

Microbial Changes in Arctic Freshwater Report of the Experiences of Lauren Watel During her PolarTREC to the Arctic

By Mary Ann Coyle SL

Lauren Watel, a teacher at St. Mary's Academy in suburban Denver, was one of 12 teachers in the Nation chosen to be paired with researchers in either the Arctic or the Antarctic as a part of the National Science Foundation funded program PolarTREC. Her particular research is working with Dr. Byron Crump to investigate the microbial communities of the main bodies of water in the Toolik Lake watershed in the Arctic. The goal of the team was to record a variety of measurements about how the water coming in to the lake changes through the landscape. Lauren wrote as follows about her research: "The particular research I am working on is to examine what microbial species are found in the Arctic, and see if their evolution and changes as a community are linked to climate change or other environmental factors. I will help the researcher make the science approachable and applicable so that students, and the general public, can grasp and understand why we are looking at these organisms, and why we should care about their roles in ecosystems."

When sampling the watershed the team heads out to sample every lake and river upstream of Toolik Lake. Their goal is to see how the water chemistry, biological and physical properties change with depth in the lakes, from lake to lake and from stream to lake. After filtering about a liter of water to trap the microbes, a DNA Extraction Buffer (DEB) is added to kill the bacteria so there is no change from the time the samples are removed from their natural habitat to when they are analyzed later.

I found Lauren's account of the extraction of DNA most interesting. Probably my interest stems from a number of years of teaching chemistry and doing some of

the same procedures. Once her collected samples were back in the lab area, they were inserted in a small centrifuge, and the DNA was then removed with a pipette, enzymes added to break up the DNA and allow the analysis of changes in the freshwater samples to begin.

There is a great quote from John Muir that says, in essence, when one tugs at a single thing in nature, one finds it attached to the rest of the world. Lauren references Muir's statement and says that the Arctic is far from a closed system. The changes going on in the polar regions have real implications for us at home as well as around the world.



Even though a major source for our carbon is from fossil fuels, another source we often forget about is that stored in permafrost. It is, of course, buried in the ground far away from where we live.

Permafrost is like a giant slab of frozen ground that lies beneath the arctic tundra. This soil contains the remains of plants and animals from hundreds to thousands of years ago. As this soil thaws, the frozen ground thaws and the materials start to break down. Microbes hasten the breakdown by eating the organic material and releasing carbon dioxide. Based on this role it is critical to understand how microbes function in the arctic carbon cycle.



Lauren says we also cannot forget that methane is another potent greenhouse gas that will be released as the permafrost melts. This gas is given off by anaerobic respiration and microbes can do this work in the absence of oxygen. The catch here is that methane is 30 times stronger at trapping heat than carbon dioxide!

Scientists tell us that both carbon and methane, once released in the Arctic, will enter the United States within a single year and will further mix to impact the rest of the global atmosphere within four years. When this happens, ecosystems will change, areas will be warmer, precipitation patterns will be affected and before long animal and human lifestyles will be altered.

Lauren's PolarTREC expedition came to an end July 2, 2014. At this point she joined her husband Ethan at the Fairbanks airport and, after a bit of rest, she and Ethan did further exploring of the coastal regions of Alaska. Lauren welcomes your thoughts and can send you classroom guides as available from her site. Lauren can be reached at L.watel@smaset.org. She is eager to share her PolarTREC experiences with school groups and/or Loretto Community learners in St. Louis and in Kentucky. To read more about her experiences you can view her journal at: <http://www.polar-trec.com/expeditions/microbial-changes-in-arctic-freshwater>.

Be sure to watch for an upcoming BBC film series, due out in 2015, showing any number of animals enjoying themselves in the Toolik watershed as well as in and along the various nooks and crannies in the Alaskan waters.