



Aquatic and Riparian Effectiveness Monitoring Program



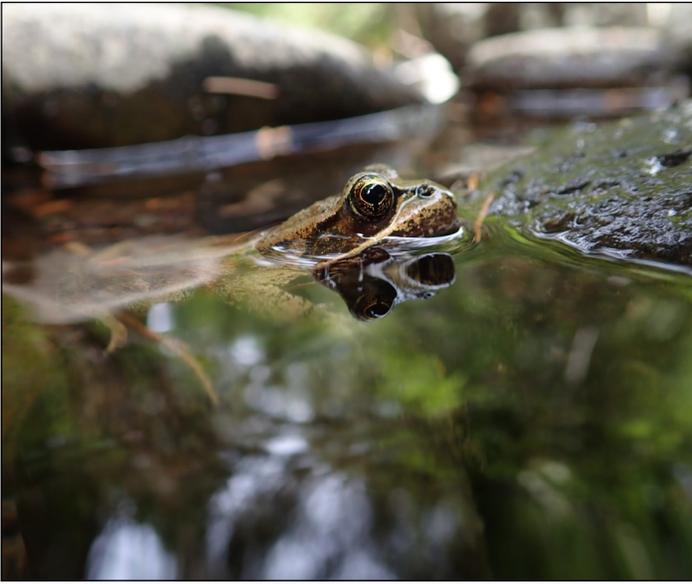
Interagency Monitoring Program – Northwest Forest Plan Area



2018 Annual Report

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Introduction



AREMP crews record and photograph amphibians observed during field surveys.

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 2018 (Oct. 2017-Sep.2018).

Accomplishments

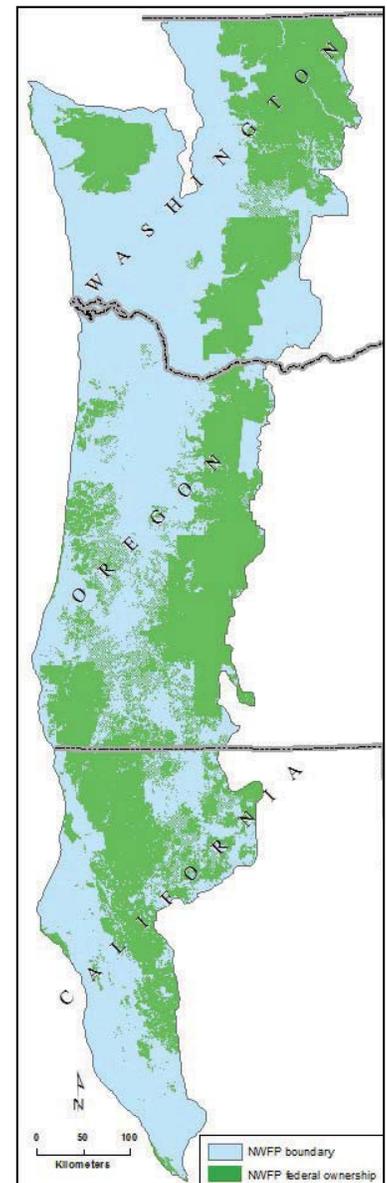
25-Year Report on Watershed Condition

The NWFP monitoring programs produce formal reports on a 5-year cycle, and the next report will add data from the period 2014-2018, marking 25 years since the initiation of the NWFP in 1994. Planning for the report continued with help from Jason Dunham (US Geological Survey), Rebecca Flitcroft

(Forest Service PNW Research Station), and Sean Gordon (Portland State University). 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 is providing GIS support following the retirement of GIS analyst Peter Eldred in January 2018.

The team is working on a synthesis of information for a number of the major watershed processes that AREMP addresses: sediment, channel geometry, large wood, macroinvertebrates and temperature. The synthesis will guide how we summarize and evaluate the data going into AREMP reports and help strengthen the relationships between our upslope riparian and inchannel analyses.

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



Status and Trend Sampling

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

Two hundred thirteen stream sites within 31 watersheds spread throughout the NWFP area were sampled during 2018 (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). Sixteen 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 2019 sites. Because we are adding three watersheds to our workload for 2019, we moved three watersheds from the 2019 rotation into 2018 to stay on schedule going forward.

