Environmental Data Center

Brie Van Dam

TFS Steering Committee Meeting

26 January 2017

Mission Statement

I. Collect and manage baseline environmental data

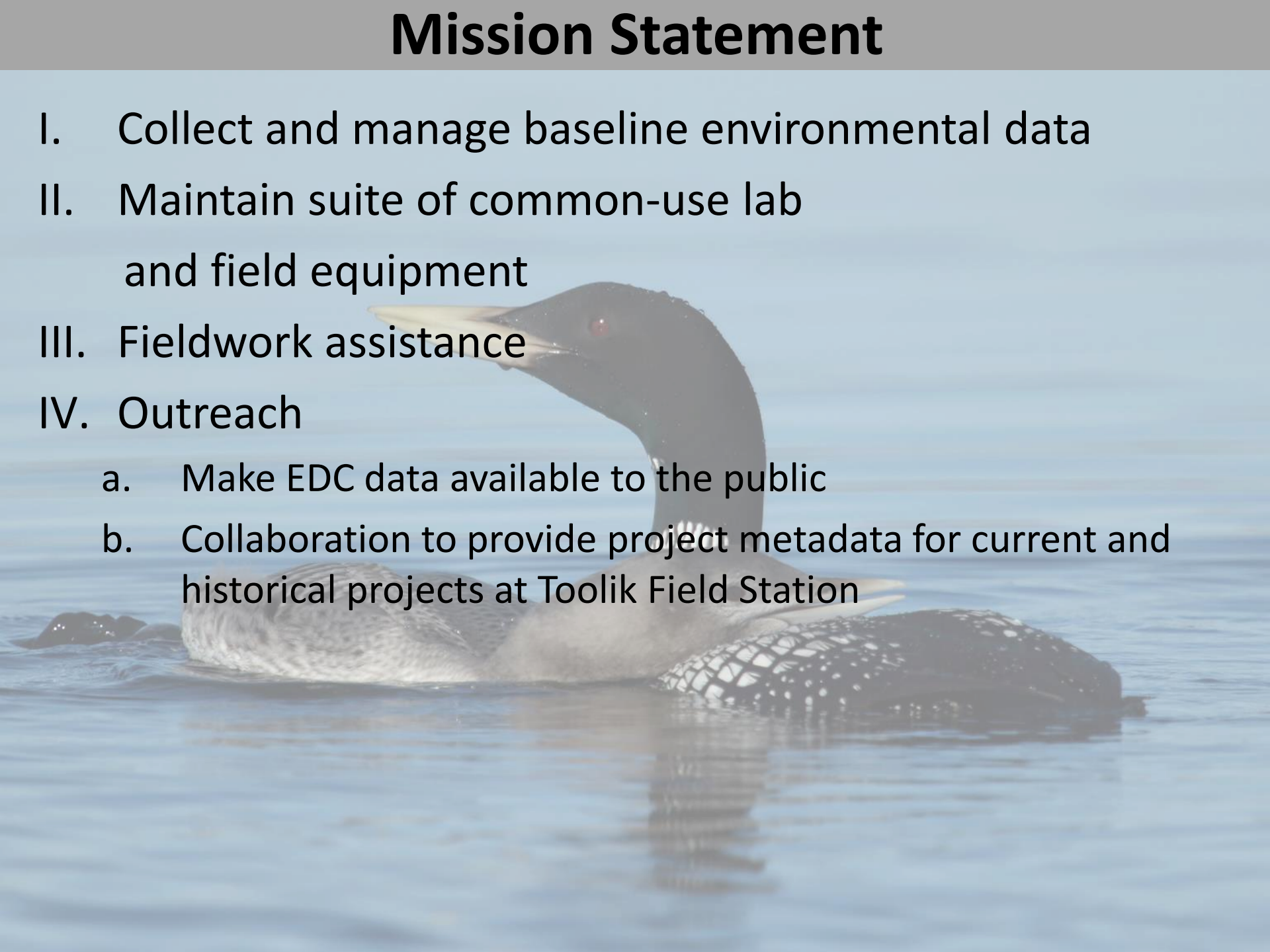
II. Maintain suite of common-use lab and field equipment

III. Fieldwork assistance

IV. Outreach

   a. Make EDC data available to the public

   b. Collaboration to provide project metadata for current and historical projects at Toolik Field Station



2017 Staffing update

EDC Manager: Brie Van Dam

Met station: Dr. Jessica Cherry departure;

