Overview of Toolik Field Station’s Environmental Data Center (EDC)

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University of Alaska, Fairbanks
Genesis of the EDC

- Participants in 2004 workshop recommended (in order of priority)
  1. Collection of key baseline environmental data to provide a context for research
  2. Purchase, maintenance, scheduling of common-use scientific equipment
  3. Limited field assistance
- These tasks rolled together into EDC
Why collect environmental data?

• Baseline data are critical to detecting change
  – Multiple projects can use these data
  – Baseline data set the context for research, saves effort by individual projects

• Environmental monitoring is difficult to fund through grants
  – Most grants focused on hypothesis testing
  – Most grants are on a 3-year cycle → gaps in environmental record

• TFS data complements and extend data collected by Arctic LTER & other projects
  – Capability for shoulder season and winter measurements
Priorities for environmental variables

I. Fundamental environmental drivers:
   - Climate data and lake temperature
   - Active-layer depth, ice and snow cover

II. Variables changing in response to environmental change:
   - Phenology of growth, reproduction, hibernation and migration patterns of plants and animals
   - Species inventories (plants, birds, mammals)
   - NDVI and trace gas flux
   - Stream and lake chemistry

III. Data needed to fill gaps in present knowledge:
   - Paleo-reconstruction of climate and vegetation history
   - Additions to TFS herbarium and species inventories
   - Stream profiles and bed temperatures
EDC history & staffing

• Christie Haupert joined as first EDC technician in 2005
• Anja Kade & Jessie Cherry joined us in 2010 & 2011, after Christie left
  – We will be searching for a replacement for Anja, who has just joined ABR
• 2.25 part-time summer assistants (Seth, Aart, 1/4 of Jorge)
• All data available through our website (or on request)
Program structure

Long-term Monitoring Programs
Science User Input
Science Advisory Committee

TFS Management Team

1. Environmental Monitoring Program
   - climate
   - biodiversity/phenology

2. Assistance to TFS science community
   - general use equipment
   - limited field support

TFS ENVIRONMENTAL DATA CENTER
### Comparison with Zackenberg monitoring model

<table>
<thead>
<tr>
<th>Climate Basis</th>
<th>Geo Basis</th>
<th>Bio Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Snow and permafrost</td>
<td>Plants</td>
</tr>
<tr>
<td>Pressure</td>
<td>Temperature</td>
<td>Species diversity and composition</td>
</tr>
<tr>
<td>Humidity</td>
<td>Active layer depth</td>
<td>– NDVI and UV-B filters</td>
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<tr>
<td>Radiation</td>
<td>Snow distribution</td>
<td>Arthropods</td>
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<tr>
<td>Wind</td>
<td>Meteorological data</td>
<td>Bird diversity/territories</td>
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<tr>
<td>Precipitation</td>
<td>Soil moisture</td>
<td>Mammals</td>
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<tr>
<td>Discharge</td>
<td>River water chemistry</td>
<td>– Casts and feces</td>
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<tr>
<td>Water temperature</td>
<td>Suspended sediment</td>
<td>– Hare, lemming, fox and musk ox surveys</td>
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<tr>
<td>Conductivity</td>
<td>Carbon dioxide flux</td>
<td>Random observations</td>
</tr>
<tr>
<td>River hydrology</td>
<td>NDVI</td>
<td>Lake flora and fauna</td>
</tr>
</tbody>
</table>

- Collected by Arctic LTER and other projects at TFS
- Monitored by the EDC at TFS
- Measured by both Arctic LTER and EDC
Meteorological station

- Main variables: air and soil temperature, relative humidity, barometric pressure, wind speed and direction, global solar and photosynthetic active radiation, precipitation and evaporation, lake temperature and water level

- Provisional data of past 15 days (not error checked)

- Query of historical data
Snow cover pictures from south end of Toolik Lake
Physical environment

Snow characteristics at phenology plots and within the image frame of heath and tussock time-lapse cameras.
Physical environment

Toolik Lake thawing and freeze-up
Toolik Field Station Virtual Herbarium

Genus: ANEMONE  Select Species: ANEMONE PARVIFLORA Michx.

