TUNDRA

Changes in ecosystem service flows given climate change

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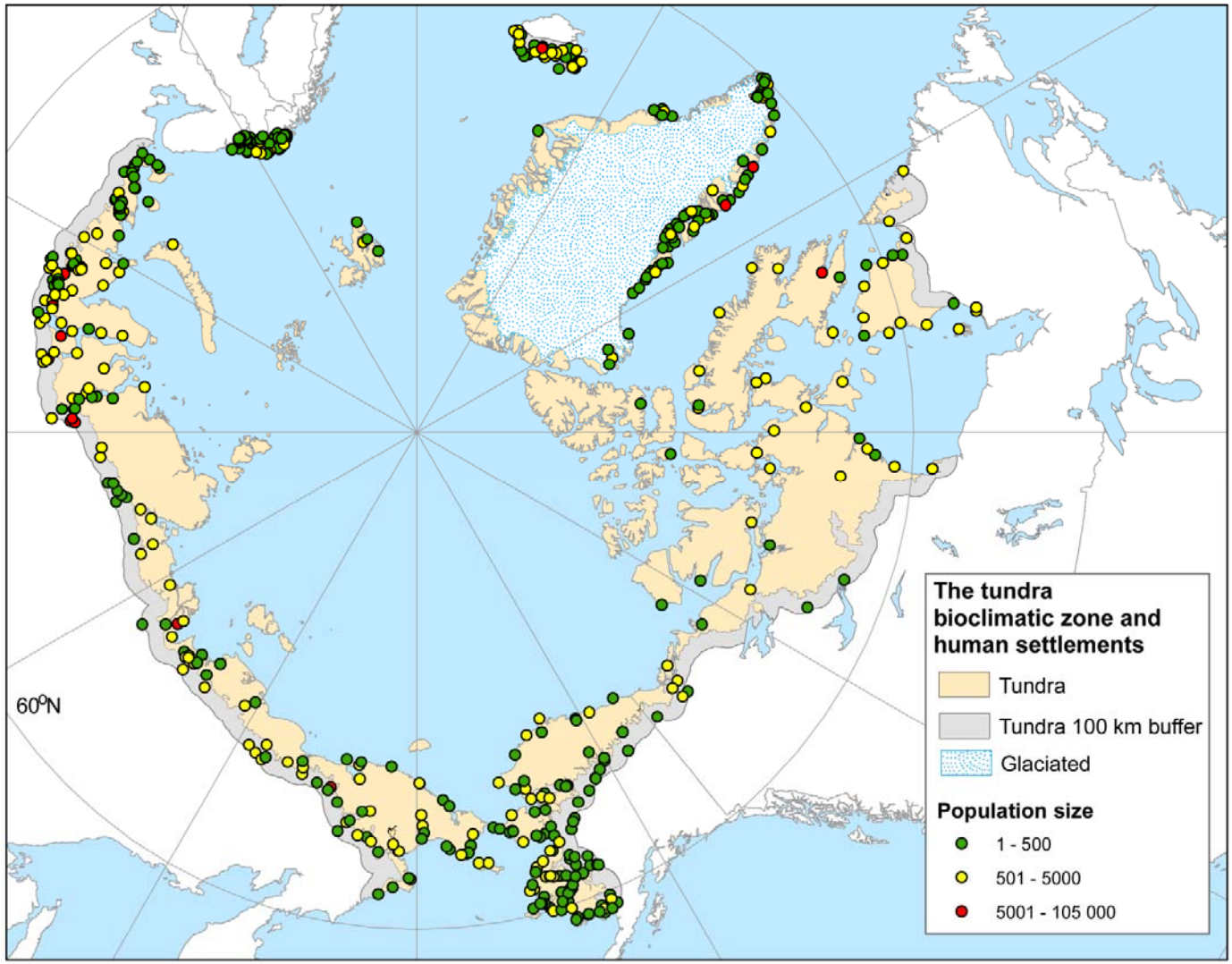
The Arctic communities

"Tundra" communities

- 910 000 inhabitants
- 7 mill. km^2
- 547 communities 95% with <5000 inhabitants
- Clusters: ice free coastal areas, fishing villages
- ~75% aboriginal origin



