

# Planning for Arctic Futures: A glimpse at interdisciplinary scenario modeling and analysis

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## Further reading:

- Borjeson et al. 2006. Scenario types and techniques: Towards a user's guide. *Futures* 38, 723-739.
- Brigham, L.W., 2007. Thinking about the Arctic's Future: Scenarios for 2040. *Futurist* 41, 27-34.
- Mueller-Stoffels, M.M. & H. Eicken, 2011. Futures of Arctic Marine Transport 2030: An Explorative Scenario Approach. In Lovecraft & Eicken, *North by 2020: Perspectives on Alaska's changing social-ecological systems*. UA Press, 477-489.
- Shell International, 2008. Scenarios: An explorer's guide. Online at: <http://www.shell.com/global/future-energy/scenarios/explorers-guide.html>

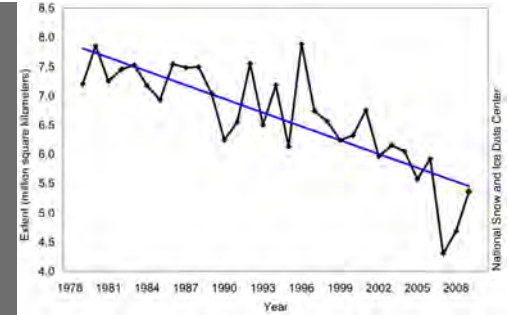




Barrow whaling camp  
(Photo: Bill Hess)

# A changing North

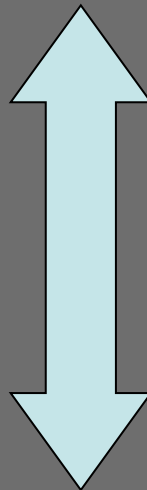
Regime shifts in climate and the environment about to exceed range of recent past variability and change



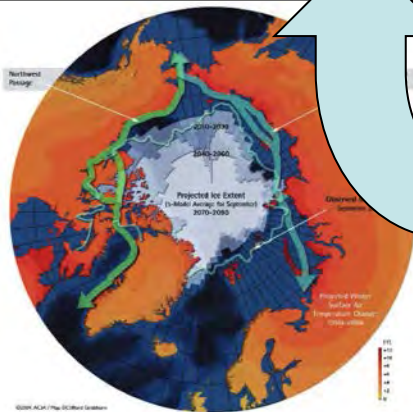
NSIDC

Sweeping impacts of change on Northern populations and cultures

Increasing inter-dependence between the Arctic region and global processes

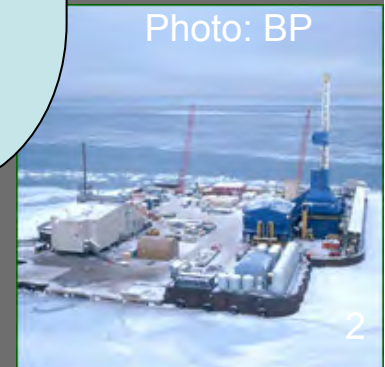


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Expansion of global geopolitical and economic interests into the North

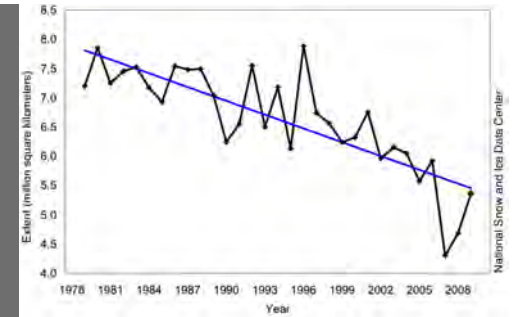
BP Northstar  
Photo: BP





Barrow whaling camp  
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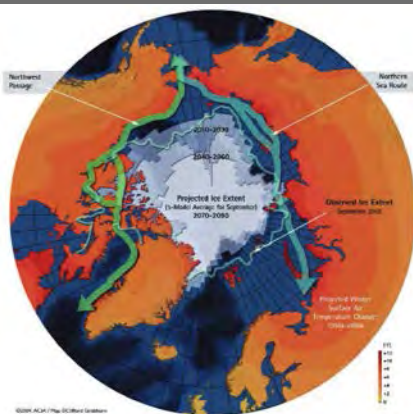
# A changing North



NSIDC

How can stakeholders best anticipate the challenges and take advantage of the opportunities that come with a rapidly changing North?

