



ARCTIC COUNCIL

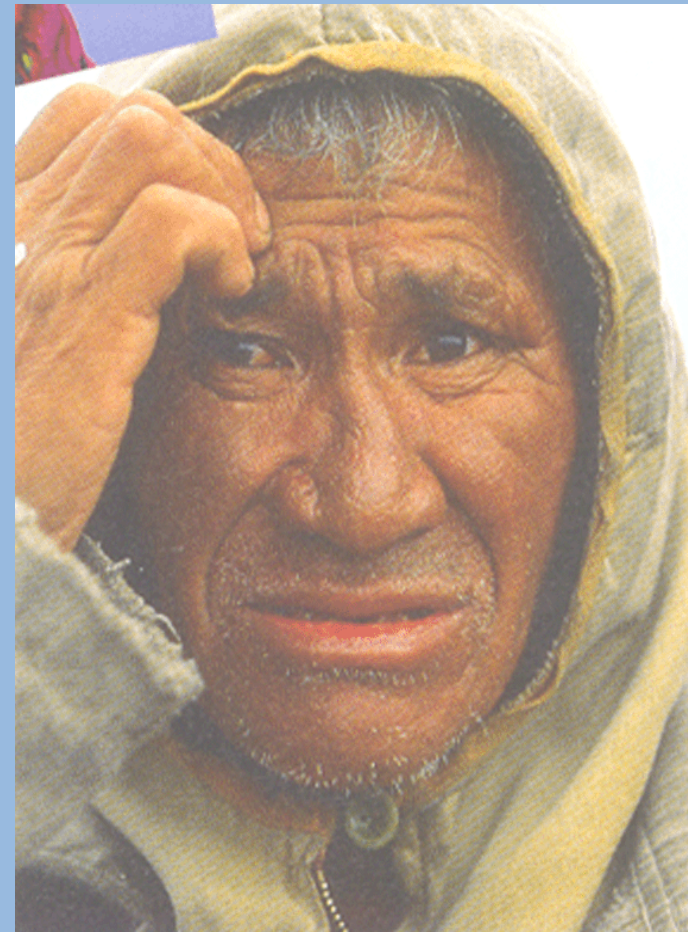
AMAP

Arctic Monitoring and Assessment Programme

Key results from the AC/AMAP report on Snow, Water, Ice & Permafrost in the Arctic (SWIPA)

Arctic A Messenger for Global Change
COP-17 side-event 06.12.2011.

