March 5, 2016

AY 2014-2015 Annual Report

Bachelor of Science in Environmental Science

Overview

The Environmental Science B.S. degree aims to provide students with rigorous interdisciplinary training in Earth Science, Chemistry, and Ecology. Program graduates are prepared for entry-level employment in resource agencies such as the Department of Environmental Conservation, the Department of Natural Resources, and the US Geological Survey. Environmental Science students are also well prepared to enter graduate programs in Earth Sciences and Ecology. The Environmental Science degree utilizes the natural laboratory available to students in Southeast Alaska both through laboratories and hands-on field exercises and through guided research projects with Program Faculty. All program students are required to complete either an internship or an individual research project within the degree program.

The Environmental Science B.S. degree is closely aligned with the Geography (GEOG) and Environmental Resources B.S. degree. These two degrees share a number of required courses primarily in Earth and Geographic Information Sciences. However, the two degrees are fundamentally different in their aims. The ENVS degree is focused on developing a rigorous, quantitative understanding of the physical, chemical and ecological processes in Earth's surface and near-surface environments. This entails course work in Chemistry, Physics, Earth Science (e.g. Hydrology and Atmospheric Science), and Biology. In contrast, the GEOG B.S. degree is focused on understanding Earth from a geographic perspective (both Human and Physical), with a focus on course work in spatial analysis (e.g. Geography, Geographic Information Science, and Remote Sensing).

Key Findings and Measures (2014-2015)

Student Data and Trends

Program Head counts

Academic Year	11/12	12/13	13/14	14/15
ENVS Majors	21	17	17	18

Program Graduates and Average GPA

Academic Year	11/12	12/13	13/14	14/15

ENVS Graduates (Avg. GPA)	2 (3.05)	2 (2.81)	2 (3.13)	3 (3.36)

In AY 2014-15, Banner listed 18 ENVS majors. The number of program students has remained relatively stable in the last four years. There continues to be some attrition of ENVS majors as evidenced by the fact that the program head count is higher (ranging from 17-21 over the four year period) than the number of program graduates (between 2-3 per year during the last four AYs).

Enrollments in Core ENVS Program Courses

Academic Year 14/15	Fall	Spring
ENVS 102	17	-
ENVS 338	10	6
ENVS 422	-	6
GEOL 104	-	14
GEOL 302	8	-

Enrollments in core program courses continue to be stable relative to previous academic years. Both ENVS 102 and ENVS 338 are cross listed with GEOG designators so the total enrollments in those courses are higher than what is shown in the table (only the students taking the course with the ENVS designator).

ENVS faculty teach additional courses that serve both the Environmental Science degree and a number other degrees in Arts and Sciences. In 2014-15, ENVS faculty included some term faculty members who helped to cover courses during a period of transition in personnel. A similar number of courses will be delivered by fewer faculty members in 2015-16.

Total enrollment in courses taught by ENVS faculty (Amundson, Buma, Connor, Hood, Hekkers, Hoferkamp, Pyare).

Academic Year 14/15 Course designator	Fall	Spring
ENVS	47	47
GEOG	36	18
GEOL	24	20
PHYS	12	13

CHEM	41	40
Total	160	138

ENVS students participating in Directed Research and Internship Classes

Academic Year	11/12	12/13	13/14	14/15
Directed Research Students	2	1	3	6
Student Internships	2	1	2	2

ENVS students continue to work on a variety of local research projects both through directed research courses and as research assistants. These projects include linking glacier dynamics to meteorological conditions (Carrie Amott), measuring glacier thickness with radar (Hunter Brown), studying local forest ecology (Ross Douglas; William Bottorf), relating weather to landslide and fire occurrences in Southeast Alaska (Danny Cooper), investigating stream chemistry and glacial run-off (Chris Salazar, Alex Whitehead, and Alex Botelho), and studying marine iron (Melissa Rhodes-Reese). These projects are supported by both student grants and a variety of state and federal grants that are managed by ENVS faculty; in 2014-15 ENVS faculty were awarded over $900k in new grants (see below), which will therefore continue to provide excellent research opportunities for our students.

Curriculum Updates

The ENVS curriculum will be undergoing significant changes in the coming year. In 2014-15 we completed a nationwide search to hire a tenure track Assistant Professor of Geology as a replacement for Cathy Connor, who had retired the year before. The search resulted in the successful hiring of Sonia Nagorski, who has a background in geology with an emphasis in hydrogeology and water chemistry. She has a strong teaching record, having already taught some core courses at UAS, is actively involved in research in Southeast Alaska, and has previously involved UAS undergraduates in her research projects. In addition to teaching introductory geology GERs, Sonia will develop new courses related to geochemistry and geological resources.

Through a series of meetings, ENVS faculty also worked on restructuring the degree requirements in response to the 5-year review and discussions with Provost Caulfield, and will submit a proposal to change the degree requirements in 2015-16. The degree restructuring will create concentration areas to better highlight faculty strengths and will also provide students with greater flexibility in their course selections. Several new courses will be proposed (or were

recently added) by new and recent hires Amundson, Buma, and Nagorski to round out the program, including Glaciology (Amundson), Sustainable Resource Management (Buma), Temperate Rainforest Ecosystems (Buma), Forest Ecosystems (Buma), Forest Field Ecology Lab (Buma), and Geological Resources and the Environment (Nagorski).

