# Mercury and methylmercury concentrations in drained basin complexes in Old Crow Flats, Yukon, Canada

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## Drained lake basins, carbon, and mercury

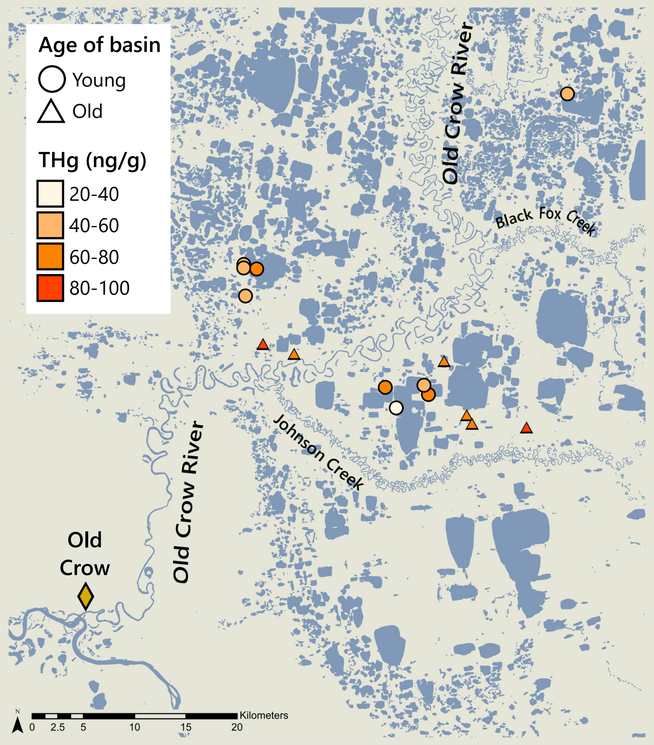
Lakes and drained basin complexes (LDBC) cover nearly one-fifth of the circumpolar North. In these complexes, drained basins accumulate organic carbon and may be associated with deposited mercury (Hg). Changing terrain conditions due to warming may create environments that favour or inhibit Hg methylation-the transformation of inorganic Hg to methylmercury (MeHg), which bioaccumulates and is a neurotoxin. In LDBCs, lake drainages create mosaics of wet and dry environments that host different microbial communities and are likely to have different Hg methylation potentials.


## Study Objective

Investigating mercury storage and methylmercury production potential in drained lake basins of various ages in the Old Crow Flats (OCF) of northern Yukon.

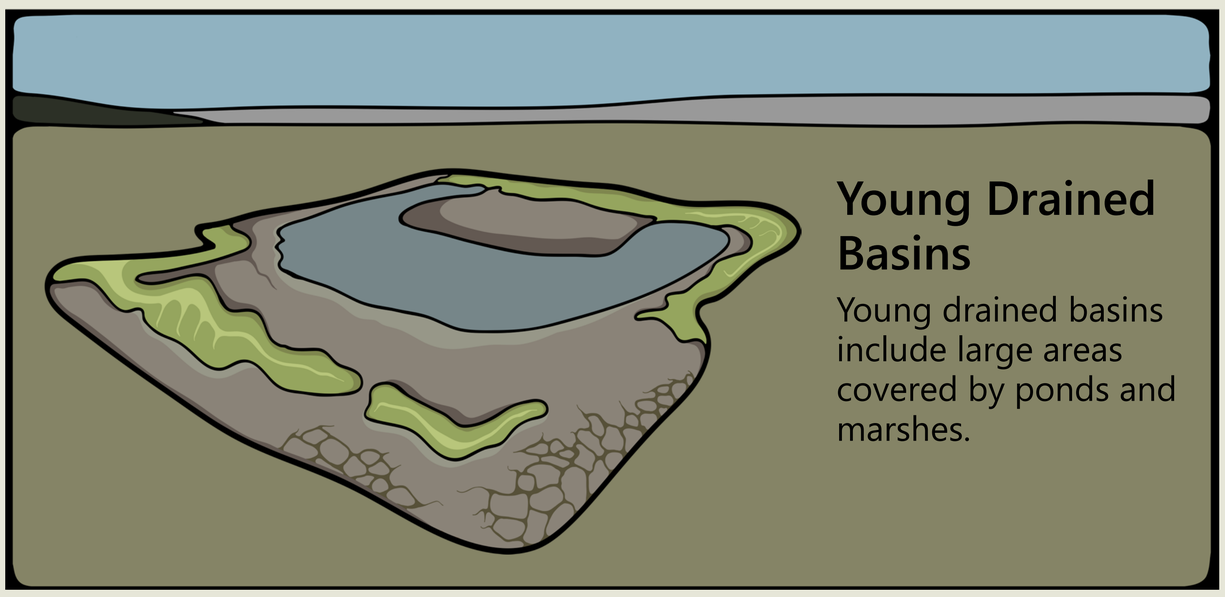
## Methodology

1. Sample peat and mineral soils in young and old drained basins.
2. Analyse samples for total mercury with a DMA-80 mercury analyzer to improve understanding of mercury storage in soils through OCF.
3. Analyse samples for methylmercury via cold vapour atomic fluorescence spectroscopy on a Tekran2700 to identify features where the methyl-total mercury ratio is high (an indicator of favourable methylating conditions).



