CRYOSOLS

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ISRIC – World Soil Information

Wageningen

The Netherlands

What are Cryosols ?

Perennially frozen soils that show

either

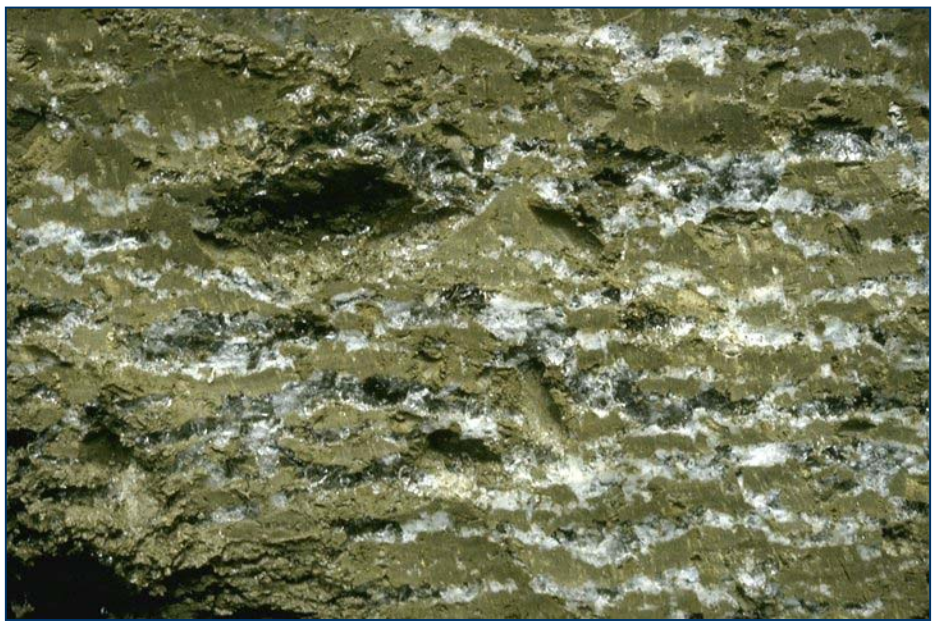
- ice segregation, cryoturbation, frost heave, cryogenic sorting or thermal cracking within 100 cm from the surface;

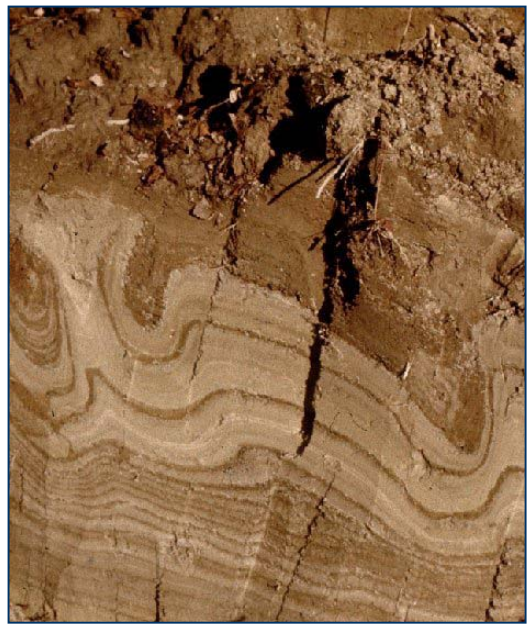
or

- evidence of thermal contraction within that depth when water is absent.

Diagnostics of Cryosols

Cryosols are defined by the occurrence of one or more ***cryic horizons*** within 100 cm from the soil surface.





Cryic horizon

A cryic horizon must have:

1. soil temperature at or below 0^0C for two or more years in succession; ***and***
2. a. in the presence of sufficient interstitial soil water, evidence of cryoturbation, frost heave, cryogenic sorting, thermal cracking, or ice segregation; ***or***

   b. in the absence of sufficient interstitial soil moisture, evidence of thermal contraction of the frozen soil material; ***and***
3. platy or blocky macrostructures resulting from vein ice development, and orbicular, conglomeratic and banded microstructures resulting from sorting of coarse soil material.