Arctic communities

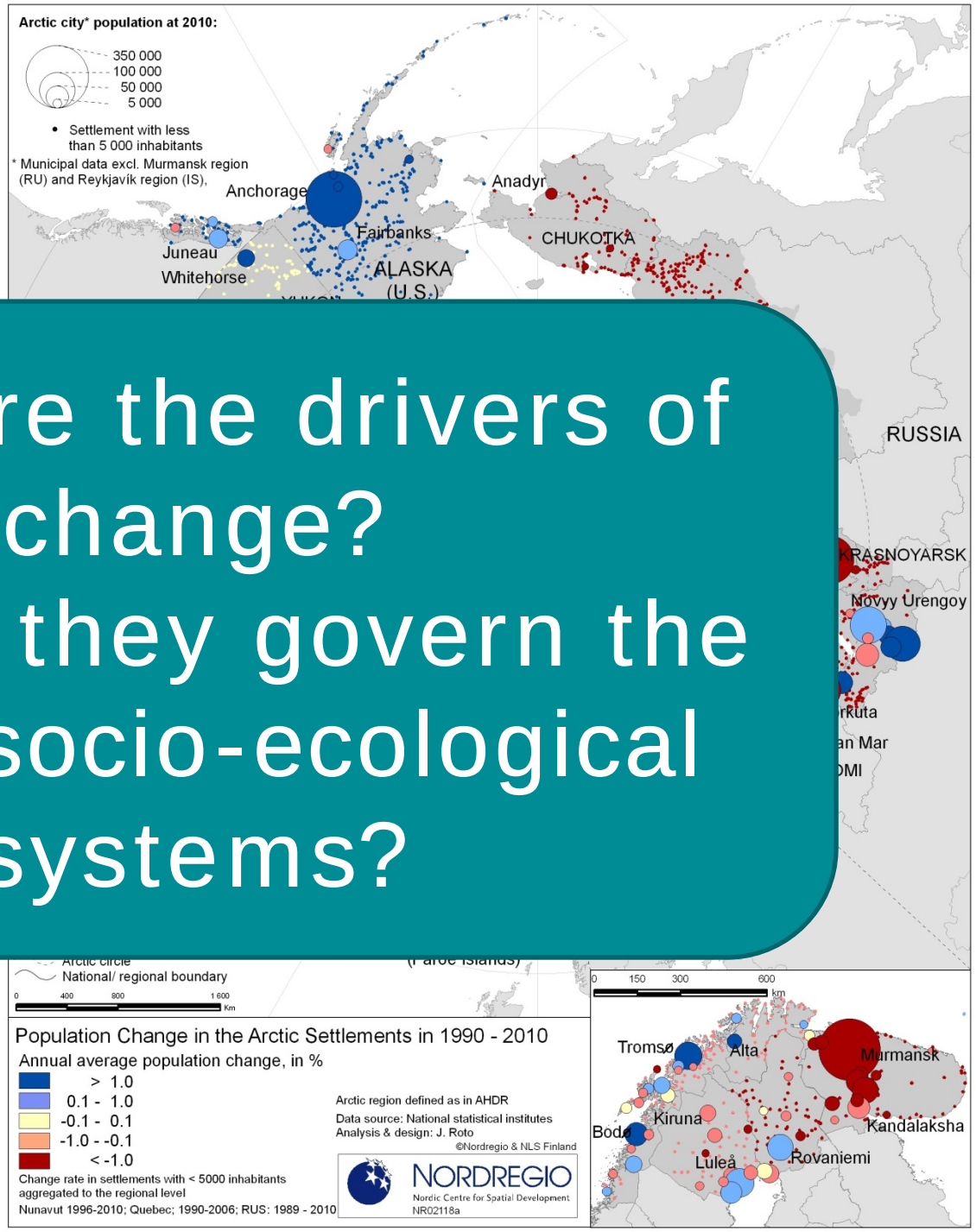
- Isolated
- High poverty rate compared to national standards
- Harvest of fish & wildlife resources
- Mixed household economy:
  - Subsistence harvest
  - Wage labor / transfer payments

The Arctic communities are changing

North
- Pop
  incr

Nordi
(incl.
- Cer

Russi
- Post
  emmigration
- New extractive industries



What are the drivers of change?
How do they govern the Arctic socio-ecological systems?

