,000 acres/person/week. While data availability and feature extraction effort appear to be barriers to using lidar in the overall AREMP assessment, AREMP will continue to explore their use for modeling upslope-inchannel relationships and assessing the quality of mapped data we do use in the assessment. The USFS and BLM are continuing to acquire lidar data and extract road and stream information, so AREMP will continue to track the potential for a dataset suitable for NWFP-wide assessment.

Sediment Delivery Modeling

AREMP has integrated a mass wasting sediment delivery risk model into its past two assessments; however, chronic erosion from roads is another sediment

delivery process that operates somewhat differently. To better reflect this process, AREMP continued work with Charlie Luce from the Forest Service Rocky Mountain Research Station to use GRAIP-lite, a GIS based tool used to predict the relative intensity of road sediment impacts on streams (USDA FS RMRS 2016). The GRAIP-lite model does not include geology, landforms and precipitation factors, so AREMP staff has been testing the integration of these elements from our landslide risk model.

Data Management

We re-designed our field data collection workflow, from the hardware used in the field, to the quality control steps, and final compilation. The new system uses modern tablet computers, more accurate Geographic Positioning System (GPS) technology, and an interactive analytical process for uploading to the final database. The new system provides a much lighter load for the crews, better quality control of data entry, the flexibility to work with different protocols, and is significantly less expensive than the equipment it replaced.

Invasive Surveys

Aquatic and riparian invasive species continue to be a threat to our Pacific Northwest Ecosystems. With support from the Forest Service Region 6 Natural Resources, AREMP continues to perform invasive searches, reports detections, and can also provide probabilistic estimates of invasive trends. In 2017, AREMP crews surveyed 143 sites in 25 watersheds for aquatic invasive species throughout the field season (June through September). AREMP crews recorded 25 verified invasive detections in Oregon and California all of which were Himalayan [Armenian] blackberry (*Rubus armeniacus*). No invasive species were detected in Washington.

Assisting Local Units & Regional Initiatives

AREMP made several program adjustments in response to needs presented by the region and the local units. We continue to explore ways to better integrate regional scale monitoring with management unit planning and national landscape level initiatives. AREMP has substantial baseline data, and the tools necessary to assess change for evolving management across the landscape.

Planning and NEPA Support

AREMP continued to make progress in making our data useful to a variety of other planning and environmental assessment processes.

AREMP staff continued to work with USFS regional fisheries staff to build a model to assess the viability of fish species of conservation concern. The 2012 USFS Planning Rule, which provides the procedures to be used in revising national forest plans, calls for the responsible official to assess whether or not the plan components will provide the ecological conditions necessary to maintain a viable population of each species of conservation concern within the plan area.

AREMP staff presented to the USFS Region 6 (OR/WA) NEPA/planners annual meeting in March on the potential uses of AREMP data in NEPA and planning. Watershed assessment is occurring at four levels: national (USFS Watershed Condition Framework), regional (AREMP, PIBO), unit (BLM district and national forest plans), and project levels. AREMP has been able to contribute data to each of these levels, but further harmonization of indicators and assessment procedures is recommended for efficiency and telling a consistent story.

AREMP also contributed data to the Southwest Oregon Adaptation Partnership (SWOAP), an assessment of potential climate change effects on BLM and USFS lands in that area.

Stream Temperature Monitoring

AREMP continued our partnership with USFS Pacific Northwest Regional Office, BLM Oregon State Office, and US Geologic Survey (USGS) For-

