

Arctic infrastructure

- Road network
- ★ Harbours
- ✈ Airports and heliports
- ▭ Vessel traffic area

Permafrost extent

- ▭ Future permafrost extent
- ▭ Baseline permafrost extent

Data sources:
 Road - Natural Earth, Alaska Department of Transportation and Public Facilities, GeoGratis and DIVA-GIS;
 Airport - OpenFlights, OurAirports;
 Harbour and sea routes - MarineTraffic, NOAA, Nordregio, NSIDC, World Port Index (NGA) 2017, AIS vessel tracking data;
 Permafrost - Hjort, J., Karjalainen, O., Aalto, J., Westermann, S., Romanovsky, V.E., Nelson, F.E., Etzelmüller, B. and Luoto, M., 2018. Degrading permafrost puts Arctic infrastructure at risk by mid-century. Nature communications, 9(1), p.5147.

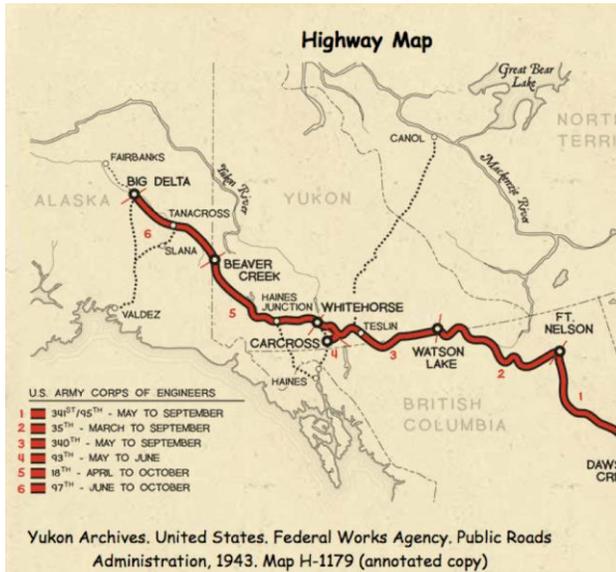
Building Arctic Futures: Infrastructure Projects and Local Scenarios

ERC Advanced Grant Project: Building Arctic Futures: Transport Infrastructures and Sustainable Northern Communities *InfraNorth* (2021 – 2025)

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Focus on Transport Infrastructures



Without forgetting about other infrastructures needed for transport (energy, information, etc.)

What Is the Role of Transport Infrastructures in Sustaining Arctic Communities?