Dr. Lars-Otto Reiersen
Prof. Terry Callaghan

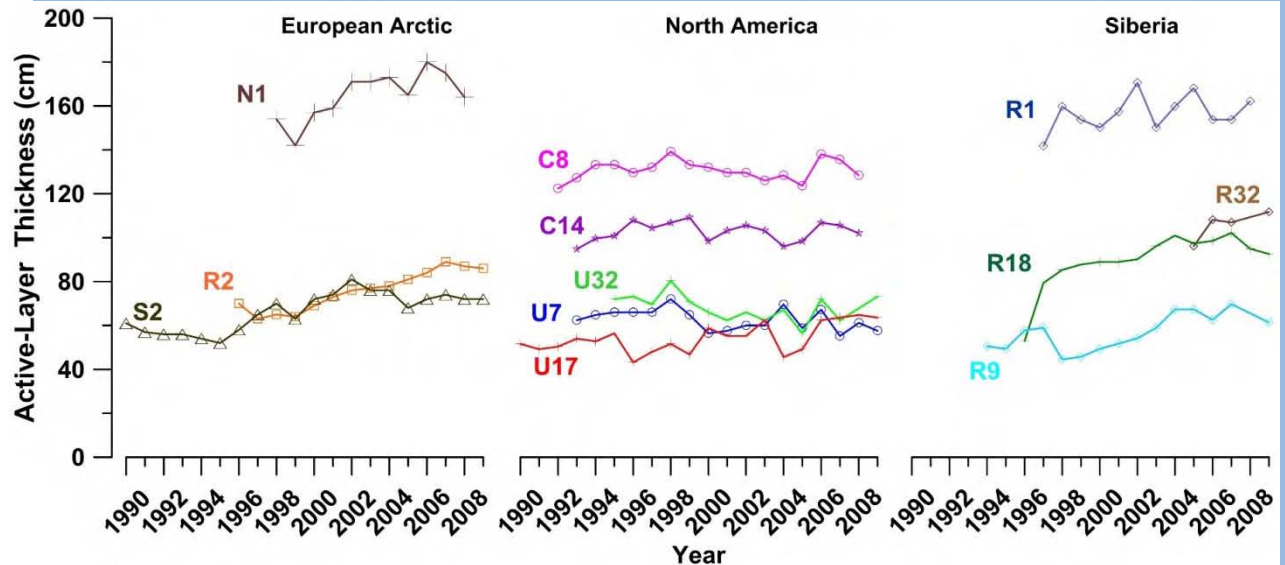
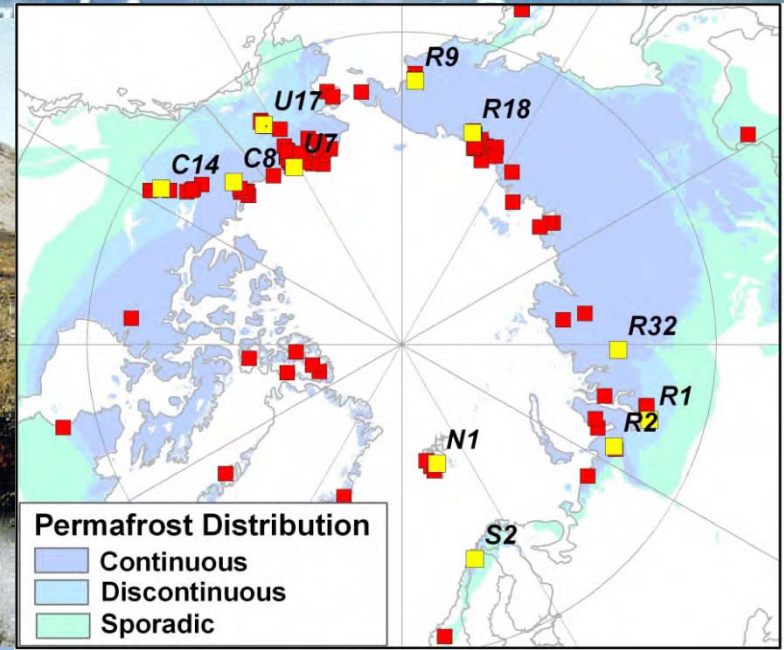
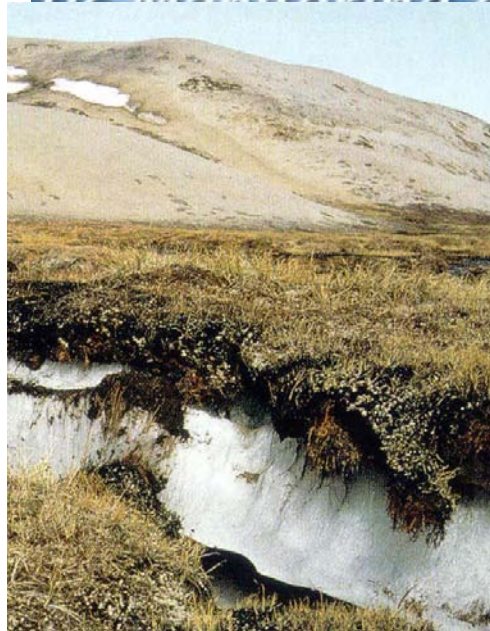


Permafrost thaw: Active Layer Thickness (ALT)