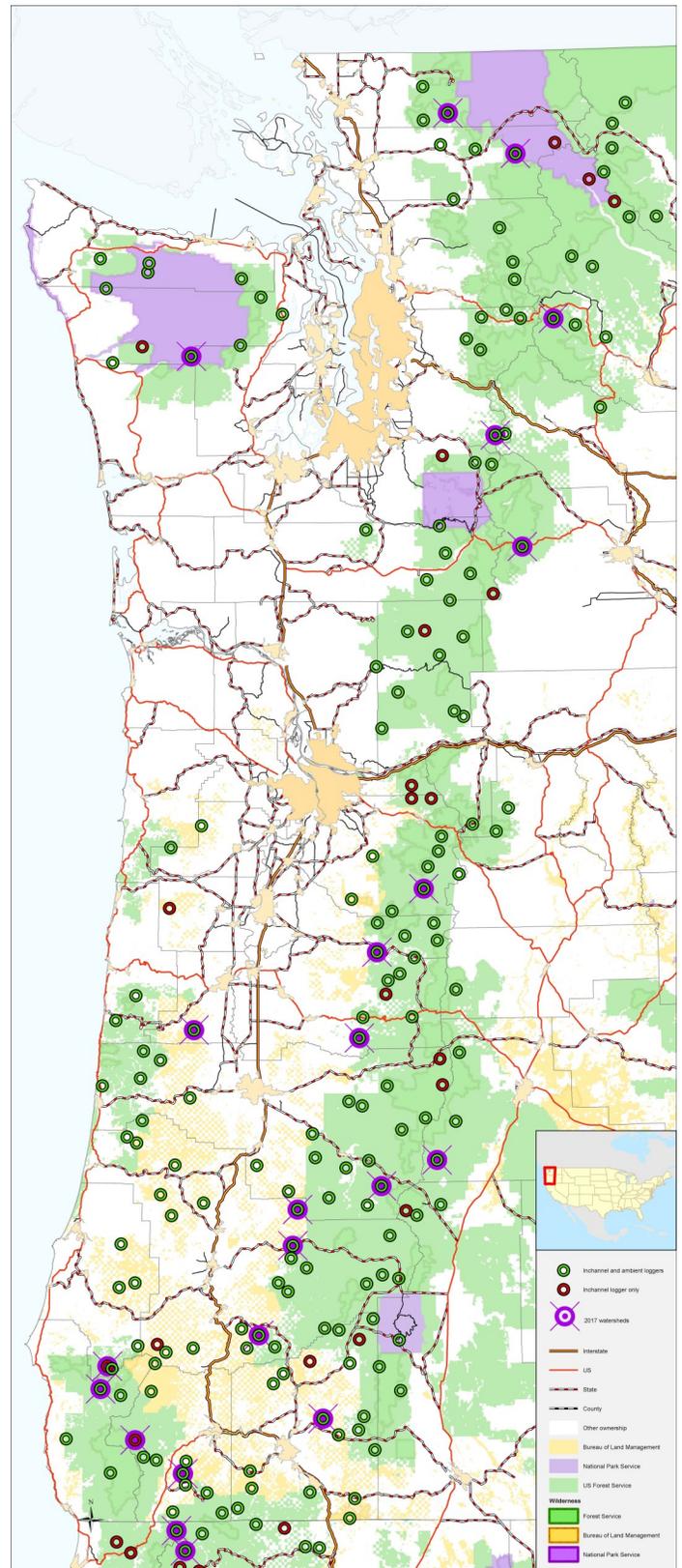


Figure 3. Location of instream and air temperature sensors placed by AREMP in the Northwest Forest Plan area of Oregon and Washington. The purple bull's eye represents watersheds surveyed for stream condition by AREMP in 2017. The green circle designates AREMP watersheds with a stream-side and upslope air sensor. The red circle depicts AREMP watersheds with an instream sensor.

est Rangeland and Ecosystem Science Center to monitor year-round instream and air temperatures in watersheds throughout the Northwest Forest Plan Area in Oregon and Washington (fig. 3). The purpose of this ongoing partnership is to provide baseline year round air and stream temperature data to climate scientists, aquatic ecologists, fish biologists and hydrologists to help determine the sensitivity of stream temperature to climate change. Temperature data is shared with the USFS Rocky Mountain Research Station as part of the NorWeST regional stream temperature project which develops spatially explicit stream network models for climate change scenarios. Outputs from these models are available on the NorWeST website for use by biologists, hydrologists, and researchers to better understand thermal impacts on aquatic species and to help prioritize conservation efforts. Many watersheds were visited and several improvements were made for this effort:

- Continued to work with local Forest Service and BLM personnel for assistance with downloading thermographs.
- The AREMP crew visited 64 watersheds to download and deploy sensors and specialists from local units visited 41 watersheds for a total of 105 watersheds visited.

