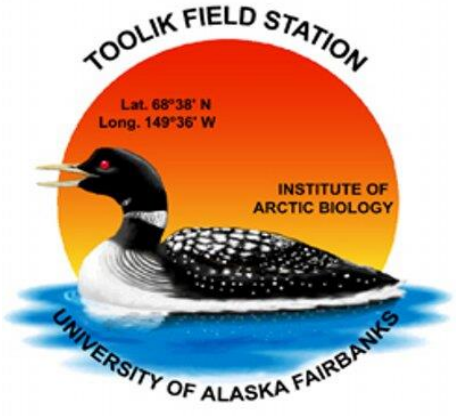
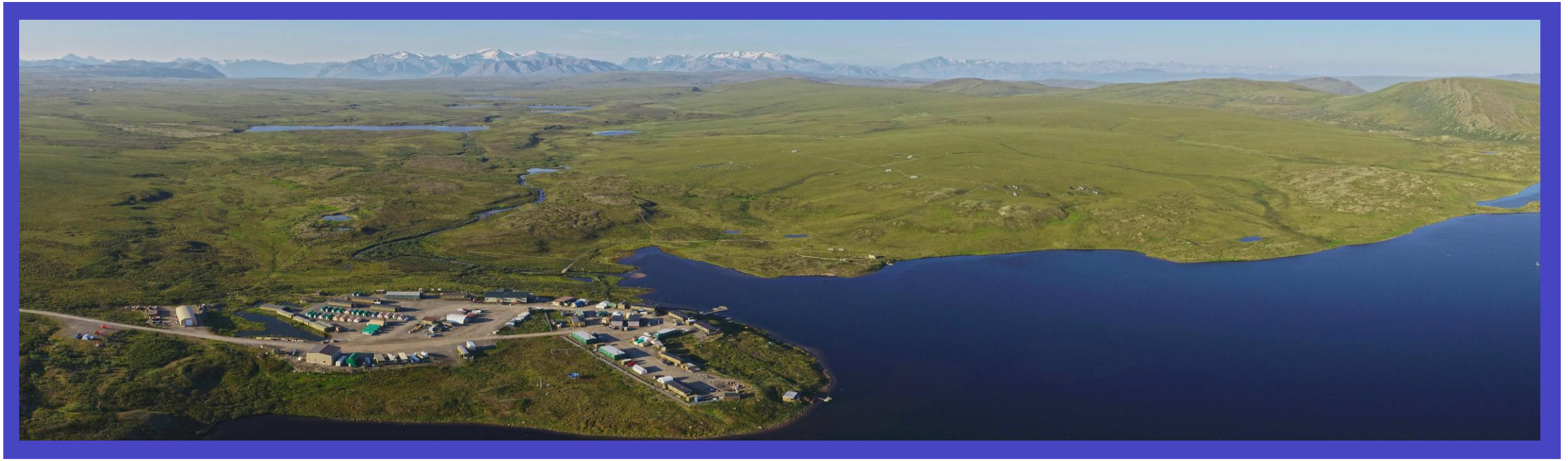
TOOLIK FIELD STATION