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 performs aquatic invasive species searches. In 2018, AREMP crews surveyed 213 sites in 31 watersheds for aquatic invasive species throughout the field season (June through September). AREMP crews recorded 10 verified invasive detections. Only one of those verified detections came from this year’s list of high concern species, which was Himalayan blackberry (*Rubus armeniacus*) in Oregon. Reed canary grass (*Phalaris arundinacea*) was on the list in past years and was detected in three watersheds this summer. Other verified detections that were not on our list of high concern species were bull thistle (*Cirsium vulgare*), common foxglove (*Digitalis purpurea*), evergreen blackberry (*Rubus laciniatus Willd*), and English holly (*Ilex aquifolium*).

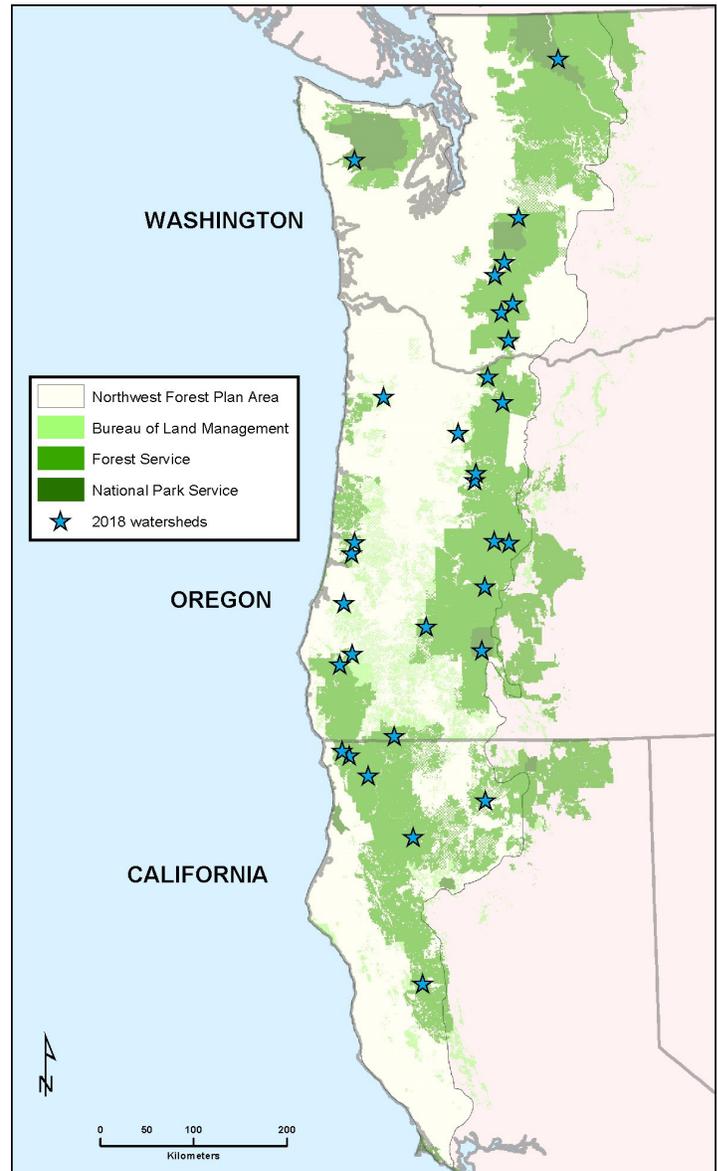


Figure 2. Map of the watersheds surveyed during the 2018 field season

Assisting Local Units & Regional Initiatives

NWFP Science Synthesis

Stephanie Miller (former team lead) and Sean Gordon (research associate) participated as co-authors on a chapter on aquatic and riparian 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 report was published in July 2018 and details can be found at: <https://www.fs.usda.gov/treearch/pubs/56335>

Outreach to Local Units

This year we coordinated field tours when AREMP crews surveyed on the Shasta Trinity NF, Six Rivers NF (fig. 3), and Mount Hood NF that were attended by District, Forest, and Regional Office Level Forest Service staff and BLM State Office staff. These events provided an excellent opportunity for AREMP staff and seasonal employees to engage with staff of the BLM and Forest Service to better understand how AREMP's monitoring assists the local units.

Planning and NEPA Support



AREMP Field Coordinator, Mark Raggon, describes sampling techniques to USFS and BLM Executives from the USFS R6 Regional Office and BLM Oregon State Office during a field trip to the Bull Run Watershed, OR.

