ANNUAL REPORT

July 1, 2018–June 30, 2019

Washington Cooperative Fish and Wildlife Research Unit

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Cover photo: Mark Sorel

Message from the Unit Leader

In the past year, we've seen lots of new faces around the WACFWRU. We have 4 new members of the Cooperator's Board (see "Cooperator's Board Member News"), my own research lab has grown substantially (now at 5 students and 3 post-doctoral scientists), and—best of all—we hired our new Assistant Unit Leader–Fisheries. In last year's annual report, I anticipated having a new AUL in place by the time I wrote this message. I'm happy to say that with a lot of hard work by our search committee, we were able to get it done.

In May, we welcomed Dr. Mark Scheuerell to the WACFWRU. Mark received his PhD in Zoology from University of Washington, and then spent 16 years just across the Montlake Cut at the NOAA Northwest Fisheries Science Center, where he built a stellar record as a fisheries ecologist with serious quantitative chops. Mark knows Washington—and the School of Aquatic and Fishery Sciences (SAFS), UW, where he is now an Associate Professor—well, which has allowed him to hit the ground running. I'm thrilled that Mark has joined us, and I'm looking forward to great things as his research program gets into gear. I want to acknowledge the work of our board members, along with Julian Olden (Professor, SAFS, UW), Phil Levin (Professor, School of Environmental and Forest Sciences, SEFS, UW), Lisa Shipley (Professor, School of the Environment, WSU), Caitlin Akselrud (PhD student, SAFS, UW), and Clint Robins (PhD student, SEFS, UW) for their work on the search committee.

Even with the time invested in the AUL search, and the longest government shutdown in U.S. history in December/January, we were able to make progress on other priorities. In last year's annual report, I laid out 3: ensuring our Sustainability, increasing our Connection, and serving our Community. Ensuring our Sustainability is all about the internal workings of the WACFWRU – making sure we're set up for success. Mark has been working to organize our boats, equipment, and storage space; we've continued to look for ways to streamline administrative functions; and we've continued our annual efforts to track student data. This year, WACFWRU projects provided 59 academic quarters/21 summers of student funding at UW, and 4 academic semesters/5 summers of student funding at WSU. This is a substantial increase over 2017–2018 (34/16 at UW and 6/5 at WSU). Its good to have the numbers to confirm that, in this aspect of our mission, we're having a real impact.

Increasing our Connection is about our role in bringing together agencies and university scientists. We put several improvements in place in 2017–2018 that we continued to build on this year: we've worked to improve communication with university investigators, continued development of our university website (https://depts.washington.edu/wacfwru/), and produced this second consecutive annual report. We are also growing our Annual Graduate Student Symposium: by switching the 2019 Symposium to lightning talks, we're encouraging more students to present their research.

In Serving our Community, we aim to improve the sense of community around fish and wildlife research and conservation, especially at our universities. The big effort this year was the kick-off of our new UW Fish and Wildlife Ecology seminar series. This is a student-run and WACFWRU-sponsored seminar series that is jointly organized by graduate labs in SEFS and SAFS. This year, my lab teamed up with Aaron Wirsing's lab, and we had two quarters of excellent seminars. My thanks to the students who made it happen. Watch depts.washington.edu/wacfwru/category/seminar-series/ for the 2019–2020 lineup (which will be organized by Beth Gardner's and Daniel Schindler's labs), and check out past seminars on our Vimeo page: https://vimeo.com/fwecosem.

My thanks to everyone who continues to support the WACFWRU and ensure our success, especially our Cooperator's Board members, and the excellent students, faculty, and agency professionals who make the important research happen. We're looking forward to another productive year.

Sarah Converse, *Seattle, September 29, 2018*

Message from the Assistant Unit Leader—Fisheries

Greetings!

This past May I began serving as the WACFWRU Assistant Unit Leader for Fisheries after 16 years at NOAA's Northwest Fisheries Science Center. I am both excited and humbled by the opportunity to further develop my research program, mentor students, and serve the needs of stakeholders throughout Washington and the Pacific Northwest.