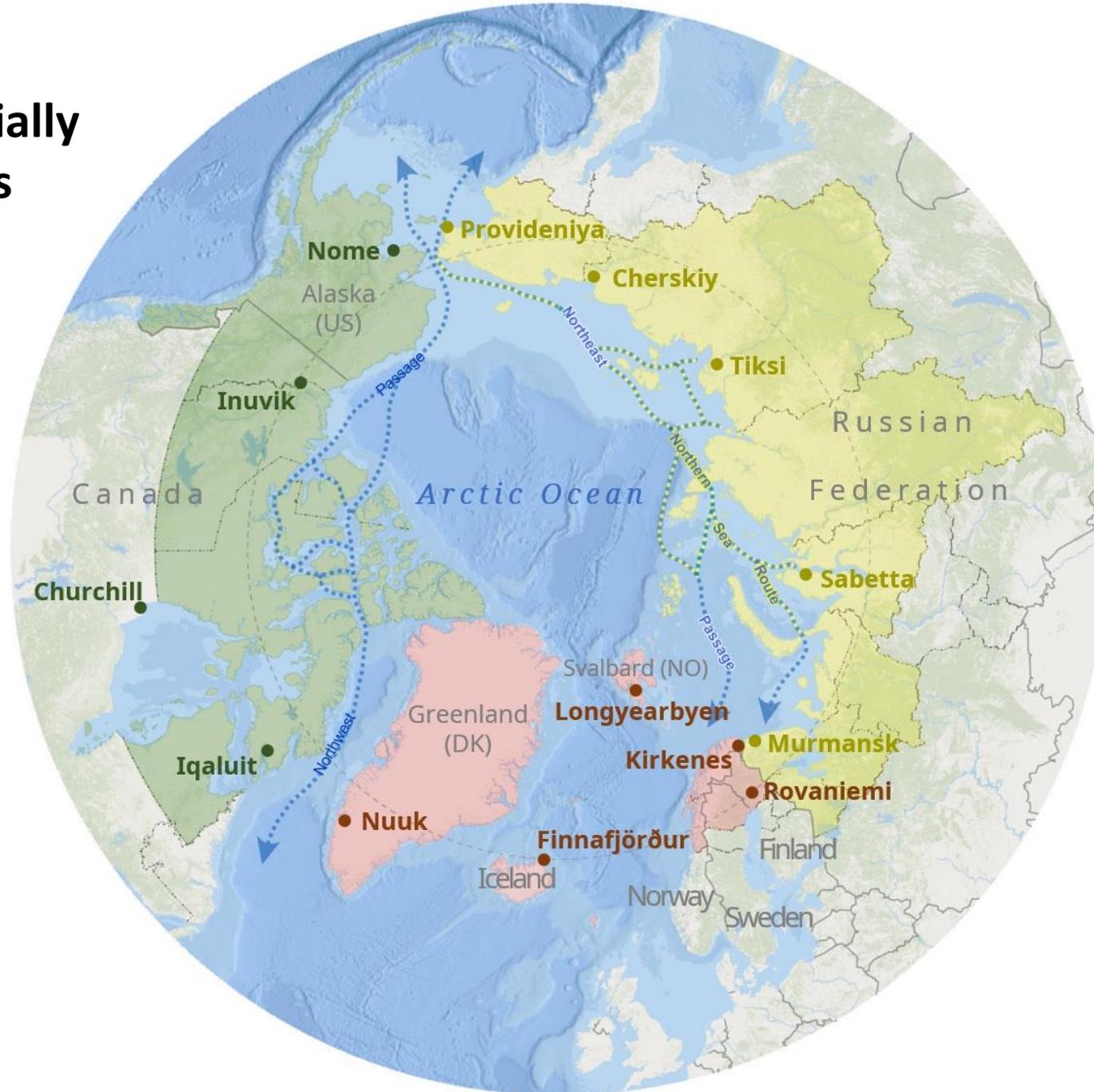
What We Know

- Discussions about ATIs are typically dominated by global (economic) concerns
- ATIs can yield local benefits AND create problems/challenges
- Local (financial, operational, etc.) control over ATIs is central

What We Do Not Know

- Which types of ATIs are potentially more important for community wellbeing than others?
- How do the impacts of ATIs interact with other factors determining community wellbeing?
- How can win-win situations between global and local actors be achieved?