Surface Water Diversion Surveys

Over 65,000 surface water diversions are thought to be on Forest Service lands; however the spatial data regarding withdrawal locations and status are often inaccurate or missing. Given the danger of these structures to entraining fish and blocking migration, the USFS Pacific Northwest Regional Office (RO) and AREMP began a partnership in 2014 to collaborate with National Forests in Region 6 to inventory and collect data on stream diversion structures. The RO and AREMP provided a protocol for Forest Interdisciplinary teams to identify and prioritize diversions to be surveyed as well as a protocol to inventory diversions in the field. In 2017 AREMP:

- Continued to accept survey data and organize

photographs, forms and other notes.

Culvert Surveys

Crew surveyed 19 culverts post-restoration as part of the Salmon Super Highway project to assess fish passage using the Forest Service National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings (Clarkin et al 2005). The Salmon Super Highway project is an ongoing partnership between the federal, state, and county governments, non-profit organizations, and local businesses. The overall goal of the partnership is to restore fish habitat in Oregon's North Coast, including the six adjacent major river systems that drain from the Coast Range into Tillamook and Nestucca bays. For further information on this partnership visit - <http://www.salmonsuperhwy.org/>.

Program updates



Employment

We employed seven year-round employees who were a combination of permanent and year-round "term" employees. Eighteen crew members were employed between May - October; they were a combination of seasonal employees and American Conservation Experience interns (ACE). AREMP Summer employment information is posted at: <https://>

www.fs.fed.us/r6/reo/monitoring/employment/.

Stephanie Miller, AREMP Program Lead, accepted a new position in January as the BLM National Riparian Lead in the Washington Office.

Christine Hirsch, from the Siuslaw National Forest, detailed in as team lead for the entire year (and was just selected as the permanent replacement!).

Peter Eldred, GIS analyst with the program since its earliest days in 2002, set his retirement for January 2018.

Youth Hires

AREMP hired 17 youth employees (under age 35) to assist with field sampling in 2017. Youth hires included 12 interns. Interns were hired in cooperation with the American Conservation Experience (ACE) program. Those interns age 25 or younger at the time of hiring were eligible to receive a direct hiring authority via the Public Land Corps Act (PLCA) after successfully completing at least 640 hours of service. This hiring authority conveys the ability to apply to government only (“merit”) position vacancies with all federal government agencies for two years after internship completion. Interns are also eligible for AmeriCorps Education awards up to \$1500 which can be used to pay education costs at qualified institutions of higher education, for educational training, or to repay qualified student loans.

The AREMP team provides additional training and encouragement on applying for federal jobs, resume reviews and opportunities to speak with federal managers and biologists to learn about federal jobs. Each crew member attends three weeks of training to learn how to conduct AREMP stream surveys, this includes one week of field training during which the participants camp in the field to practice surveys before heading out on 8 day stints during the field season. Additionally, AREMP provides training in wilderness first aid, CPR, blood-borne pathogens and how to administer epinephrine pens, annual defensive driver training to operate federal vehicles, a ride-along for crew members with BLM Safety Of-

ficers to practice driving on gravel roads, and a “right to know” training which covers all the potentially hazardous chemicals they may come in to contact with for preserving samples and calibrating water quality meters.

New Projects in 2018



Environmental DNA (eDNA) Sampling

eDNA is a surveillance tool used to detect genetic material in aquatic ecosystems and determine species presence. We will continue our work with Dr.(s) Brooke Penaluna and Richard Cronn from the USFS Pacific Northwest Research Station this winter on sample design and field collection protocols to collect samples during the 2018 field season across the NWFP area. A two person crew will collect additional eDNA samples for a study that will examine the efficacy of using eDNA to detect invasive species in lakes and reservoirs.

Literature Cited

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GRAIP/](https://www.fs.fed.us/GRAIP/)

Acknowledgements



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Teresa Kubo (EPA) and Kim Kratz (NOAA) for continued AREMP funding.

Jim Capurso (FS R6) funded aquatic invasive species monitoring.

Brian Staab (FS R6) and Louisa Evers (BLM OSO) helped procure funding for deploying thermographs.

The BLM Oregon/Washington State Office Budget and Finance, Human Resources and Mobile GIS Specialists for support and guidance.

Oregon State University Oregon Sea Grant Extension and Portland State University provided training, support and guidance in the implementation of the invasive species monitoring protocol.