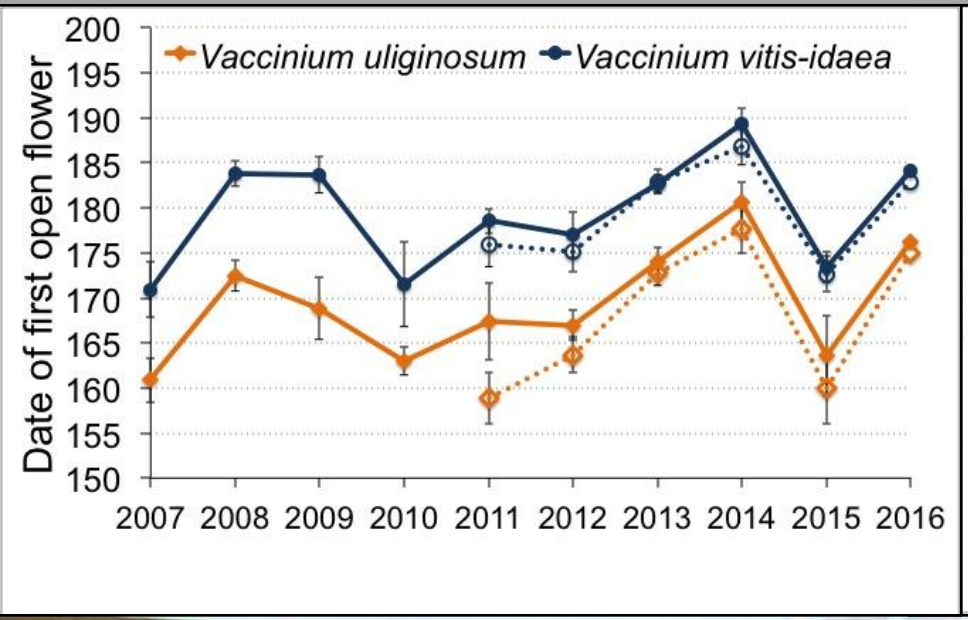
Lily Cohen will continue as technician, supervised by Bob Bolton (IARC)

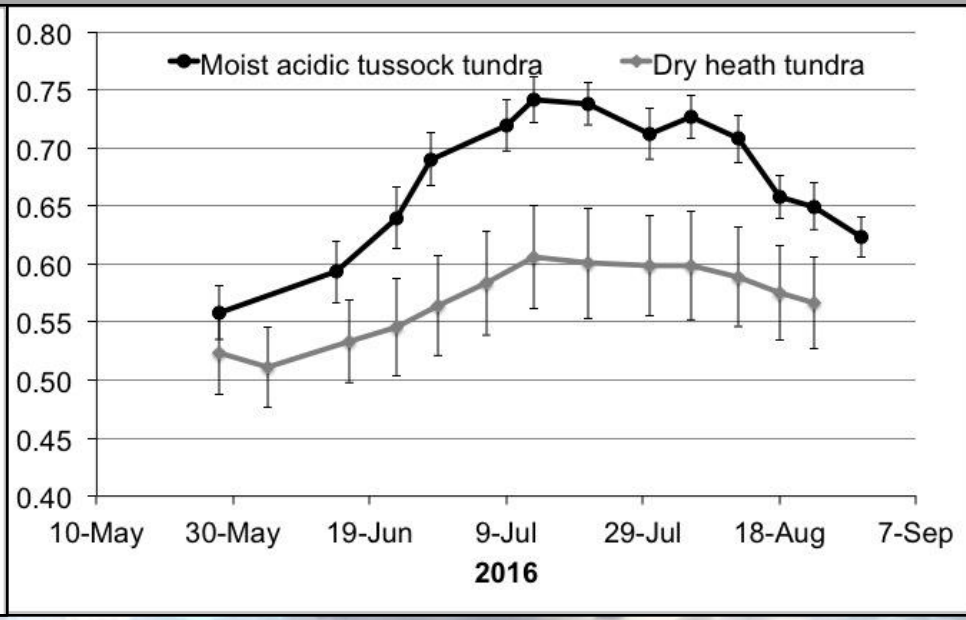
Naturalist: Seth Beaudreault (seasonal, returning)

EDC Technician: Juliette Funck (seasonal, returning)

Lab Manager: Jorge Noguera (seasonal, split-time with GIS, returning)