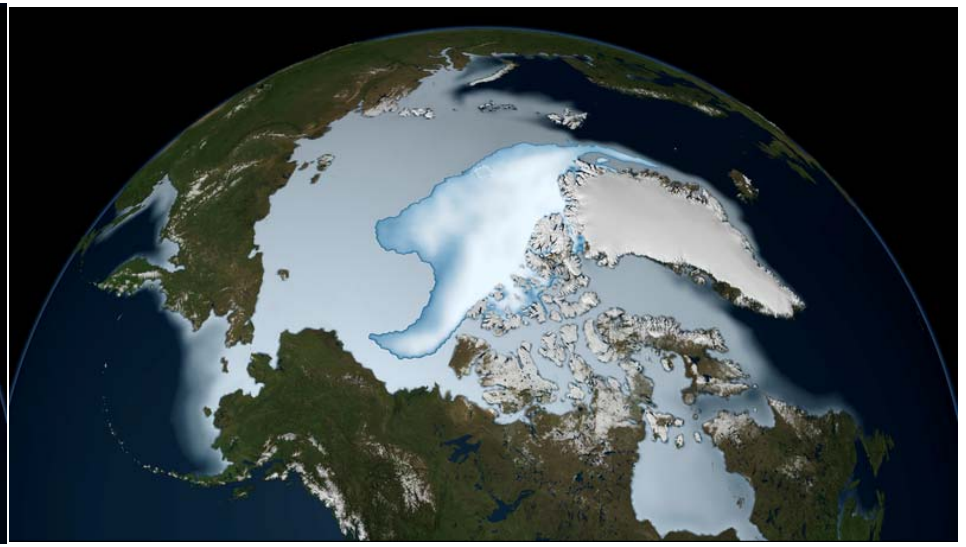
Arctic drivers of change

Climate: Sea ice is melting

Sea Ice coverage (passive microwave sensors)