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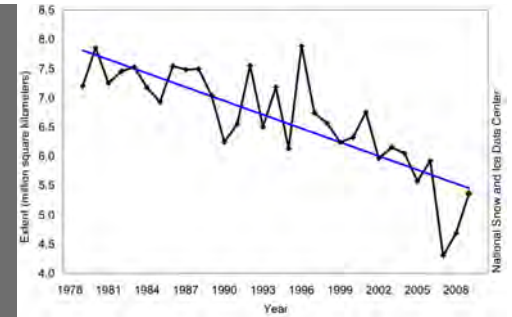
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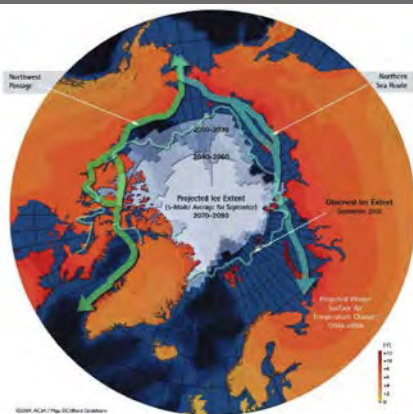
# A changing North



NSIDC

How can we best utilize different approaches in prediction and observing systems to track and project such change in interdisciplinary settings?

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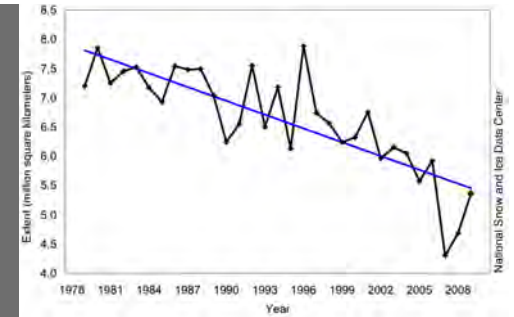
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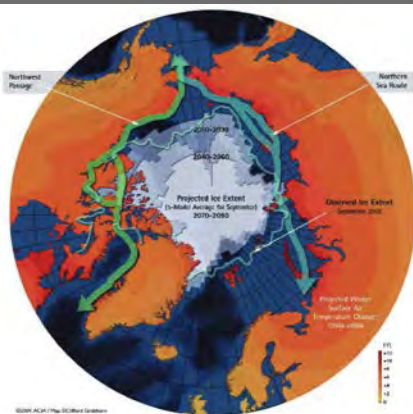
# A changing North



NSIDC

How can we ensure that the resulting information is relevant and useful to decision-makers or stakeholders?