SECOND ALL SCIENTISTS' MEETING & WORKSHOP



SYNDONIA BRET-HARTE



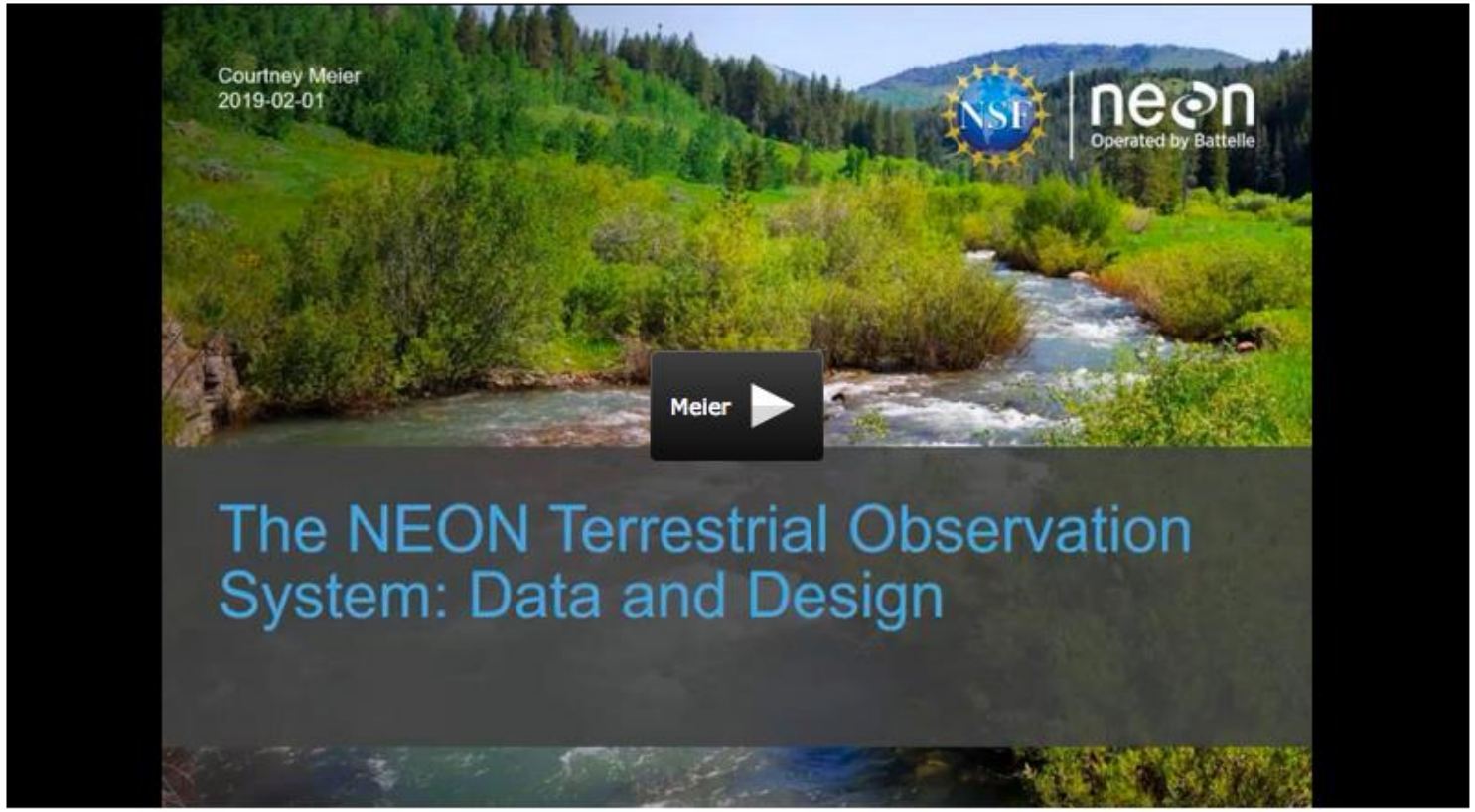
SECOND TOOLIK ALL SCIENTISTS' MEETING

- Held February 1-2, 2019
- Approximately 90 attendees (some attended remotely)
  - As compared to ~70 for the first Toolik All Scientists' Meeting
- 16 speakers
- 31 posters
- 2nd day: workshop on future directions for science support
- Lots of positive energy
- Oral presentations and poster abstracts are available on our website

2019 Toolik All Scientists Meeting – Portland, OR, February 1-2, 2019

The goal of this meeting is to promote collaboration and synthesis among Toolik researchers and others working in the Arctic

| All Scientists Meeting: Full Agenda | Poster Abstracts |



Click on a presentation to load

Friday 8:40am	Courtney Meier *The NEON Terrestrial Observation System: Data and Design*	pdf
Friday 9:00am	Alexander Kholodov *Role of permafrost in evolution of terrestrial ecosystems in changing climate at the North Slope of Alaska*	pdf

Friday 11:40am	Sally MacIntyre *Arctic Lakes -Implications of Hydrodynamics on GHG Emissions*	pdf
Friday 1:40pm	Megan Machmuller *Quantifying drivers of Arctic carbon-climate feedbacks across scales*	pdf
Friday	Helen Chmura	

SECOND ALL SCIENTISTS' MEETING AND WORKSHOP

- Workshop: 9 Breakout Groups

1) **Common Use Equipment/Additional Scientific Services/Molecular/Genomics capability on site**
2) **NEON integration**
3) **Higher order data products from SEDC**
4) **New/upgraded facilities**
5) **Landscape Planning**
6) **Identifying and removing obstacles to edge season/winter work**
7) **Environmental sustainability**
8) **Education and Outreach**
9) **Strategic planning for Toolik Field Station**

