

Toolik Lake: Tol_AK_TUN AK TLK (Tundra)

Contact persons: Donie Bret-Harte ffmsb@uaf.edu, jhobbie@mbi.edu

Location: 68° 38' N, 149° 36' W, elevation 720 m

History: Toolik Lake and its surroundings have been a major site for long-term ecological research in the North American Arctic since 1975 and became the Arctic LTER site in 1988. The Toolik Field Station (TFS) provides year-round infrastructure and logistic support. It is within the BLM-designated Toolik Lake Research Natural Area (RNA), comprising 77,447 acres; the RNA is designed to foster and protect research. Much of what is known about the structure and function of terrestrial and aquatic ecosystems of the Arctic as well as the effects of climate change and feedbacks to global climate comes from the long-term, process-based ecological research projects at Toolik Lake. Web information: <http://ecosystems.mbl.edu/ARC>, <http://www.uaf.edu/toolik>.

Key characteristics: The vegetation is dominated by tussock tundra, but includes dry heath tundra, wet sedge tundra, and riparian shrub tundra. The landform of the Toolik Lake RNA is rolling hills and small watersheds containing numerous pristine lakes and streams. These streams and lakes have been used for landscape-level manipulative experiments. Climate in the Toolik Lake RNA is typical of much of the tundra domain. Mean annual temperature is approximately -10°C, and mean summer temperature is approximately 7-10°C. Mean annual precipitation is 300 mm y⁻¹, and 45% of the precipitation falls as snow. The Toolik Lake RNA is underlain by continuous permafrost; permafrost temperatures at 20 m depth are still cold (-5 to -8°C) despite climate warming, so the permafrost is relatively stable. The ecological effects of climate change are beginning to appear at Toolik Lake but change is slow in part because the permafrost is not yet thawing. There is a measurable change in the vegetation where shrubs are becoming more and more abundant and lake temperatures in the summer are slightly warmer. There has also been a large increase in the alkalinity of streams and lakes over the past decade, a change which we interpret as caused by an increase in soil thawing and subsequent weathering. The Toolik Lake RNA is owned by the US Bureau of Land Management (BLM), a public agency. Toolik Field Station is owned and operated by the University of Alaska Fairbanks on land that is leased from the BLM. Typically, 350-400 scientists from approximately 140 different institutions stay at TFS each year while doing research.

Existing infrastructure: The Arctic LTER and TFS together operate eight weather stations within the Toolik RNA. Data from these stations are available on the Arctic LTER web site. TFS is in negotiation with the National Park Service to locate an interagency air-quality monitoring site within the Toolik RNA for these four networks: NADP (National Atmospheric Deposition Program - approximately 200 sites nationwide), IMPROVE (Interagency Monitoring of Protected Visual Environments - network of approx. 120 sites nationwide), MDN (Mercury Deposition Network - 30-40 sites nationwide) and CASTNet (Clean Air Status and Trends Network - 30-50 sites nationwide). TFS will be the flagship terrestrial site for the US Arctic Observatory Network (AON) to be established as the US contribution to the International Polar Year (IPY), and will be closely linked to other arctic observatories in Russia, Sweden, Greenland, and Canada. Two flux towers for measurement of CO₂ flux, H₂O flux, and energy balance, one of which will also be equipped with methane instrumentation, will be established within the Toolik Lake RNA as part of this AON project.

Facilities:

Housing and other support facilities. TFS has housing for 53 year-round and 54 summer scientists.

Laboratories. TFS currently provides laboratory space for researchers in seven multi-use modular laboratories (total of 9,740 sf).

Electrical power and water. Currently, generation capacity consists of 5 generators (50 kw, 80 kw, 125 kw, and 2 new 160 kw units) that distribute electricity at 480 V. Electrical power Tundra and Taiga domains (TU_TA_18_19) page 5

generated by TFS would be available to a NEON facility, provided that NEON pay for any extra electrical lines and upgrades.

Internet access and cyberinfrastructure. Internet access at TFS is provided through a T-1 fiberoptic line that is spliced into the fiberoptic line that runs from Prudhoe Bay to Fairbanks along the TAPS.

Accessibility by road and air. TFS and much of the Toolik Lake RNA are accessible from either Fairbanks, Alaska (350 miles to the south) or Prudhoe Bay, Alaska (140 miles to the north).