Sarah has skillfully guided the Unit through a period of change and growth over the past two years, which has made my transition as smooth as possible. I am grateful for her leadership and I look forward to working alongside her as we move forward.

Last year Sarah wrote about the importance of sustaining the Unit into the future, increasing our connections with scientists and stakeholders, and serving our community. I also share her vision for the Unit as a vibrant nexus of research and communication. As such, in the coming year I will be exploring new research options, recruiting graduate students, and teaching a new course at UW on environmental data science. I have been busy these past few months familiarizing myself with the people, policies, and procedures at USGS and UW. I've also had the pleasure of chatting with a number of scientists from our cooperating agencies, local tribes, academia, and private business about research and outreach opportunities.

One of the aspects that drew me to this position was the chance to get my hands and feet wet again. Although much of my recent research has focused on the analysis of data, I have always appreciated the insights to be gained from empirical, field-based research. Therefore, I expect to develop a research program focused on Pacific salmon and the ecosystems they inhabit, working in collaboration with many of you. I also anticipate working on a number of other statewide issues, such as the increasing predatory roles of nonnative, warm water fishes like bass and northern pike.

I am originally from Minnesota, but I have considered Washington my home since I moved here in 1997 to begin graduate school at UW. My wife was born and raised in Bremerton and our two daughters were born here in Seattle. My family enjoys spending time outdoors and I am extremely fortunate to have a job that allows me to directly experience the many natural wonders around us. With any luck, I'll get a chance to see you out there as well, whether at work or play.

Mark Scheuerell, Seattle, *September 3, 2019*

Unit Award Recipients

The Gilbert B. Pauley Award—2018

Awarded annually for best student presentation at the Annual Student Symposium

Taylor Ganz, School of Environmental and Forest Sciences, University of Washington; advised by Dr. Laura Prugh

The John Pierce Outstanding Graduate Student Award—2018

Awarded annually to the graduate student who best embodies the spirit and mission of the WACFWRU

Sarah Bassing, School of Environmental and Forest Sciences, University of Washington; advised by Dr. Beth Gardner

Photos: above: Dan DiNicola; below: iStock.com/JeffGoulden

above, left: Taylor Ganz presents her Pauley-award winning seminar, Washington's predator-prey project: patterns of mortality in ungulates of northern Washington, at the 2018 WACFWRU Annual Student Symposium.

above, right: Sarah Bassing accepts the inaugural John D. Pierce Outstanding Graduate Student Award. Pictured (l-r): Beth Gardner, Sarah Bassing, Ms. Donna Pierce-Gjeldum (sister of John Pierce, former WACFWRU Board member), and Sarah Converse.

Cooperator's Board Member News

The Cooperator's Board is composed of representatives from each of the WACFWRU's Cooperators. Check the back cover of this report for Board member names and contact information. This year we welcomed four new members.

In October 2018, we welcomed Dr. Jerry Nelson to the Board, when Jerry took the position of Science Division Manager in the Washington Department of Fish and Wildlife (WDFW) Wildlife Program. Jerry has a PhD in Zoology from North Carolina State University. For the past 18+ years he has worked for WDFW, with the majority of that time spent as the Deer and Elk Section Manager. Jerry is looking forward to facilitating work between WDFW and WACFWRU on a variety of terrestrial and marine endeavors with a strong priority on exploring research questions that have tangible, management implications. A year ago, Dr. Matthew Vander Haegen was serving on the Board in an interim position, following the death of Mr. John Pierce in February 2018. Our thanks to Matt for stepping in and maintaining our close connection to WDFW.

