February 14, 2022

AY 2020-2021 Annual Student Assessment Report

Bachelor of Science in Environmental Science
Bachelor of Science in 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
Jason Fellman, Assistant Research Professor of Environmental Science

The B.S. Environmental Science (ENVS) and the B.S. 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 and ENRE students are required to complete either an internship or an individual research project within their degree.

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 AY2017-2021

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	AY21
#1	3.12	N/A*	4.34	3.57	4.49
#2	3.81	3.83	3.0	3.9	4.08
#3	4.57	3.89	N/A**	5.26	5.29
#4	2.45	3.64	4.57	5.13	4.86
#5	4.08	3.92	4.12	4.17	4.28

*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 tenet of the ENVS/ENRE 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	AY21
ENVS S491 (internship)	3	1	4	5	7	3
ENVS S498 (research)	2	2	5	6	4	7

ENVS and ENRE students continue to be involved in a variety of local and regional 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.

Example student projects from summer 2020 through spring 2021.

- Joe Vordebruggen assisted Dr. Nagorski with developing an evaluation of contaminants in nearshore blue mussels along the Lost Coast of Southeast Alaska for a National Park Service-funded project. The intended field sampling campaign was canceled due to the pandemic, but Joe worked diligently to assemble relevant background research that will be key components of the final report that Nagorski will write and Joe will serve as co-author on.
- Michaela Zurflueh conducted a marine debris project at home in Kodiak (due to the pandemic). There, she quantified and sorted debris that she collected on beaches and linked its accumulation to geomorphic features of the coastline. Dr. Nagorski mentored her via Zoom regarding her methods, analyses, results, conclusions, and report writing.
- Rosie Rudy received funding from BLaST to evaluate microplastics in rain and snow. She developed the project idea, wrote the proposal, conducted field work and laboratory analysis, and wrote a report.
- Erin Galla applied for and obtained student research funding from INBRE to investigate mercury concentrations in fish. Dr. Nagorski trained her how to calibrate and use the newly acquired Direct Mercury Analyzer in our analytical lab and to run analyses. Her months-long process resulted in very interesting results with a lot of potential interest to the public regarding mercury concentrations in commonly consumed salmon, rockfish, halibut, and other species. She will be

traveling to the INBRE annual retreat in spring of 2022 to present her findings.

- Connor Johnson worked with Dr. Fellman and Dr. Hood on the Juneau Road system stream monitoring project, assisted in Alaska EPSCoR Fire and Ice stream sampling, and finished his undergraduate research project of sorting and identifying stream drift samples.
- Dean Thiart worked with Dr. Pyare and partners at the Jensen-Olsen Arboretum to create a drone-based mapping product of the Arboretum grounds.
- Amy Jenson worked with Dr. Amundson on modeling glacier outburst floods, and how they evolve from one year to the next. The project results provide insights into glacier hydrology as well as informing decision makers about outburst flood hazards. Amy presented preliminary findings at the Northwest Glaciologists Meeting in October 2021 and will be a lead author on a peer-reviewed paper stemming from this work.

These projects are largely supported by faculty grants. ENVS/ENRE 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.

5. Evaluation of Data Collected During AY 2020-21

ENVS and ENRE students "meet expectations" in all student learning objectives. Students performed well across all SLOs and we continue to have robust numbers of students taking internships and directed research projects, despite challenges presented by the pandemic. The SLOs are primarily assessing upper division courses. Thus most students in these courses had already completed two or more years at the university and were likely better equipped to handle the pandemic, both psychologically and academically, than those who were just entering the university at the start of the pandemic. We are especially concerned about the impact that the pandemic has had on students that entered the university during the pandemic.

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- and technology-oriented courses. We were unable to offer as many of these courses this year due to the pandemic, but plan to offer several such courses next year.

Shabadrang Khalsa served as the ENVS and ENRE lab manager this year. She was instrumental in making the transition to distance physics labs go smoothly. Maintaining continuity in this position, with an effective lab manager that has subject area expertise, will ensure smooth delivery of labs and allow faculty to focus on content and course delivery.

The ENVS and ENRE program has seen growth in recent years. This resulted in a record number of graduates in AY19-20 and a similar number in AY20-21 (5 ENVS and 2 ENRE). We anticipate similar numbers next year, despite reductions in enrollment that occurred due to the pandemic. Enrollment in the ENRE degree is consistently lower than enrollment in the ENVS degree. In order to make both degrees more attractive, build a stronger cohort of students, and streamline recruitment and program coordination, we recently established the UAS Program on the Environment, which includes the B.S. Environmental Science, the B.S. Environmental Resources, and the B.A. Environmental Studies. These degrees 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 have also worked with the recruitment and web teams to update program content. Preliminary data indicates that these changes have resulted in more students enrolling in the Environmental Resources degree.