Current trends

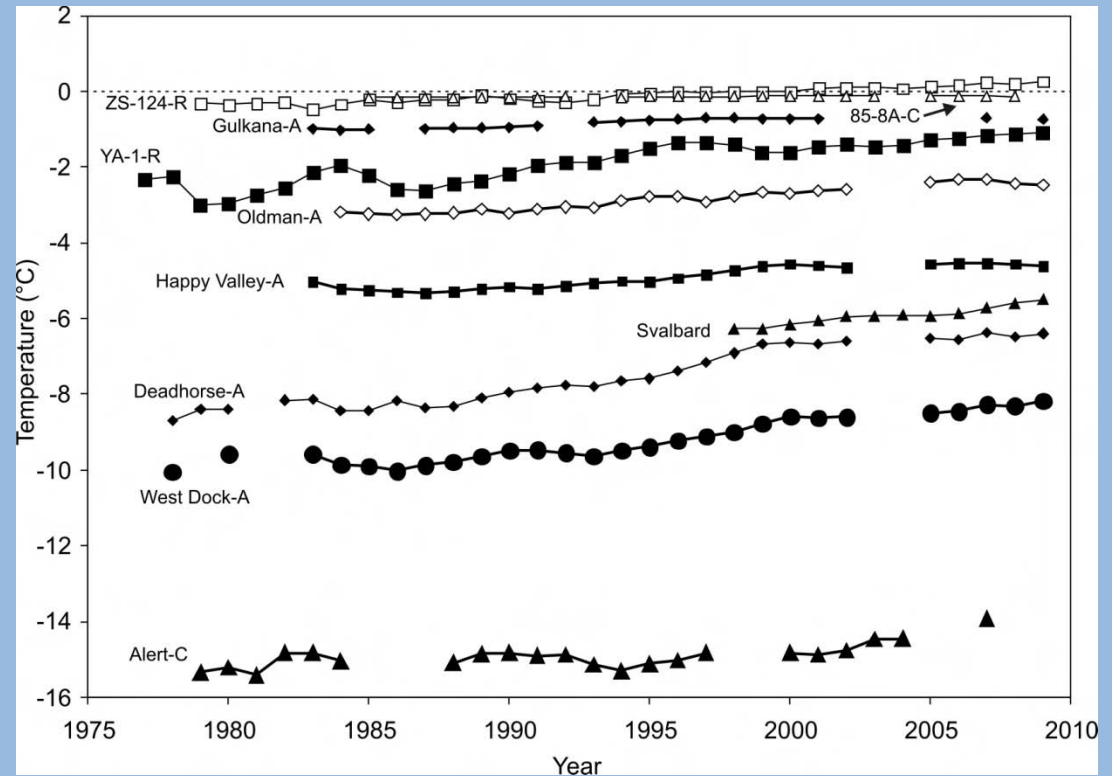
Future predictions

Why do we care?



ALT is increasing in most regions

AMAP Permafrost ground temperatures Automatic Monitoring and Assessment Programme



Romanovsky et al., 2010

Warming typically between 0.5 to 2 °C

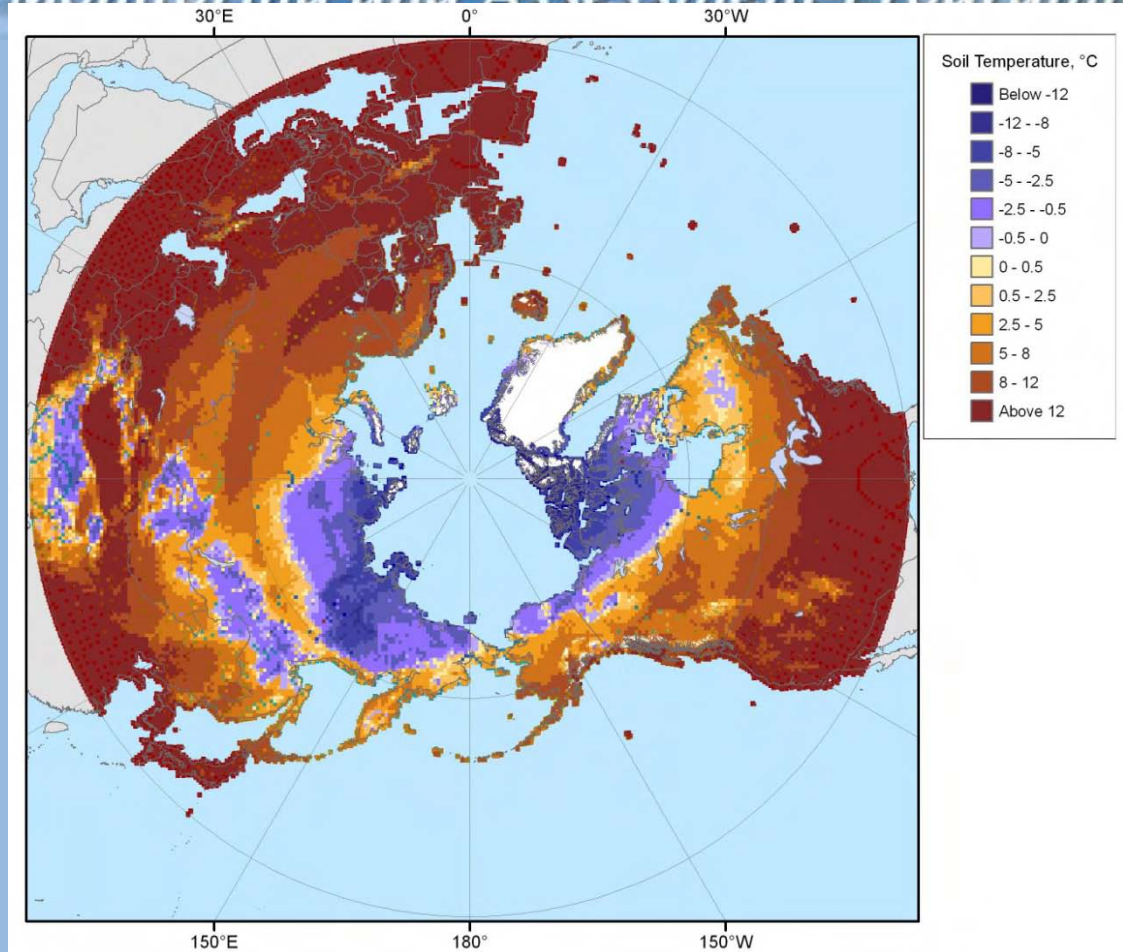
Projections for year 2090

Arctic Monitoring and Assessment Programme

Current trends

Future predictions

Why do we care?