The 2012 USFS Planning Rule, which provides the procedures to be used in revising national forest plans, calls for the development of both forest-level and regional-scale monitoring strategies. Even forests not yet under revision (the case for Region 6 Westside forests in the NW Forest Plan area), were required to develop strategies within 4 years ("or as soon as practicable"). These plans are still in development, but direction from the Regional Forester cited AREMP data as an example of broad-scale monitoring data, which should be integrated into this pro-

cess. AREMP summarized our data for use in pilot reports being created by the Mt. Hood, Gifford Pinchot and Willamette National Forests.

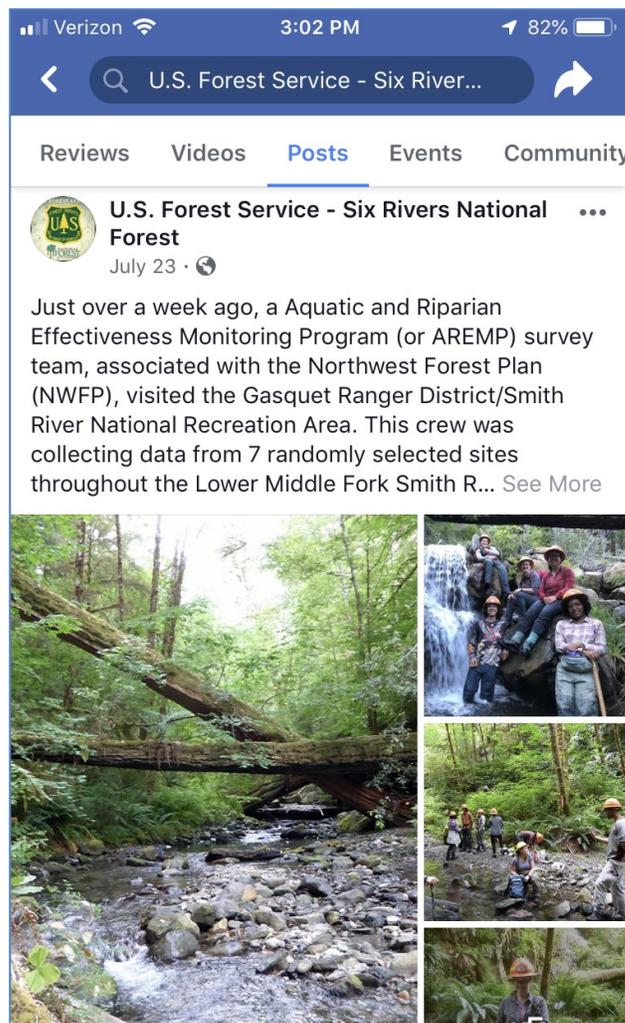


Figure 3. Snapshot of Facebook post by the Six Rivers National Forest highlighting an AREMP crew surveying on the Gasquet Ranger District.

AREMP continued our partnership with USFS Pacific Northwest Regional Office, BLM Oregon State Office, and US Geological Survey (USGS) Forest 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.

Stream Temperature Monitoring



Temperature sensor attached to a boulder with epoxy and a cable.

In 2018, AREMP continued to work with local Forest Service and BLM personnel for assistance with downloading thermographs. AREMP visited 68 watersheds to download and deploy sensors and specialists from local units visited 41 watersheds for a total of 109 watersheds visited.

During the 2019 field season we will continue to replace temperature sensors that were originally deployed during the 2011 field season as their battery life comes to an end. We plan to replace units with the Onset HOBO Tidbit MX2203 temperature sensors which have replaceable batteries and can detect when the unit is out of the water. Data from these sensors can be downloaded with a tablet or smart phone, negating the need to use a shuttle device from Onset for downloading. This will hopefully reduce download errors and equipment failure in the field and make it easier to tell when (if) a stream is dry.