Genesis of Cryosols

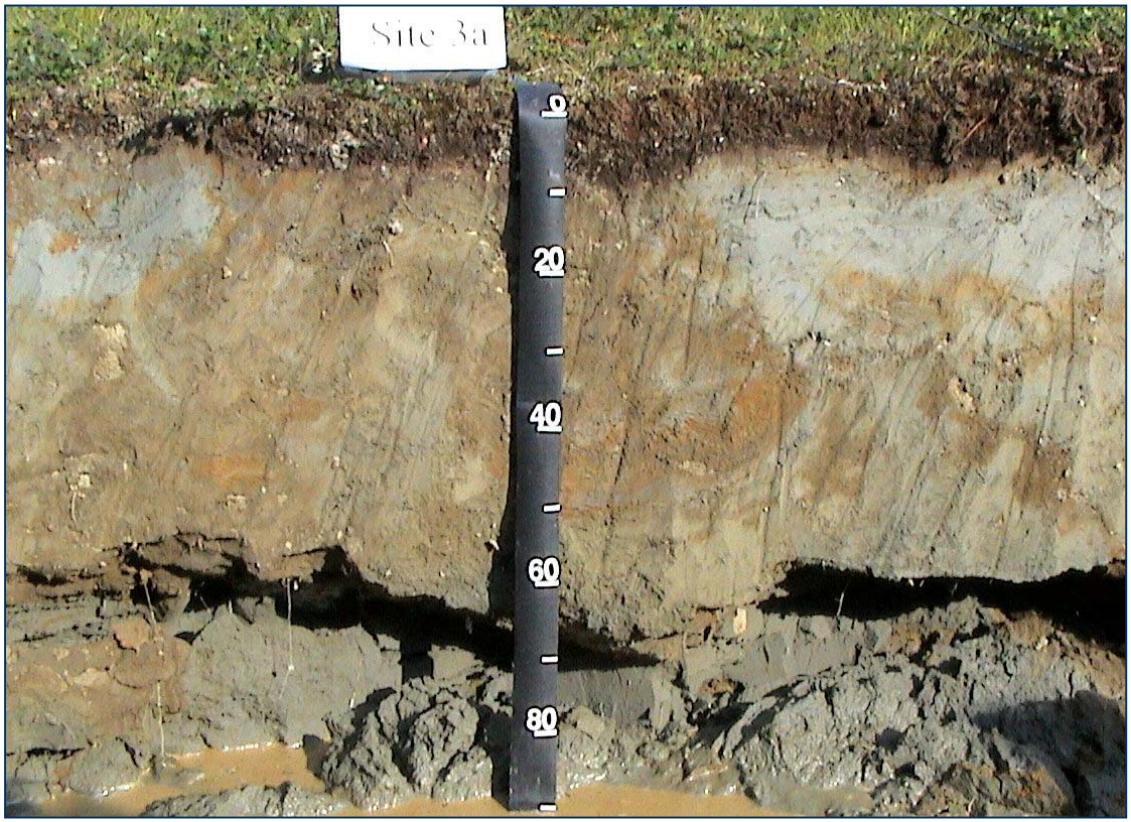
Main soil-forming factor is:

Climate

Main soil-forming processes result from the combination of a permanently frozen subsoil and a freeze-thaw layer *("active layer")* above, leading to:

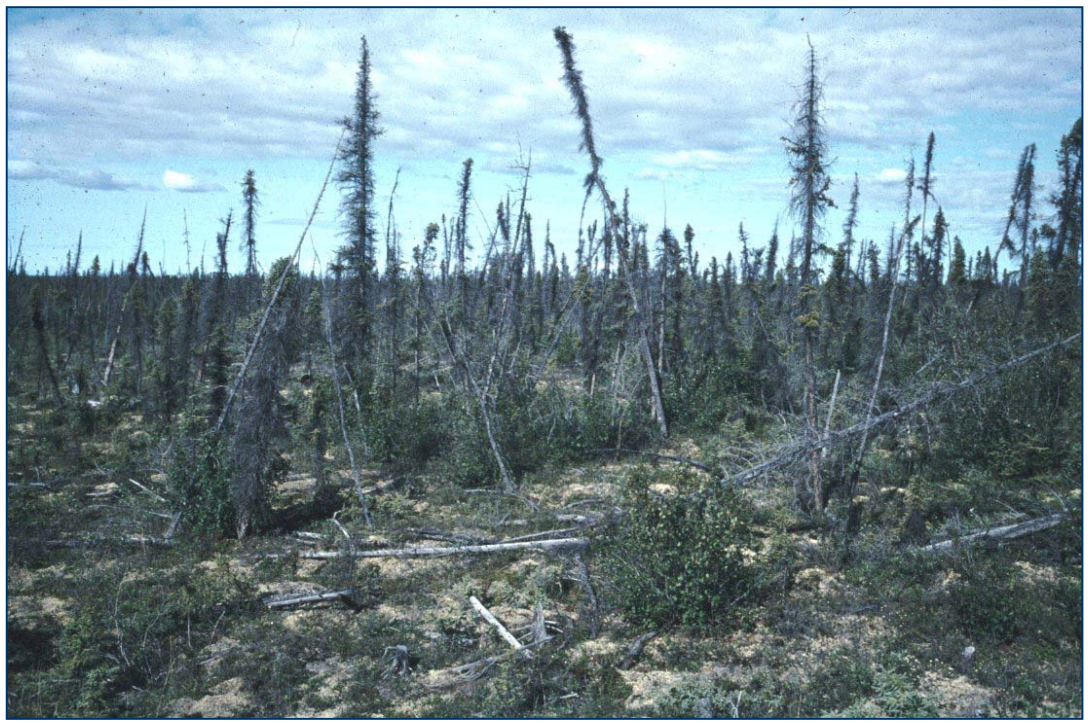
- gleying
- movements in the soil
- accumulation of organic matter without mineralization