Dr. Joshua Halofsky joined the Board in autumn 2018 as the representative for the Washington Department of Natural Resources (WDNR). Josh received his PhD in Forest–Wildlife Interaction from Oregon State University. Since becoming a Natural Resource Scientist with WDNR 13 years ago, Josh has been examining trade-offs in forest-related values, and how disturbances, including climate change and management, influence the sustainability of those values. As a new WACFWRU member, Josh is interested in fostering connections between DNR and other state agencies, the USGS, and the broader UW and WSU communities. Josh took over for Dr. Richard Bigley, who retired at the end of 2018 after 30 years with WDNR and 19 years on the Board. Richard is now dedicating his time to home projects, sailing, and traveling the world with his wife, Sabra. Our best wishes go out to Richard in his retirement.

Dr. James Unsworth joined the Board in February 2019, when he started his new role as Assistant Regional Director–Science Applications, USFWS Region 1. Jim has had a long and distinguished career in wildlife management. From 2015–2018 he served as the Director of the Washington Department of Fish and Wildlife. Prior to his move to Washington, Jim spent 30 years working for Idaho Fish and Game. Jim is looking forward to working with the Washington Cooperative Research Unit and other CRUs in the Pacific Region to support graduate education and science projects targeting at-risk-species and landscape ecology. Jim has a PhD in Forestry, Wildlife and Range Sciences from University of Idaho. Jim's addition to the Board follows the interim roles of Dr. Steve Morey and Ms. Deanna Spooner, who stepped in after the departure of Mr. Paul Heimowitz in June 2018. Paul had served on the Board for 10 years. Paul continues his work at USFWS Region 1, where he is now focused on invasive species. Our thanks to Steve, Deanna, and especially to Paul.

Dr. Annette Hoffmann joined the board in summer 2019. Annette represents the Washington Department of Ecology (WDoE), where she recently took the position of Environmental Assessment Program Manager. Annette received her PhD in Biostatistics–Quantitative Ecology and Resource Management from University of Washington. Previously, Annette spent 24 years working for the WDFW as both a biometrician and as a regional program manager where she applied her scientific background to managing fisheries and fish hatcheries. Annette is looking forward to using her expertise and experience to guide applied fish and wildlife science with research that is responsive to management needs. Annette took the place of Dr. Carol Smith. Carol, after 4 years with WDoE and the WACFWRU Board, moved to a new position as Executive Director for the Washington State Conservation Commission. Notably, Carol serves as the first woman Executive Director of the WSCC in its 80-year history. Our sincere congratulations and best wishes to Carol.

Finally, Dr. Lisa Shipley will be taking a role on the Board, where she will share responsibility for representing the School of the Environment at Washington State University with Dr. Kent Keller. Lisa is no stranger to the WACFWRU, having collaborated with WDFW for many years through WACFWRU-facilitated projects. Lisa received her PhD in Wildlife and Fisheries Sciences from Texas A&M University and has served on the faculty at WSU since 1997, where she is a Professor in the School of the Environment.

Annual Student Symposium

The 2018 WACFWRU Annual Student Symposium was held in conjunction with the WACFWRU annual meeting on October 17 at the Center for Urban Horticulture on the University of Washington campus. The full lineup included:

Photo: SolomonCrowe/iStock/Thinkstock/

WASHINGTON COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT

WACFWRU

Annual Student Symposium

Wednesday, October 17, 2018

Center for Urban Horticulture, 3501 NE 41st St, Seattle, WA 98105

depts.washington.edu/qcons/wacfwru-2018/

2:00 pm **Welcome**
Sarah Converse, *Unit Leader, Washington Cooperative Fish and Wildlife Research Unit*
Dan Brown, *School of Environmental and Forest Sciences, UW*

2:15 pm **Snowshoe hare population ecology in lynx-occupied areas of Washington**
Paul Jensen, *School of the Environment, Washington State University*

2:33 pm **Washington State Common Loons: multi-state occupancy modeling using citizen science and survey data**
Hannah Sipe, *Quantitative Ecology and Resource Management Graduate Program, UW*