In 2019, we will conduct a review of current temperature sensor locations in the Forest Service AqS Stream Temperature database to locate stream temperature monitoring sites that potentially overlap with AREMP monitoring sites to enable data sharing and decrease redundancy. Additionally, we hope to identify temperature sensor locations in California that overlap with AREMP monitoring sites with the ultimate goal of expanding our year-round temperature monitoring to California. Cur-

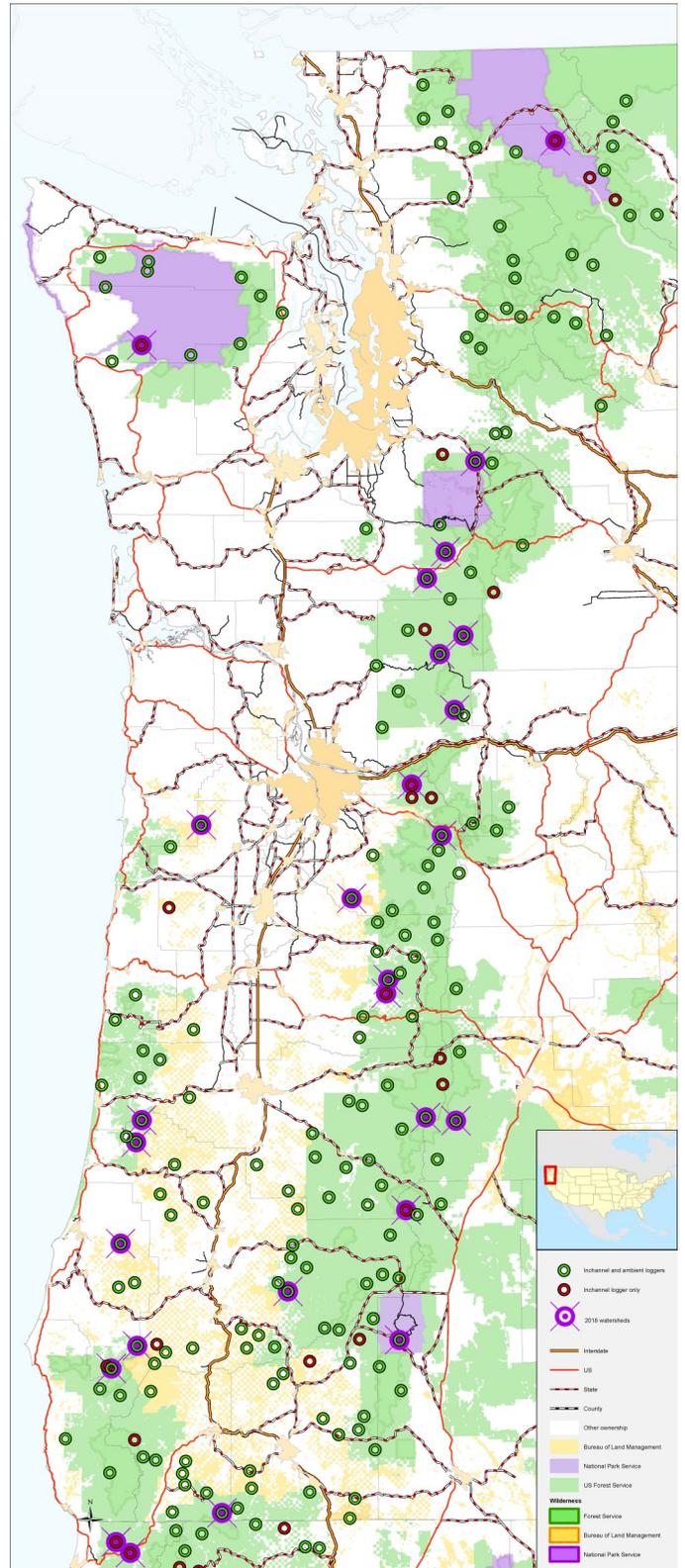


Figure 3. Location of instream and air temperature sensors placed by AREMP in the Northwest Forest Plan area of Oregon and Washington. The purple bull's eye represents watersheds surveyed for stream condition by AREMP in 2018. The green circle designates AREMP watersheds with a stream-side and upslope air sensor. The red circle depicts AREMP watersheds with an instream sensor.

rently these temperature sensors are placed at the beginning of the field season (spring) and removed in the fall during years the watershed is surveyed (about eight years). As time allows, we would also like to reduce redundancy with local units at BLM and NPS sites.

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. In 2018 AREMP utilized our end-of-season staff to collect data at sites identified by the forests highlighted below.