1) COMMON USE EQUIPMENT/MOLECULAR/ETC

Toolik "Molecular Revolution"

- What new work could we do if we had this facility?
  - Real time population structure, environmental and ancient DNA, soil and plant microbial communities, quantitative stable isotope probing
- Why do this at Toolik?
  - Extract and stabilize DNA, RNA, proteins for shipping; increase sampling capacity, decrease shipping volume, decrease shipping of hazardous chemicals (ethanol or organic salts)
  - Know whether PCR reaction has worked and samples are good; reduce risks of shipping the unknown
  - RFLP id of plant roots to tailor plucking

1) COMMON USE EQUIPMENT/MOLECULAR/ETC

A Toolik molecular revolution would require:

- Super clean lab space that is closed and dedicated to molecular work
  - This is perhaps the biggest challenge
- Laminar flow hood with UV hood
- A variety of small lab equipment, including: Tissue grinder/ bead beater, Homogenizer, Pipettes (calibrated), Multipipettor (calibrated), Two microcentrifuges, Balance (3-place), Plate centrifuges, Thermocycles, Sonicating bath, Heat block, wiggling (need two), Electrophoresis, Qubit and/or picogreen, Gel imager, Mini-Ion nanopore technology, Incubator/oven, -20 clean freezer, Freeze dryer that can handle larger number of samples than the current one, new seals on old freeze dryer
- Potential conduit and agreement (work flow) to UAF core lab
- Need to think about how to manage waste stream: plastics, chemical waste

1) COMMON USE EQUIPMENT/MOLECULAR/ETC

Low Hanging Fruit:

- New shovels (trench shovel, sharp shooter)
- More DI water systems (new equipment needed); need to differentiate between water purity needs: ultrapure versus nanopure; stockpile 40 L carboys to transfer from one lab to another
- Big wet hood that is clean and easily accessible, with bench space nearby
- New oven, more oven space
- New freeze drier that doesn't leak
- Sink in the winter lab (right outside door of winter lab) for taxidermy
- Root washing sink with gentle dishwasher sprinkling hoses (could be outside)
- Rotary evaporator to reduce the need to ship samples in methanol
- Sediment corer
- Sediment grab sampler
- Supplies that many people use, such as every Licor spare part know to women
- New ethic for inventory and sharing to reduce old junk, waste, shipping
- Chemicals, disposables and equipment orphanage/swap meets

1) COMMON USE EQUIPMENT/MOLECULAR/ETC.

DREAM EQUIPMENT (probably unrealistic for now):

- Shimadzu TOC/TN
- Smart-Chem discrete analyzer
- Ion chromatograph
- Liquid chromatograph
- Elemental analyzer
- Shimadzu dual beam UV spectrophotometer
- Piccaro deuterium and oxygen, 13CO2
- Piccaro CO_2, CH_4, N_2O and NH_3 analyzers
- Common use gas chromatograph for analysis of CO_2, CH_4 and N_2O
- Incubation facilities for experimental manipulations
- Ground penetrating radar

2) NEON INTEGRATION

Biggest impediment is knowledge gap in user community of how NEON works, what NEON provides, and how the scientific community can leverage NEON assets

- Clarify what NEON has and how you can access it
  - Protocols, data, plot locations, sampling design, etc.

Can NEON better leverage Toolik GIS (maps, etc.)?

- Toolik GIS could provide NEON maps of interest. They could show sampling coordinates/plots and associated data products

NEON data products are a fire hose – hard for the community to narrow down on what would be useful to an individual researcher. Need to better target interests with specific Toolik research groups

- Improve data access, tutorials on data use. Data portal looks intuitive, but in practice does not seem to work very easily

NEON assignable assets could be a really great resource for arctic researchers, and obvious work to be done here to get the word out. (assignableassetrequests@battelleecology.org). The community is not up to speed on what NEON assignable assets is, or how to make requests. How does permitting work? NEON permits do not cover external research on NEON permitted locations.

