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AY 2019-2020 Annual Student Assessment Report

Bachelor of Science in Environmental Science
Bachelor of Science in Geography and Environmental Resources

1. Program Overview

Faculty:

Eran Hood, Professor of Environmental Science
Sanjay Pyare, Associate Professor of Environmental Science
Jason Amundson, Associate Professor of Geophysics
Sonia Nagorski, Assistant Professor of Geology
Allison Bidlack, Associate Research Professor of Environmental Science
Jason Fellman, Assistant Research Professor of Environmental Science
Christian Kienholz, Assistant Research Professor of Environmental Science

The B.S. Environmental Science (ENVS) and the B.S. Geography and Environmental Resources (ENRE) provide students with rigorous interdisciplinary training in Earth science, chemistry, and ecology. Program graduates are well-prepared (i) for entry-level employment in resource agencies such as the Alaska Department of Environmental Conservation, the Alaska Department of Natural Resources, and the US Geological Survey and (ii) to enter graduate programs in Earth sciences and ecology. The degrees use 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 ENVS students are required to complete either an internship or an individual research project within their degree, and ENRE students are highly encouraged to do the same.

The ENVS and ENRE degrees share a number of required courses, primarily in Earth sciences and geographic information systems (GIS). 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, and Earth science (e.g. hydrology and physical geology). In contrast, the ENRE degree is focused on understanding the Earth from a geographic and resource management perspective.

2. Program Student Learning Outcomes (SLOs)

By the time that they have completed their degree, students in the ENVS and ENRE program can:

1. Describe the fundamental Earth system components, their organization, and how they interrelate,
2. Collect and quantitatively analyze environmental data,
3. Convey technical concepts in environmental science to other scientists and the public,
4. Explain how environmental science is incorporated into different professional fields,
5. Relate environmental science to broader societal issues and solutions, and
6. Conduct research in an environmental field and/or provide support for environmental resource management.

3. Assessment Strategy

Students are assessed on the first five learning outcomes based on specific assignments completed in classes that are required for the ENVS and ENRE degrees. Assessment of the sixth learning outcome is based on the number of ENVS students who successfully complete research and internship opportunities in a field related to their major. For learning outcomes 1-5, the specific assignments that are assessed for program students are detailed in the table below. Student performance for each learning outcome is rated by program faculty on a scale of 1-6. There are three categories within this range: 1-2 represents “Does Not Meet Expectations”, 3-4 represents “Meets Expectations”, and 5-6 represents “Exceeds Expectations”. The sixth learning outcome is evaluated both quantitatively and qualitatively based on the number and type of student research and internship experiences in a given academic year.

		UAS Competencies								
Conceptual Basis for SLO	*SLO*	*Communication*	*Quantitative Skills*	*Information Literacy*	*Computer Literacy*	*Professional Behavior*	*Critical Thinking*	*Assessment Tool*	*Assessment Method*	*Course*
Knowledge	#1		X	X	X			Modeling Exercises	Evaluation of student comprehension of model outcomes relevant to Earth system processes	Earth’s Climate System (ENVS S422) / Glaciology (ENVS S302)
Analysis	#2		X				X	Hydrology Lab	Evaluation of accuracy of data collection and depth of analysis	Hydrology (GEOL S302)
Communication	#3	X		X	X	X		GIS Research Project/Poster	Evaluation of how results of GIS analyses were presented and visualized	Intro. GIS (ENVS S338)
Application	#4	X				X		Presentations	Evaluation of student comprehension of presentations from practitioners	ENVS Seminar (ENVS S492)
Consequences	#5			X			X	Case Study	Evaluation of geoscience principles of natural hazards/ resources; Grade distribution	Natural Hazards (ENVS S213) / Geological Resources and the Environment (ENVS S320)

4. Data Collected for Program Assessment During AY2017-18

Assessment of SLO #'s 1–5: Average score of students in courses listed in the table above over the past three years; AY17 was the first year that this scoring rubric was applied.

Student Learning Outcome	Average Student Score			
	AY17	AY18	AY19	AY20
#1	3.12	N/A*	4.34	3.57
#2	3.81	3.83	3.0	3.9
#3	4.57	3.89	N/A**	5.26
#4	2.45	3.64	4.57	5.13
#5	4.08	3.92	4.12	4.17

*Based on performance in ENVS S302/S422, neither of which were offered in AY18 due to sabbatical leave.
**Based on performance in ENVS S338, which was taught by an adjunct during AY19 due to sabbatical leave and therefore not evaluated.