- **Mt. Hood National Forest:** AREMP visited 21 diversion sites, 13 had some type of diversion structure while at 8 sites no diversion was found. No diversions were flagged as needing more attention. Crayfish were found entrained in a barrel structure at one site.
- **Wallowa-Whitman National Forest:** AREMP visited 27 diversion sites, 20 had some type of diversion structure while at 7 sites no diversion was found. Fish were found entrained at three sites and upstream of the diversion structure on two sites with entrainment potential.
- **Umatilla National Forest:** AREMP visited 9 diversion sites, only 3 had some type of diversion structure while at 6 sites no diversion was found. No diversions were flagged as needing more attention. Fish were found to be entrained at one site.

Culvert Surveys

AREMP staff have been working with individual Forests and BLM units to update the fish barrier layers in preparation for the upcoming 25 year report. Last spring, there were 247 no data culverts on fish bearing streams within the Region 6 GIS culvert layer within the AREMP footprint. We were able to



Crew Leader Erika Winner and her crew conduct a culvert survey on Coos Bay District BLM lands, OR.

update the information on 67 sites through discussions with local units and additional sites were surveyed by AREMP crews (33 sites) and local crews funded by AREMP (51 sites). In addition, AREMP crews surveyed 50 culverts on the BLM Coos Bay District to fill in unknowns in the BLM barrier layer.

One AREMP crew surveyed 8 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/>.

Beaver Habitat Surveys

AREMP provided three crew members and surveying equipment for this project to help understand the distribution and influence of beaver dams on water quality and storage in the Umpqua River Basin, OR. The work is being done as part of a PhD dissertation research by a graduate student at Oregon State University and is supported by the U.S. APHIS, National

Wildlife Research Center, U.S. Geological Survey Forest and Rangeland Ecosystem Science, and members of the Umpqua Beaver Working Group, including U.S. Fish and Wildlife Service and the U.S. Bureau of Land Management, Medford and Roseburg Districts. Work began in 2018 with surveys of dam presence and beaver activity across the basin and pilot monitoring of stream temperature at select beaver dam sites. Expanded water quality and quantity monitoring is expected to occur for the summer of 2019.

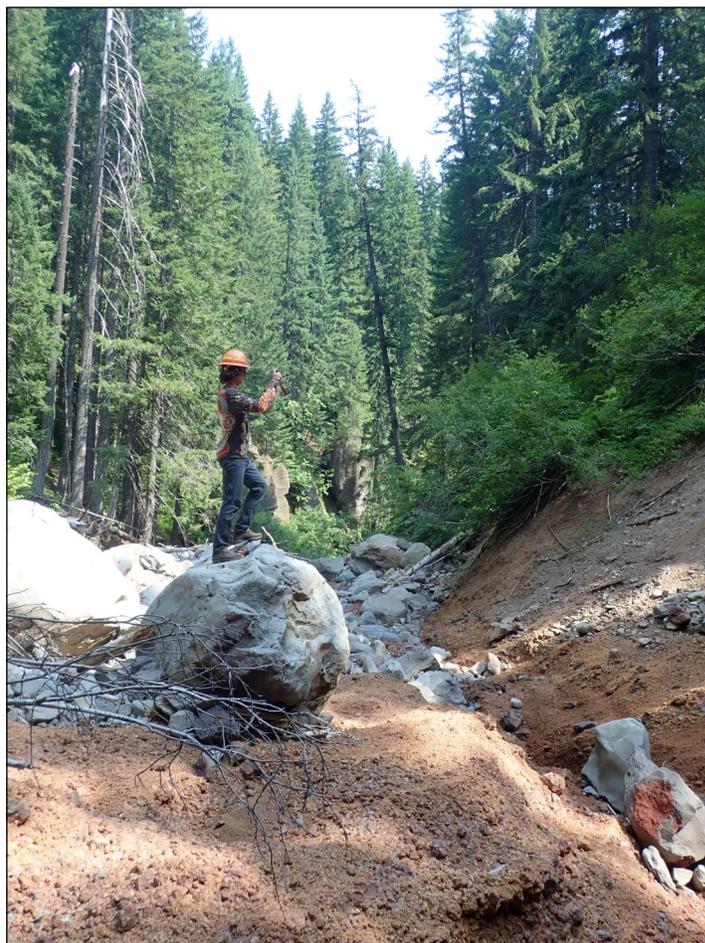
Program updates

Employment

We employed six year-round employees who were a combination of permanent and year-round "term" employees. Christine Hirsch officially became the Program Lead after detailing into the position over the last year. Our GIS Analyst, Peter Eldred, retired in January 2018. He began his career at AREMP in 2002. Nineteen BLM employees were hired as crew members between May - October; they were a combination of seasonal employees and interns. AREMP Summer employment information is posted at: <https://www.fs.fed.us/r6/reo/monitoring/watershed/employment/>

Youth Hires

AREMP hired 19 youth employees (under age 35) to assist with field sampling in 2018. Youth hires included 7 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.



