

## Day 1 – July 28<sup>th</sup>, 2022: 10:15 -11:15 am AK time

Leading question: What current resources, funding, opportunities, and technology exist to support Polar STEM field and in-classroom experiences?

### 1.

**Title:** A Tale of Two Cities: Empowering Students on the Frontlines of Climate Change through Field Experience

**Presenter:** Alex Chumbley (virtual) & students (virtual)

### Abstract

A group of approximately 20 high school students from Miami-Dade College - Homestead Campus's Upward Bound program was hosted by the Juneau Icefield Research Program for a one-week field experience in July 2022. This one-week experience left our students excited for the field of polar science and poised them to make nuanced connections between the two cities: Miami and Juneau. During this talk, our students themselves will share both their experiences in Alaska and the ways they connected this experience to their everyday life. They begin by sharing the details of their field experience, such as coring trees, analyzing a soil pit, identifying glaciers, and collecting water samples for future analysis; in their stories, you will hear the ways the students have deepened both their content knowledge and their appreciation for climate science. Afterwards, they will share how they leveraged these experiences in Alaska to make complex and nuanced connections between the changes seen in Juneau to the changes they live every day in Miami-Dade County. The connections the students made between Alaska and Florida coalesced around four major themes all undergirded by the impact of climate change: How have the people, the local economies, the land, and the waterways shifted as result of climate-change? This talk will focus on the latter two themes: the story of land and the story of the water. The story of the land foregrounds the connection between glacial melt in Alaska with sea-level rise in Florida. Students now have first-hand experience seeing the impact of glacial isostatic rebound in Alaska and have experienced intermittent flooding on sunny days in Southern Florida during a "King Tide." Experiencing drastically different impacts from the same overarching phenomenon of climate change positioned our students to grapple with this information on a deeper level and reach a more complex understanding. The story of the water focuses on the unexpected ways circulation patterns in our world's oceans influence the coastal ecosystems of Florida and Alaska. Additionally, students connect the ways that marine life have been impacted by climate change in both in Florida and Alaska. Overall, we hope our students' presentation illuminates the power of field-experiences. In particular, we contend that this experience has deepened our students content knowledge thereby empowering them to make more nuanced connections than possible in a traditional brick-and-mortar school setting. Ultimately, their experience travelling to a city 4000+ miles away has allowed our students to better understand the impacts they are experiencing on a daily basis in their own backyard.

**2.**

**Title:** Navigating the New Arctic Community Office: Connecting educators with Arctic research

**Presenter:** Jenna Vater (in-person)

**Abstract:**

Connecting educators with Arctic research, outcomes and products is imperative to inspiring learners to engage with Polar STEM fields. Organizations like the Navigating the New Arctic Community Office (NNA-CO) can act as a bridge between Arctic researchers and educators. In this presentation, we will introduce the NNA-CO, its education and outreach efforts, and how educators can engage with the office. This session will also highlight several examples of Navigating the New Arctic (NNA) projects that inform about and/or engage educators and students in Arctic research.

**3.**

**Title:** Current and future outreach resources for incorporating Arctic field science in the classroom from a research station in Arctic Alaska

**Presenter:** Haley Dunleavy (in-person)

**Abstract:**

Toolik Field Station is an Arctic research station located on the northern foothills of the Brooks Range, Alaska. The station aims to facilitate a deeper understanding of the Arctic by fostering science and education, and hosts up to 500 scientists and students every year while supporting the publication of thousands of peer-reviewed studies over the course of its nearly 50 year existence. Despite its significant impact on advancing science's collective understanding of the Arctic, Toolik's outreach to STEM education programs does not reach its full potential. Here, we present an overview of currently available resources and potential future initiatives that Toolik is interested in using to further develop our science outreach and communication to classrooms and STEM programs both within and outside of the state.

Currently, Toolik offers resources, accessible via its website, that could be used in the development of classroom modules on environmental data analysis and natural history observations. Toolik's Spatial and Environmental Data Center (SEDC) collects long-term, open-access monitoring datasets on weather, snow and ice thickness, atmosphere and air quality, plant phenology and growth, and bird migrations. Many visiting researchers archive their data collected from the Toolik region in open-access online databases like DataOne or the Arctic Data Center. In addition to these quantitative resources, the SEDC also offers qualitative materials through which students could learn about the Arctic, including animal and plant guides, a virtual herbarium, time lapse photographs of nearby tundra and lake sites, and virtual "street view" tours of the field station and experimental plots. Since 2006, the Toolik Naturalist Journal has provided daily accounts of natural history observations, also available on Toolik's website. These entries are written at a middle school reading level, include accompanying photographs, and are often translated into Spanish by Toolik staff. Additionally, the Toolik GIS and Remote Sensing department collects and analyzes spatial data derived from drone and satellite imagery and bathymetry surveys, in addition to creating a variety of maps. In the future, Toolik GIS hopes to create an interactive online platform for accessing and visualizing drone imagery.