Gleying in Cryosols



Gleying in Cryosols is very common as a result of water stagnation on the perennially frozen subsoil.

Movements in Cryosols (1)



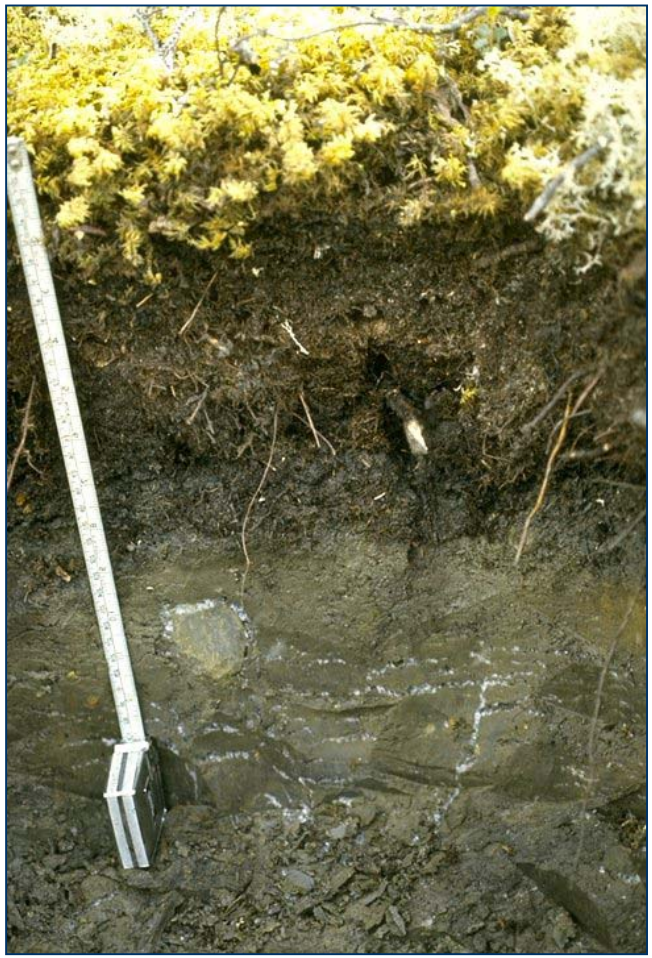
Fallen and oblique growing trees as a result of soil movements in Cryosols.

Canadians call this a *“drunken forest”*.

Movements in Cryosols (2)

Horizon involutions in a Canadian Cryosol

Organic matter in Cryosols



Organic matter accumulation as *histic horizon* in Canada.

Little or no mineralization because of lack of biological activity.

Classification of Cryosols (1)

- **Typical qualifiers**: *glacic, turbic*
- **Strong expression qualifier**: *thionic*
- **Intergrade qualifiers**: *andic, calcic, gleyic, gypsic, histic, leptic, mollic, natric, salic, and umbric*

