

Save northern high-latitude catchments

To the Editor — Northern freshwaters are changing rapidly in response to global warming and human perturbation. Such change is often abrupt and unexpected: catchment storage and release of water is inherently nonlinear. Being able to understand and predict these ecosystems is essential in order to sustain their services and ensure social prosperity in this rapidly changing region. Nevertheless, more and more of the small research catchments in high latitudes are being shut down. Here, we make the case for reversing this trend to sustain long-term catchment research in the north.

Long-term catchment monitoring in the northern latitudes is in a precipitous decline; for example, the number of operational climate stations with precipitation data usable for climate research purposes in the Canada's Prairie Provinces and northern territories has diminished rapidly (Fig. 1), and this trend is mirrored in other circumpolar regions of the world. All in all, more than half of previously extant far-northern hydrological research catchments have been closed, with a 40% reduction since the year 2000 (Fig. 1). This decline in our ability to detect, understand and predict the responses in northern water resource systems to the changing climate and human perturbations has key consequences for populations in more southerly latitudes because the northern circumpolar region is a key driver of the global climate system¹.

One of the most alarming aspects of the decline in observations of the cold northern regions is that it is contemporaneous with rapid warming. Recent observations show record-breaking temperatures year-on-year in the Arctic². All components of the hydrological cycle have been affected by this warming: changes in the distribution and duration of snow cover and permafrost³; shorter and milder winters⁴; increased winter flows with associated changes in nutrient fluxes⁵; and elevated concentrations of dissolved organic carbon concentrations⁶. The observed changes in dissolved organic carbon concentrations are of particular concern because soil organic carbon stocks of Arctic and boreal regions are orders of magnitude more sensitive to temperature increase than those of any other biome⁷.

Most anthropogenic changes are superimposed on a natural variability that can enhance, mask or even weaken responses to a perturbation. We therefore need long-term observations to detect, understand and

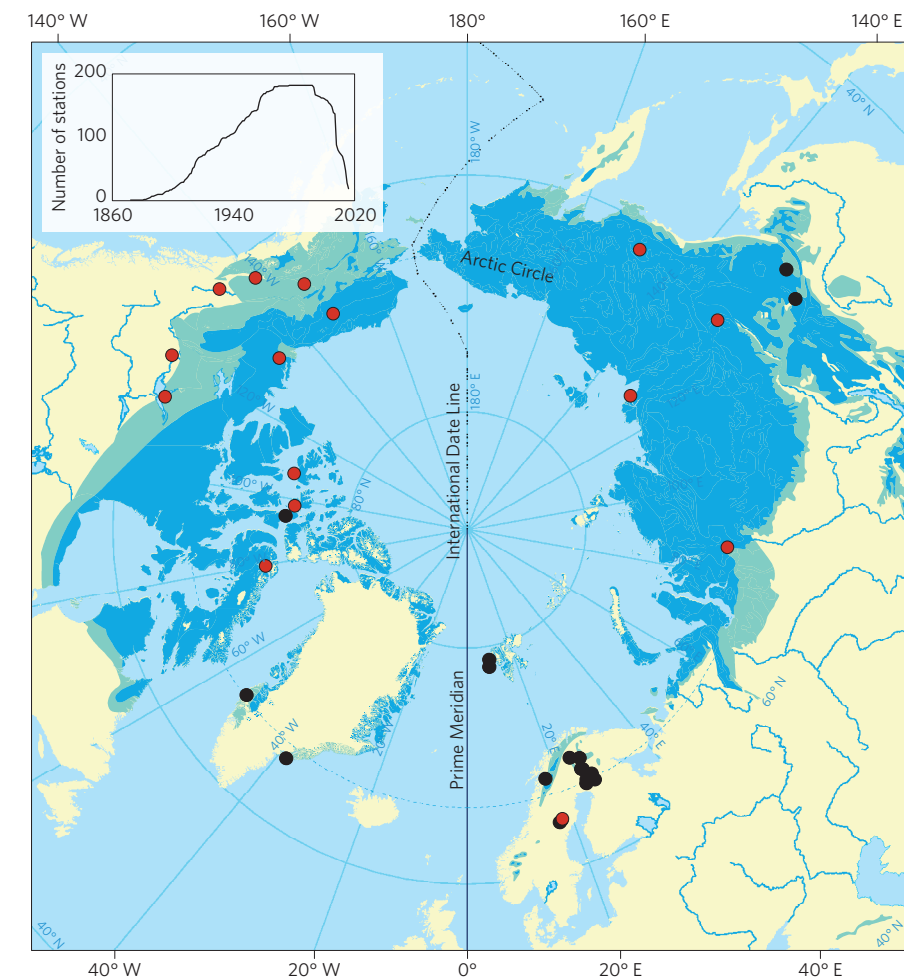


Figure 1 | Decline in high-latitude research. Many long-term hydrological research catchments measuring at least two components of the water balance in permafrost areas, and/or north of 64° N, have shut down (red symbols, sites in active use; black symbols, those terminated the last decades). Continuous and discontinuous permafrost is shown in dark blue and turquoise, respectively. Inset: number of operational climate stations in Canada's Prairie Provinces and northern territories with archived homogenized precipitation data (<http://www.ec.gc.ca/dccha-ahccd/>).

predict changes in freshwater quality, quantity and ecology. As warming in many northern regions will probably result in conditions outside of the measured climate variability recorded on human-generation timescales, a continued collection of empirical data is crucial.

Early detection of change is desperately needed. There is strength in the diversity of research catchments that remain: they can be leveraged to help build and test robust tools applicable across cold regions. Multinational efforts that promote the exchange of data and

information will improve decision making and reduce the vulnerability of peoples living in both northern and temperate regions to circumpolar change.

We urgently need to stem the tide of the decline in pan-Arctic catchment research. Without these catchments, policy to mitigate environmental change may no longer be made based on sound science. □

References

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Hjalmar Laudon^{1*}, Christopher Spence²,
Jim Buttle³, Sean K. Carey⁴,
Jeffrey J. McDonnell⁵, James P. McNamara⁶,

Chris Soulsby⁷ and Doerthe Tetzlaff⁷

¹Department of Forest Ecology and Management, SLU, 901 83 Umeå, Sweden. ²Environment and Climate Change Canada, Saskatoon, Saskatchewan S7N 3H5, Canada. ³Department of Geography, Trent University, Ontario K9J 7B8, Canada. ⁴School of Geography and Earth Sciences, McMaster University, Ontario L8S 4K1, Canada. ⁵Global

Institute for Water Security, National Hydrology Research Centre, University of Saskatchewan, Saskatchewan S7N 3H5, Canada. ⁶Department of Geosciences, Boise State University, Boise, Idaho 83725, USA. ⁷Northern Rivers Institute, School of Geosciences, University of Aberdeen, Aberdeen AB24 3UF, UK.

*e-mail: Hjalmar.Laudon@slu.se