Study Regions and Initially Proposed Field Sites



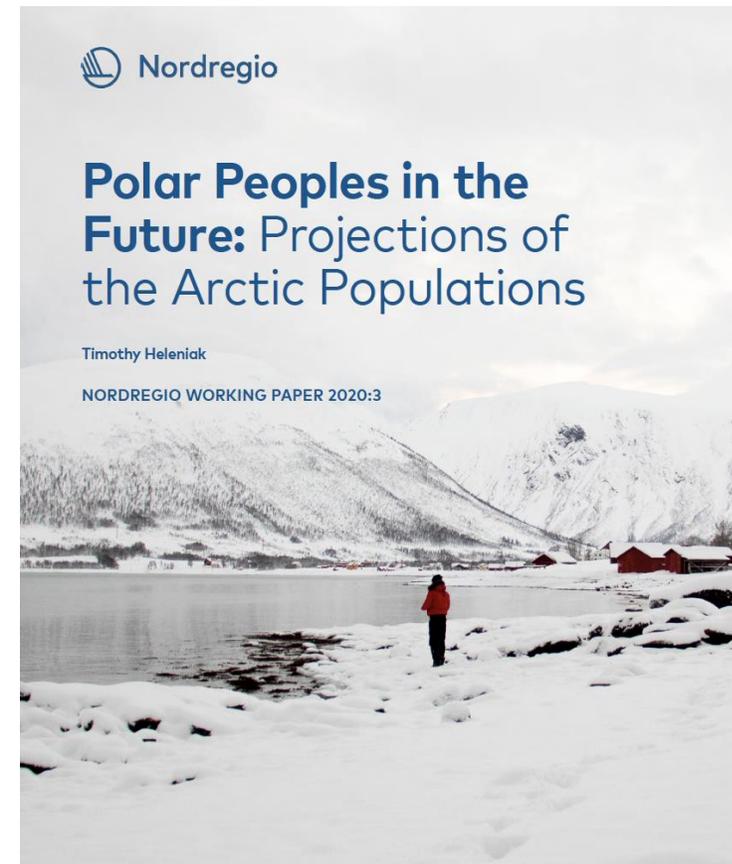
Current InfraNorth Research Sites



Integration Component

Methodological and theoretical integration across study regions and case studies areas

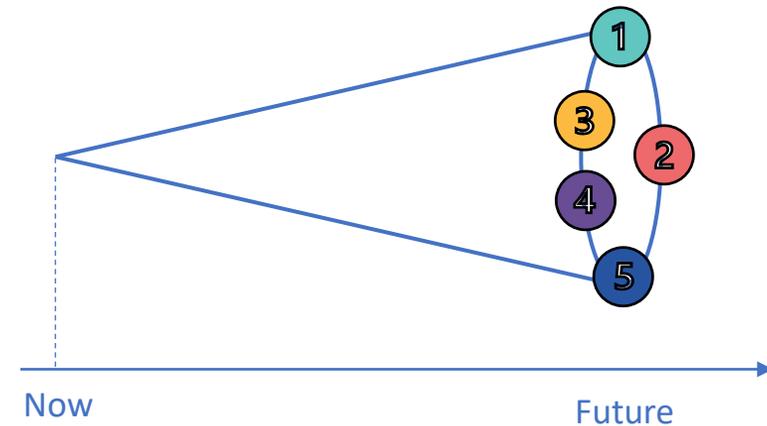
- Ethnographic fieldwork with interviews and participant observation
- Population dynamics on the local, regional and national levels
- Field surveys (questionnaires)
- Qualitative and quantitative data
- Multimedia infrastructure archives (cartographic storytelling, digital archives)
- **Local scenario workshops + panarctic scenario forum**