1980

2012

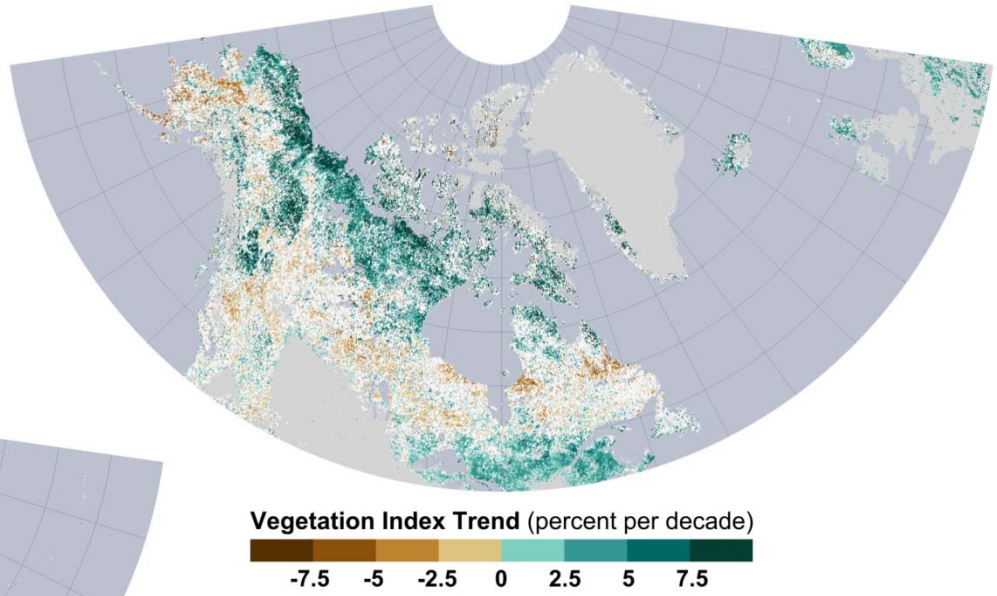


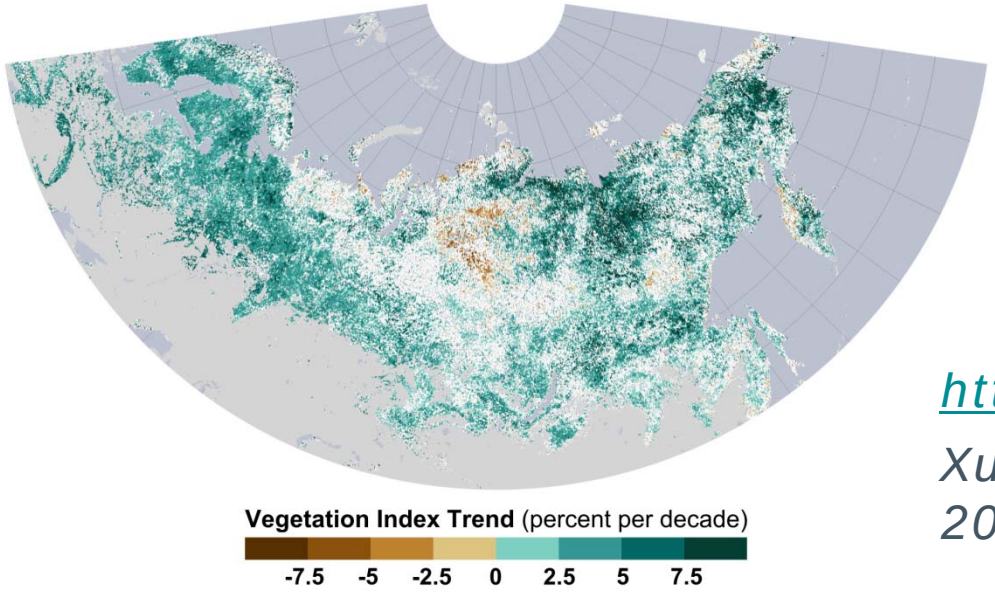
http://earthobservatory.nasa.gov

Arctic drivers of change

Climate: The greening of the Arctic

Trend in photosynthetic activity (NDVI, AVHHR/MODIS 1982-2011)





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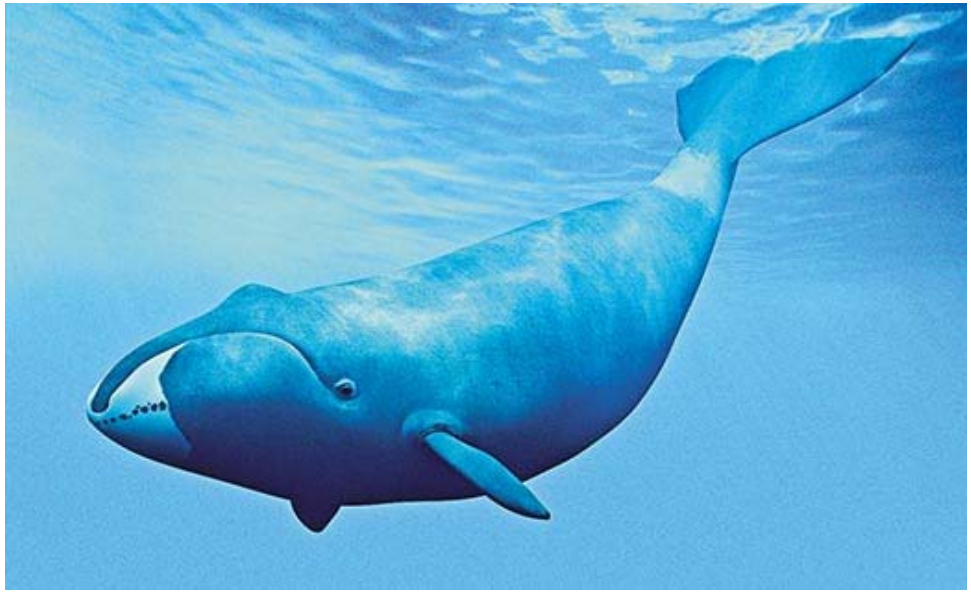
Xu et al. Nature Climate Change 2013

Arctic drivers of change

The legacy of Arctic explorers: Sequential mining of natural resources



- Bowhead whale
  - Almost extirpated by hunting in the 19th century, slowly recovering but still very rare

Arctic drivers of change

The legacy of Arctic explorers: Sequential mining of natural resources

- Walrus
  - Almost extirpated by hunting, slowly recovering since the 1950s but still low abundance

Arctic drivers of change

Climate and historic over-harvest combined

- The ecosystems are in recovery from previous over-harvest
- Climate change have increasing impact
  - The ecosystems show large fluctuations
  - Ecosystem changes are difficult to predict or even explain after they have taken place.
  - No baseline exists for a “pristine” ecosystem and a “status quo” management is not an option