7. Additional Program Information

Exit Interview Information

We have traditionally sent out surveys to program graduates via email and typically receive very few to no responses (as was the case this year). Next year we plan to make the surveys anonymous and will send them to students as soon as they apply for graduation.

Faculty productivity and service

Program faculty have had success procuring external funding and publishing peer-reviewed manuscripts, having been awarded $1.28M in research grants and publishing 12 peer-reviewed manuscripts in 2020.

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 and the Office of Intellectual Property and Commercialization.
- Dr. Amundson served as the UAS representative for the Alaska Space Grant Program.
- Dr. Hood served as PI on the NSF-funded Coastal Margins Research Coordination Network, which includes researchers from seven universities primarily in the Pacific Northwest
- Dr. Fellman is the UAS representative for the Alaska Climate Adaptation Science Center and served as the Interim Co-director of the Alaska Coastal Rainforest Center.
- Dr. Pyare represented UAS on the Alaska CAN Southeast Network, a professional network of focusing on transitions to, and completion of, post-secondary education.
- Dr. Nagorski served as the Natural Sciences representative to the UAS Faculty Senate.
- Dr. Nagorski served as the Alaskan councilor to the National Association of Geoscience Teachers.
- Dr. Pyare served as the program coordinator of the Associates of Science degree at UAS (overhauling that degree), the Environmental Sciences Forestry Internship Coordinator to implement training and work opportunities in forestry/mapping projects for UAS interns.
- Dr. Hood and Dr. Amundson collaborated with 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. Nagorski and Dr. Hood are working with local emergency officials and other geoscientists to assess a newly identified potential landslide hazard in the Lemon Creek valley.
- Dr. Pyare served on the national Fulbright U.S. Scholar Peer Review Committee and the Fulbright Indonesia bi-national review committee of the American Indonesian Exchange Foundation.
- Dr. Pyare served on the Tongass Wildlife Climate Change Vulnerability Assessment to guide development of a climate adaptation plan for regional federal land management.
- Dr. Pyare served on the Place-based Learning (PBL) network of the Association of Alaska School Board. Served to build a common regional resource for place-based educational opportunities.
- Dr. Pyare advised the Goldbelt Heritage Foundation to support curriculum specialists developing culturally responsive STEM curriculum for transitional students.
- Dr. Nagorski and Dr. Hood presented public lectures and interpreter training sessions and were

guest scientists at a local school.

8. Appendix

List of publications in 2020

1. Eidam, E.F., D.A. Sutherland, D. Duncan, C. Kienholz, J.M. Amundson, and R.J. Motyka, 2020. Morainal bank evolution and fjord infilling during a tidewater glacier stillstand, on seasonal to decadal timescales, *J. Geophys. Res. Earth Surf.*, 125, e2019JF005359, https://doi.org/10.1029/2019JF005359.

2. Kienholz, C., J. Pierce, E. Hood, J.M. Amundson, G. Wolken, A. Jacobs, S. Hart, K. Wikstrom Jones, D. Abdel-Fattah, C. Johnson, and J. Conaway, 2020. Deglacierization of a marginal basin and implications for outburst floods, Mendenhall Glacier, Alaska, *Front. Earth Sci.*, 8, 137, https://doi.org/10.3389/feart.2020.00137.

3. Amundson, J.M., C. Kienholz, A.O. Hager, R.H. Jackson, R.J. Motyka, J.D. Nash, and D.A. Sutherland, 2020. Formation, flow, and break-up of ephemeral ice mélange at LeConte Glacier and Bay, Alaska, *J. Glaciol.*, 66(258), 577-590, https://doi.org/10.1017/jog.2020.29.

4. Jackson, R.H., J.D. Nash, C. Kienholz, D.A. Sutherland, J.M. Amundson, R.J. Motyka, D. Winters, E. Skyllingstad, and E.C. Pettit, 2020. Meltwater intrusions reveal mechanisms for rapid submarine melt at a tidewater glacier, *Geophys. Res. Lett.*, 47, e2019GL085335, https://doi.org/10.1029/2019GL085335.

5. Bidlack, A.L., S. Bisbing, B. Buma, H. Diefenderfer, J. Fellman, I Giesbrecht, K. Lertzman, S. Perakis, D. Butman, D. D'Amore, W. Floyd, S. Fleming, E. Hood, B. Hunt, P. Kiffney, G. McNicol, B. Menounos, and S. Tank (2020) Climate-Mediated Changes to Linked Terrestrial and Marine Ecosystems across the Northeast Pacific Coastal Temperate Rainforest Margin, *Bioscience*, https://doi.org/10.1093/biosci/biaa171

6. Edwards, R.T., D. D'Amore, F.E. Biles, J.B. Fellman, E. Hood, J.W. Trubilowicz, and W.C. Floyd (2020) Riverine Dissolved Organic Carbon Export in the Eastern Gulf of Alaska, *J. Geophys. Res.–Biogeosciences*, https://doi.org/10.1029/2020JG005725.