Extensive thawing in the southern boundary
of permafrost region

Changes in hydrology



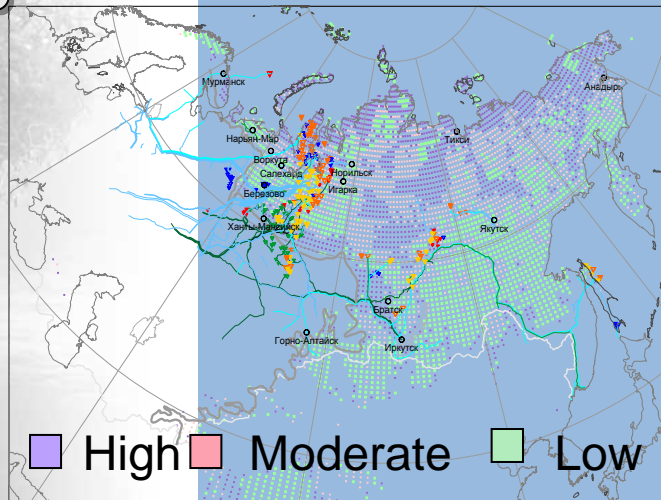
Current trends

Future predictions

Drying of ponds in many areas, new ponds in others

Damage to Infrastructure

Why do we care?



Vulnerability to thaw



Damage to ecosystems

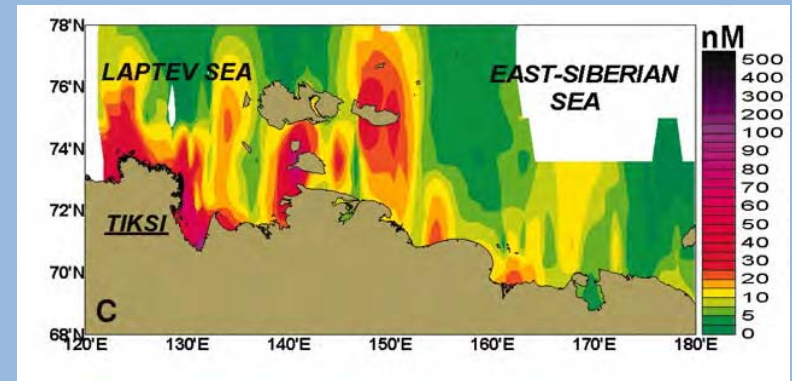
Current trends



Future predictions

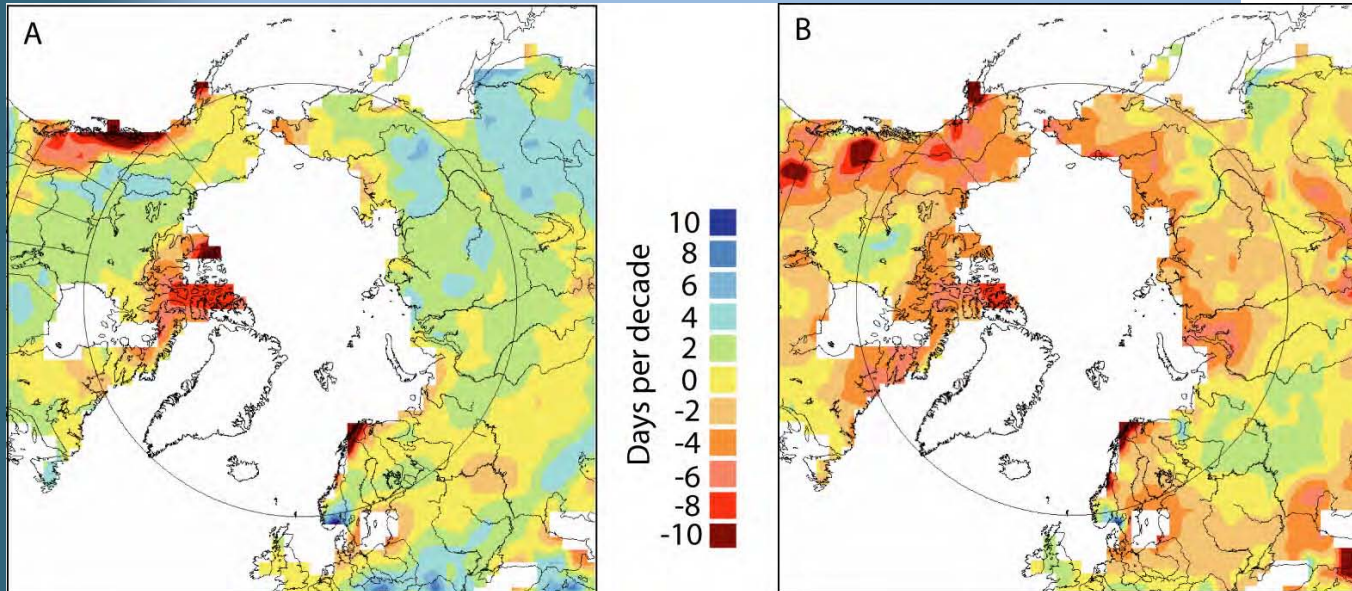
Why do we care?

