Peat and forests save permafrost from melting

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Permafrost may be buffered against the impacts of climate change by peat and vegetation present in the northern regions, according to a study by McMaster researchers.

Permafrost is frozen soil that remains at or below 0 oC for at least two consecutive years. Currently, it covers more than 30 per cent of the Earth's surface and about 42 per cent (four-million square kilometres) of Canada's land mass.

The study was published recently in *Geophysical Research Letters*.

"There is no doubt that northern regions are warming and permafrost is melting as shown by numerous observations and modeling studies," says Altaf Arain, co-author of the study and associate professor in the School of Geography and Earth Sciences. "However, there is large uncertainty about the rate and magnitude of permafrost degradation and thaw depth."

Previous studies using the U.S. National Center for Atmospheric Research Community Climate Model suggest that global warming is rapidly melting permafrost in the North regions. According to those studies, only a million square kilometres of the currently estimated 10.5-million square kilometres of permafrost would remain by the end of this century.

However, Arain says these studies failed to consider the impact of peat

and vegetation cover.

“A layer of peat above the permafrost acts as insulation by trapping air pockets, which reduce heat transfer and helps permafrost retention,” he says. “Vegetation can also help slow the rate at which permafrost melts because it shades the ground.

Arain and co-author Dr. Ming-ko (Hok) Woo, professor emeritus at the School of Geography & Earth Sciences, used the NCAR Community Land Model (CLM3) with several modifications and historical climate records. Their results indicated that although permafrost degradation was predicted over the 2000 to 2100 period, areas with mineral-based soil and no vegetation were most affected.

Forest cover provided more protection than shrubs or bare ground, and thick layers of peat were such effective insulators that permafrost showed only minimal decline even by 2100.

On the other hand, Arain adds, disturbance of the ground cover on a local scale or fires in the boreal forest and tundra can lead to accelerated permafrost thaw. Forest fires in permafrost regions, which may become more prevalent in the future, can reduce surface organic layer, and this can affect ground thaw on both local and regional scales. Preservation of peat layer and forests may help in maintaining permafrost in northern regions.

Source: McMaster University