

continued from page 7...

Danger to indigenous people and ecosystems

Climate changes can affect the vegetation on the tundra. In Arctic Russia alone, 200,000 indigenous people live partly as nomads, surviving by reindeer herding. Erosion and changes to the landscape are expected to have a negative effect on the traditional lifestyle of the indigenous people and threaten their livelihoods.

Speeding up the greenhouse effect

For thousands of years the tundra has worked as a carbon sink, because dead vegetation does not rot but is stored in the ground. Thinning of the permafrost allows micro-organisms to break down the biological material. In this process, methane and carbon dioxide are released. In Alaska it is documented that the tundra has changed from being a carbon stock to becoming a source of carbon to the atmosphere. The carbon is mostly released as methane, because the rotting process is happening in wet soil with little or no supply of oxygen.

Water gathering on top of the permafrost will often lead to increased melting, ground erosion, and canals

and holes in the ice. Removal of the topsoil leads to further melting of permafrost. These processes contribute to the self-perpetuating mechanism of more releases of carbon dioxide and methane contributing to the greenhouse gas effect.

UNEP recommends continuous surveillance of areas with permafrost and the significant damages which the melting can do to infrastructure, ecology, indigenous people and to enhancing greenhouse effect.

For further reading:

The EU project: Permafrost and Climate in Europe (PACE), www.cf.ac.uk/earth/pace/
The Arctic Council, Arctic Climate Impact Assessment (ACIA), www.acia.org
International Permafrost Association (IPA), www.geodata.soton.ac.uk/ipa/
IPCC, Special report on The Regional Impacts of Climate Change, An assessment of Vulnerability, Chapter 3: The Arctic and the Antarctic www.ipcc.ch/pub/wg2SPMfinal.pdf
Permafrost maps: www.grida.no/prog/polar/ipa

Lars Kullerud, Director
UARctic, www.uarctic.org

Svein Tveitdal, Managing Director
UNEP/GRID-Arendal
www.grida.no

The UN Climate Panel on Permafrost

Permafrost is sensitive to changes in temperature;

By 2050 more dispersed permafrost areas are expected;

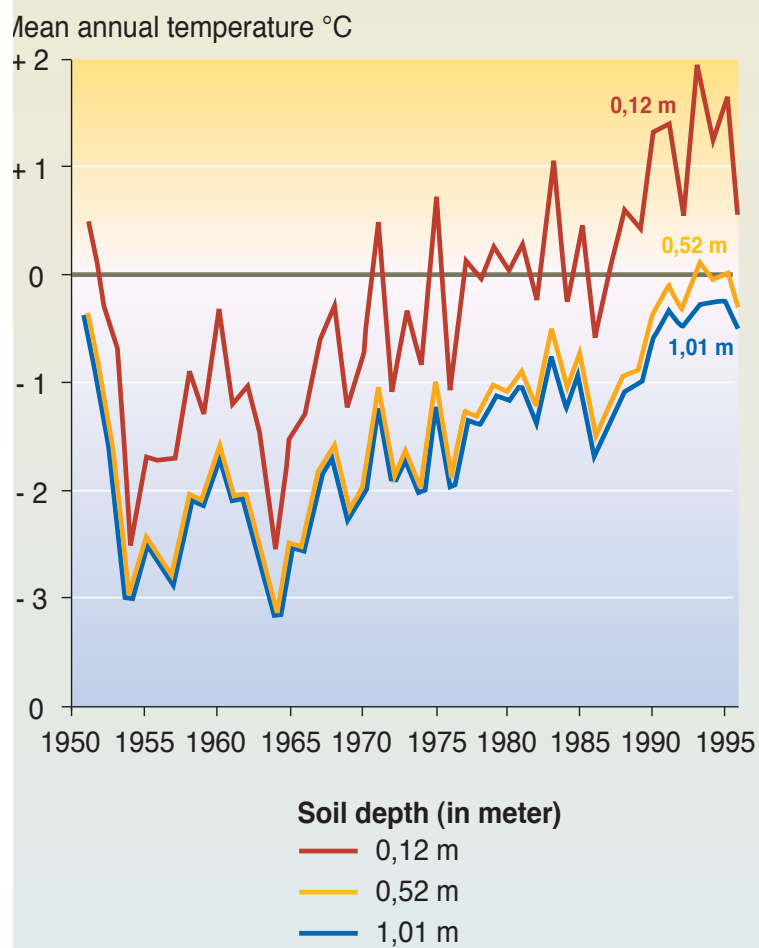
Areas with a lot of permafrost are expected to stay relatively stable because of the large amounts of ice;

A visible increase in the thickness of the active permafrost layer is expected;

The result of a reduction of permafrost caused by global warming is expected to lead to:

- Increased erosion and danger of landslides
- Break down of ice-rich landscapes
- Damage to vegetation
- Changes to ecosystems and animal life
- Damage to buildings, roads and pipelines
- Changes to agriculture
- Changes to building methods
- Additional emissions of greenhouse gases

Change in permafrost temperatures at various depths in Fairbanks (Alaska)



Vital Graphics on Climate Change, UNEP/GRID-Arendal, Philippe Rekaewicz, 2000

UNEP/GEO-3: POLAR BEARS AND SEALS SUFFER IN WARMER TEMPERATURES

Hunting ringed seal, the preferred diet for polar bears, has become a lot more difficult over the past decades for the large white bear. With warmer temperatures in the Arctic, the ice, where the ringed seal feed and give birth, melts earlier. When the polar bears come out of winter hibernation in early spring the ice may already be gone and so are the seals. The polar bear is left starving in a period when it should build up its body fat for the coming birthing period.

