



# Convergent Arctic Research Perspectives and Education (CARPE)

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## Innovations in Graduate Education

The CARPE NRT graduate program tackles the complex socio-ecological challenges of changing seasonality in the Arctic using a convergence research framework that respects the viewpoints of Arctic residents. The program integrates project-based learning and protocols for cultivating and sustaining community partnerships, prioritizing process over product to prepare students to address emerging grand challenges posed by a changing Arctic and its cascading impacts on society. CARPE's successes offer valuable guidance to graduate programs seeking to integrate convergence research and community partnerships into student training.

## Theme of Changing Seasonality in the Arctic

The cascading effects of climate change on natural and human systems are more evident in the Arctic than anywhere else on Earth. Rising temperatures, dramatic sea ice reductions, glacier and ice sheet mass loss, and thawing permafrost influence Arctic peoples' and ecosystems' daily activities and well-being. Particularly profound changes result from shifts in seasonality including the timing of cultural, biological, physical, and chemical events. Phenological mismatches affect Arctic residents' hunting and foraging, fishing, shipping, mobility, and community infrastructure.



## Courses and Training

CARPE trainees aim to:

- Design and conduct **convergent research projects** focused on the impacts of changing seasonality on the Arctic's natural and human systems
- Build capacity to engage with Arctic residents

Five Innovative CARPE Courses:

- Arctic Seminar – Introduction to Arctic Systems Science and changing seasonality
- Arctic Research Methods I & II – Develop skills in cold regions research methods and Indigenous community engagement
- Arctic Challenges I & II – Co-develop and conduct convergent research projects with community partners.



Skills and Competencies

- Science communication
- Science of team science
- Research ethics
- Convergence theory and practice

Workshops and Training

- Arctic Climate Change and Community Collaborations winter workshop in Fairbanks, AK (UAF)
- Cold regions field training (Mt. Washington)
- Engaging Arctic Residents workshops (Gaaltije)

Learn More



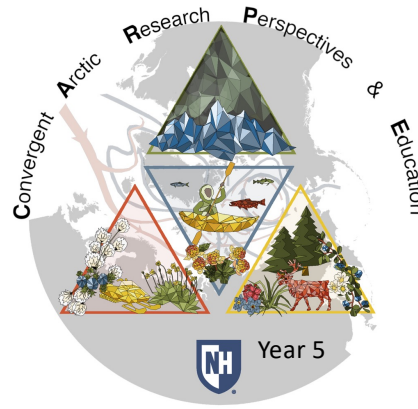
Please visit the CARPE website: <https://marine.unh.edu/carpe-nrt>

This project is supported by the National Science Foundation Research Traineeship (NRT) and Navigating the New Arctic (NNA) programs (NRT-NNA #2125868, PI Varner)

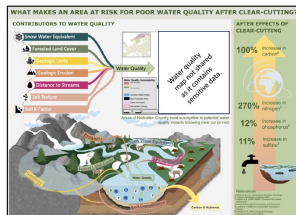
Figures and photos courtesy of CARPE faculty, trainees, and partners. CARPE logo designed by trainee Emma Burkett.

Special thanks to External Evaluators Mariko Chang and Sadie Davis from Mariko Chang Consulting, Inc. for their comprehensive data collection and invaluable feedback.

**UNH Land Acknowledgement** – As we all journey on the trail of life, we wish to acknowledge the spiritual and physical connection the Pennacook, Abenaki, and Wabanaki Peoples have maintained to N'dakinna (homeland) and the aki (land), nebi (water), olakwika (flora), and awaasak (fauna) which the University of New Hampshire community is honored to steward today. We also acknowledge the hardships they continue to endure after the loss of unceded homelands and champion the university's responsibility to foster relationships and opportunities that strengthen the well-being of the Indigenous People who carry forward the traditions of their ancestors.