Release of methane



Release of 1% of carbon on continental shelves would double atmospheric CO₂

Snow cover duration



Autumn onset

Spring thaw

Snow season timing from the NOAA weekly dataset 1972/73 to 2008/09

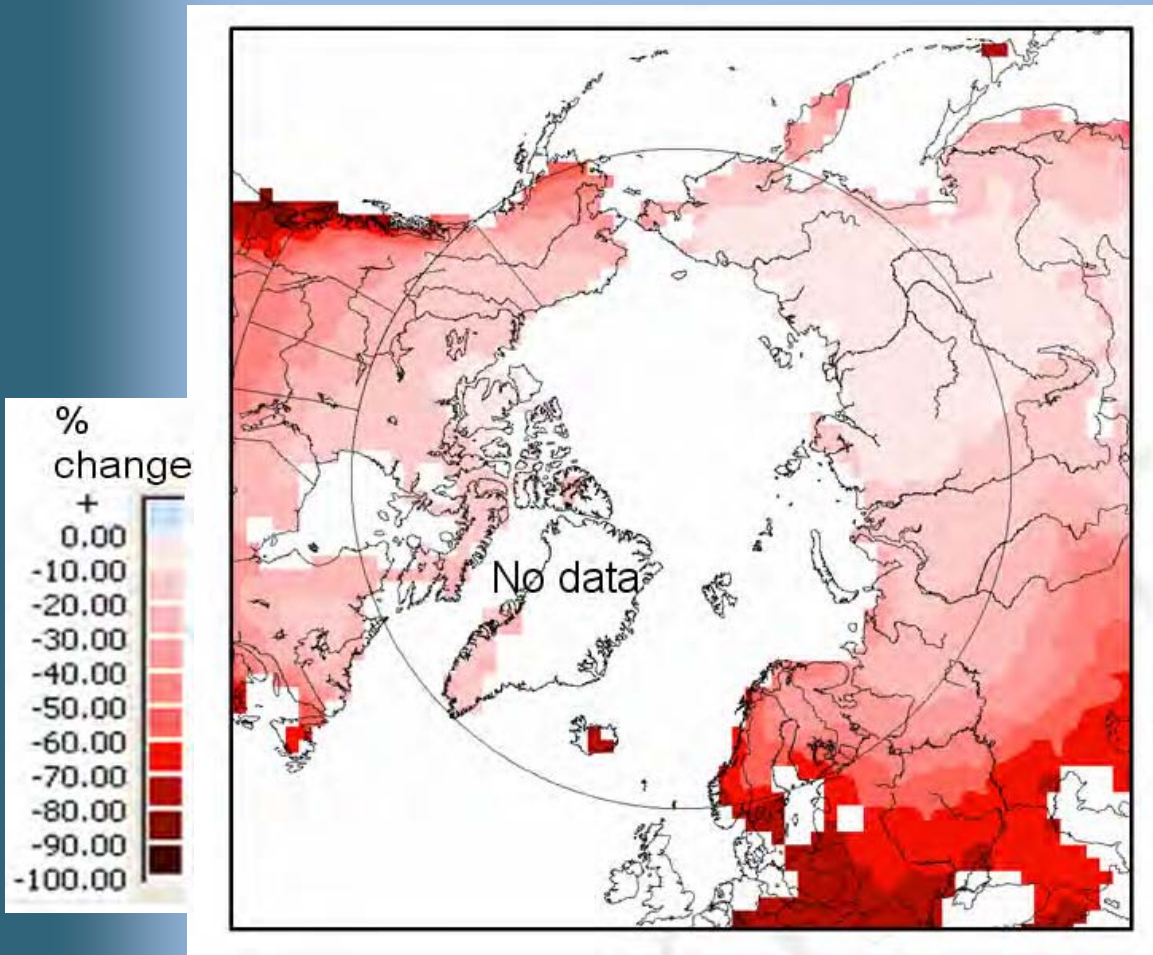
Decrease of 3.4 days per decade 1972-2009

Current trends

Future predictions

Why do we care?