- NEON should provide direct links to site host information and use Toolik's permitting webpage as an example
- NEON can provide Letters of Support to researchers applying for grants that leverage NEON
- NEON requests a min 4 weeks notice for obtaining letters of support, etc. Permitting, etc. takes longer

2) NEON INTEGRATION

- NEON Data workshop at Next All Scientist meeting? Or perhaps at Toolik Field Station? This would be an easy way for NEON to target a large interested audience without having to bring the audience to NEON.
- There is a need to Identify synergistic data-sets between NEON and existing research to improve efficiencies.
- NEON protocols – The community needs a better understanding of what they are. Weekly Toolik talk shops during the field season would be a great way to promote this kind of education
- NEON should expand data tutorials and youtube videos that can be used with students – initial feedback is positive
- NEON should put plot maps in Toolik Dining hall
- TOOLIK IS AN IDEAL TESTING GROUND for integrating NEON science with existing science. There is a large community of folks to that live, eat, sleep, and work together. There are a number of ideas that could be tested at the field station to facilitate incorporation of NEON science with the research community

3) HIGHER ORDER DATA PRODUCTS FROM SEDC

Topics:

- Climate summaries/synthesis
- New products that link spatial and EDC data, e.g. phenology estimated across landscape
- New products that take advantage of our UAS capability
- Data sharing for products produced by EDC/GIS staff
- Data attribution/authorship
- Bringing dark data into the light

3) HIGHER ORDER DATA PRODUCTS FROM SEDC

Dark Data

- TFS should be interested in obtaining and curating legacy dark data sets, esp. basic climate and phenology data.
- Create a MyToolik survey to capture who has dark data and learn what data researchers are interested in.
- Create registry listing who owns which dark datasets

Attribution

- Higher order data sets requiring experimental design input from SEDC should require authorship from those TFS staff involved
- Data collected by SEDC staff funded by cooperative agreement should be immediately made public, and this fact should be made explicit upfront when requesting services
- If PI/project wishes to have sole ownship of data, they should provide funding for GIS/EDC to carry out work.

3) HIGHER ORDER DATA PRODUCTS FROM SEDC

Working group to determine broad community datasets

- ARCSS grid at Toolik and Imnavait
- strike balance between project-specific requests versus long-term monitoring activities from EDC and GIS departments
- Potential GIS drone-based projects:
  - snow cover
  - vegetation land cover
  - surface temp
- Potential EDC projects :
  - general climate summaries (daily, monthly means etc)
  - gap-filled, user-friendly weather data set
  - SIF & DEM
  - Radiation maps (slope/potential radiation)

4) FACILITY UPGRADES

Immediate needs

- *EMT facility rental or replacement*
  - Why? Safety. Current EMT shack inadequate to treat serious injuries – no running water, leaking, bad location.
  - Update since Portland: NSF agreed to include EMT facility rental or procurement in 2019 budget. Requirements now being evaluated
- *Move forward with building lab 5* as primary winter lab. Target 2020.

4) FACILITY UPGRADES

Intermediate needs

- *Flux hut/space physics lab/aeronomy expansion/relocation*
  - Why? Increased demand to expand autonomous instruments, inadequate and saturated space, etc.
  - Can we relocate to accommodate atmospheric measurements but in a location that is more accessible?
  - Act now: Set up a workgroup with all current players to ID requirements, scope, coordinate science
- *Extending connectivity by internet and radio*. How can we better get data real-time all the way to Imnavait and other more remote research sites?
- *New washeteria in the residential area*
  - Why? Current building has limitations, can't be used in colder months because of bad insulation, is not in residential area. Currently only CG has showers for winter and shoulder seasons which is a real limitation, especially if shoulder season activity picks up in the future.

4) FACILITY UPGRADES

Longer term needs

- *Future lab concept*: Configurable/consolidated/co-located lab spaces, which will make it easier, more practical/functional to move from a building to another.
  - Why? In the next few years, over 50% of structures will be over 30 years old. Structures starting to show ages, leaking, etc.
  - Need for modular facilities, with configurable rooms that can be re-organized based on demand/needs by moving furniture around.
  - Have a plan for all new lab structures, locations, e.g conglomerate 4 or 5 units, with covered atrium in middle
  - Idea was discussed to try the moveable furniture concept in lab 6 during remodeling, but there's no time for this as the work is procured from this spring. Lab 5 will likely be the building where this concept can be implemented.
  - Common equipment spaces needed. Better space management for common use equipment, short term/long term user groups, etc.
  - Learn from places that already have done this (e.g. WRRB at UAF, U of Michigan)
- *Lecture hall/audiovisual/plenary space*
  - Why? Community center aging, structural problems, can't accommodate large groups, need to have a better space for education and outreach

5) LANDSCAPE PLANNING

- What areas to open up?
- What areas or rules to define areas to set aside?