I. Baseline Environmental Monitoring Program





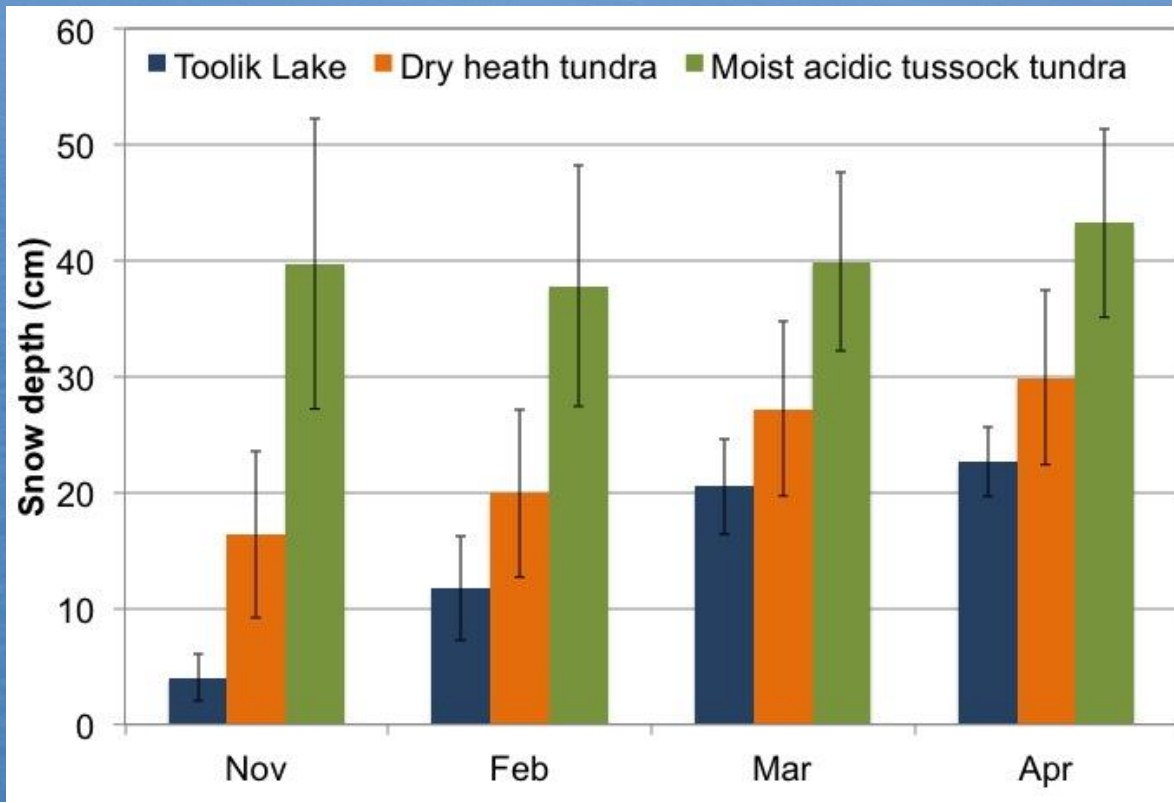
Biological Monitoring Program

- Vegetation phenology
- NDVI
- Avian point counts
- Bird arrivals/departures
- Naturalist journal

I. Baseline Environmental Monitoring Program

Snow monitoring program

- Time lapse imagery
- Manual surveys of depth and density (SWE)
- Sonic ranger snow depth at met station
- Radiation (albedo) at met station



I. Baseline Environmental Monitoring Program

Herbarium

- 140 live photos added to online virtual herbarium, 100 photographed and identified, waiting for verification
- Collection of aquatic macrophytes
- TFS vascular plant guide

Petasites frigidus — Asteraceae

arctic sweet coltsfoot — June

Photos: Adeline Murthy

Identification: Stems arise from creeping rootstocks; basal leaves triangular, toothed, long-petiolated; stem leaves ovate-lanceolate, clasping; inflorescences mostly pistillate or mostly staminate flowers; corollas white to light purplish. Habitat: Wet tundra, along creeks, shores. Range: Alaska, Canada, Siberia, Eurasia, northern Europe. Found throughout most of Alaska.