Crew member Morgan Holland stands atop a boulder for photographic documentation of a stream survey site in the Lava Creek watershed, Gifford Pinchot National Forest., WA.

In 2018, AREMP hosted two additional interns using the Department of Interior Direct Hiring Authority (DHA) for Resource Assistants Internship Program. The program is a direct hiring initiative through which the BLM develops 11-week rigorous summer internship opportunities for current college students or recent graduates (within six months of graduation date), with particular attention given to ensure full representation of women and participants from historically Black, Hispanic, Asian Pacific Islander and Native American Schools or other schools with diverse student populations. After students complete the 11-week internship and graduate from their degree program, they are eligible for direct hire and can be appointed non-competitively to a career conditional permanent position within the BLM or other land managing agency such as the National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs and the Bureau of Reclamation. The direct hire au-

thority can be used for two-years beginning on the date the participant completes their degree requirements. For more information on this program please visit: <https://www.blm.gov/careers/students-and-grads/direct-hire-program>.

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 auto-injectors, annual defensive driver training to operate federal vehicles, a ride-along for crew members with BLM safety officers to practice driving on gravel roads, and a “right-to-know” training which covers all the potentially hazardous chemicals they may come into contact with such as ethanol for preserving samples and Virkon to disinfect waders and wading boots.



A yellow site marker lets crews know they are on site, Bull Run watershed, OR.

Presentations

Hirsch, Chris. 2017 (December 12). The Use of Remote Sensing and GIS data in The NW Forest Plan Aquatic Assessment. American Geophysical Union National Meeting, New Orleans, LA.

Hirsch, Chris. 2018 (April 11). AREMP Study Plan and invitation to participate. USFS R6 2018 Fish and Watershed Program Managers Meeting, Lincoln City, OR.

Hirsch, Chris. 2018 (April 24). AREMP Study Plan and invitation to participate. OR/WA BLM Aquatics, Soil, Air Annual Training. Welches, OR.

Hirsch, Chris.; Flitcroft, Rebecca.; Dunham, Jason. 2018 (May 8). Region 5 NWFP Forests webinar.

Hirsch, Chris.; Raggon, Mark. 2018 (July 12). Field Tour on the Shasta-Trinity National Forest.

Hirsch, Chris.; Raggon, Mark. 2018 (July 13). Field Tour on the Six Rivers National Forest.

Hirsch, Chris.; Andersen, Heidi. 2018 (August 24). Field Tour on the Mt Hood National Forest.

Hirsch, Chris.; Raggon, Mark. 2018 (September 7). Executive Field Tour in the Bull Run watershed on the Mt Hood National Forest.

Publications

Reeves, Gordon H.; Olson, Deanna H.; Wondzell, Steven M.; Bisson, Peter A.; Gordon, Sean; Miller, Stephanie A.; Long, Jonathan W.; Furniss, Michael J. 2018. Chapter 7: The aquatic conservation strategy of the northwest forest plan—A review of the relevant science after 23 years. In: Spies, T.A.; Stine, P.A.; Gravenmier, R.; Long, J.W.; Reilly, M.J., tech. coords. 2018. Synthesis of science to inform land management within the Northwest Forest Plan area. Gen. Tech. Rep. PNW-GTR-966. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 461-624. [[link](#)]

Literature Cited

Clarkin, K.; Connor, A.; Furniss, M.J.; Gubernick, B.; Love, M.; Moynan, K.; Wilson Musser, S. 2005. National Inventory and Assessment Procedure—For identifying barriers to aquatic organism passage at road-stream crossings: USDA Forest Service, National Technology and Development Program, 7700—Transportation Management.

Acknowledgements

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Teresa Kubo (EPA) and Kim Kratz (NOAA) for continued AREMP interagency support and guidance.