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BP Northstar  
Photo: BP



# Five approaches to anticipate futures

**Forecasting:** *Quantitative prediction of outcomes based on conceptual or mathematical models*

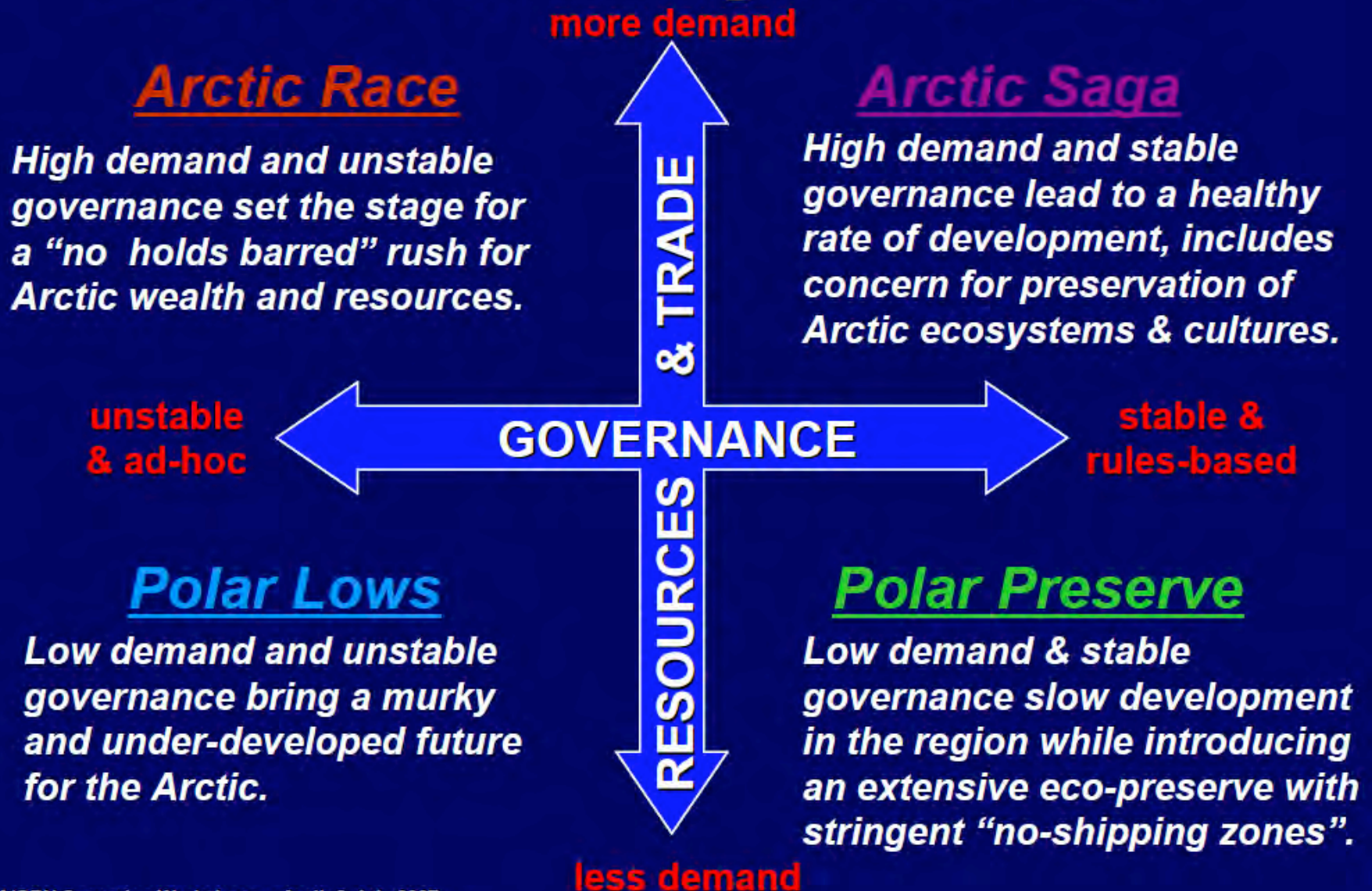
- Stationarity
- Simplified (analytical or complex) system models
- Analogs (paleo, historical, geographical)
- Numerical system models (climate models, earth system models)

**Foresight:** *Systematic, mostly qualitative exploration of full range of plausible future outcomes*

- Scenarios and foresight – expert assessments (narratives, refined analyses)

# Scenarios on the Future of Arctic Marine Navigation in 2050

AMSA  
Brigham



# Scenario elements

- **Scenario**: an internally consistent, plausible vision of the future (typically several decades out); typically considered as a bundle of scenarios that defines a plausible decision space
- **Defining question (DQ)**
- Participation & **knowledge co-production**: Expert/stakeholder consultation & involvement
- Summary/**synthesis** of available information on present state and trends relevant to DQ
- **Key drivers** or factors; key uncertainties; **indicators**; driver/uncertainty bundles = specific scenarios



# Scenario/foresight history

- Herman Kahn (1950/60s): The unthinkable
- Royal Dutch Shell (1970-): Oil crisis of 1973 & rise of Russia as natural gas supplier
- Scenarios as a planning & strategy tool in the business sector 1980s to today
- Scenarios as a tool in sustainability & resilience science

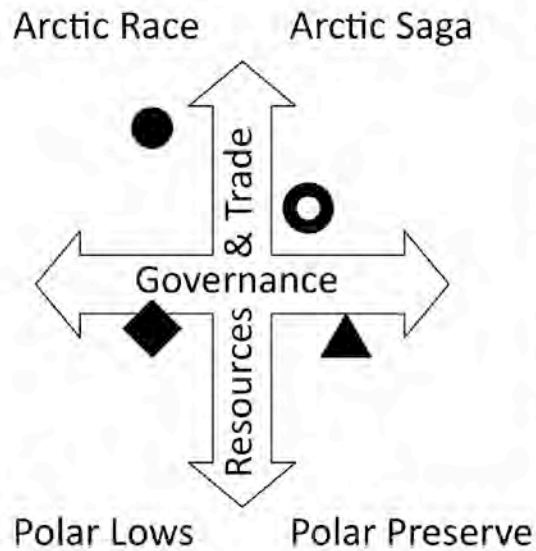
# Steps in scenario identification

- Co-develop **defining question**
- Summarize **current knowledge & trends**
- Identify important **drivers** (factors, forces)
- Identify **key uncertainties** (from key drivers)
- Develop **scenarios as plausible futures** for bundles of key drivers & uncertainties
- Identify **indicator** variables
- Integrate scenarios into planning process by **tracking indicators** & **developing strategies** cognizant of scenarios