P. frigidus swarm

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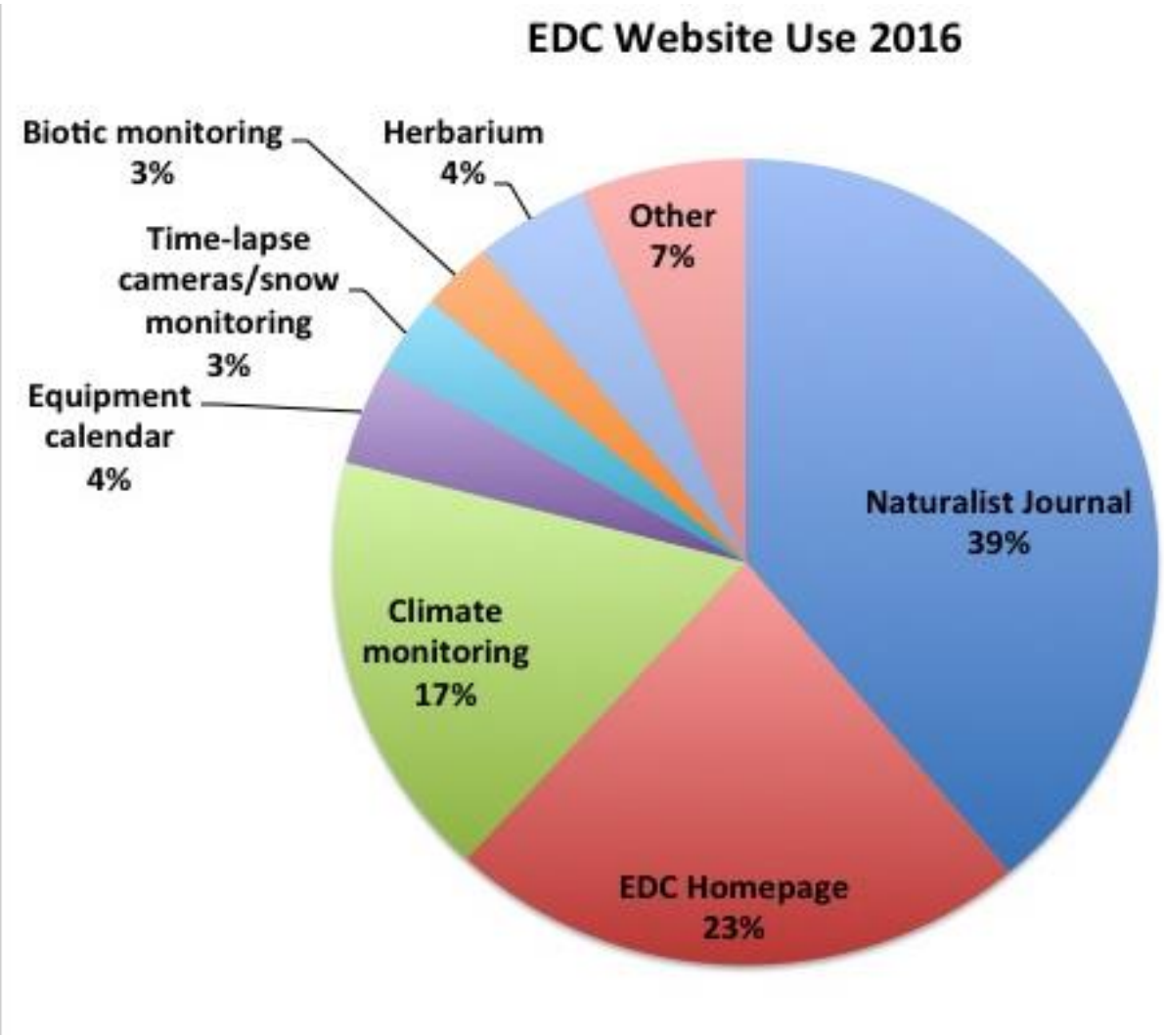
I. EDC Website



- **34,766 pageviews**
  3,184 unique visitors

10/1/2015 – 9/30/2016

- Updated annual summaries
- Updated common use equipment
- Updated data downloads
- Bird guide improvements
- Online Herbarium updates

I. Data Usage

Meteorological data

- **249 requests** from **68 different users** were made for meteorological parameters

Biological data

- Biological data, including plant phenology and avian point counts and NDVI, were downloaded **33 times** from the website this year

Updates

- Data archival with IARC
- DOI assignments and data submission to NSF Arctic Data Center

I. Data Usage

Examples of data use (not full list)

- Real-time **met data** to drive experimental decisions
- **Vegetation phenology, NDVI, and snow depth and density data** for 2015 and 2016 used by Daniel Obrist's group to understand how differences in mercury dynamics were atributable to different vegetation dynamics
- **Vegetation phenology** used by Carly Phillips to estimate timing of seed dispersal to plan late season research at TFS.