Student learning outcome 6 reflects a central tenant of the ENVS Program, which is to involve program students in hands-on research through faculty research projects and internships at local resource agencies.

Assessment of SLO #6: Headcount of students enrolled in internship and directed research courses. Credits received during summer are counted toward the following academic year.

SLO #6	AY16	AY17	AY18	AY19	AY20
ENVS S491 (internship)	3	1	4	5	7
ENVS S498 (research)	2	2	5	6	4

ENVS and ENRE students continue to be involved in a variety of local research projects and internships. and student participation in these opportunities has grown in recent years. Student projects with program faculty covered a wide variety of topics and developed skills that will benefit students looking to attend graduate school and get jobs in environmental science and resources. Student research projects included: modeling the evolution of glacier outburst floods over decadal timescales (Amy Jenson[1]), analysis of salmon escapement data (Michaela Zurflueh), environmental impacts of animal farming (Ashley Ford), sampling and analysis of microplastics in Juneau area streams and glaciers (Muriel Walatka, Jacob Eberhardt), field and mapping investigations into forest ecology linkages with landslides (Kelly Gerlach), aquatic drift and hydrochemistry in glacier streams (Connor Johnson and Mollie Dwyer), avalanche dendrochronology (Mackenzie Wilson), development of a drone-based mapping product of Jensen-Olsen Arboretum (Dean Thiart), and GIS/remote sensing mapping of Auke Cape (Fredrik Thorsteinson).

These projects are largely supported by faculty grants as well as through UAS URECA awards. ENVS faculty continue to be successful in bringing in external funds from a variety of state and federal agencies so we expect that students will continue to have ample opportunities to participate in research.

[1]Lead author on an in-prep publication that will be submitted for peer review in 2021.

5. Evaluation of Data Collected During AY2019-20

ENVS and ENRE students "meet expectations" in all student learning objectives.

Scores for student learning outcome #1 were down markedly from the previous year. This is likely at least partially a result of this outcome being evaluated for courses that are offered in alternating years: ENVS S302 (Glaciology) and ENVS S422 (Earth's Climate System). Earth's Climate System is typically only taken by Environmental Science students, whereas due to its broader appeal Glaciology is taken by a wider variety of students. Although a longer record of student scores in this category will be necessary to make meaningful statements about trends, we should strive to improve student quantitative understanding of data and models, particularly for students with less technical background.

6. Future Plans to Improve Student Learning

Many graduates of the ENVS and ENRE program pursue technical careers that involve field work and analysis of field data. To provide students with more hands-on learning experiences and better prepare them for future employment, we have started offering more field-oriented courses. In Spring 2019 we offered, for the second time, a UAV (unmanned aerial vehicle) surveying course immediately after finals week. The course was successful despite severe limitations placed on the course as a result of COVID-19.

A hiring freeze and other budget constraints delayed the hiring of a lab manager until spring semester. We hired Shabadrang Khalsa into the position and had her work on expanding the position to provide more support than in past years, including refinement of lab exercises, development of class demonstrations, and coordination of program gatherings. Shabadrang was only in the position for a little more than a month when COVID-19 forced a transition to distance delivery of courses. She was very helpful during this transition, which required development of new lab exercises on the fly. We need to maintain continuity in this position going forward to keep our programs running smoothly.

The major challenge with the ENVS and ENRE program continues to be enrollment, particularly in upper division classes, although encouragingly we have seen modest growth in recent years, resulting in a record number of graduates (5 ENVS and 4 ENRE) in AY19-20.

Enrollment in the ENRE degree is consistently lower than enrollment in the ENVS degree. In order to make the degree more attractive, build a stronger cohort of students, and simplify recruitment and program coordination, we have proposed (along with colleagues in Social Sciences and Humanities) establishing a UAS Program on the Environment, which will include the B.S. Environmental Science, the re-named B.S. Environmental Resources, and the soon to be renamed B.A. Environmental Studies (formerly B.A. Geography, Environmental, and Outdoor Studies). These degrees will have a shared core of courses, several interdisciplinary courses that span all three degrees and are accessible to students in all three degrees, and clear pathways to switch between degrees. In conjunction with these changes, we also plan to work with the recruitment and web teams to update program content.

7. Additional Program Information

Exit Interview Information

We sent out surveys to our program graduates but only received feedback from one student. We had previously proposed conducting the surveys through the Environmental Science Seminar (ENVS S492), but that has not worked very well since many students that take the class are not yet ready to graduate. Going forward, the program coordinator will work with advising to create a list of students that have applied for graduation each year and then contact those students individually.