**Scenario Building for Arctic
Communities: Developing Plausible
Futures for
Churchill, Canada
and Kirkenes, Norway**

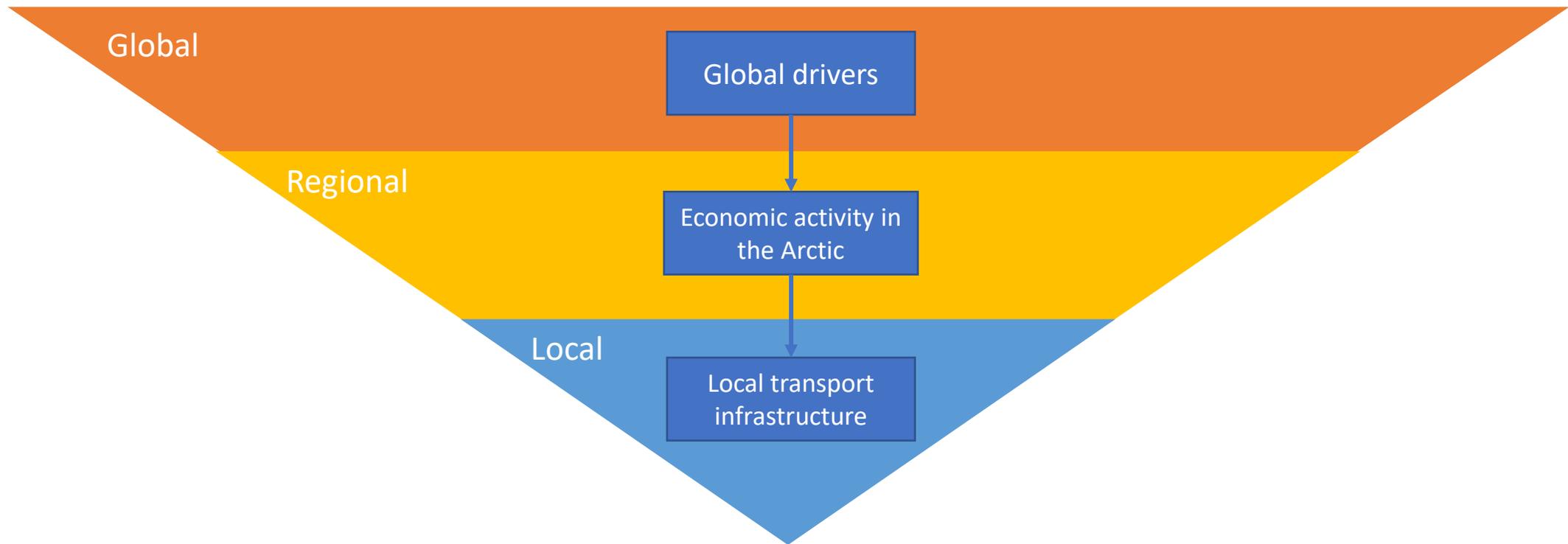
Scenarios and scenario building

- A **scenario** is a **plausible** and **thought-provoking narrative** about how the **future** of the considered system could look like
- **Scenario building** is a method of creating multiple scenarios to explore different plausible futures of the considered system to answer a certain question
- For example, “How can the infrastructure in settlements of Churchill in Canada and Kirkenes in Norway develop until 2050?”