ANEMONE PARVIFLORA
Family: Ranunculaceae
Division: Magnoliophyta
Scientific Name: ANEMONE PARVIFLORA Michx.

Ranunculaceae

PHILIP SMITH MOUNTAINS QUAD: Innwaat Creek, 1 km northeast of the Institute of Northern Engineering trailer, Zone 6 7613548 N 406891 E; 68.6201 N., 149.2890 W. S-facing dry sideslope, common. Growing with VACCINIUM VITIS-IDAEA, SALIX PHILEOLOGYA and DRYAS OCTOPETALA. Elev. 869 m.

Katrina Managan, Rachel Prunier. Amy Breen Carroll 1 07-Jun-01
Det. by Carolyn Parker (ALA), January 2002
Accession #: 286

TOOLIK FIELD STATION HERBARIUM
University of Alaska Fairbanks

Alaska, U.S.A.
Vegetation monitoring

**Plant phenology**
- Monitoring of key phenological events such as timing of first leaves, flowers and seed dispersal
- Focus on species typical of moist acidic tussock and dry heath tundra

**NDVI**
- Record vegetation greening index at phenology plots
Daily sightings of bird species
Songbird density

![Graph showing changes in density of various songbird species over time](image)

- Lapland longspur
- Savannah sparrow
- American tree sparrow
- White-crowned sparrow

![Images of bird species](image)
All data available to public

- All data available through website or on request
- All parameters are defined, data have consistent organization, basic quality assurance, metadata
- Metadata published in Global Change Master Directory
- Data have been used in several publications already
All data available to public

• EDC web site gets quite a lot of use
  – Approximately 80,000 hits from May 2011 to July 30, 2012
  – Changed from StatCounter to Google Analytics in February of 2012, which provides more detailed information
2,714 people visited this site

- Visits: 7,049
- Unique Visitors: 2,714
- Pageviews: 22,408
- Pages / Visit: 3.18
- Avg. Visit Duration: 00:02:45
- Bounce Rate: 46.42%
- % New Visits: 38.49%

61.51% Returning Visitor
4,336 Visits

38.49% New Visitor
2,713 Visits
Visitors Flow

Starting pages
7.01K Visits 3.84K Drop Offs

United States
6.28K

/edc/index.php
4.3K

1st Interaction
3.17K Visits 1.43K Drop Offs

United Kingdom
112

/edc/weather/index.php
599

Canada
58

/edc/journal/index.php
489

India
39

/edc/weather/index.php
270

France
38

/edc/weather/index.php
154

2nd Interaction
1.73K Visits 754 Drop Offs

(+24 more pages)
714

(+23 more pages)
739

© 2012 Google
### Location

**% of visits:** 100.00%

<table>
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<th>Metric</th>
<th>Value</th>
<th>Site Avg.</th>
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<td>Bounce Rate</td>
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### Field and laboratory equipment

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<tr>
<th>EQUIPMENT</th>
<th>Image 1</th>
<th>Image 2</th>
<th>Image 3</th>
<th>Image 4</th>
<th>Image 5</th>
<th>Image 6</th>
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<td>Freeze dryer</td>
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<td>Hydrolab profiler</td>
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<td>Incubator: dry</td>
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<td>Incubators: wet</td>
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<td>Leaf area meters</td>
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<td>Microscopes</td>
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<td>Unispec analyzer</td>
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Weekend course

“Introduction to the Arctic”

- 15 course participants (REUs, RAs, grad students)
- Explored arctic ecology through interactive lectures and hands-on lab activities
- Provided larger context for student projects and fostered work relationships among peers
- Received outstanding reviews from both students and supervisors
Toolik’s EDC - the future

• Our goal is to ensure that continuous, consistent and good quality baseline data are available to set the context for research
  – EDC program has been valuable so far
  – Not anticipating a dramatic expansion
  – Plan to continue existing program
• Need to be flexible, complement what NEON, AON, LTER are doing
• Continue to provide common-use equipment, limited field assistance in shoulder seasons, outreach
• Eventually, it would be great to synthesize long-term monitoring records at TFS for publication
• Working group & plenary discussion on coordination of observations to gather input