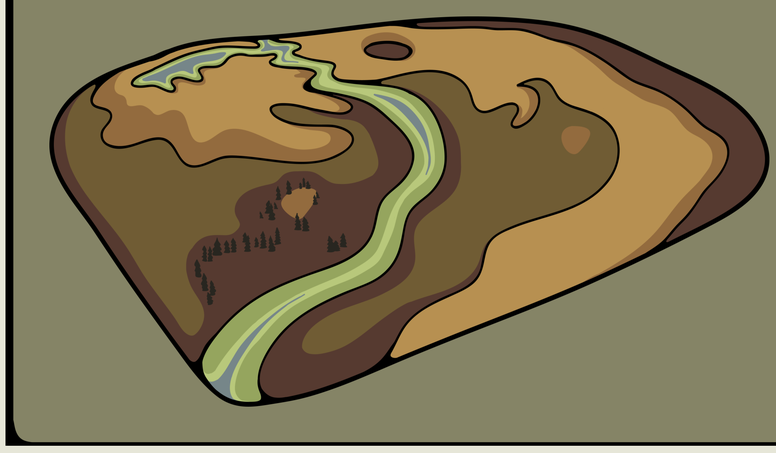

## Old Crow Flats

A 5600 km$^2$ thermokarst lowland underlain by continuous permafrost that includes thousands of lakes. It is a part of Vuntut Gwitchin First Nation's (VGFN) Traditional Territory.

## Young Drained Basins

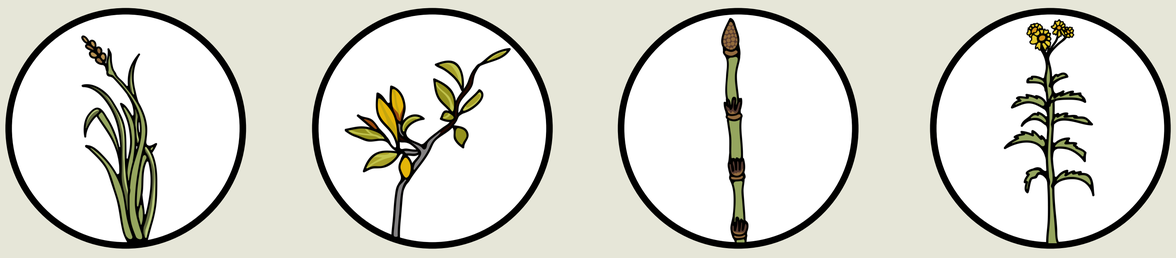
Young drained basins include large areas covered by ponds and marshes.



## Old Drained Basins

Old drained basins have well established permafrost and large expanses of bog-stage vegetation.

## Vegetation in young drained basins.



Sedges *Carex*
Willow *Salix*
Horsetail *Equisetum*
Marsh fleawort *Senecio congestus*

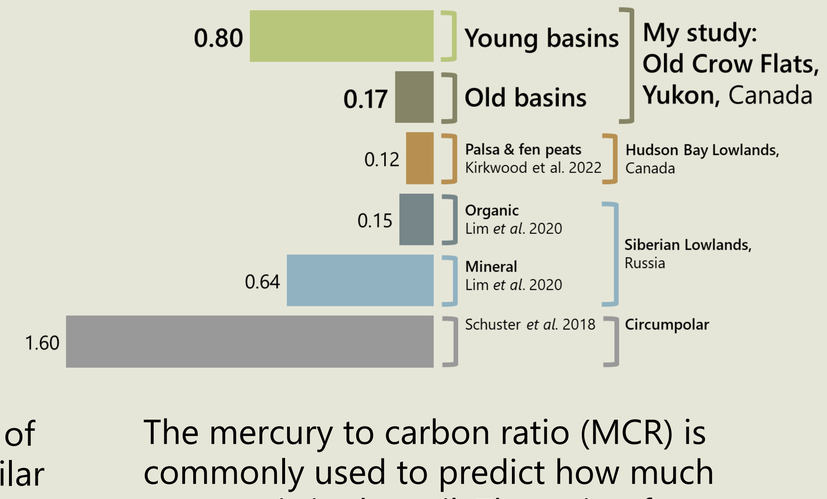
## Vegetation in old drained basins.

Peat Moss *Sphagnum*
Lowbush cranberry *Vaccinium vitis-idaea*
Labrador tea *Ledum groenlandicum*
Caribou lichen *Cladonia rangiferina*

### Total mercury final concentration (ng g$^{-1}$)

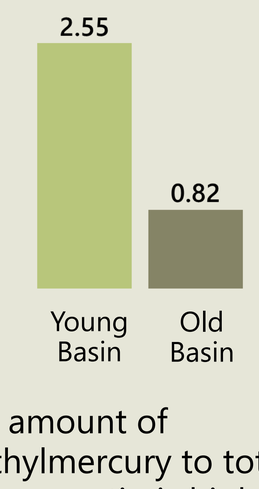

The overall amount of total mercury is similar across the Flats.

### Total mercury to soil organic carbon ratio (µg g$^{-1}$)




The mercury to carbon ratio (MCR) is commonly used to predict how much mercury is in the soil. The ratio of mercury to soil organic carbon in old basins is relatively low and consistent with observations from other permafrost peat complexes in Siberia and in the Hudson Bay Lowlands .

### Methylmercury to total mercury ratio (%)




The amount of methylmercury to total mercury ratio is higher in young basins, where marshy conditions are widespread and sphagnum-dominated bogs have not yet developed.

## Implications

Climatic warming may impede permafrost aggradation in recently drained basins, preventing the surface heaving and transition towards sphagnum-bog development, as is typical of drained basins in Old crow Flats. In such young drained basins with delayed permafrost aggradation, the widespread ponds and marshes with extensive sedge growth associated with higher mercury methylation potential may persist. This would lead to an increase in the proportion of the landscape with conditions favorable to net mercury methylation.

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