Andrews Forest NEWSLETTER

Issue 21 Fall 2016

Shedding Light on Streams

Andrews Forest researcher Dana Warren recently led two projects focused on the role forest canopies along streams and their regulation of stream light availability, which influences water temperature, in-stream primary productivity, nutrient dynamics, and, thereby, the entire aquatic ecosystem. In one publication, Dana and his team outline a conceptual framework for understanding change in stream ecosystem processes and communities when disturbance first creates high light. As a young forest develops, stream light decreases; however, later in stand development canopy gaps are created by localized disturbances, such as windthrow, and stream light increases, but in patches. A second publication reports results of in-stream experiments to explicitly examine how the spatial variability of stream light patches affects primary production and stream nutrient demand. In well-lit sections of the stream periphyton growth was nutrient limited; conversely, light availability was the limiting factor in poorly-lit sites. Ultimately, in the sites with more light patches (*i.e.*, sites with old-growth riparian forests), the stream shifted frequently between light- versus nutrient-limitation. This translates to co-limitation of primary production by light and nutrients at the larger whole stream scale. This work adds an important spatial consideration of stream light while its focus on riparian forest stand development adds an important temporal dimension to stream ecology theory, anchored by the River Continuum Concept, which emphasizes ecosystem variation longitudinally from small streams to large rivers.

A stretch of McRae Creek at the Andrews Forest where Dana Warren and colleagues study light and streams.

An Interdisciplinary Carbon Budget

Experimental Watershed 1 at the Andrews Forest continues to serve as a site of intensive long-term interdisciplinary work. Part of our oldest small watershed management study established in the 1950s, this watershed has made an outsized contribution to scientific discovery. Sustained monitoring of hydrology, climate and vegetation dynamics over decades provides rich baseline datasets, which, along with electrical power, draw collaborative research teams seeking new insights into forest and stream ecosystem processes. A recent article in the *Journal of Geophysical Research: Biogeosciences* by Alba Argerich and eight colleagues presents a stream carbon budget for the watershed. The team of biogeochemists, hydrologists, ecologists and atmospheric scientists was able to bring together data and insights from a group of complementary studies collocated in Watershed 1. Long-term stream chemistry, flow, and sediment budget data were combined with shorter-term efforts to quantify stream metabolism, hyporheic flow paths and carbon fluxes to produce a rare outcome: a comprehensive carbon budget for a headwater stream over a decade.

Andrews Forest researcher, Alba Argerich, preparing to measure gas exchange between the stream and the atmosphere.

This carbon budget illustrates the role that headwater streams play as hotspots of carbon processing and export, despite accounting for a small fraction of total watershed area. On a per-hectare basis, Watershed 1 carbon exports are comparable to global estimates for rivers. Globally, however, annual carbon export from rivers is similar to terrestrial net ecosystem carbon production, whereas in Watershed 1 it amounts to 6% of terrestrial production; this discrepancy reflects the capacity of highly-productive forests of the western Cascades to accumulate and store large amounts of carbon.

HJA
HJ ANDREWS EXPERIMENTAL FOREST

The Andrews Forest Newsletter
Issue 21 Fall 2016

The **Andrews Forest Newsletter** is a semi-annual publication of the Andrews Forest Program.

Editors:
Lina DiGregorio, OSU
Mark Schulze, OSU
Fred Swanson, USFS

Contact:
Andrews Forest Newsletter
College of Forestry
330 Richardson Hall
Oregon State University
Corvallis, OR 97331-5752

andrewsnewsletter@fsl.orst.edu

Web: *http://andrewsforest.oregonstate.edu*

Twitter: *@andrews_forest*

Facebook: *facebook.com/AndrewsForest*

The H.J. Andrews Experimental Forest

Where Ecosystems Are Revealed

The H.J. Andrews Experimental Forest is the hub of a cooperative program of research, education, and research-management partnership involving Oregon State University and the USDA Forest Service's Pacific Northwest Research Station and Willamette National Forest. The mission of this partnership is to support basic and applied research concerning forests, streams, and watersheds, and to foster strong collaboration among ecosystem science, education, natural resource management, arts, and the humanities.

Letter from the Leadership

Perturbations in a system form the basis of an experiment, a variation that might reveal a mechanism or a testable hypothesis. Perturbations are typically exciting for scientists. Recent perturbations in our LTER Network (including a disturbing number of terminations and probations of site programs) are not exciting, but rather suggest that the larger system external to us is off-kilter somehow, somewhere. Reminding ourselves of our own history, purpose, and aspiration can sometimes help regain our bearings. In 1984, National Science Foundation officer James Callahan penned an essay in *BioScience* entitled simply "Long-Term Ecological Research." He laid out a lofty aspiration for LTER at the end of that essay: "long-term ecological research may be useful in diagnosing and solving the increasing array of fundamental ecological problems generated by a world increasingly rich in the quantity, but ever poorer in the quality, of most human life." Rising above the latest fad or scheme, LTER is the grown up in the room, the anchor in a storm focused on persistently pursuing our mission as a scientific enterprise, but also our aspiration as articulated by Callahan. This issue of our newsletter is a reminder that at the Andrews Forest we are wholly engaged in both. We remain attentive to, but undaunted by, ultimately inapt external distractions. It is both humbling and calming to see how well we know ourselves, and also the work of long-term ecological inquiry.