Publications

- 7 manuscripts published in 2016 using EDC data

Davie-Martin, C.L., et al, 2016. Concentrations, gas-particle distributions, and source indicator analysis of brominated flame retardants in air at Toolik Lake, Arctic Alaska. Environ. Sci.: Processes Impacts, 18,1274.

Kobayashi, et al.. 2016, Quantifying the understory vegetation phenology in Alaska from time-lapse cameras and satellite measurements. *Remote Sensing of the Environment*.

Krause, J., et al., 2016. The effect of extreme spring weather on body condition and stress physiology in Lapland longspurs and white-crowned sparrows breeding in the Arctic. General and Comparitive Endocrinology, 237, 10-18, http://dx.doi.org/10.1016/j.ygcen.2016.07.015.

Moser, J.G., et al., 2016. Water uptake of Alaskan tundra evergreens during the winter-spring transition. American Journal of Botany, 103 (2): 298 – 306, 2016; http://www.amjbot.org/.

Perez, J.H., et al., 2016. Nestling growth rates in relation to food abundance and weather in the Arctic. The Auk: Ornithological Advances.

Treat, C.C., et al., 2016. Longer thaw seasons increase nitrogen availability for leaching during fall in tundra soils. Environ. Res. Lett. 11, 064013.

Van Dam, B., Helmig, D., Doskey, P.V., and Oltmans, S. J. 2016. Summertime surface ozone behavior and deposition to tundra in the Alaskan Arctic. JGR: Atmospheres, 121, 8055-8066, doi:10.1002/2015JD023914.

II. Common-use equipment

Equipment	2016	2015	2014	2013	2012	2011	2010	2009
Muffle furnace	21	16	33	43	34	31	25	11
Shaker table	12		58	10	27		3	16
Centrifuge	0					6	11	
Autoclave	19	15	15	15	15	11	23	13
Freeze drier	2	4		30	66	76	81	106
Leaf area meter (Licor)	9	1		7		18		51
Leaf area meter (WinFolia)	55	29	12	58	37	5		
Balances	72	84	129	36	83	63	60	46
Hot stir plates	3	42	16					
Compound microscope	35	6		9	75			
Unitron Stereoscope	35	15	27	61	51	94	14	79
Heerburgg Stereoscope	11		11	16	106	51	3	79
Leica LED Stereoscope	54	30						
Zeiss Primostar microscope	15	5						
Hydrolab water profiler	46	52	88	70	70	76	77	26
Unispec spectral analyzer	35	23	18	13	37	76		
Flow Tracker	13	46	26	10	10			
Soil moisture probes	28	67	6					
Soil temperature probes	35	11						
Handheld weather meter	2	7	7					
Dry Incubator	20			38	12	71	48	15
Incubation baths (6 total)	309	572	551	363	523	406	238	270
Total	**831**	**1025**	**997**	864	1146	984	583	712

III. Field Work Assistance

- 2016 season: ~**226 hrs, 26 researchers**
  Examples (not full list):
  - Winterized meteorological stations for Ken Tape in October
  - Measured snow depths at 12 control and snow fence plots at Ice Cut for Ellen Dorrepaal in March, and measured CO_2 flux and thaw depth in the same plots in July.
  - Assisted the LTER Streams RA with weekly water samples and filtering from several locations on the Oksrukuyik, Kuparuk, and Toolik Inlet Rivers between the end of August and early October.
  - Sampled each of the Fog Lakes on a bi-weekly basis and Toolik Lake weekly with LTER Lakes group through September.
  - Winterized stream gauge and Toolik Lake meteorological raft in September
  - Sampled inlet stream after breakup for Sally MacIntyre