- New boardwalk construction could be used to streamline access to currently less-accessible areas
  - Improve access to relatively undisturbed research areas
- Suggested Parameters:
  - Multiple different locations within the same combinations of geology and vegetation would be helpful as reference - and research areas
  - Preferable to not have "new areas" downstream of disturbed areas
  - Nice to have sites that afford opportunities for terrestrial and stream research, as well as lake access
  - A buffer betweeen reference areas and new research areas could limit, but not totally prevent access

5) LANDSCAPE PLANNING

Comments on SEDC's initial set of proposed sites:

- Site B will be focal point of future research
- Sites A-F have already had archaeological surveys
- A general issue is that access roads off of the Dalton are associated with former gravel pits
  - These access roads are also used as staging areas for hunters
- Due to proximity to lakes/streams already used in research, some of these proposed sites may not be compatible with some uses, such as fertilization
- Some proposed "new areas" span 2-3 land surface ages and/or parent materials, which is preferable
- Proposed "Reference areas" won't be perfect, but we can't let the perfect be the enemy of the good

5) LANDSCAPE PLANNING

- Questions:
  - What is the maximum driving distance from TFS people will tolerate?
  - Access roads off of the Dalton need to be graded - could we get permit to do that?
  - How many vehicles can TFS support at any given time?
  - Desirable to locate one of these areas near NEON? OK with NEON?
  - Should we set aside some of these areas as "reference" areas designated for non-destructive research only?
  - Should researchers that are permitted to destructively harvest samples from reference areas be required to archive and/or share samples?
  - How large should these reference areas and new areas be? Start with 50%?

5) LANDSCAPE PLANNING

- Is there something comparable that could be done for streams or lakes?
  - What should the rules be?
    - Limited damage
    - Contribute to sample archive? Are there existing sample archives? What would rules be for accessing samples from the archives?
    - Open data
    - Sample sharing?
  - Could sample archive also be used for samples from manipulated areas?
  - SEDC has already created unofficial "set-aside areas" in the areas currently experiencing intensive research activity around TFS - should we permanently enshrine them as reference areas?
    - How should they be marked in the landscape?
- This needs to be discussed with BLM – will it require additional archaeological surveys?

6) IDENTIFYING & REMOVING OBSTACLES TO WINTER WORK

- Common use winter survival equipment/clothing could be provided by TFS for short-term projects (similar to Antarctica model).
- Shower module not operable in winter & shoulder season – new washeteria will address this but could be prioritized to facilitate expanding shoulder season capacity sooner.
- More public outreach/awareness from TFS regarding winter and should-season support (possibly a webpage devoted to explaining wintertime resources)
  - TFS support for autonomous instruments (we already do this, but could be advertised better)
  - Snowmachine support (equipment staged for summer or retrieved from field, personnel support for people with little snowmachine/winter fieldwork experience)
  - Heated buildings for snowmachine maintenance and to stage/pack equipment.
  - Wintertime fieldwork orientation (proper clothing, emergency preparedness, basic snowmachine troubleshooting)
  - Flexible truck schedule with advanced notice
  - Use of NEON Assignable assets

6) IDENTIFYING & REMOVING OBSTACLES TO WINTER WORK

- Emergency access to TFS during winter (driveway maintenance) – continue leasing bulldozer to ensure easy egress
- Lab 5 will improve wintertime lab/workspace capacity.
- Value of keeping Toolik open during the winter not reflected solely by userdays, should take into account total projects operational during winter (including autonomous instruments). In many cases data collected during winter contributes disproportionately to scientific inferences.

7) ENVIRONMENTAL SUSTAINABILITY

Some changes that could be easily implemented

- -80C Freezer to -70C – apparently this saves quite a lot of energy, yet does not significantly affect cryo-storage
- Sharing TFS metrics – we thought strategically posting certain metrics (ie. cost of water disposal, fuel for electricity, trash disposal) along with suggestions for conservations, could lead to greater awareness among users.
- User meetings at TFS – Tuesday Talking Shop, or a special after-dinner meeting, could be used to introduce and reinforce current sustainable practices, such as
  - Reminder to use towers instead of flush toilets
  - 2 min shower
  - Reduce heater use in housing
  - Share freezer/oven space
- Contentious issue - no hot lunch (Quality of Life?) Offering a hot lunch option everyday could save on energy and water use. More leftovers might also be consumed.