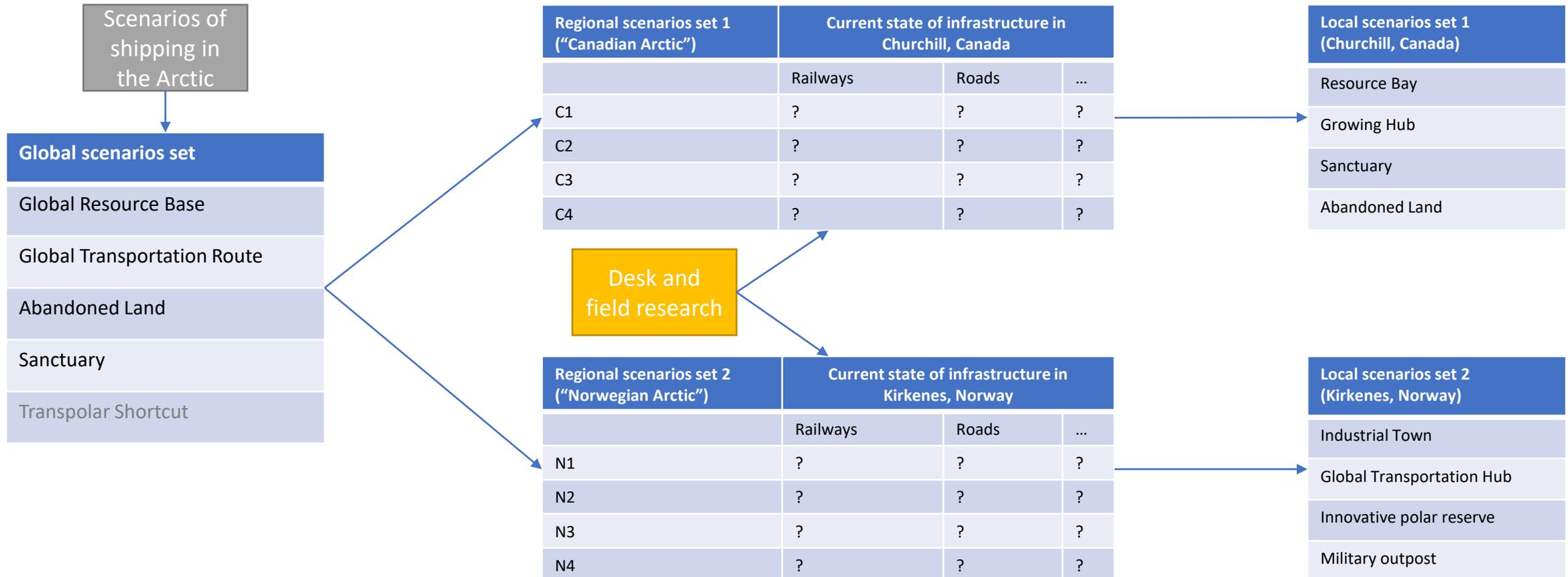
Multiscale scenario building

- **Multiscale** scenario building is a method of developing scenarios that consider the impacts of various factors at different levels of scale, such as global, regional, and local. (Biggs, 2007; Kok, 2007)