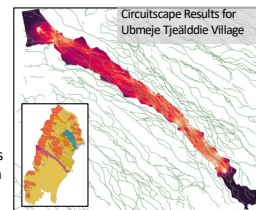
## Cohort 1 – From Forest to Flow: Convergence Research on Water Quality Parameters in Swedish Forested Landscapes



The first Cohort of CARPE trainees completed a student-led, convergent research project identifying areas vulnerable to water quality degradation related to clear-cutting forestry practices across Northern Sweden. Products provided to Sámi partners included a map that highlights areas where water quality is most sensitive to clear-cutting as well as a brochure synthesizing results for community decision-making. This cohort has prepared a paper on Graduate Student-Led Convergence Research Strategies and Best Practices for Arctic Community-Aligned Research.

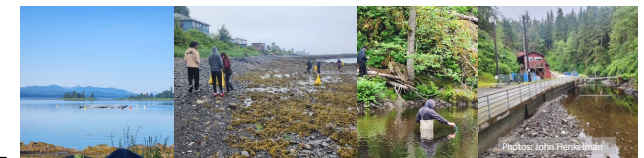
## Cohort 2 – Reindeer on the Run: The Impacts of Climate Change on Reindeer Movement in Sápmi in Northern Sweden

Cohort 2's convergence research project, examines how climate change and anthropogenic disturbances are influencing reindeer movement across Sámi village herding areas in Northern Sweden. They consider the contribution of Arctic warming to permafrost thaw, ice and snow, and wildfire frequency as well as the human effects on Sámi Village Boundaries, roads, railroads, landcover, topography, and population. They developed Cost Surface maps and conducted a Circuitscape analysis to study the potential for reindeer movement. The team is working with partners from the villages of Viikosjärvi and Övre Soppero to better understand the specific needs of Sámi reindeer herders.



## Cohort 3 – Microplastic and Water Quality Assessment of Gunnuk Creek Watershed, Kake Alaska

Cohort 3 is establishing a foundation for a long-term collaborative water quality monitoring program with the community in Kake, Alaska. The focus is to advance both environmental studies and sustainability through community-centered engagement with high school students to inspire the next generation of place-based scientists. Partners include the the Alaska Youth Stewards (AYS) summer program, teachers from the Kake City School District, the Village of Kake leadership, the Kake Natural Resources Department, the local Forest Service, SEALaska Corporation, Sealaska Heritage Institute, and other academic researchers working in Kake. Cohort 3 trainees bring expertise from geochemistry, geophysics, social sciences, and recreation management. They will return to Kake in summer 2026 to collaborate on water quality measurements with these partners on the Gunnuk Creek and other local streams.



## Cohort 4 – Convergence Research Projects in Development

Community Listening for a Changing Subsistence Species: Bearded seals from the Arctic to Bristol Bay



Phenological Asynchronicity and Delayed Cuing of the Arrival of Migratory Birds into Spruce Hole Bog



Enhancing Arctic Plant Establishment for Coastal Erosion Control Through Microbial Amendments.

	Arctic Data	Site Progress	Soil Temp.	Soil Moisture
Intended Use	Soil temperature and moisture data from the Arctic region to inform microbial amendment strategies.	Installation of sensors and data collection systems at the study site.	Monitoring of soil temperature and moisture over time.	Monitoring of soil moisture and temperature over time.
Data Acquisition Method	Field recorder	PhotoCam data or strategic camera networks	Soil probe	Soil probe
Intended analysis	StatSoft	GIS through Python	RStudio	RStudio

Figure 1. Diagram representing available data variables, which may be used for analysis, and the algorithm corresponding to each variable and its analysis method.

## Faculty Cohort – Sustaining Successful Elements of CARPE



By fostering connections among UNH faculty, CARPE is strengthening institutional capacity for interdisciplinary research that aligns with the university's strategic priorities. CARPE's successes provide a model for training graduate students through cohort-based, convergent research that addresses pressing societal challenges and actively engages communities.

CARPE is committed to sustaining its advances and innovations in graduate training. Plans include documenting lessons learned through publications and reports; continuing to teach cohort-based convergence in the course Arctic Ecology and Society; promoting the online Arctic Climate Change and Community Collaborations course currently being developed at UAF; recognizing the Spruce Hole Bog site as a living classroom and developing partnerships at the sites with the Town of Durham; pursuing a Convergence Innovator Digital Badge to encourage continued interdisciplinary research experiences; and maintaining connections among trainees and faculty through a dedicated LinkedIn group.