As we expand our Polar STEM efforts, we hope to 1) increase the accessibility of current resources via improvements to our website, 2) build new resources specifically for outreach, and 3) increase classroom visits, either virtual or in-classroom, to share with students about Toolik and its research community. Current work on this goal includes contributing to the growing effort on changing the

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narrative about who “belongs” in science. Through social media, web stories, Skype-A-Scientist sessions, and other outreach products, we are working on highlighting the diverse identities within Arctic science that are represented at Toolik as well as emphasizing the availability and variety of career pathways into science. As the largest scientific research station in the Arctic, Toolik Field Station values the importance of developing a STEM outreach program that matches the strength of its research support. We welcome further feedback and future collaboration towards advancing this initiative.

4.

**Title:** “New” Earth and Planetary Sciences Polar Proving Ground – The Juneau Icefield Research Program

**Presenter:** Seth Campbell

**Abstract:** A discussion on the direction of the Juneau Icefield Research Program and the aims and goals of the program moving forward.

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### Day 2 July 29<sup>th</sup>, 2022: 10:20 -11:20 am AK time

Leading question: What are the current needs of students related to Polar STEM, what are the logistical challenges and barriers to these students, and how can we break barriers and build community within Polar STEM?

1.

**Title:** Inspiring Girls Expeditions of Alaska: Removing barriers to accessing field sciences and the outdoors for teenaged youth and early career professionals

**Presenter:** Joanna Young (virtual)

#### **Abstract**

Inspiring Girls Expeditions empowers 16-18 year-old high school girls and gender-expansive youth through 12-day backcountry expeditions that combine science, art, and outdoor exploration. At Inspiring Girls Expeditions of Alaska based at the International Arctic Research Center at the University of Alaska Fairbanks, we offer three expeditions per summer: 1) Girls on Ice Alaska, our flagship mountaineering expedition with a focus on glacier and alpine ecosystems, 2) Girls on Water, a sea kayaking expedition examining the nearshore marine ecosystem, and 3) Girls in the Forest, a packrafting and hiking expedition that explores the Interior Alaskan boreal forest landscape. Given that field sciences and outdoor recreation are traditionally male-dominated, Inspiring Girls was created in order to welcome young women into these spheres. Though we acknowledge our name is imperfect, Inspiring Girls has since evolved to welcome girls, non-binary youth and gender non-confirming youth. We take an intersectional approach to inviting marginalized groups into field sciences by intentionally building teams of participants from a diversity of socio-economic, racial, ethnic, and family backgrounds. Importantly, our tuition-free format removes a substantial barrier to access to extracurricular science and outdoor programs. In addition to participants, Inspiring Girls also serves as a learning opportunity

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for the early career scientists, artists, and outdoor guides who we employ as instructors, through professional development trainings in e.g. culturally-responsive pedagogy, LGBTQ+ allyship, and traditional Land Acknowledgement. This presentation will discuss the approaches Inspiring Girls Expeditions of Alaska uses to create opportunities for both high schoolers and young professionals in field science and outdoor recreation, rooted in best practices from the literature and 10+ years of experience hosting expeditions in Alaska.

### 2.

**Title:** PSECCO: A New Community Office for Supporting Early Career Scientists and Advancing Equity and Inclusion in the Polar Sciences

**Presenter:** Mariama C. Dryak<sup>1,2</sup>(virtual), Rebecca Batchelor<sup>1</sup>, Bradley Markle<sup>2</sup>, Anne Gold<sup>1</sup>

1. CIRES Education & Outreach, University of Colorado Boulder
2. INSTAAR, University of Colorado Boulder

#### **Abstract**

While the polar sciences offer unique opportunities for international, transdisciplinary research as well as connections with Indigenous knowledge systems, the US polar science community remains unrepresentative of the diversity of the country itself. While there are many reasons for this, including those familiar throughout STEM as well as the explicit historical exclusion of certain groups in polar science specifically, early career scientists in the polar community are driving efforts to broaden participation in polar research. **The newly launched Polar Science Early Career Community Office (PSECCO) seeks to empower, elevate and give agency to the early career polar scientists who are leading the charge to make the polar sciences more welcoming, inclusive and diverse.** The office will foster community among early career polar scientists and educators, provide funding, training and travel opportunities, partner with other organizations to share opportunities, resources and support leadership development, while working together towards a more just, inclusive, diverse, equitable and accessible polar science environment. Launched early in 2022, we invite all current and future polar scientists and educators to join PSECCO in building community together.

### 3.

**Title:** The Intersection of Sustainability and Resource Development

**Presenter:** Taylor Ferguson (in-person)

#### **Abstract:**

Lack of access to information and an in-depth understanding of the Arctic's resources are major barriers for many students, especially underrepresented populations, when considering career choices in Alaska. Alaska Resource Education (ARE) is working to knock down these barriers for students across Alaska. ARE has several programs to teach students K-12 about Alaska's natural resources, the science behind them, their associated careers, and most importantly their role in a sustainable future for the Arctic.