This is just one example of how the general increase in global temperatures have an immense effect on the Arctic environment, as described in the recently released United Nations Environment Programme (UNEP)'s Global Environment Outlook report (GEO3).

Measurements from 1979 to 1997 indicate an increase of 1° Celcius per decade in the eastern Arctic and a decrease of -1° Celcius in the western Arctic.

At the same time the protective stratospheric ozone layer has thinned. There have been sporadic episodes of severe stratospheric ozone depletion over the past 30 years and a 7.5 per cent decrease in Arctic ozone between the 1970s and 1990s. For each 1 per cent decrease in stratospheric ozone, there is about a 1 to 2 per cent increase

in ultraviolet radiation. The impacts are serious and can affect the entire food chain of the Arctic. For example, reduced ozone protection damages phytoplankton and other microbial organisms that power the life systems of the Arctic.

The warmer temperatures also reduce the snow and ice cover. This, together with increased levels of pollutants on the land surface, reduce the amount of reflection of sunlight adding to the overall warming effect.

The changes are a stark reminder of the interconnectedness between the earth's surface, its water masses and its atmospheric systems. Polluting human activities both in and outside the Arctic according to scientists contributes to most of these changes.

Most Arctic states embrace the Kyoto Protocol and other climate change instruments with the exception of the withdrawal of the USA.

For further reading:

GEO-3 www.grida.no/geo3
AMAP (1977) Arctic Pollution Issues: A State of the Arctic Environment Report nsidc.org/arcticmet/basics/primer_sources.html
CAFF (1994) The State of Protected Areas in the Circumpolar Arctic agdc.usgs.gov/caff/caff_maps.html

Arctic Sea Ice: A Vanishing Kingdom

The Intergovernmental Panel on Climate Change has confirmed that human-induced climate change is a reality. It can no longer be dismissed as a theoretical, academic, concept nor a politically motivated doomsday prophecy.

The Arctic is one of the regions on earth where climate change will be seen early, and most dramatically. Arctic indigenous communities are already noticing some of these changes: warmer winters, early spring breakup, and thinner than usual ice. This traditional knowledge echoes the scientific evidence:

- Air temperatures in the Arctic have on average increased by about 5°C over the last 100 years.
- Arctic sea ice extent decreased by approximately 3 per cent per decade between 1978 and 1996.

The results of climate modeling of vary in detail, but all show a clear trend towards an overall warming in the Arctic, and a resulting melting of the sea ice. The models suggest that by 2080, arctic sea ice will completely disappear during the summer months.

These are dramatic and rapid changes in an ecosystem defined by being frozen. A slight shift in temperature, bringing averages above freezing, will completely alter the character of this region, from one of ice covering the seas and permafrost stabilizing the ground, to one of open water and large tracts of land simply melted away. The consequences for humans and animal species, such as polar bears, that are adapted to the current Arctic ecosystem, will be severe.

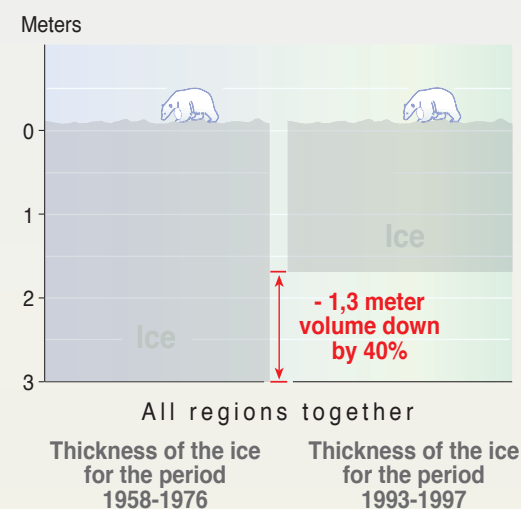
"New information indicates the greatest future challenges to the conservation of polar bears may be ecological change in the Arctic as a result of climate change..." (Polar Bear Specialist Group, 2001).

In the southern range of polar bears, for example the Hudson and James Bays of Canada, sea ice is already

melting earlier in the spring and forming later in the autumn. The time bears have on the ice, storing up energy for the summer and autumn when there is little available food, is becoming shorter. As the periods without food are extended, the overall body condition of these bears decline. This is particularly serious for pregnant or nursing females, and young cubs. In Hudson Bay, scientists have found the main cause of death for cubs to be either an absence of food or lack of fat on nursing mothers.

"For every week earlier that break-up occurs in the Hudson Bay, bears will come ashore roughly 10kg lighter and thus in poorer condition. With reproductive success tied closely to body condition, if temperatures continue to rise in response to increases in greenhouse gas emissions and the sea ice melts for longer periods, polar bear numbers will be ...continued page 9

Thinning of the Arctic sea ice cover



Vital Graphics on Climate Change, UNEP/GRID-Arendal, P. Rekaewicz, 2000