Projected changes in snow cover duration between 1970-1999 and 2049-2060



Projected decreases are
between 0 and 100%

Current trends

Future predictions

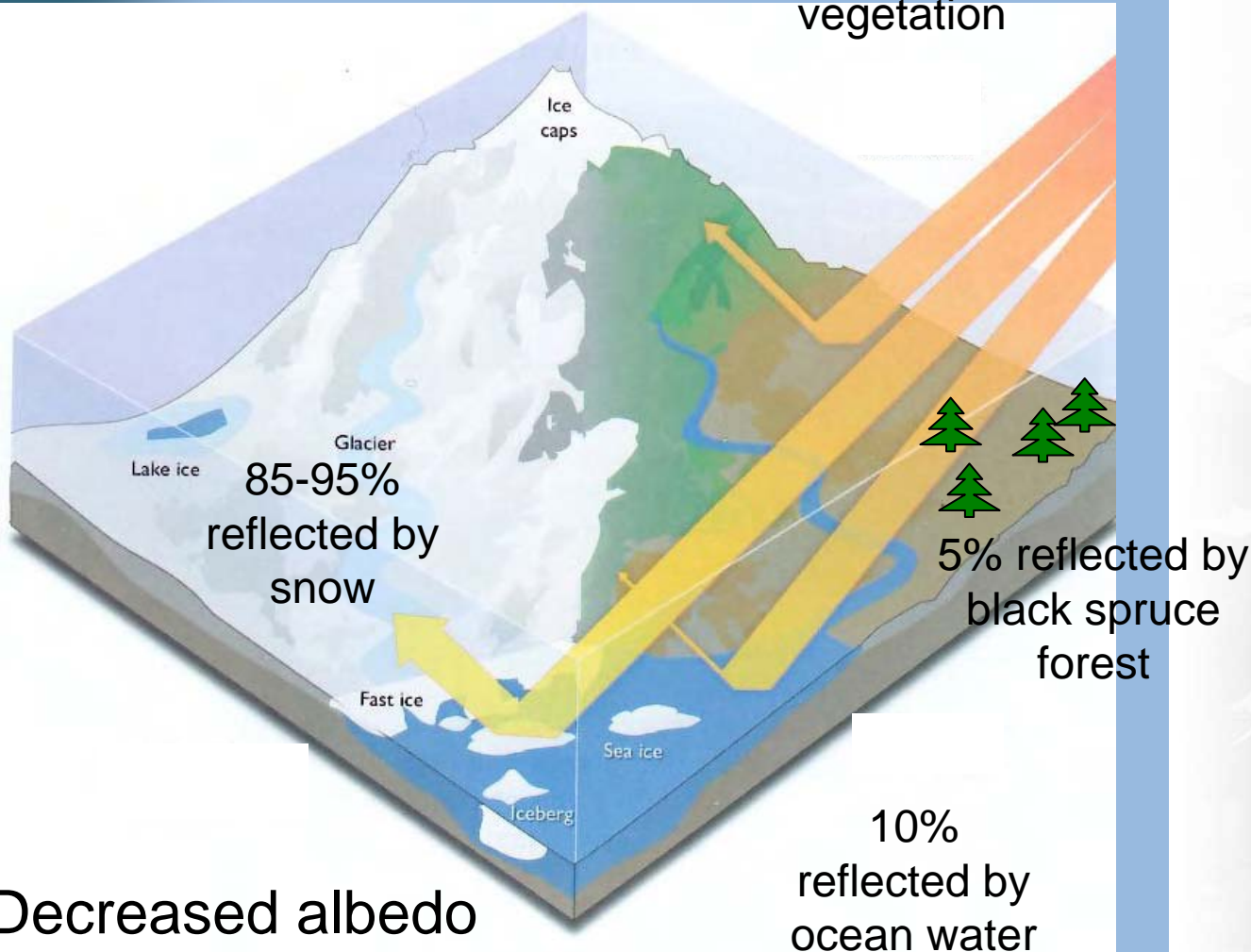
Why do we care?