Arctic drivers of change

Harvest of renewable resources:
New opportunities evolve (and disappear)

Crab fishing, North Norway

Fish farming, North Norway

Arctic drivers of change

Traditional subsistence harvest is changing

Caribou hunting, Yukon

Reindeer herding and Gas exploitation, Yamal

Seabird hunting, Greenland

Arctic drivers of change

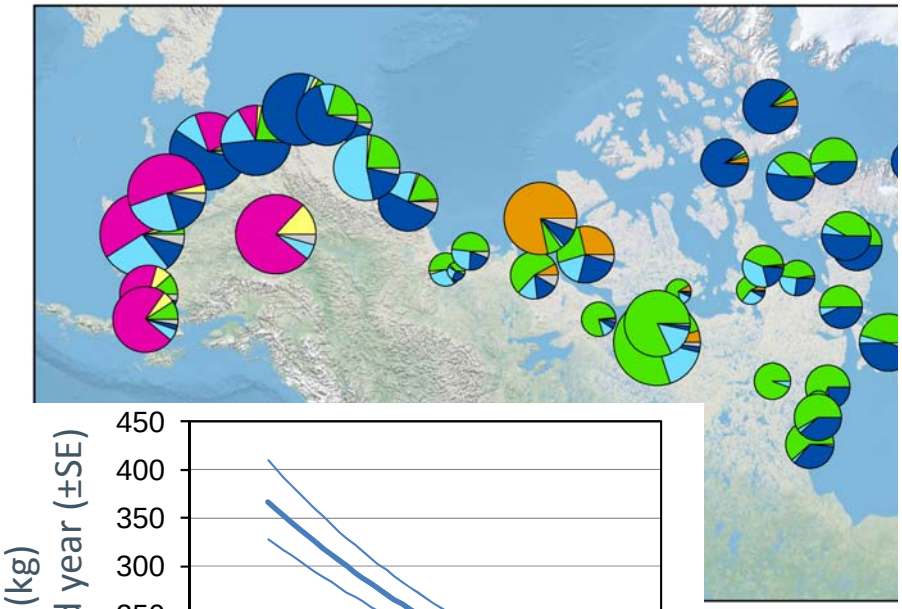
Traditional subsistence harvest is changing

- Increased wage labor & transfer payment from the south
- Increased importation of food
- Limited market access for local products
- Reduced importance of subsistence/local harvest for livelihoods

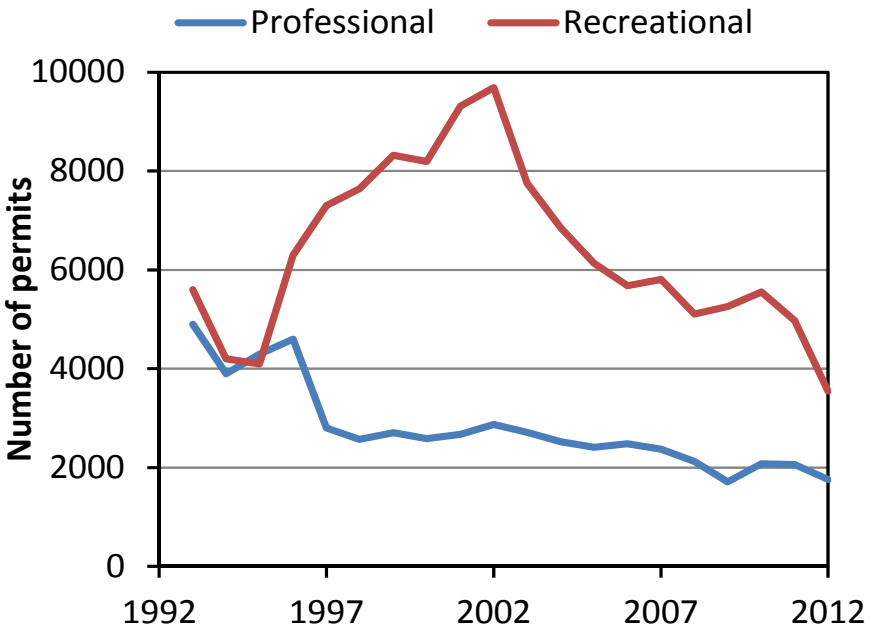
Arctic drivers of change

Reduced importance of subsistence harvest for livelihoods in..