Exit Interview Information

This year was the first year that we surveyed graduating students. We received surveys from two of the three graduates.

Both of these students were attracted to the small class sizes at UAS and the opportunity to study environmental processes in their backyard through lab classes and field trips. The hands on learning provided by the environment and by the fact that program faculty are actively conducting research in the local environment helped them to solidify their understanding of course concepts and the relationships between various courses within the degree. They both participated in research projects with faculty, and one did an internship with NOAA. Both students were pleased with the education and advising that they received at UAS, and would recommend the program to other students. One student is planning to apply for graduate school to study oceanography; the other was accepted into graduate school at the University of Wyoming.

Some specific suggestions that they provided for improving the program include (i) adding additional upper division courses in atmospheric science and oceanography, (ii) incorporating more programming into coursework, and (iii) bringing more guest speakers into the classroom to expose students to work that is being done in Southeast Alaska by various agencies.

In response to these suggestions: (i) Although we would like to add courses in atmospheric science and oceanography, this seems unlikely given current faculty workloads and course enrollments. (ii) We plan to introduce more programming into coursework (e.g., Amundson will have students use MATLAB in a series of homework assignments for a glaciology course to be offered in Spring 2016). (iii) Finally, we have been in discussion with the Alaska Coastal Rainforest Center about combining their brown bag seminar series with the Environmental Science Seminar, which is a required course for ENVS majors and can be repeated for credit when content varies. This would help to solidify connections between UAS and other agencies and would help students to develop relationships with potential future employers.

Potential Future Program Changes

In 2014-15 term faculty member Mike Hekkers compiled a database of past ENVS graduates. We plan to continue updating this database yearly. Of the 47 students that have graduated from

UAS with a B.S. Environmental Science, 18 (38%) went on to graduate school, 33 (70%) have careers in science, and 8 (24%) of the science-employed graduates are in the private sector and 25 (76%) are working for agencies.

Space is a real issue for the program. We need clustered faculty offices, dedicated teaching space that suits the labs we offer (and provides access to lab closets) and also continued dedicated lab space. Our research and research needs are expanding, as evidenced by the grant money received during 2014-15. This expansion in research will require additional space for personnel, including postdoctoral scholars, graduate students, and undergraduate research assistants.

We now have a "full" complement of faculty and can cover our fundamental program needs. We expect to continue to bring new classes on line as Nagorski develops courses and Buma increases his teaching load from 6 to 18 credits in AY 2016-2017.

Faculty accomplishments

Publications (18)

Bartholomaus, T.C., **J.M. Amundson**, J.I. Walter, S. O'Neel, M.E. West, and C.F. Larsen, 2015. Subglacial discharge at tidewater glaciers revealed by seismic tremor. *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL064590.

Peters, I.R., **J.M. Amundson**, R. Cassotto, M. Fahnestock, K.N. Darnell, M. Truffer, and W.W. Zhang, 2015. Dynamic jamming of iceberg-choked fjords. *Geophys. Res. Lett.*, 42, doi:10.1002/2014GL062715.

Cassotto, R., M. Fahnestock, **J.M. Amundson**, M. Truffer, and I. Joughin, 2015. Seasonal and interannual variations in ice melange and its impact on terminus stability, Jakobshavn Isbræ, Greenland. *J. Glaciol.*, 61(225), 76-88, doi:10.3189/2015JoG13J235.

Krapek J, **Buma B**. 2015. Yellow-cedar: Climate change and natural history at odds. Frontiers in Ecology and Environment. 13: 280-281.

Buma B, Livneh B. 2015. Potential effects of forest disturbances and management on water resources in a warmer climate. Forest Science. 61: 895-903

Buma B, Barrett T. 2015. Signs of disturbance disequilibrium and directional change in the world's largest temperate rainforest. Global Change Biology. 21: 3445-3454.

Buma B. 2015. Disturbance interactions: Characterization, prediction, and the potential for cascading effects. Ecosphere. 6:art70.

Livneh B., J.S. Deems, **B. Buma**, J.J. Barsugli, D. Schneider, N.P. Molotch, K. Wolter, and C.A. Wessman, 2015. Catchment response to bark beetle outbreak in the upper Colorado River basin. Journal of Hydrology. 523: 196-210.