2:51 pm **Are fish processing plants reservoirs for disease?**
Catrin Wendt, *School of Aquatic and Fishery Sciences, UW*

3:09 pm **Evaluating geochemical tracers in fish fin rays: a non-lethal approach for threatened species**
Michaela Lowe, *School of Aquatic and Fishery Sciences, UW*

3:27 pm **Determining patterns of change in Chinook spawning timing in the Skagit River Basin**
Catherine Austin, *School of Aquatic and Fishery Sciences, UW*

3:45 pm **Quantitative diet reconstruction: food webs supporting juvenile suckers in the Upper Klamath Basin**
Erin Horn, *Department of Civil and Environmental Engineering, UW*

4:03 pm **Washington's predator-prey project: patterns of mortality in ungulates of northern Washington**
Taylor Ganz, *School of Environmental and Forest Sciences, UW*

4:21 pm **Washington's predator-prey project: species co-occurrence across a human-dominated landscape**
Sarah Bassing, *School of Environmental and Forest Sciences, UW*

4:40 pm **Presentation of awards**
Sarah Converse, *Unit Leader, Washington Cooperative Fish and Wildlife Research Unit,*
Eric Gardner, *Assistant Director, Washington Department of Fish and Wildlife*

▶ **For More Information:** Verna Blackhurst, 206-221-5424, vernab@uw.edu

USGS science for a changing world · W · U.S. Fish & Wildlife Service · Washington Department of Fish and Wildlife · Wildlife Management Institute · Washington Department of Natural Resources · Department of Ecology State of Washington

Research Projects

The WACFWRU is pleased to have facilitated $5,992,184 in funding in 2018–2019 ($1,281,244 in new dollars and $4,710,940 in continuing dollars). The WACFWRU Unit Leader and cooperating faculty at UW and WSU worked with 5 different federal agencies in addition to our 3 state cooperating agencies. All funded projects in the WACFWRU Unit Leader's research group are listed by funder, including project title and dates, with student and post-doc support listed below the project title. For cooperating faculty, projects are listed by university and funder, including project title, principal investigator, department, and project dates, along with student and post-doc support.

Sarah Converse, WACFWRU Unit Leader

National Oceanic and Atmospheric Administration

- Integrating data sources to characterize demographic responses of Columbia River salmon and steelhead to threats and management actions; October 2019–May 2023
  Mark Sorel, *PhD student*

U.S. Geological Survey

- Restoration tools for Oregon silverspot butterfly; May 2018–September 2020
  Cassandra Doll, *MS student (advised at Washington State University by co-PI Cheryl Schultz)*

Department of the Navy – Joint Region Marianas

- Evaluating and mitigating the effects of brown treesnakes on Guam's birds; February 2019–January 2023
  Staci Amburgey, *Post-doctoral fellow*

Washington Department of Fish and Wildlife

- Understanding Common Loon distribution and abundance in Washington; May 2018–June 2019
  Hannah Sipe, *MS student*

North Pacific Research Board

- Integrated abundance and movement models for marine mammals, September 2018–March 2020
  Nathan Hostetter, *Post-doctoral fellow*

Other

- Integrated population modeling for evaluating status and effects of management actions in Streaked Horned Larks, June 2019–2023
  Abby Bratt, *MS student (supported by College of the Environment Graduate Research Opportunity Enhancement Program)*
- Integrated population models that account for the effects of environmental variability on abundance and demographic rates for species with complex life histories, September 2018–2022
  Amanda Warlick, *PhD student (supported by National Science Foundation Graduate Research Fellowship)*
- Synchrony of seabird survival, March 2017–2020
  Martina Kadin, *Post-doctoral fellow (supported by Swedish Academy of Sciences*)

Cooperating Faculty, University of Washington

National Oceanic and Atmospheric Administration

- To monitor the health and status of abalone populations in southern California: an examination of Withering Syndrome pathogen prevalence and future risk, March 2019–March 2020
  PI: Carolyn Friedman, *School of Aquatic and Fishery Sciences*
  Kahana Pietsch, *undergraduate student*