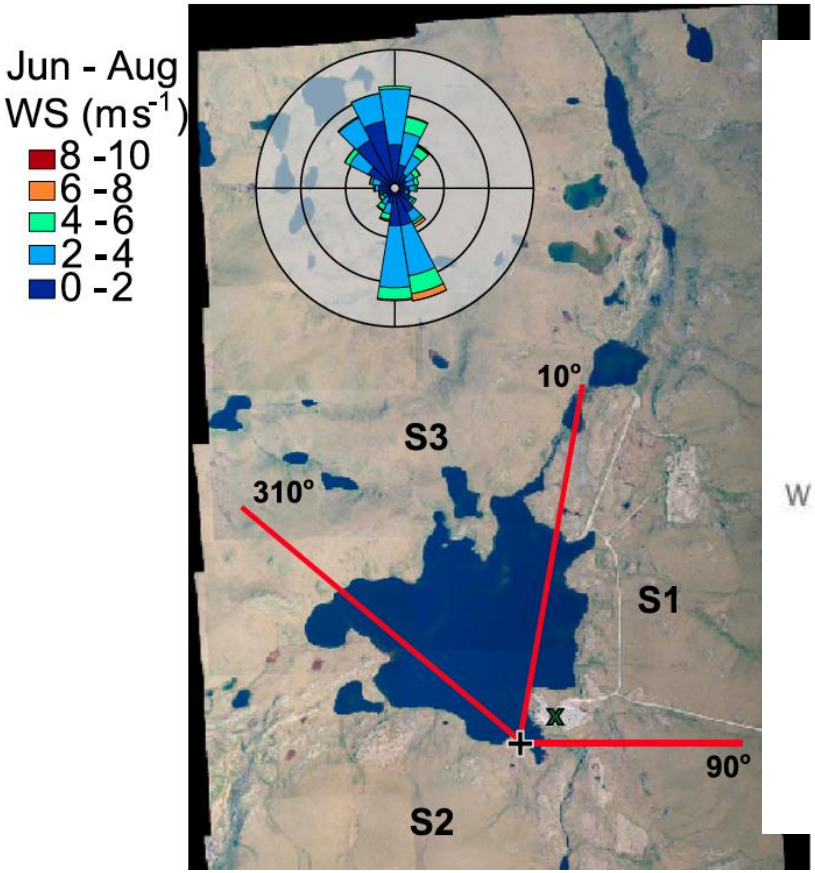


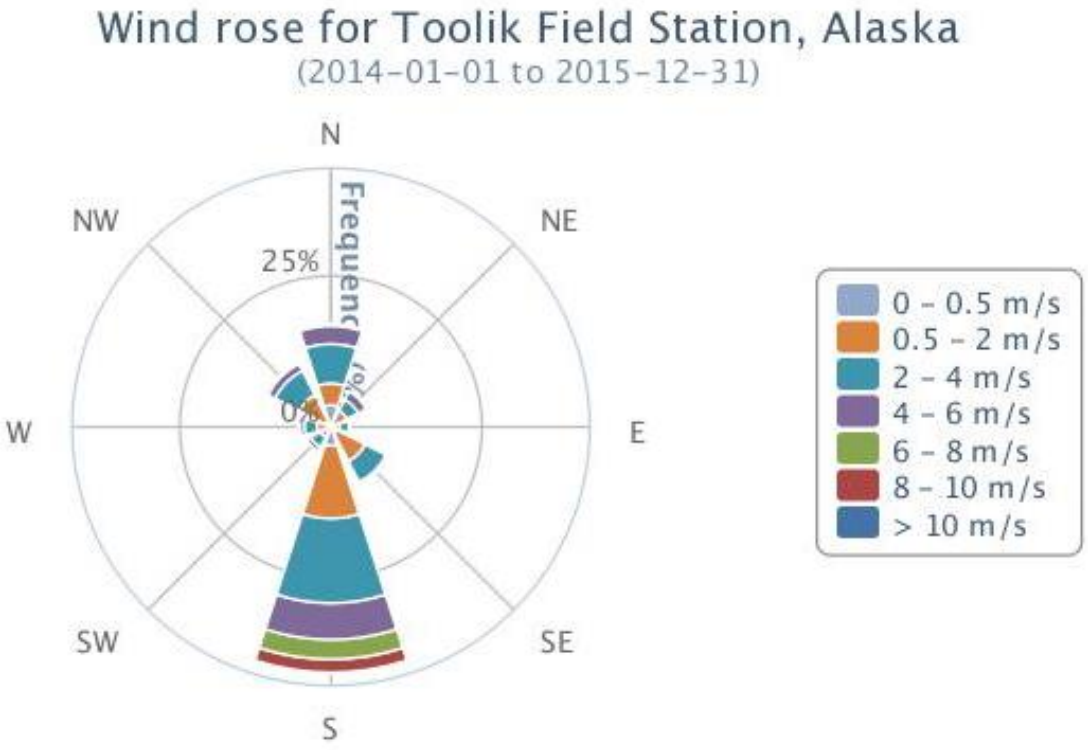

IV. New and Continuing Projects

- Collaboration on vegetation phenology methods comparison with ITEX Snapshot phenology protocols, EDC observations, and EcoIS/EcoIP photographic analysis
- Continue adding live plant photos to online Herbarium
- Continue with aquatic macrophyte sample collection
- Update TFS vascular plant guide, publish
- Biological data products