Buma B, Johnson AC. 2015. Disturbance interactions mediated by topography: Wind exposure, landslide susceptibility, and yellow cedar decline in southeast Alaskan temperate rainforests. Geomorphology. 228, 504-511

Buma B, Poore B, Wessman CA. 2014. Interacting disturbances and their effect on carbon, charcoal, and further implications for carbon sequestration in forests. Ecosystems. 17(6): 947-959

Shanley, C.S., **S. Pyare**, M.I. Goldstein, P. Alaback, D. Albert, C. Beier, T. Brinkman, R.T. Edwards**, E. Hood,** A. MacKinnon, M. McPhee, T. Patterson, L. Suring, D. Tallmon, and M. Wipfli (2015) Climate change implications in the northern coastal temperate rainforest of North America. *Climatic Change*. doi:10.1007/s10584-015-1355-9

O'Neel, S., **E. Hood**, A. Bidlack, S. Fleming, M. Arimitsu, A. Arendt, E. Burgess, C. Sergeant, A. Beaudreau, K. Timm, G. Hayward, J. Reynolds, and **S. Pyare** (2015) Icefield-to-ocean linkages across the northern Pacific coastal temperate rainforest ecosystem. *BioScience*, doi:10.1093/biosci/biv027

D'Amore, D., R. Edwards, P. Herendeen, **E. Hood**, and J. Fellman (2015) Dissolved organic carbon fluxes from hydropedologic units in Alaskan coastal temperate rainforest watersheds. *Soil Science Society of America Journal* 79: 378-388. doi:10.2136/sssaj2014.09.0380

Hood, E., T.J. Battin, J. Fellman, S. O'Neel, and R.G.M. Spencer (2015) Storage and release of organic carbon from glaciers and ice sheets. *Nature Geoscience* 8, 91–96. doi:10.1038/ngeo2331

Spencer, R.G.M., W. Guo, P. Raymond, T. Dittman, **E. Hood**, J. Fellman, and A. Stubbins (2014) Source and biolability of ancient dissolved organic matter in glacier and lake ecosystems on the Tibetan Plateau. *Geochimica et Cosmochimica Acta*, 142: 64-74. Doi: 10.1016/j.gca.2014.08.006

Connor, C. (2015). Tracking glacial landscapes: High school science gets real. Alaska Park Science, 12 (2), http://www.nps.gov/articles/aps-v12-i2-c6.

Kovach, R. P., S.C. Ellison, **S. Pyare**, and D.A. Tallmon. 2015. Long-term phenological variation in Pacific salmon throughout Southeast Alaska. Global Change Biology 21:1821-1833.doi: 10.1111/gcb.12829

Lewis, T., **S. Pyare**, and K. Hundertmark. 2015. Little Ice Age endemism: landscape genetics of brown bears (Ursus arctos) in a recently deglaciated landscape. Journal of Biogeography 42: 1701–1713

New awards ($904,363)

Burton, J.C., **Amundson, J.M.**, and M. Dennin. Collaborative Research: Investigating jamming in iceberg-choked fjords with field observations, laboratory experiments, and numerical models, National Science Foundation Division of Materials Research, $96,808, 8/1/15-7/31/18.

Amundson, J.M., R.J. Motyka, J. Nash, E. Skyllingstad, and D. Sutherland. Collaborative Research: Impact of subglacial discharge on turbulent plume dynamics and ocean-glacier heat and mass transfer, National Science Foundation Division of Polar Programs, $498,483, 9/1/15-8/31/19.

Hood, E. and **S. Pyare**, 2015-2016. Linking landscape characteristics and stream temperature in the coastal temperate rainforest of southeast Alaska. *USGS National Institutes for Water Resources*. $19,264.

O'Neel, S., **E.Hood**, A. Arendt, C. Larsen, D. Hill, and A. Bidlack. 2015-2017. Ice2O:Assessing ecosystem-wide implications of glacier change in the PCTR. Alaska Climate Science Center. $200,000 ($36K to UAS).

Hood, E., 2013-2016. Alaska Climate Science Center Advisory Committee. $24,800.

Buma, B., and A. Bidlack. Alaska Yellow Cedar Decline Impact Assessment and Restoration Baseline, 2015. PI, with Allison Bidlack (Alaska Coastal Rainforest Center) $30,007

Buma, B., and R. Barnes. Novus professional development grant. 2015. "Fire effects on black carbon and microbial activities." PI/co-PI, linked proposal with Rebecca Barnes (Colorado College) $1,500

Buma, B., **E. Hood**, and J. Fellman. NASA EPSCoR RID Grant. 2014 - 2015. "Linking LIDAR and stream organic carbon export: Can aboveground biomass and landscape composition be used to predict the export and biogeochemistry of stream organic carbon?" PI, with Eran Hood & Jason Fellman (Hydrology, UAS) and Rick Edwards (USFS) $29,919

Nagorski, S., 2015. Contribution of mercury and persistent organic pollutants by spawning salmonids to southeastern Alaskan streams. Idea Network of Biomedical Research Excellence (INBRE) pilot grant. $119,139.

Nagorski, S., 2015. Assistance with development of the Freshwater Contaminants Protocol for the National Park Service's Southeast Alaska Network Inventory and Monitoring Program, National Park Service. $4,526

Nagorski, S., A.Schroth, B.Rosenberg, E.Hood, S.Pyare, D.Nimick. 2014-2015 Evolution and dynamics of iron and other metals in glacial and wetland streams entering the Berner's Bay region. Alaska EPSCoR. ($35,487)

Nagorski, S. and D.Engstrom, 2015. Current and Historical Mercury Sources and Deposition to Remote Southeast Alaskan Lakes. National Park Service ($8250)