—Michael Paul Nelson, Principal Investigator of the Andrews Forest LTER Program, Ruth H. Spaniol Chair, Department of Forest Ecosystems and Society, Oregon State University

Student Spotlight—Elise Heffernan

Elise Heffernan is a Masters student in the Department of Forest Ecosystems and Society at Oregon State University. Elise studies the patterns of canopy microclimates and interactions with canopy epiphytes. She advised by Barb Lachenbruch and Christopher Still. Elise spent the summer helping to instrument an old-growth Douglas-fir tree with sensors at different heights to measure real-time variations in the microclimates of the surrounding stand of trees. The sensors record temperature and leaf wetness every 15 minutes at 10 meter increments along the tree. Additionally, relative humidity, wind speed and wind direction are measured at the base of the tree and at the highest accessible point (~50 meters above ground). Elise's research will involve comparing values in old-growth canopy with those in secondary forest canopy to clarify their microclimates. When taken in concert, this suite of metrics can begin to elucidate the micrometeorological processes occurring in the canopy, and shed light on the interactions among these processes and a host of canopy-dwelling biota including epiphytes, birds, and invertebrates.

Elise recording data in Watershed 1 (above), and in the canopy of an instrumented tree in the Andrews Forest (below).

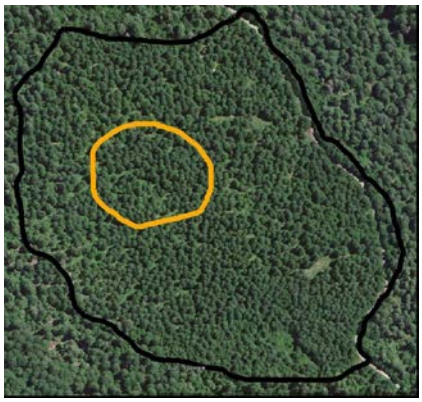
Faculty Faces—David Bell

David Bell, center, speaks about vegetation plots at the Andrews Forest.

David Bell hopped around the country (schooling at Colorado State, Northern Arizona, and Duke and post-docing at Wyoming) before landing in 2014 as a Research Forester with the PNW Station in Corvallis. Dave's research focuses on understanding and predicting ecological change in terrestrial ecosystems in response to climate and land-use change. The main goal of Dave's research is to provide novel forest ecology insights and useful predictions, such as maps of vegetation state, change, and risk, to managers working across diverse regions and ownerships. A prolific paper publisher, Dave has quickly integrated into the diverse Corvallis forest ecology research community while maintaining links with colleagues elsewhere. The resulting publication stream hits a wide range of topics: vegetation modeling and mapping at local to regional to national scales, use of remote sensing data in analysis of forest decline in response to drought and climate change, and critical assessment of modeling, to name just a few. As his academic journey suggests, he is comfortable working in the diverse ecosystems of the Southwest, Southeast, and Northwest. The Andrews Forest community is fortunate to have Dave step into leadership roles in forest ecology as some of our most senior members entertain notions of retirement.

Land Management Connection—A Silviculture Experiment

The Uneven-Aged Management Project (UAMP) is one of several replicated, operational-scale silviculture studies in plantations conducted cooperatively by the Willamette National Forest and Andrews Forest scientists. Nearly 20 years ago, when thinning treatments in UAMP's 35- to 50-year-old Douglas-fir plantations were implemented, the intent was to explore economic and ecologic trade-offs in converting plantations to multi-species, mixed-age stands. To continue the study, the Willamette National Forest recently obtained funding to re-measure the UAMP study sites in 2017. The data will be used to "revision" the long-term treatment plan. Preliminary findings indicate that the first treatments did not create gaps large enough to encourage Douglas-fir regeneration. Whether the original treatment plans will help meet long-term objectives will be weighed against contemporary social interests for Federal lands and new science. When this study was implemented almost 20 years ago, we had a very incomplete understanding of long-term societal interests as well as possible stand responses. This effort will be a "course correction" in a true adaptive management effort.


The canopy of ca 50-year-old plantation is quite monotonous; the UAMP study (outined) aims to create structural, age-class, and compositional diversity.

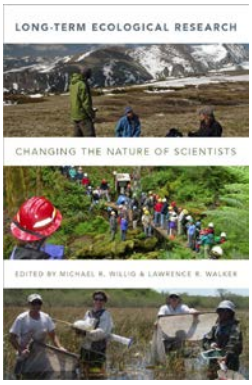
Without This Place

Without This Place, a two-minute video short created by Freshwaters Illustrated, tracks a researcher through the Andrews Forest and highlights key discoveries of the research at the site. The video, and others including symposium talks, can be viewed on the Andrews Forest Youtube channel, *https://www.youtube.com/channel/UCFd4IHt3s2nvFNz4NCDr-1g*.