The student that did respond appreciated the one-on-one instruction that they had with program faculty in their upper division courses and the close relationship that they developed with their advisor, but found it difficult to complete the courses that were needed for graduation due to scheduling conflicts or insufficient course offerings. They felt that this issue may not have arisen had they been recruited into the program sooner.

Faculty productivity

Program faculty have had success procuring external funding and publishing peer-reviewed manuscripts, having been awarded $0.98M in research grants and publishing 15 peer-reviewed manuscripts in 2019 (see appendix). We anticipate that the departure of Dr. Kienholz in late 2019 will result in a drop in research productivity, although we are planning to hire a postdoc to build on his work. In addition to research, faculty were involved in a variety of service activities, including:

- Dr. Hood was the UAS representative to the UA Statewide Research Council, the Office of Intellectual Property and Commercialization, and was on the steering committee for the NSF-funded Coastal Margins Research Coordination Network.
- Drs. Kienholz, Hood, and Amundson collaborated with staff from the National Weather Service, the US Geological Survey, the USFS, and the City and Borough of Juneau to coordinate monitoring efforts on the glacier lake outburst flood on Mendenhall River.
- Dr. Amundson served as the UAS representative for the Alaska Space Grant Program.
- Dr. Nagorski served as faculty senator for the Department of Natural Sciences and chaired the faculty Sustainability Committee.
- Dr. Nagorski presented at community science events at Alaska State Museum and Thunder Mountain High School.
- Dr. Hood serves as the UAS representative for the Alaska Climate Adaptation Science Center.
- Dr. Pyare led the effort to redesign the UAS Associates of Science degree.
- Dr. Pyare organized and ran a GEO Hack online event, in which students competed with other universities to work on a solution to a societal challenge using Earth Observation data.
- ENVS faculty regularly review manuscripts and NSF proposals.

8. Appendix

List of publications in 2019

1. Nagorski, S.A., S.D. Kaspari, E. Hood, J.B. Fellman, and S.M.Skiles (2019). Radiative forcing by dust and black carbon on the Juneau Icefield, Alaska, *J. Geophys. Res. Atmospheres*, 124, 3943–3959, https://doi.org/10.1029/2018JD029411.

2. Fellman, J.B., E. Hood, S.A. Nagorski, J. Hudson, and S. Pyare, (2019). Interactive physical and biotic factors control dissolved oxygen in salmon spawning streams in coastal Alaska, *Aquat. Sci.*, 81(2), https://doi.org/10.1007/s00027-018-0597-9.

3. Sutherland, D.A., R.H. Jackson, C. Kienholz, J.M. Amundson, W.P. Dryer, D. Duncan, E.F. Eidam, R.J. Motyka, and J.D. Nash, 2019. Direct observations of submarine melt and subsurface geometry at a tidewater glacier, Science, 365(6541), 369–374, https://doi.org/10.1126/science.aax3528.

4. Carnahan, E., J.M. Amundson, and E. Hood, 2019. Impact of glacier loss and vegetation

succession on annual basin runoff, Hydrol. Earth Syst. Sci., 23, 1667–1681, https://doi.org/10.5194/hess-23-1667-2019.

5. Vore, M.E., T.C. Bartholomaus, J.P. Winberry, J.I. Walter, and J.M. Amundson, 2019. Seismic tremor reveals spatial organization and temporal changes of subglacial water system, J. Geophys. Res. Earth Surf., 124, 427–446, https://doi.org/10.1029/2018JF004819.

6. Kienholz, C., J.M. Amundson, R.J. Motyka, R.H. Jackson, J.B. Mickett, D.A. Sutherland, J.D. Nash, D.S. Winters, W.P. Dryer, and M. Truffer, 2019. Tracking icebergs with oblique time-lapse photography and sparse optical flow, LeConte Bay, Alaska, 2016-2017, J. Glaciol., 65(250), 195–211, https://doi.org/10.1017/jog.2018.105.

7. Cassotto, R., M. Fahnestock, J.M. Amundson, M. Truffer, M.S. Boettcher, S. de la Peña, and I. Howat, 2019. Nonlinear glacier response to calving events, Jakobshavn Isbræ, Greenland. J. Glaciol., 65(249), 39–54, https://doi.org/10.1017/jog.2018.90.

8. Li, X., Y. Ding, E. Hood, R. Raiswell, T. Han, X. He, S. Kang, Q. Wu, Z. Yu, S. Mika, S. Liu, and Q. Li (2019) Dissolved iron supply from Asian glaciers: Local controls and a regional perspective, *Global Biogeochem. Cy.*, 33, 1223–1237, https://doi.org/10.1029/2018GB006113.