- National Atmospheric Deposition Network
  - National Trends Network (precip pH, conductance, calcium, magnesium, sodium, potassium, sulfate, nitrate, chloride, etc)
  - Mercury Deposition Network (total Hg)
  - Potential collaboration with NPS - IMPROVE, BLM

Siting





- National Atmospheric Deposition Network
  - National Trends Network (precip chemistry)
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Siting

Questions?

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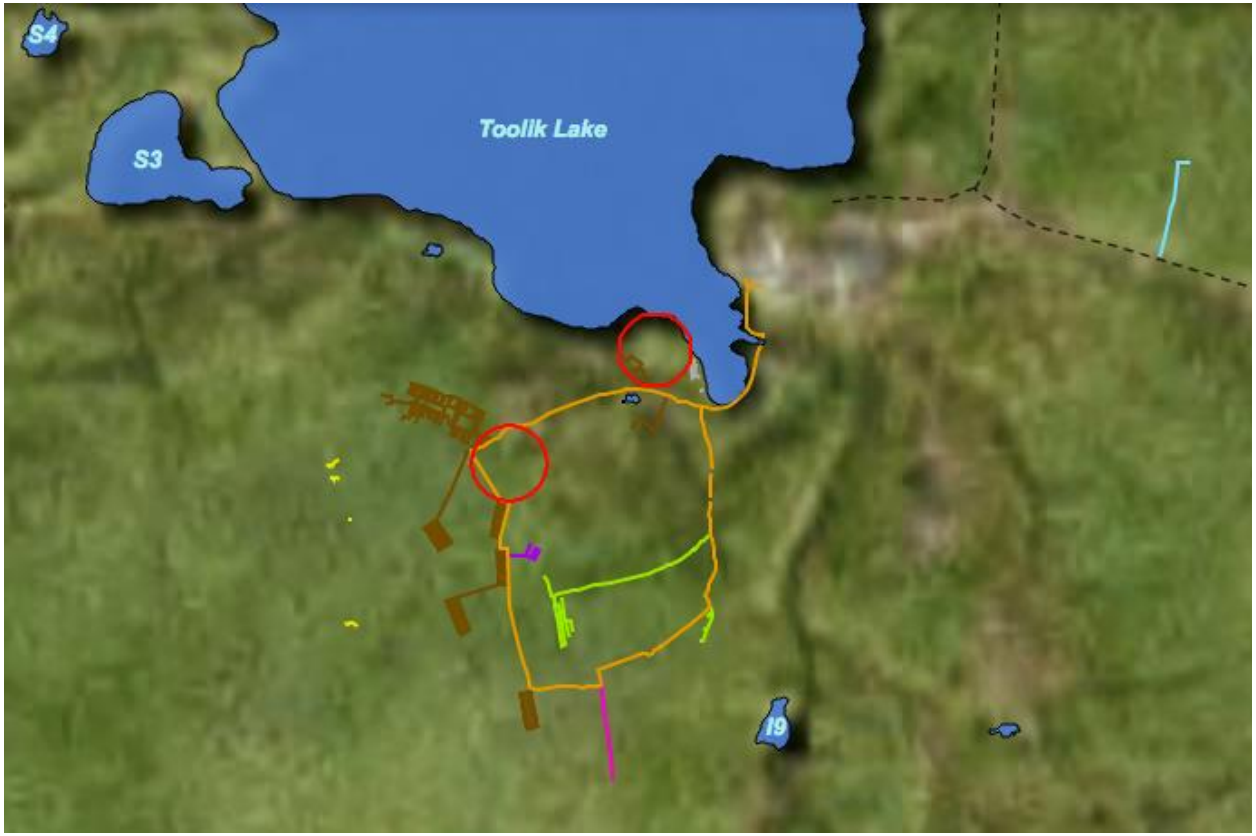
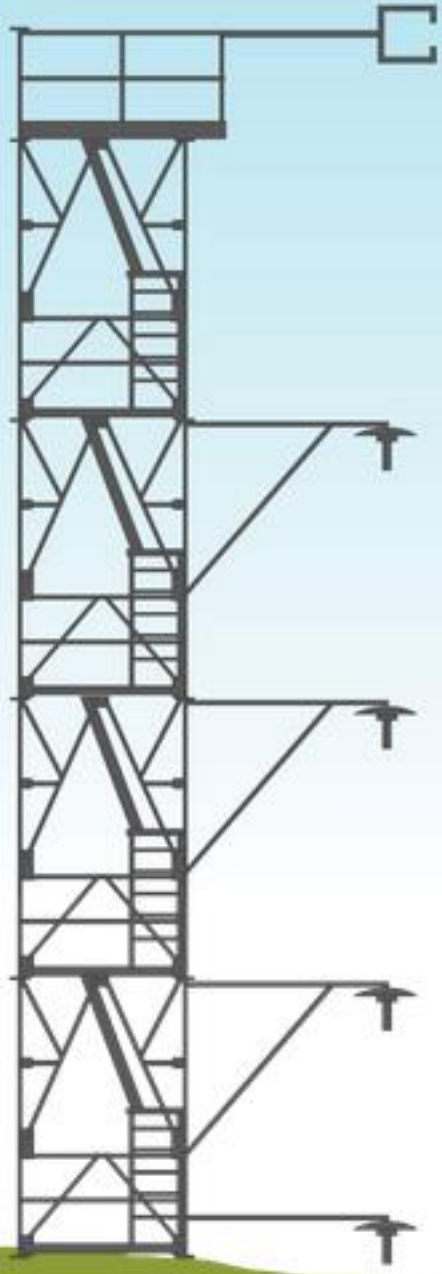