- Rockfish remotely operated vehicle—Mathematics, Engineering, Science Achievement (MESA) video review, July 2018–September 2020
  PI: Terryl Ross, *College of the Environment*
  Melinda Car, *undergraduate student*

Bureau of Reclamation

- Quantitative diet reconstruction of the food webs supporting juvenile suckers in the Upper Klamath Basin using fatty acid based mixing models, August 2017–September 2019
  PI: Michael Brett, *Civil and Environmental Engineering*
  Henk Ufkes, *undergraduate student*
  Evan Ponto, *undergraduate student*

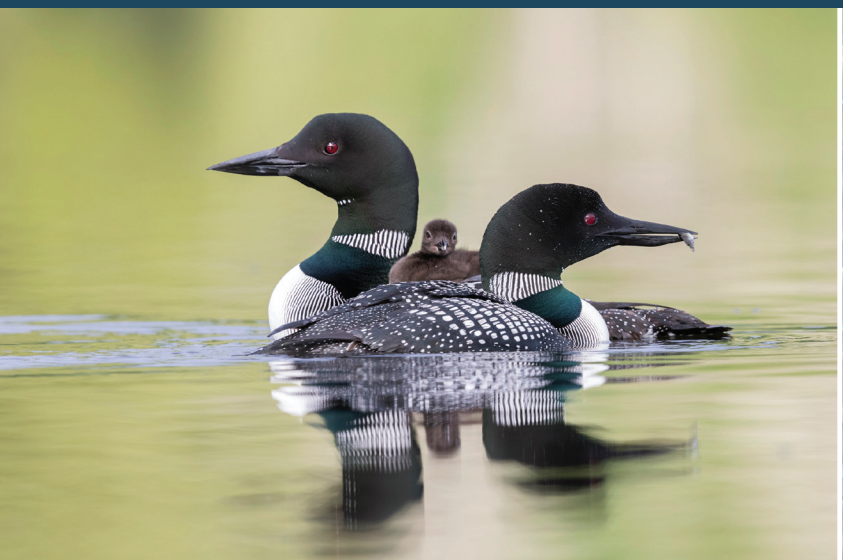
U.S. Fish and Wildlife Service

- Population assessment of Wrangel Island Snow Geese using satellite imagery-Phase 2, March 2015–March 2020
  PI: Christian Grue, *School of Aquatic and fishery Sciences*

- Adaptation of Infectious Haematopoietic Necrosis (IHN) virus to Pacific Northwest Chinook salmon and impacts on other salmonids, August 2016–September 2021
  PI: Kerry Naish, *School of Aquatic and Fishery Science*
  Daniel Hernandez, *PhD student*

- Lateral and longitudinal occupancy of Chehalis floodplain habitats to guide restoration and conservation, October 2018–September 2020
  PI: Julian Olden, *School of Aquatic and Fishery Sciences*
  Thiago Couto, *PhD student*

Photos, above: Cheryl Schultz; below, l to r: iStock/BrianLasenby, Eric Regehr



- Inferring habitat use and migratory behavior of bull trout in the White River using microchemistry, October 2017–September 2020
  PI: Daniel Schindler, *School of Aquatic and Fishery Sciences*
  Michaela Lowe, *MS student*

- Evaluating environmental DNA technology to streamline protection of anadromous habitat, March 2019–September 2019
  PI: Daniel Schindler, *School of Aquatic and Fishery Sciences*
  Sarah O'Neal, *PhD student*

U.S. Geological Survey

- Tracing the age of wetland and aquatic carbon emissions across northern latitudes, March 2019–September 2020
  PI: David Butman, *School of Environmental and Forest* Sciences
  Matthew Bogard, *Post-doctoral fellow*