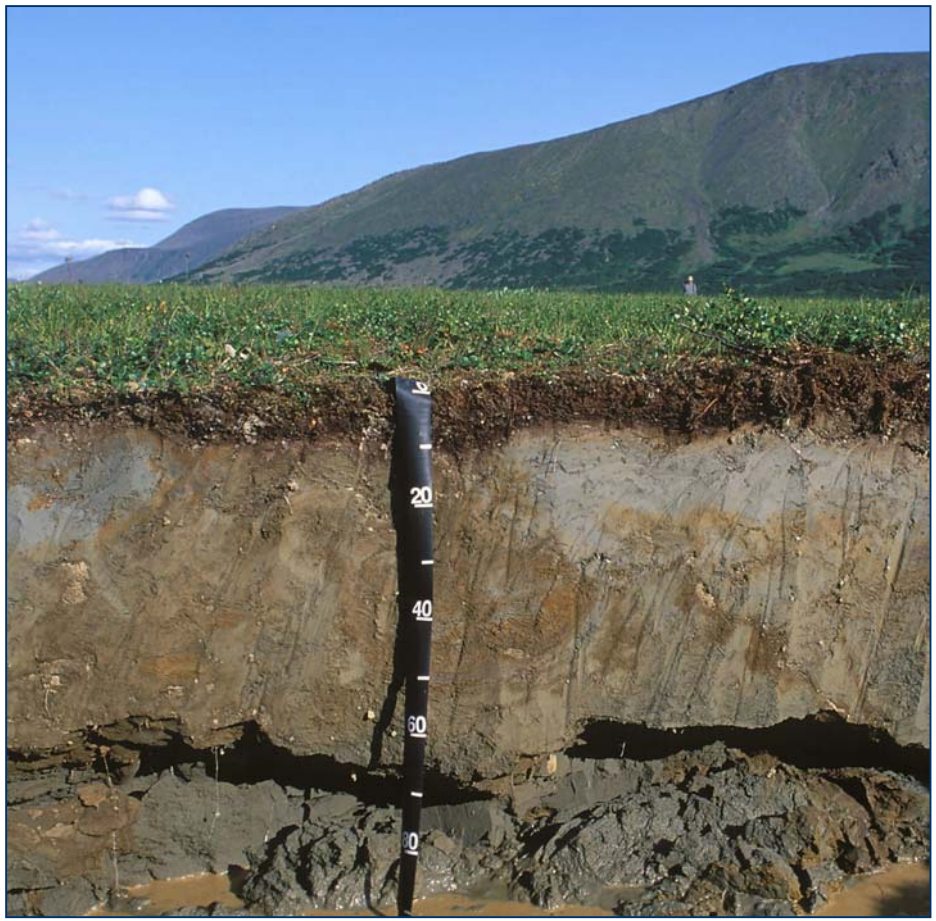
Classification of Cryosols (2)

- **Secondary characteristics qualifiers**, related to defined diagnostic horizons, properties or materials: *aridic, lithic, stagnic and yermic*
- **Secondary characteristics qualifiers**, not related to defined diagnostic horizons, properties or materials: *oxyaquic*

Classification of Cryosols (3)

- **Haplic qualifier**, where non of the above applies: *haplic*

Examples of Cryosols (1)

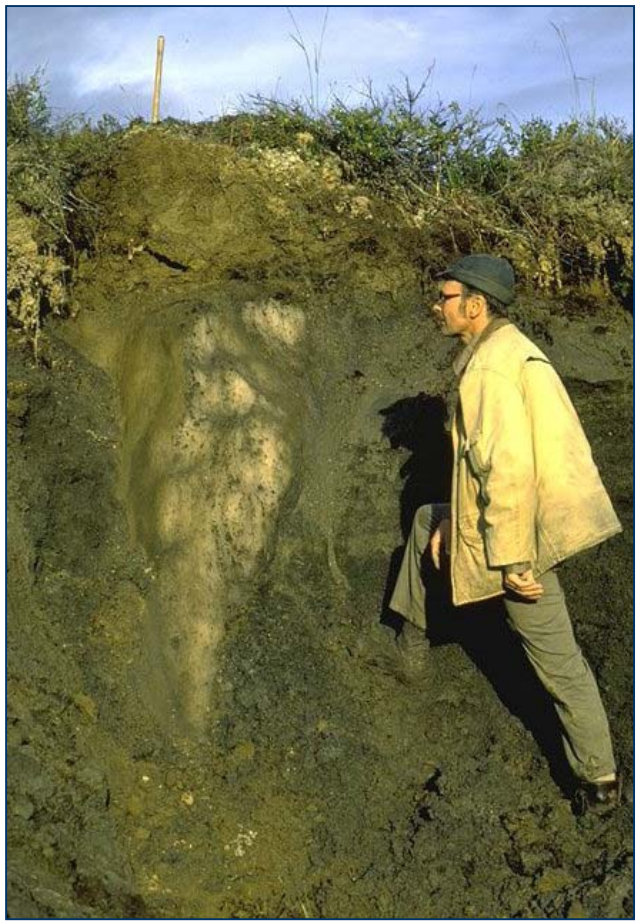


Gleyi-Turbic Cryosol / Turbi-Histic Cryosol (Gleyic), Russia

Examples of Cryosols (2)

Turbi-Histic Cryosol (Epigleyic and Glacic), West Siberia

Examples of Cryosols (3)

