University of Lethbridge News Release

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U of L geographers observe climate-related tipping point to accelerated permafrost thaw

Research by Drs. Laura Chasmer and Chris Hopkinson, University of Lethbridge geography professors, indicates that the 1997–1998 El Niño may have served as a tipping point for accelerating permafrost loss in their study area in the Northwest Territories.

The study, Threshold loss of discontinuous permafrost and landscape evolution, has been published in the latest issue of the prestigious journal Global Change Biology.

“What we’re seeing is that the permafrost thaw has accelerated since the severe El Niño that we had in 1998. Between 1970 and 1998, the area of permafrost in our study site shrunk by roughly four per cent. Between 1998 and 2015, it shrunk by an additional 13 per cent,” says Chasmer. “The research shows that unusually warm air temperatures, a shortened snow-cover period and the timing of snowfall may have shifted the watershed into a new state. This could have significant effects on greenhouse gas fluxes, water resources, wildfire and food security.”

“The extra energy during and following El Niño shifted the state of the system into an entirely new condition and created this accelerated rate of change,” says Hopkinson. “What we don’t know is whether the watershed system has readjusted to a new kind of steady state or whether it’s going to continue that rapid acceleration of loss.”

Chasmer and Hopkinson surveyed the Scotty Creek watershed, about 50 kilometres south of Fort Simpson in the Northwest Territories, using airborne Light Detection and Ranging (LiDAR). They conducted surveys in 2008, 2011, 2015 and 2016. Their data, combined with increased runoff from this watershed and others nearby, indicate that similar patterns of permafrost loss may be occurring across the region. Within their study area, the snow-covered season is 35 days shorter than it was in the 1970s.

Permafrost, made up of layers of old moss and soil that remain continuously frozen for two years or more, contains a large store of carbon. When it starts to thaw, significant amounts of carbon and methane are released into the atmosphere. In addition, thawing permafrost saturates the ground, causing trees and infrastructure like houses to tip over and slump, and creates difficult terrain for animals and traditional hunters to traverse. Chasmer and Hopkinson

also suspect the increase in shrubbery they've found is because water runoff from thawing plateaus gathers into small channels and streams, which could dry out some of the wetland areas.

"That has potentially big implications for forest fires," she says. "If wetlands dry out they become a fuel source, which could be why much larger areas of northern ecosystems are starting to burn."

"If this rate of loss continues, total permafrost loss within our study area could occur by around 2044," says Hopkinson. "We need to continue monitoring this area by doing LiDAR surveys every few years to determine if the system is in a new steady state or if it's continuing to decline."

An illustration of the changes seen in the study area can be found on YouTube.

This news release can be found online.

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