- Transgenerational impacts of endocrine disrupting chemicals on innate immunity, September 2017–August 2020
  PI: Ram Savan, *Department of Immunology*
  Matthew Hendricks, *Post-doctoral fellow*

- Ichthyophonus in Pacific herring, January 2017–January 2022
  PI: Chelsea Wood, *School of Aquatic and Fishery Sciences*
  Catrin Wendt, *MS student*

Sea Grant

- An ecosystem modeling approach to investigate direct and indirect effects of geoduck aquaculture expansion in Washington State, February 2014–August 2019
  PIs: Glenn VanBlaricom, *School of Aquatic and Fishery Sciences;* Patrick Sean McDonald, *Program on the Environment*

Washington Department of Fish and Wildlife

- Ungulate-predator dynamics in northern Washington, July 2016–June 2021
  PIs: Beth Gardner/Laura Prugh/Aaron Wirsing, *School of Environmental and Forest Sciences*
  Sarah Bassing, *PhD student (Gardner)*; Taylor Ganz, *PhD student (Prugh)*; Lauren Satterfield, *PhD student (Wirsing)*

- Crab Team: European green crab early detection and monitoring November 2018–December 2018
  PI: Kate Litle, *Washington Sea Grant*
  Kelly Martin, *MS student*

- Crab Team: European green crab early detection and monitoring, Phase 2, February 2019–June 2019
  PI: Kate Litle, *Washington Sea Grant*
  Kelly Martin, *MS student*

- Shoreline monitoring toolbox—protocol implementation and data management, January 2018–January 2020
  PI: Kate Litle, *Washington Sea Grant*

Photos: Mark Sorel

Program in the Spotlight

A population model for listed salmonids in the Interior Columbia River Basin

Principal Investigator:	Sarah Converse, Washington Cooperative Fish and Wildlife Research Unit, University of Washington
Personnel:	Mark Sorel, PhD student
Funder:	National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center
Partners:	National Oceanographic and Atmospheric Administration, Washington Department of Fish and Wildlife, Yakama Nation, Grant and Chelan County Public Utilities Districts

Within the Interior Columbia River Basin there are three Evolutionarily Significant Units of Chinook salmon and three Distinct Population Segments of steelhead trout listed under the U.S. Endangered Species Act. These populations remain at low abundance due to degradation of spawning and juvenile rearing habitats and dams in their migration corridor, among other factors. Tools for recovery include restoration of spawning and rearing habitat, conservation hatcheries, predator control, and dam management to facilitate migration. However, these actions are expensive, and allocating resources with maximal efficiency will be necessary for salmon recovery. Therefore, information is required to understand how both management actions, coupled with the increasing threat of climate change, will influence population viability. To fill this need, we are developing an integrated population model. The model will be fit to spatio-temporal datasets including, 1) spawner abundance and juvenile productivity in freshwater, and 2) mark-recapture data on the survival of salmon throughout their life cycle. By fully utilizing the available datasets through integrated modeling, we can describe the uncertainties present in each dataset, while allowing information to be shared among them. The model will be capable of projecting the effects of actions affecting specific population processes, such as reproduction, on population viability. The model will be used to inform recovery plans and the allocation of resources among management actions to improve population outcomes.

- Skagit River Chinook spawning phenology and multispecies salmonid distribution, March 2018–June 2020
  PI: Tom Quinn, *School of Aquatic and Fishery Sciences*
  Catherine Austin, *PhD student*

- Improving preseason forecasts for U.S. coho salmon management units by accounting for spatially structured temporal variation in age-at-maturity,; March 2019–February 2020
  PI: Daniel Schindler, *School of Aquatic and Fishery Sciences*
  Lukas DeFilippo, *PhD student*

- Nonnative finfish marine aquaculture–Engrossed House Bill (EHB) 2957 implementation, December 2018– June 2020
  PI: James Seeb, *School of Aquatic and Fishery Sciences*