**4.**

**Title:** Making connections – Field experiences for high school students with Upward Bound and the Juneau Icefield Research Program – Scott Braddock (in-person)

**Presenter:** Scott Braddock

**Abstract:** During the summer of 2022, Upward Bound high school students from Miami and Washington joined researchers from the Juneau Icefield Research Program on week-long field experiences in Juneau, Alaska. The overall aim of the collaboration between the Juneau Icefield Research Program and Upward Bound is to introduce high school students to Earth and Climate sciences through participation in science research, exploring outdoor classrooms, and making connections between their homes and a rapidly changing Arctic environment. The collaboration between UB and JIRP is funded to continue over the next 3 years as we look for ways to build on and improve this amazing experience for students.

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**Day 3 July 30<sup>th</sup>, 2022: 10:20 -11:20 am AK time**

Leading question: How can we best create engaging and real-world Polar STEM and related experiences for students in the classroom?

**1.**

**Title:** Icebergs In Maine

**Presenter:** Erin Towns (in person)

**Abstract:**

Trying to make the Arctic relevant can be challenging in the classroom. Participants will be introduced to a student created photography exhibit (shown in person and virtually) that served as a capstone project for an interdisciplinary Arctic course that combined social studies, polar climate change studies, and visual arts. PolarTREC teacher, Erin Towns will share how she took her field experience as part of the Greenland Subglacial Tremor Project and directly related it to local and state contemporary issues, making learning fun, tangible, and relevant for her students.

**2.**

**Title:** How T3 Alliance and Upward Bound are engaging students in STEM

**Presenter:** Tate Barhaug (in person)

**Abstract**

T3 Alliance works with programs such as Upward Bound to facilitate an engaging environment for students interested in STEM. Seeing the clear picture that young students have the capability and desire to make a positive difference in their communities, these programs work to cultivate community oriented leaders with problem solving skills and a growth mindset. Through a network of educators at universities and high schools, students are exposed to real world problems and the tools that they need to ideate and prototype solutions. The network provides a wealth of information through connecting students to experts while simultaneously giving them the opportunity to engage with technology. This

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technology is housed in a Makerspace where students are encouraged to experiment with new techniques and learn through a hands-on working environment. The students also have the opportunity to engage in the Upward Bound Summer Program where they experience this process over a five week period at University of Alaska Fairbanks. Just as the students grow, the programs grow as well with each new educator, researcher and community member that joins to make a positive difference in the lives of others through technology, culture and opportunities.

### **3.**

**Title:** Democratizing STEM with Polar Science

**Presenter:** Christine Hirst Bernhardt & Dr. Holly Miller (in person)

#### **Abstract**

Earth and Space sciences encompass the most neglected realm of science education in the United States, as well as the lowest representation of Women and People of Color. For over a century, high school science coursework has minimally included biology, chemistry and physics, integrating Earth sciences in middle grades and eliminating astronomy. There has been no national test, curricula or standardization, which immediately eliminates rich opportunities for learning, such as the integration of polar science. The scarcity of course offerings and absence of Advanced Placement or IB courses have relegated coursework to university settings, by which time the moment to select a STEM field has likely passed. Secondary and primary environments are critical for the formation of a STEM identity, particularly amongst girls and students of non-dominant groups. This talk will explore the integration of polar sciences in formal education settings to foster STEM identities and build bridges between science, community, and the classroom. Utilization of Earth Systems science with a lens to the poles can unify learning from other contents, while providing opportunities to explore the evidential sources of knowledge of our world.

The inclusion of Earth and Space content (ESS) into NGSS courses, provides a unique opportunity to contextualize science learning. NGSS assigned equal weight to the content areas of life, physical and ESS, which is a stark difference from the previous 100 years of education, and allows for a drastic restructuring of course sequencing. There is now a far greater emphasis on Earth-Space systems across all grade levels, reflecting the interdisciplinary nature of the field. The exposure to meaningful and relevant science activities can provide an inclusive environment to traditionally marginalized students who do not see the real world applicability of science in their lives.

Students in urbanized settings may have even less academic exposure to astronomy and space sciences through a vicious cycle of deficit thinking and systematic oppression. Curricularization and oversimplification may look like non-local examples, unrelatable representation, and a failure to incorporate areas of relevancy and urgency from daily life into the classroom. This can further complicate the incorporation of polar sciences, which may seem abstract, complicated, and unnecessary. One can only imagine the magnification of this separation following a year of remote, removed learning mediated by a screen. By providing mechanisms of access to polar sciences connected to local environments, educators can facilitate authentic learning experiences to previously excluded students in these fields. Earth sciences and polar education has potential to disrupt colonial narratives while providing greater access to 21st century skills.