Summer field staff for assessing stream condition included: Nicholas Capuzzi, Hannah Ferguson, Jessica Il, Christian James, Bryan Keohane, Joseph Kren-

zelok, Daniel Lord, Colin Martin, Jack Murray, Morganne Price, Virginia Pritchard, Nicolette Ratz, Rosalee Reese, Cheyanne Rico, Stephen Staiger, Katherine Valentine and Alanna Wong.

Hydrologists and Fish Biologist from local FS, BLM and NPS units assisted with downloading thermographs throughout the NWFP area.

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Please visit our website for more information:

<http://www.reo.gov/monitoring/watershed-overview.shtml>

Appendix A—Watersheds Surveyed in 2017

Watersheds surveyed in 2017 with the number of sites surveyed in each watershed. Sites where quality assessment/quality control (QA/QC) were also conducted are denoted by (# sites). QA/QC sites are where a second independent crew returned to sample the same reach to determine variability in our measurements.

State	Province	Local Unit	6th Field HUC	6th Field HUC Name	Creek Code	COUNTY	Number Sites
CA,OR	Klamath/Siskiyou	Siskiyou	171003110302	DUNN CREEK	CADUN	Del Norte	6
CA	Klamath/Siskiyou	Shasta-Trinity	180102120205	GURLEY GULCH	CAGUR		6
CA	High Cascades	Stasta-Trinity	180200031301	POTEM CREEK	CAPTM	Shasta	5
CA	Klamath/Siskiyou	Klamath	180102090101	SOUTH FORK INDIAN CREEK	CASFI	Siskiyou	5
CA	Klamath/Siskiyou	Klamath	180102100404	SOMES CREEK	CASOM	Siskiyou	4
OR	High Cascades	Deschutes	170703010205	BROWNS CREEK	ORBWN	Deschutes	8
OR	Western Cascades	Umpqua	171003010808	BLITZEN FACIAL	ORBZF	Douglas	6
OR	Washington/Oregon Coast Range	Siskiyou	171003050203	ELK CREEK	OREKC	Coos	4
OR	Klamath/Siskiyou	Rogue River-Siskiyou	171003110801	FLORENCE CREEK	ORFLO	Josephine	5
OR	Western Cascades	Willamette	170900010201	UPPER HILLS CREEK	ORHIL	Lane	7
OR	Franciscan	Siskiyou	171003100602	ROGUE/ILLAHE	ORILL	Curry	6(1)
OR	Western Cascades	Willamette	170900050304	DETROIT RESERVOIR/KINNEY CREEK	ORKIN	Linn	4(1)
OR	Klamath/Siskiyou	Medford	171003070809	LITTLE BUTTE/LICK	ORLIK	Jackson	5
OR	Klamath/Siskiyou	Medford	171003110503	MC MULLIN CREEK	ORMCM	Josephine	7
OR	Western Cascades	Eugene	170900060205	OWL CREEK	OROWL	Linn	5
OR	Western Cascades	Roseburg	171003010602	PASS CREEK	ORPAS	Douglas	5
OR	Western Cascades	Mt. Hood	170900110205	POT CREEK	ORPOT	Clackamas	6
OR	Washington/Oregon Coast Range	Salem	171002050101	UPPER SOUTH FORK OF ALSEA RIVER	ORSFA	Benton	10(1)
OR	Klamath/Siskiyou	Roseburg	171003020503	STOUTS CREEK	ORSTO	Douglas	6
WA	Olympic Peninsula	Olympic NP	171001020403	GRAVES CREEK	WAGRV		4
WA	North Cascades	Mt. Baker-Snoqualmie	171100050705	LOWER BAKER LAKE	WALBL	Whatcom	5(3)
WA	North Cascades	Mt. Baker-Snoqualmie	171100050604	MIDDLE CASCADE RIVER	WAMCR	Skagit	6(4)
WA	North Cascades	Wenatchee	170200110201	UPPER NASON CREEK	WANAS		5
WA	High Cascades	Wenatche	170300020305	NORTH FORK TIETON RIVER	WANTI	Yakima	4
WA	Western Cascades	Mt. Baker-Snoqualmie	171100130102	UPPER GREEN RIVER/TWIN CAMP CREEK	WAUGN	King	7(2)