Washington Department of Natural Resources

- Washington State trails: the health benefits of nature; September 2018–June 30, 2019
  PI: Gregory Bratman, *School of Environmental and Forest Sciences*
  Sara Park Perrins, *PhD student*

- Long-term monitoring and focus studies in shoreline biota in Puget Sound, October 201–June 2019
  PI: Megan Dethier, *Department of Biology*

- Roads prescription scale effectiveness monitoring project, October 2017–December 2019
  PI: Erkan Istanbulluoglu, *Civil and Environmental Engineering*
  Amanda Manaster, *PhD student*
  Asif Mahmood, *undergraduate student*

- Landscape evaluations for 20-year plan, April 2018–June 2019
  PI: Van Kane, *School of Environmental and Forest Sciences*

- Riparian extensive vegetation monitoring, model transferability testing, April 2019–December 2019
  PI: Monika Moskal, *School of Environmental and Forest Sciences*

- Scoping an Extensive Riparian Monitoring Implementation Pilot Project, April 2019–December 2019
  PI: Monika Moskal, *School of Environmental and Forest Sciences*

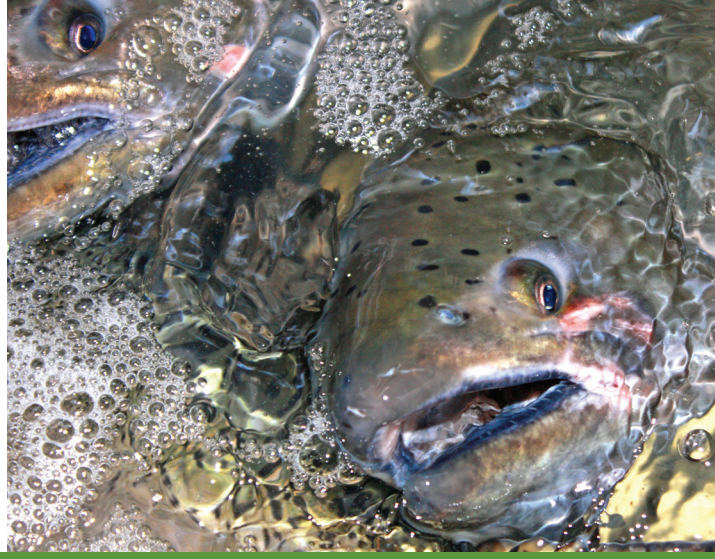
- Wetland mapping tool, July 2018–June 2019
  PI: Monika Moskal, *School of Environmental and Forest Sciences*

- Integer programming techniques that will improve forest estate models used in forest land planning for Washington State Department of Natural Resources-managed state lands in the Olympic Experimental State Forest, September 2012–June 2019
  PI: Sandor Toth, *School of Environmental and Forest Sciences*

- Work plan for the University of Washington in managing and facilitating a scientific review process for the Cooperative Monitoring, Evaluation, and Research Committee by the Independent Scientific Peer Review Program, January 2018–June 2021
  PI: Daniel Vogt, *School of Environmental and Forest Sciences*

Photo: iStock.com/Wirepec





Photos, l to r: iStock.com/aussiesnakes, SeventhDayPhotography; Benjamin Sandford

Washington Department of Ecology

- Washington wetland mapping, May 2016–March 2019
  PI: Monika Moskal, *School of Environmental and Forest Sciences*
- Environmental DNA monitoring for aquatic invasive plants in Washington State, July 2017–June 2019
  PI: Julian Olden, *School of Aquatic and Fishery Sciences*
  Thiago Couto, *PhD student*
- Non-targeted screening analysis of six freshwater fish fillet samples, April 2018–March 2019
  PI: Andrew James, *Center for Urban Waters, UW-Tacoma*
  Zhenyu Tian, *Post-doctoral fellow*
  Dave Ward, *undergraduate student*