Albedo and insulation

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20% reflected by tundra
vegetation



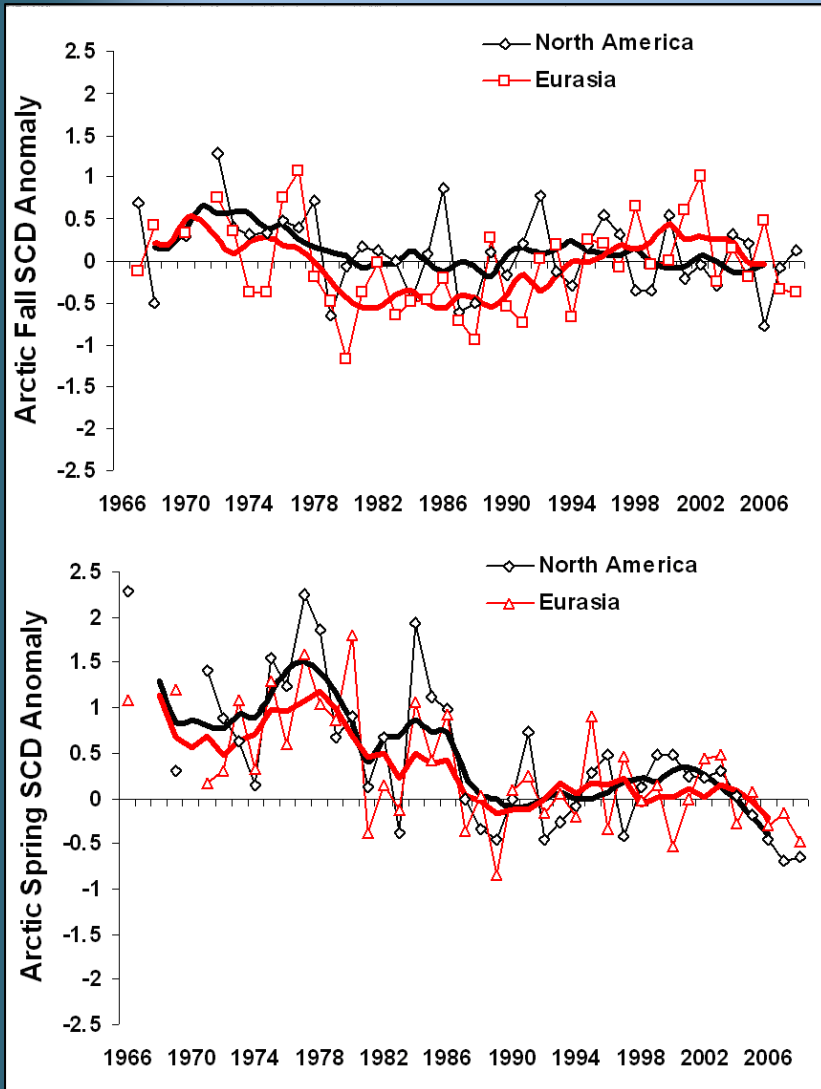
Current trends

Future predictions

Why do we care?