In Memory—Bill Ferrell

Bill Ferrell, highly-respected OSU Professor of Forest Science and a mentor to key Andrews Forest leaders over the decades, passed away in June at the age of 95. At a celebration of his life, many scientists recalled Bill's crucial influence on them as undergraduates; notably, his messages that there's plenty of science in the study of forests, and follow the science wherever it may lead. Always curious, open to new ideas, and a lover of forests, both native and managed, Bill in a sense mentored the whole Andrews Forest community. This intergenerational view is conveyed in the poem, *The Change of Worlds,* by writer-in-residence Joseph Bruchac with the line, "Like the fallen fir that returns to moss."

New LTER Book



In the new book, *Long-Term Ecological Research: Changing the Nature of Scientists,* edited by MR Willig and LR Walker, 35 senior scientists reflect on the impact of their participation in LTER on their careers and more broadly. Additional essays provide perspectives of NSF leaders, social scientists, and an historian. Sherri Johnson, Susan Stafford, and Fred Swanson contributed on behalf of Andrews Forest.

Arts and Humanities

In early October, thirty nature writers gathered at the Andrews Forest from around the West—from as far as Tucson, and Fort Collins, and Homer—to share views and affirm their commitments to working for the wellbeing of the world. This was the sixth such biennial gathering; past events have harvested some interesting poetic contributions to *The Forest Log,* hosted on the Spring Creek Project webpage.

Visiting visual artists recently contributed art works for display at the Andrews Forest headquarters buildings. Fiberartist Mary Burns contributed a weaving (*see image, right*) after her visit to the forest with writer/husband John Bates. This creative couple has been active in the North Temperate Lakes LTER site program in northern Wisconsin. Eugene artist Josh Krute contributed two block prints of tree rings; one is adorned with a botanical image by illustrator Ellie Tu.

Lissy Goralnik, Michael Nelson, Hannah Gosnell, and Mary Beth Leigh (Bonanza Creek LTER program, Fairbanks, AK) have extended their study of engagements of arts and humanities across the 25-site LTER network. An earlier study found that a great majority of sites has significant commitment to these collaborations. A recently published follow up study reveals conviction that arts-science collaborations cultivate inspiration and empathy for the natural world and can "catalyze relationships among scholars, the public, and the natural world." See *http://rdcu.be/l2M1* for more.

Image, top right: Black/white weaving "Awaken" by Mary Burns, woven on her hand-jacquard loom while in residence at Andrews Forest in 2015.

Citizen science is effective for stream monitoring as well as outreach

There is increasing interest in citizen science as a means of engaging non-scientists and promoting environmental stewardship attitudes and behaviors. Patrick Edwards, an assistant professor in Environmental Sciences and Management at Portland State University, leads a long-term stream ecology citizen science program that samples Lookout Creek and similarly-sized creeks in the Portland area. The 11-year program has been extremely effective in involving diverse groups of high school students and non-science majors at PSU in monitoring stream invertebrate communities.

Portland State University students and citizen scientists at Lookout Creek, Andrews Forest.

Edwards recently published an article in *PLOS One* investigating the value of invertebrate data generated by non-specialists for assessing stream condition. While there are examples of the scientific value of citizen science data collected by avid hobbyists (*e.g.*, breeding bird survey) and in programs that require no specialist knowledge (*e.g.*, the Community Collaborative for Rain Hail and Snow), there continue to be doubts about whether non-specialists can generate useful data for taxonomically diverse and difficult groups like stream invertebrates. Edwards compared data from student field subsampling and identification to expert processing in a lab environment, and conducted a detailed statistical analysis of sources of variability within stream reaches, among streams, and over time. The study showed that non-specialists were able to collect data that are consistent enough to detect differences in community assemblages among streams and over time in a given place in response to climate variability. Citizen science can be a useful tool for managers interested in tracking changes in stream health and impacts of climate change.

Support for the Andrews Forest

The Andrews Forest Program appreciates your interest in our research and educational programs. As you may know, our work is centered around forests, watersheds, and our engagement with the land. The Andrews Forest Fund enables individuals and organizations to support a range research, education, outreach, and arts and humanities programs at the Andrews Forest.

Gifts to the Andrews Forest Program are tax deductible, and we hope you will consider a gift before year-end.

Gifts from people like you have helped support research on long-term vegetation dynamics in the Pacific Northwest, and workshops for teachers to build data literacy and design inquiry-based curricula.

You can make a lasting impact on our work with a gift to support the Andrews Forest. To learn more, please call 541-737-8480 or visit *http://andrewsforest.oregonstate.edu/donate.* If you would like to receive a gift card by mail, please let us know.