7. Behnke, M., A. Stubbins, J. B. Fellman, E. Hood, T. Dittmar, and R. G. M. Spencer (2020) Dissolved organic matter sources in glacierized watersheds delineated through compositional and carbon isotopic modeling. *Limnology and Oceanography,* 66: 438-451, https://doi.org/10.1002/lno.11615.

8. Hood, E., Fellman, J. B., & Spencer, R.G. M. (2020) Glacier loss impacts riverine organic carbon transport to the ocean. *Geophysical Research Letters*, *47*, e2020GL089804, https://doi.org/10.1029/2020GL089804.

9. Fellman, J. B., Hood, E., Behnke, M. I., Welker, J. M., & Spencer, R. G. M. (2020). Stormflows drive stream carbon concentration, speciation, and dissolved organic matter composition in coastal temperate rainforest watersheds. *Journal of Geophysical Research: Biogeosciences*, *125*,

e2020JG005804, https://doi.org/10.1029/2020JG005804.

10. Pitman, K.J., J.W. Moore, M.R. Sloat, A.H. Beaudreau, A.L. Bidlack, R.E. Brenner, E. Hood, G. Pess, N. Mantua, A.M. Milner, V. Radić, G. Reeves, D.E. Schindler, and, D. Whited (2020) Glacier Retreat and Pacific Salmon, *BioScience*, 70: 220–236, https://doi.org/10.1093/biosci/biaa015.

11. Kohler, T.J., P. Vinšová, L. Falteisek, J.D. Žárský, J.C. Yde, J. E. Hatton, J.R. Hawkings, G. Lamarche-Gagnon, E. Hood, K.A. Cameron, and M. Stibal (2020) Patterns in Microbial Assemblages Exported From the Meltwater of Arctic and Sub-Arctic Glaciers, *Frontiers in Microbiology*, 11: 669, https://doi.org/10.3389/fmicb.2020.00669.

12. Lepak, R., S. Janssen, D. Krabbenhoft, M. Tate, R. Yin, W. Fitzgerald, S. Nagorski, J. Hurley, and D. Engstrom (2020). Resolving atmospheric mercury loading and source trends from isotopic records of remote North American lake sediments. *Environmental Science and Technology,* 54, 15, 9325-9333. DOI: 10.1021/acs.est.0c00579

List of grants awarded in 2020

1. Amundson, J.M., M.O. Navarro, S. Pyare, G.D. Wright, and S.A. Nagorski. Undergraduate field studies across the icefield-to-ocean environment of Southeast Alaska. Alaska Space Grant Program, $84,924.

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

3. Harley, J. and E. Hood. Combining local traditional knowledge and machine learning to predict the future safety of shellfish harvests in a changing climate. Alaska Climate Science Center, submitted $187,473.

4. Hood, E. and J. Fellman. NSF Alaska EPSCoR: Fire and Ice Project, $123K.

5. Fellman, J.B. and T. Thornton. CESU Alaska Coastal Rainforest Center Director Support. USDA Forest Service, $42,090.

6. Nagorski, S. Contaminants Inventory of Intertidal Mussels along the Lost Coast of Southeast Alaska. National Park Service, $17,287.

7. Pyare, S. and J. Fellman. Community and tribal youth engagement in a stream-network assessment of salmon thermal-habitat in the Situk River watershed of Yakutat, Alaska. USGS Climate Adaptation Science Center, $199,418.

8. Pyare, S. An earth-observation course in community-based, environmental problem solving as a pre-college STEM springboard. Alaska Spacegrant, $23,035.

9. Pyare, S. GeoHackathon: a GER-aligned, team-based springboard in integrative STEM for environmental-health disciplines. Alaska INBRE, $12,992.

10.. Pyare, S. Building continuity in the STEM pipeline through a re-engineered Associates of Science degree. STEPS Alaska, $8,661.

11. Pyare, S. Environmental Science Forestry Internship. Clarence & Verle Kramer Memorial Foundation fund, $7,346.

12. Fellman, J.B. Proposal to host the Alaska Climate Science Center. US Geological Survey Climate Adaptation Science Center, $205,808.

13. Nagorski, S., J.B. Fellman, and E. Hood. Collaborative research: Linking landslide and windstorm exposure to regional carbon stocks and fluxes in the largest US forest carbon reservoir, southeast Alaska. NSF Division of Earth Sciences, $46,401.

14. Fellman, J.B. and A. Bidlack. Investigating the influence of watershed variability on biogeochemistry and meta-food web dynamics in southeast Alaskan streams. USDA Forest Service, $49,460.

15. Hennon, G. and J.B. Fellman. Investigating microbial productivity at the terrestrial-marine interface in Lynn Canal. NSF Alaska EPSCoR, $27,930.