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: Ellie Diggins, Matthew Bouffard, Brian Knees, Sabina Hagen-Botbol, Emily Heaston, Chisara Iwuchukwu, Chuck Williams, Morgan Holland, Christina Linkem, Peter Adler, Victor Cortes, Autumn Gibson, Erika Winner, Linda Xiong, Ben McClellan, Ahmeer Majied, Halie Hajek, James Stockdale, Anna Freedman-Peel, Rosalee Reese 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:

<https://www.fs.fed.us/r6/reo/monitoring/watershed/>



Appendix A—Watersheds Surveyed in 2018

Watersheds surveyed in 2018 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	High Cascades	Shasta-Trinity	180200040102	Upper Ash Creek	CAASH	Siskiyou	8
CA	Klamath/Siskiyou	Klamath	180102090501	North Fork Dillon Creek	CAJAK	Klamath	6
CA,OR	Klamath/Siskiyou	Six Rivers	180101010104	Lower North Fork Smith River	CAPER	Del Norte	6
CA	Klamath/Siskiyou	Six Rivers	180101010204	Lower Middle Fork Smith River	CASHY	Del Norte	7
CA	Klamath/Siskiyou	Klamath	180102100104	Garden Gulch-South Fork Salmon River	CASMV	Siskiyou Glenn/Mendocino/ Lake	6
CA	Klamath/Siskiyou	Mendocino	180101040103	Baldy Creek-Black Butte River	CAUBB		4
OR	Western Cascades	Mt. Hood	170800010503	Middle Bull Run River	ORBUL	Multnomah	6
OR	Western Cascades	Umpqua	171003020302	Dumont Creek	ORDMT	Douglas	6(1)
OR	High Cascades	Crater Lake NP	180102030101	East Fork Annie Creek	OREFA	Klamath	8(2)
OR	Washington/Oregon Coast Range	Rogue River-Siskiyou	171003050201	Headwaters South Fork Coquille River	ORHSC	Coos	7
OR	Washington/Oregon Coast Range	Coos Bay BLM	171003050401	Moon Creek-North Fork Coquille River	ORNCQ	Coos	6
OR	Washington/Oregon Coast Range	Salem BLM	171002030201	Headwaters Nestucca River	ORNES	Yamhill	7
OR	Washington/Oregon Coast Range	Siuslaw	171003030705	Upper North Fork Smith River	ORNFS	Douglas	6
OR	Western Cascades	Willamette	170900060301	Headwaters Quartzville Creek	ORQTZ	Linn	7
CA,OR	Klamath/Siskiyou	Rogue River-Siskiyou	171003090106	Steve Fork Carberry Creek	ORSFC	Josephine/Jackson	8
OR	Western Cascades	Willamette	170900040301	Elk Creek-South Fork McKenzie River	ORSFM	Lane	7
OR	High Cascades	Deschutes	170703010104	Snow Creek-Deschutes River	ORSNW	Deschutes	8
OR	Western Cascades	Mt. Hood	170800010201	Still Creek	ORSTL	Clackamas	7(7)
OR	High Cascades	Deschutes	170703020203	Summit Lake	ORSUM	Klamath	8
OR	Western Cascades	Willamette	170900060103	Donaca Creek-Middle Santiam River	ORSX2	Linn	7(1)
OR	Washington/Oregon Coast Range	Coos Bay BLM	171003030704	Spencer Creek-Smith River	ORULS	Douglas	5
OR	Western Cascades	Salem BLM	170900090403	Pine Creek Molalla River	ORUMR	Clackamas	8
OR	Washington/Oregon Coast Range	Medford BLM	171003020801	Wilson Creek-West Fork Cow Creek	ORUWC	Coos	7(1)
WA	Western Cascades	Gifford Pinchot	170800020106	Tillicum Creek-Lewis River	WAALC	Skamania	7
WA	Western Cascades	Gifford Pinchot	170701050902	Lava Creek	WABLB	Skamania	7(3)
WA	North Cascades	NP	171100050401	Fisher Creek	WAFSR	Skagit	4
WA	Olympic Peninsula	Olympic	171001020205	Sams River	WASAM	Jefferson	4
WA	Western Cascades	Gifford Pinchot	170800040507	Siler Creek	WASIL	Lewis	7
WA	Western Cascades	Gifford Pinchot	170800020103	Twin Falls Creek-Lewis River	WATWN	Skamania	5(1)
WA	Western Cascades	Mt. Baker-Snoqualmie	171100140307	Silver Creek-White River	WAUWS	Pierce	6
WA	Western Cascades	Gifford Pinchot	170800040502	Willame Creek	WAWIL	Lewis	7