North America….

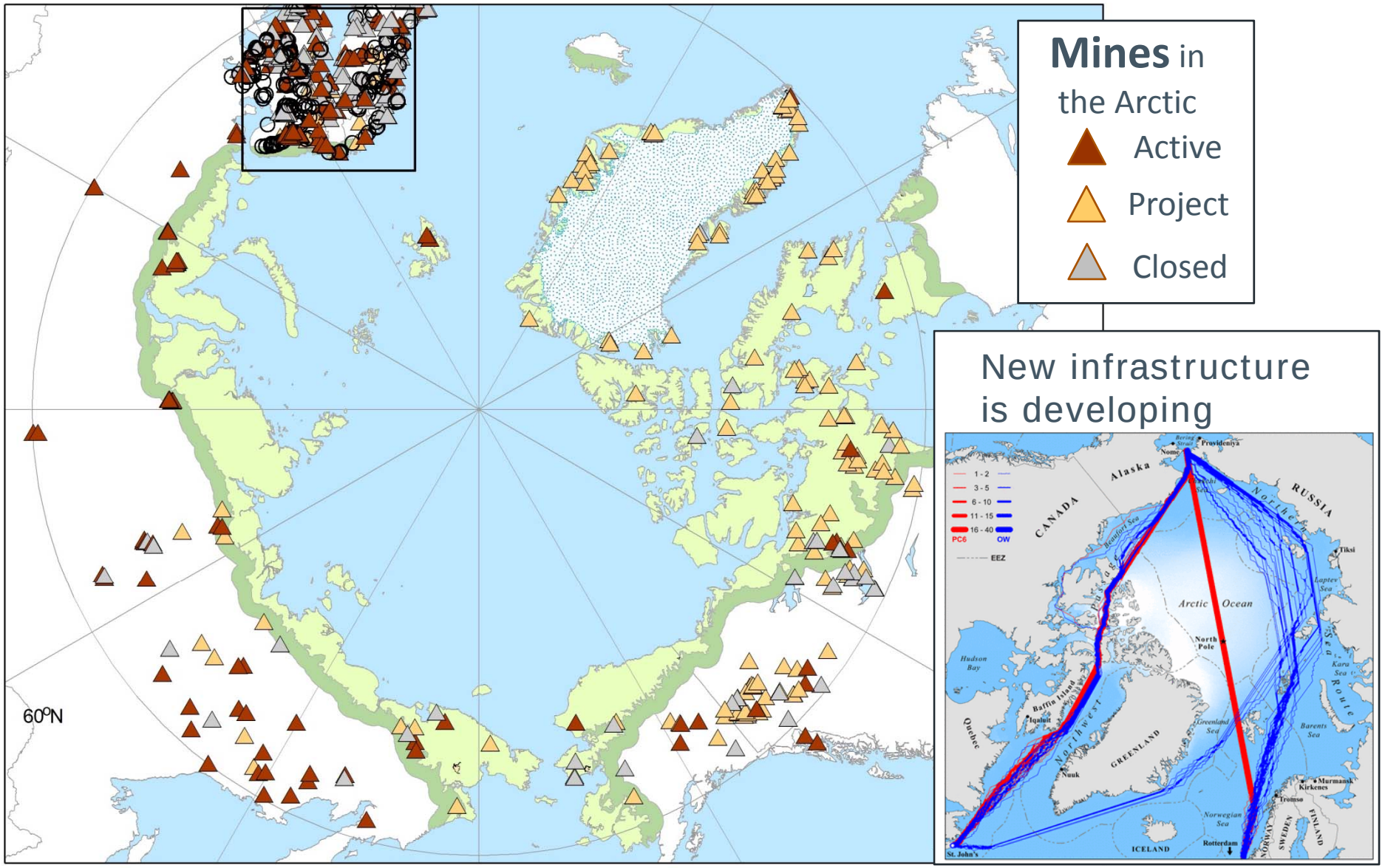


..and Greenland



Arctic drivers of change

Extractive industries and climate change



Arctic drivers of change
Extractive industries in Frontier areas

- Poor infrastructure
- “Platforms”: Weak integration with local & regional economy
- Industry vs. small scale-societies: Volatile & conjuncture dp, “boom & bust”