The CAL measures free acidity (H^+ as pH), conductance, calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), sulfate (SO_4^{2-}), nitrate (NO_3^-), chloride (Cl^-), and ammonium (NH_4^+). The CAL also measures orthophosphate, but only for quality assurance as an indicator of sample contamination.

Site operators collect samples Tuesday morning within 24 hours of the start of precipitation. With e MDN sample, the entire sampling train is replaced with one that is cleaned by the Mercury Analytical Laboratory (HAL) at Eurofins Frontier Global Sciences, Inc., Seattle, Washington. Rigorous cleaning ensures that each sampling train component is essentially mercury-free. The HAL supplies the collection bottles already charged with the hydrochloric-acid preservative. By following those procedures and stringent sampling protocols, the MDN is able to report mercury concentrations below 1 part per trillion (<1 nanogram/liter).

All MDN samples are sent to the HAL, which analyzes all forms of mercury in a single measurement and reports this as total mercury concentrations. At the end of 2005, 23 MDN sites also opted for methyl mercury analysis. The HAL reviews field and laboratory data for completeness and accuracy, and flags samples that were mishandled, compromised by precipitation collector failures, or grossly contaminated. The HAL delivers all data and information to the NADP Program Office for final checks and resolution of remaining discrepancies. Data then are made available on the NADP Web site.



Measurements	Frequency	Tower top	Mid-levels	Near ground surface
CO_2/H_2O concentration & flux	20 Hz	✓		
3D wind speed & direction	20 Hz	✓		
Dust (particulate mass)	2 wks	✓		
Dust (particulate size)	1 Hz	✓		
Aerosol optical depth	30 min	✓		
Secondary precipitation (absence/presence)	when event occurs	✓		
Direct & diffused radiation	1 Hz	✓		
Incident short-wave radiation	1 Hz	✓		
Net short-wave & net long-wave radiation	1 Hz	✓		
Wet deposition chemistry & precipitation isotope	2 wks	✓		
Phenological image & snow depth	15 min	At the tower top & 3 m above ground		
Isotopes in CO_2, ^{13}C concentrations	.5 Hz	✓	✓	✓
Isotopes in H_2O (^{18}O, ^{2}H concentrations)	.5 Hz	✓	✓	✓
CO_2 concentration	1 Hz	✓	✓	✓
H_2O concentration	1 Hz	✓	✓	✓
PAR (Photosynthetically Active Radiation)	1 Hz	✓	✓	✓
Air temperature	1 Hz	✓	✓	✓
Biological temperature	1 Hz		✓	✓
2D wind speed & direction	1 Hz		✓	✓
Barometric pressure	1 Hz	4.95 m above ground		

Data management

- We follow the best practices of data management as recommended by NSF.

  E.g. parameter definition, consistent data organization, basic quality assurance, documentation of metadata, data protection

- All data are freely available on the EDC website, and the Global Change Master Directory.