Decreased albedo
leads to warmer springs

Snow cover duration



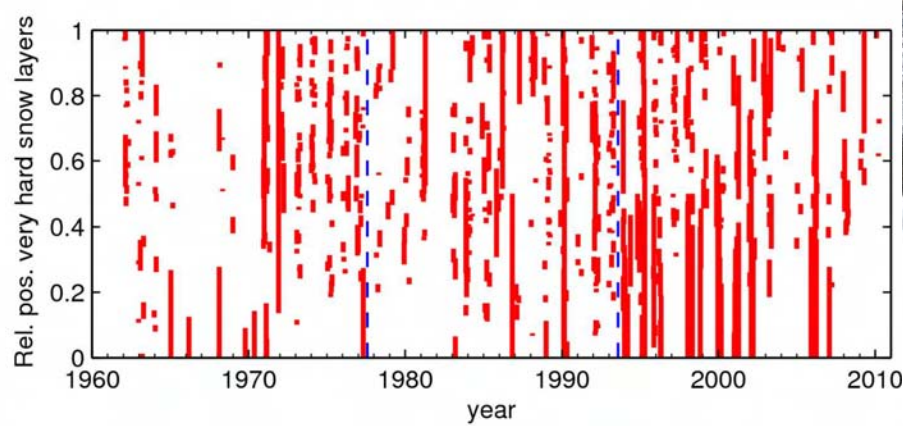
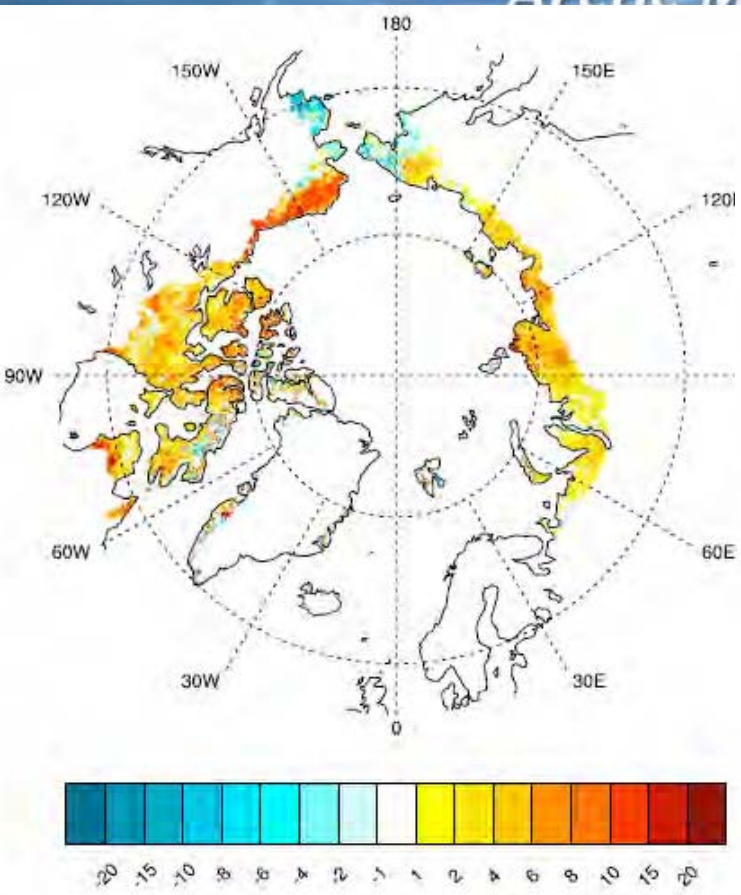
Current trends

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Why do we care?

Decrease of 3.4 days
per decade 1972-2009

Impacts on Ecosystem Services



General increase in plant production

Increased mid-winter thaw events lead to icing and deaths of thousands of animals e.g. reindeer

Feedbacks: The Arctic cryosphere is a *rapidly changing* key element of the global climate system

It has cooled the earth by:-

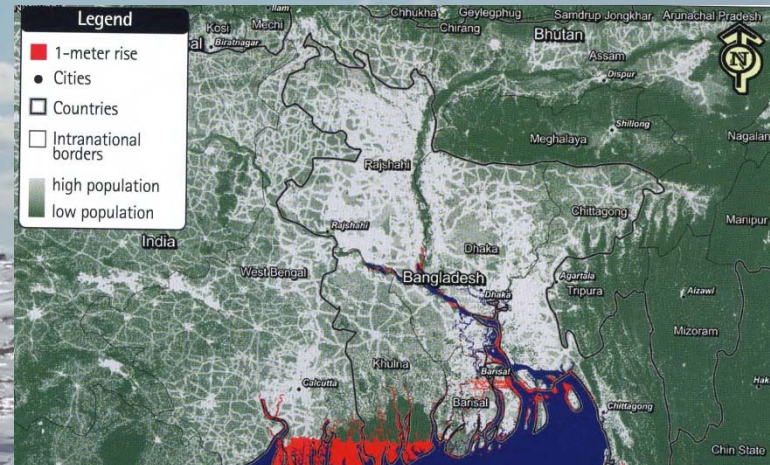
Reflecting heat from the sun

Regulating greenhouse gases

It has redistributed the Earth's heat – warmer North, cooler tropics

It regulates sea level

It provides unique habitats for people and nature



Consequences of change



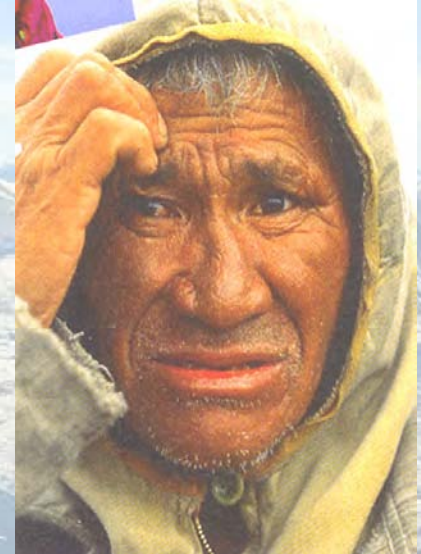
Consequences of change

Challenges

Opportunities

Arctic
residents
Losers?

Insecure travel routes,
diminishing traditional
food sources



The global
community
Winners?
(*multi-
national
industry*)



Sea level
rise,
amplified
warming

Better access
to oil and gas
resources,
new shipping
routes