Arctic drivers of change
Extractive industries in Mature areas

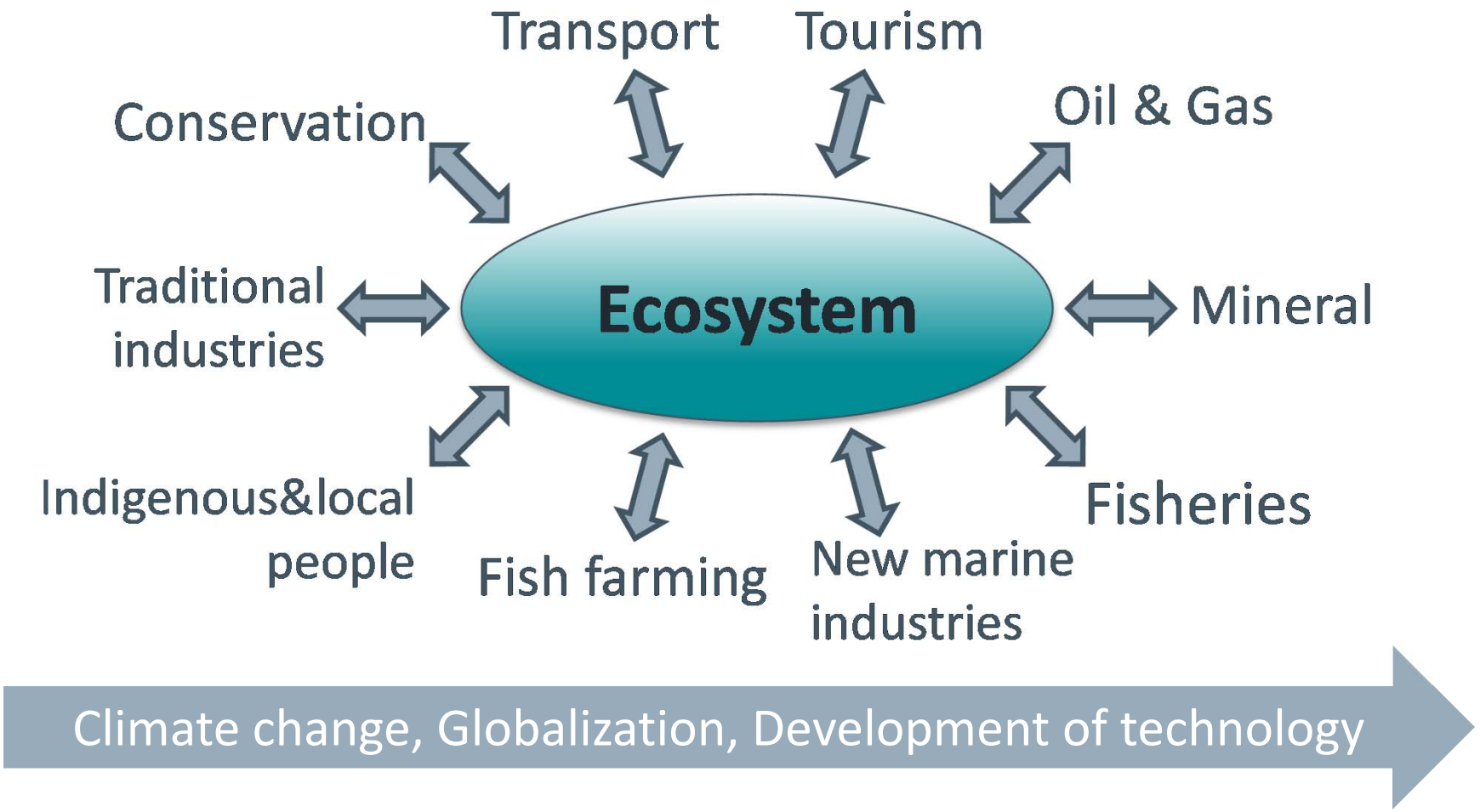
- Better infrastructure
- Integration with local & regional economy
- More stable enterprises
- More resilient??

Iron mine LKAB, Sweden

Natural Gas Plant, Norway

Arctic drivers of change

The combined impact on ecosystem services



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