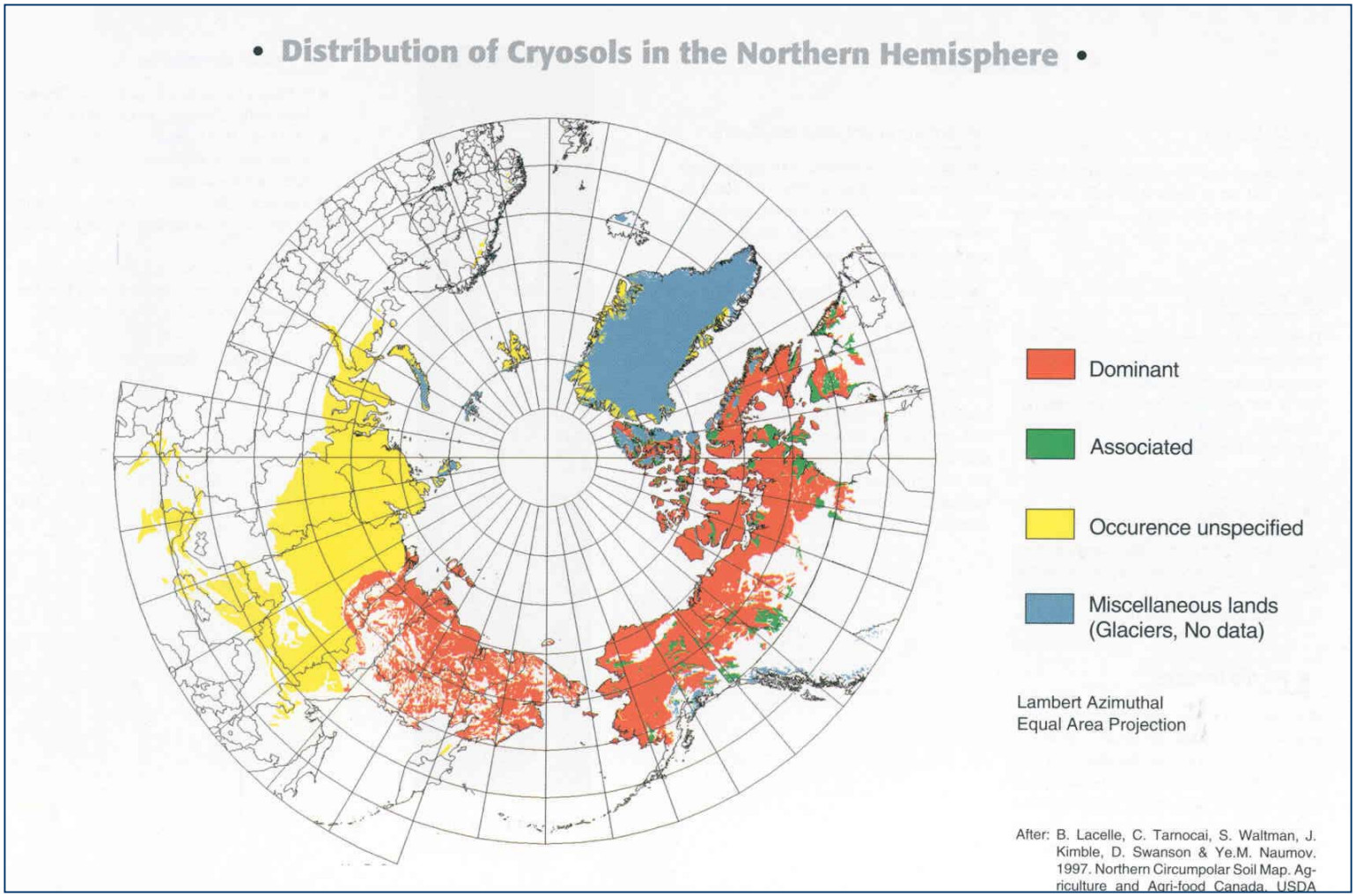


Glaci-Histic Cryosol, Canada

Examples of Cryosols (4)

Epistagni-Turbic Cryosol, Russia

Distribution of Cryosols (1)



Distribution of Cryosols (2)

One of the most widespread soils, covering some 1.77 billion ha or some 13 % of the Earth's land surface, mainly in the arctic, antarctic, subarctic and boreal regions, as well as at high elevations in the Himalayas, the Rocky Mountains, the Andes and (sporadic) the Alps.

Associated soils

Fluvisols, Gleysols and Histosols in low-lying positions.

Cambisols, Leptosols, Regosols, Podzols, Luvisols and Umbrisols in upland areas.