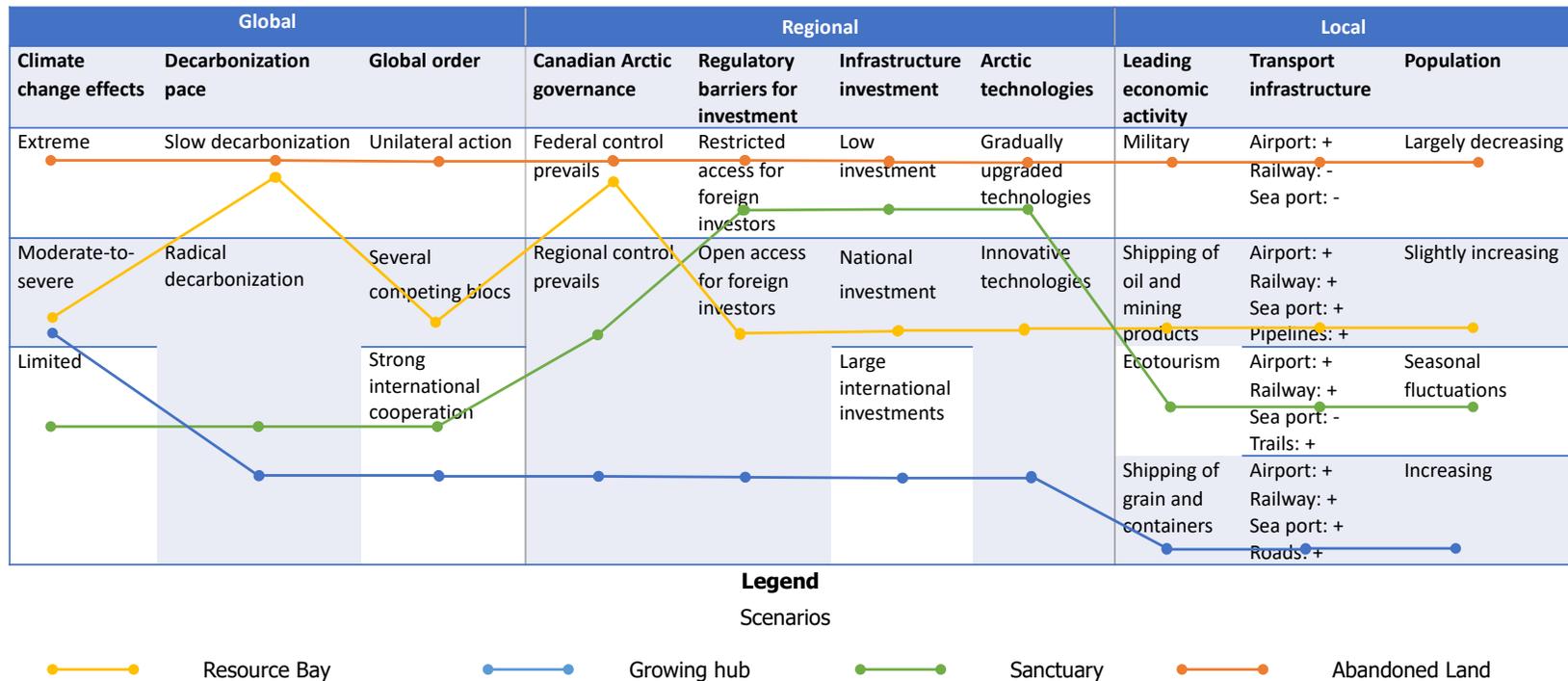
Localization of top-down scenarios

- Top-down scenarios are expert-driven, developed at aggregate (e.g., global) scales for the purpose of generating a consistent set of driving forces for other applications
- Top-down scenarios can be used to provide context or 'boundary conditions' for scenarios at more local levels
- Developing nested narratives that articulate how high-level narratives might manifest at local levels



Ensuring consistency of scenarios

- **Morphological analysis** - reveals **uncertain factors** and their **possible manifestations** (Zwicky, 1969; Ritchey, 2011)
- **Morphological matrix (MM)** as a visual tool for morphological analysis
- Example of a MM for Churchill



Examples of scenario narratives for Kirkenes

- 1. Industrial Town:** The Sydvaranger iron mine is upgraded and produces the largest amount of iron ore in Norway by 2030. A new port is built to serve the mining industry, and the town develops into an industrial center. Some energy-consuming industries such as steel manufacturing are attracted to the town. Although the airport has been upgraded and most people use the airport to get to and out of Kirkenes, the primary transport mode used for freight is still shipping. There is no significant increase in tourism due to the industrial nature of the town's development.
- 2. Global Transportation Hub:** The new port of Kirkenes is built and equipped with modern technology for navigating in icy waters, serving a wide variety of vessels, from cruise to container ships, to research submarines. The Kirkenes-Rovaniemi railway is built according to high environmental standards. The port is included in the Northern Sea Route, and it becomes a major Arctic hub for global transportation. Kirkenes also becomes a hub for Arctic tourism. The town becomes a bustling center of commerce, science, and education and grows significantly in size and population.
- 3. Innovative Polar Reserve:** The Norwegian government cancels any new railway projects, and the existing railway is dismantled. The iron ore mine is closed, and there are no new explorations of fossil fuels in the Norwegian part of the Barents Sea. To protect the fragile ecosystem of Finnmark and the well-being of the population, several restrictions are put in place, and the Sami population plays a significant role in community governance. Private motorized vehicles are forbidden in the settlements, and visitors must adhere to strict rules regarding waste disposal and fire use. New environmental policies stimulate the development of green technologies and the growth of innovative start-ups.
- 4. Military outpost:** Kirkenes has declined due to climate change and geopolitical tensions. The area is vulnerable to flooding and avalanches. The old port is difficult to use due to the rising sea level. The military presence has increased due to a perceived conflict with Russia, hindering the development of new railways and causing the Sami people to leave their pastures. The lack of jobs and recreation opportunities causes many locals to leave the area, while military and related services personnel continue to come in. The tourism industry has also suffered. The Norwegian government decides to move the town to the west of river Tana due to security reasons, leaving the remaining inhabitants struggling to survive in a harsh environment.