When at meetings join working groups focused on environmental sustainability to provide new insights and practices

7) ENVIRONMENTAL SUSTAINABILITY

- Reduce travel to TFS – reduce our carbon footprint by avoiding unnecessary travel
  - Science Support could be used more, especially with autonomous instrumentation, to reduce the number of short trips to TFS
  - Explore whether NSF would support funding Remote Access to TFS, as INTERACT does
  - Encourage multiple projects to share a single technician when possible
- Sustainability task force – larger issues will require a great deal of research to evaluate their validity and effectiveness. A working group or task force could be established to evaluate the following topics:
  - Incorporating more solar and wind energy into TFS operations
  - Paper vs. durable plates
  - Industrial Composter, composting toilets
  - Ways to reduce heating of weather port tents
    - Radiant heat barriers
    - Smart grid power on timed regime
- The soon-to-be released CPS energy audit will provide many suggestions and insights

8) OUTREACH & EDUCATION

It would be nice to make the Arctic more real to people who are far away from it.

- It has always been a challenge for LTER to meet standards of broad outreach requirements.
- Find more ways to reach out to local communities around Toolik
  - We should try to bring native community members to the station
  - Need to use people who have connections to local communities to develop a long lasting relationship
  - It can be challenging to get the right audience during outreach efforts in local communities (hunting, etc). Sometimes partnering with others who are present in a community (like FWS) can improve networking
- Can we make it easier to get accommodations at Coldfoot/visitor center to increase participation in Tuesdays evening seminars?
- Consider an REU site proposal
- Can we partner with UAF's Rural Student Services?
- Organize programs like Girls on Ice: Girls on Tundra!

8) OUTREACH & EDUCATION

- Incorporating classes and outreach personnel into TFS has some challenges
  - Bringing students to Toolik is expensive
  - In early days, some high school students came up for 6 weeks, but this was not accepted well by research community
  - Had issues in past with media and outreach just impacting researchers without proper planning (handled better now)
  - Lack of communication about Toolik even at UAF – a lot of people don't know what Toolik does
- What can NEON do to help with education?
- Consider developing a holistic vision for a more integrative outreach effort for the whole community, rather than single efforts by research projects as is common now
- Can we create opportunities for undergrads to go to Toolik without being part of an existing research program?
- Consider bringing people from media to train scientists to talk about their science to the public
- Consider training for educators to be better prepared during a field course

9) STRATEGIC PLANNING FOR TFS

Why? All along, we have been tactical and reactionary; it is time for us to control our own destiny

Toolik Strengths:

- Flagship arctic research station, world class research
- Long-term experiments and observations
- One of the few places in the Arctic where year-round research can take place and researchers can explore the full annual cycle in tundra ecosystems
- Access to a wide diversity of landscapes: mountains, foothill tundra, coastal plain, boreal forest
- Great scientific services
- Awesome community

Toolik vulnerability

- 88% NSF funding

Two strategic goals:

- Diversify funding sources
- Become a year-round flagship arctic station conducting research in a sustainable manner

9) STRATEGIC PLANNING FOR TFS

Toolik "moonshots" = things that could increase our clientele, open up new opportunities

- Year-round operations (hasn't been fully taken advantage of, yet) – promote winter use
- Aeronomy lab – open us up more to the space physics community, NASA funding
- Getting off of diesel and incinerator – promote atmospheric research (and sustainability)
- Increasing use by classes (undergraduate or graduate) – better education facilities needed
- Helicopter that is not solely for NSF projects
- Philanthropy
- (more incremental) Making process of working at Toolik easier for people funded by agencies other than NSF

9) STRATEGIC PLANNING FOR TFS

Strategic Planning Process

- Identify stakeholders (Internal, researchers, NSF, educators, public)
- Draft of a plan by TFS managers and Steering Committee
  - Assign leadership: Everyone's problem is no one's problem
- Coordination with NSF
- Input and buy-in from the community – workshop at next All Scientist's meeting in 2021

SECOND ALL SCIENTISTS' MEETING & WORKSHOP

- Thanks to everyone who attended, for their scientific contributions and excellent advice
- Thanks to the members of the Steering Committee and organizing committee, and TFS staff assistance to make the travel smooth
- TFS is working to implement suggestions, though it will take a while to get them all
- The first two All Scientists' meetings have been well attended and spark collaboration and enthusiasm
- We are looking forward to the next one!

THANK YOU!

QUESTIONS?