9. Hood, E., J. Fellman, R.T. Edwards, D. V. D'Amore, and D. Scott (2019). Salmon-derived nutrient and organic matter fluxes from a coastal catchment in southeast Alaska, *Freshwater Biol.*, 64, 1157–1168, https://doi.org/10.1111/fwb.13292.

10. Hock, R., G. Rasul, C. Adler, B. Cáceres, S. Gruber, Y. Hirabayashi, M. Jackson, A. Kääb, S. Kang, S. Kutuzov, Al. Milner, U. Molau, S. Morin, B. Orlove, and H. Steltzer, 2019: Ch. 2 - High Mountain Areas. (**E. Hood** - Contributing Author) In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

11. Goldstein, M.I., D.C. Duffy, S. Oehlers, N. Catterson, J. Frederick, and S. Pyare (2019). Interseasonal movements and non-breeding locations of Aleutian Terns *Onychoporion aleuticus*, *Marine Ornithology*, 47, 67–76.

12. Buma, B., S.M. Bisbing, G. Wiles, and A.L. Bidlack (2019). 100 yr of primary succession highlights stochasticity and competition driving community establishment and stability, *Ecology*, 100(12), e02885, https://doi.org/10.1002/ecy.2885.

13. Buma, B., E. Batllori, S. Bisbing, A. Holz, S.C. Saunders, A.L. Bidlack, M.K. Creutzburg, D.A. DellaSala, D. Gregovich, P. Hennon, J. Krapek, M.A. Moritz, and K. Zaret (2019). Emergent freeze and fire disturbance dynamics in temperate rainforests, *Austral Ecol.*, 44, 812–826, https://doi.org/10.1111/aec.12751.

14. Bisbing, S.M., B.J. Buma, L.E. Oakes, J. Krapek, and A.L. Bidlack, AL. (2019), From canopy to seed: Loss of snow drives directional changes in forest composition, *Ecol Evol*., 9, 8157–8174, https://doi.org/10.1002/ece3.5383.

15. McNicol, G., C. Bulmer, D. D'Amore, P. Sanborn, S. Saunders, I. Giesbrecht, S. Gonzalez Arriola, A. Bidlack, D. Butman, and B. Buma (2019). Large, climate-sensitive soil carbon stocks mapped with pedology-informed machine learning in the North Pacific coastal temperate rainforest, *Environ. Res. Lett.*, 14(1), 014004, https://doi.org/10.1088/1748-9326/aaed52.

List of grants awarded in 2019

1. Nagorski, S.A. Novel investigation into the magnitude of plastic pollution in coastal southeast Alaska. University of Alaska Faculty Initiative Fund, $18,000.

2. Nagorski, S.A. Alaska IDeA Network of Biomedical Research Excellence (INBRE) Special Requests, $8,179.

3. Kienholz, C., E. Hood, and J.M. Amundson. Acquisition of surveying equipment (UAVs, GNSS receivers) and associated hardwareand software to support research and undergraduate training at the University of Alaska Southeast. NSF Instrumentation & Facilities, $38,143.

4. Amundson, J.M and C. Kienholz. Impact of glacier and fjord dynamics on seal habitat. North Pacific Research Board, $244,488.

5. Hood, E. and G. Wolken. Avalanches as public hazards and agents of landscape change. Alaska Climate Adaptation Science Center, $150,202.

6. Bidlack, A., J. Fellman, and E. Hood. NSF Alaska EPSCoR: Fire and Ice Project, $164,000 for 2019–2020.

8. Bidlack A. and J.B. Fellman JB. Hydrologic controls on watershed biogeochemistry. USDA Forest Service, $29,316.

9. Bellmore R.J., J.B. Fellman, M. Dunkle, and C.C. Caudill. Influence of hydrologic heterogeneity on river food webs and salmon productivity in southeast Alaska. US Geological Survey Climate Adaption Science Center, $199,620.

10. Behnke M., J.B. Fellman, E. Hood, and R.G.M. Spencer. Smoky ice: Is tourism feeding fossil fuel to glacial and coastal ecosystems? National Geographic Early Career Grant, $9,999.

11. Hood, E. and J.M. Amundson. Improving forecasting of the Suicide Basin Outburst Flood. USGS Alaska Climate Adaptation Science Center, $108,000.

12. Pyare, S. GeoHackathon: a GER-aligned, team-based springboard in integrative STEM for environmental-health disciplines. Alaska IDeA Network of Biomedical Research Excellence (INBRE), $12,187.