Cooperating Faculty, Washington State University

Washington Department of Fish and Wildlife

- Northern Leopard Frog population and modeling, disease surveillance, and headstart optimization, January 2019–October 2020
  PI: Caren Goldberg, *School of the Environment*
  Bernardo Traversari, *MS student*
- The influence of fuel reduction treatments on the nutritional ecology of mule and white-tailed deer in northeastern Washington, July 2013–June 2020
  PI: Lisa Shipley, *School of the Environment*
  Meghan Camp, *Post-doctoral fellow*
  Anna Staudenmaier, *MS student*
- Snowshoe hare density; Daniel Thornton, School of the Environment, August 2017–August 2020
  PI: Paul Jensen, *MS student*

Photos: above: Dan Sorel, iStock.com/Andrew Peacock; below: iStock.com/MikeLane45

Washington Department of Ecology

- Washington State University Biocontrol 2018, integrated weed control project , March 2018–June 2019
  PI: Jennifer Andreas, *Agriculture and Natural Resources Program Unit*
- Washington State University beach watchers 12, February 2018–October 2018
  PI: Chrys Bertolotto, *Snohomish County Extension*
- Washington State University beach watchers 13, March 2019–September 2019
  PI: Chrys Bertolotto, *Snohomish County Extensio*n
- Per- and polyfluoroalkyl substances (PFAS) chemical action plan; July 2017–December 2018
  PI: Chris Page, *The William D. Ruckelshaus Center*
  McKyzie Clark, *undergraduate student*
- Defining net ecological benefit for implementation of Engrossed Substitute Senate Bill (ESSB) 6091, March 2018–December 2018
  PI: Jon Yoder, *State of Washington Water Research Center*
- Tri-cities ozone, August 2018–June 2019
  PI: Lee Yunha, *Civil and Environmental Engineering*
  Kai Fan, *PhD student*

Photo: iStock.com/MikeLane45

Program in the Spotlight

The influence of fuel reduction treatments on the nutritional ecology of mule and white-tailed deer in northeastern Washington

Principal Investigator: Lisa Shipley, School of the Environment, Washington State University

Personnel: Meghan Camp, Post-doctoral fellow; Anna Staudenmaier, MS student

Funder: Washington Department of Fish and Wildlife

Fire suppression over the last 100 years has resulted in densely-stocked forests with continuous overstories and heavy fuel loads in the interior western United States. Because these conditions promote severe wildfires that threaten human safety and alter natural forest communities, land managers have implemented fuels reduction treatments such as commercial thinning and prescribed burning to reduce chances of wildfire and promote healthy forests. These treatments reduce overstory canopy cover and increase light penetration to the forest understory, which can improve forage resources for native herbivores. Therefore, we examined the biomass and nutritional quality of understory vegetation and the nutrient intake of tractable mule and white-tailed deer across treated and untreated stands. These stands, located in the Colville National Forest of northeastern Washington, ranged from 0–100% tree canopy cover and 1–22 years post-thinning. Fuels reduction treatments halved canopy cover and more than doubled forage biomass. Forage biomass decreased with overstory canopy cover, and increased curvilinearly with time since treatment, with peak biomass at ~14 years post-treatment. The amount of digestible energy and protein deer ingested daily increased with forage biomass, and deer were able to meet their summer maintenance requirements, but not higher lactation requirements in experimental stands. Both deer species selected diets consisting primarily of nutritious deciduous shrubs and forbs promoted by open canopies. However, mule deer consumed diets higher in tannins and were able to harvest food faster, whereas white-tailed deer consumed higher quality diets with a greater variety of plant species. Diets of the two deer species were most divergent when forage biomass was very low and very high. Our findings suggest that fuels reduction treatments, especially those reducing the tree canopy to <50% in dry Douglas-fir/ponderosa pine forests, benefit sympatric deer by providing more abundant and nutritious forages for at least 2 decades post-treatment.

Photos, l to r: iStock.com/tonda, milehightraveler

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Assistant Unit Leader— Wildlife	Vacant	
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