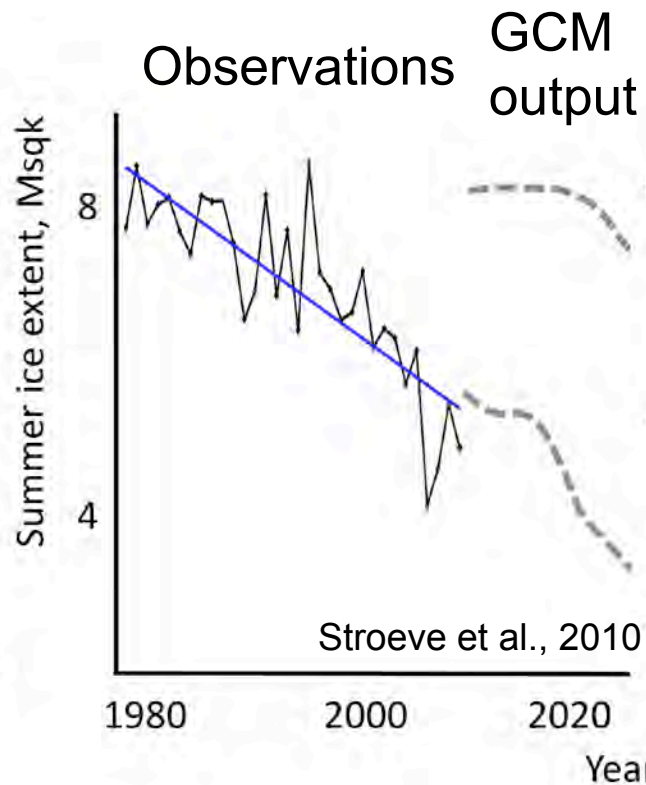


# Decision-making in a changing Arctic

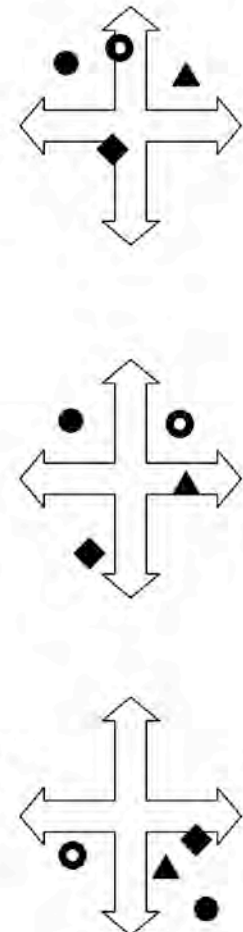
## Scenarios



## Indicators

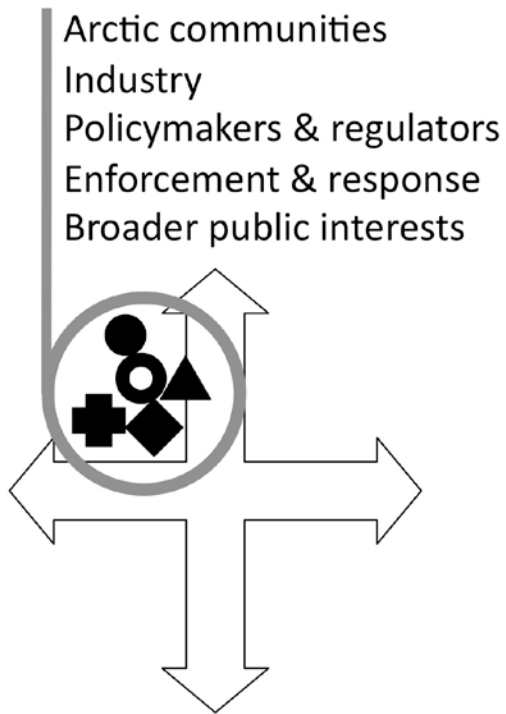


## Futures

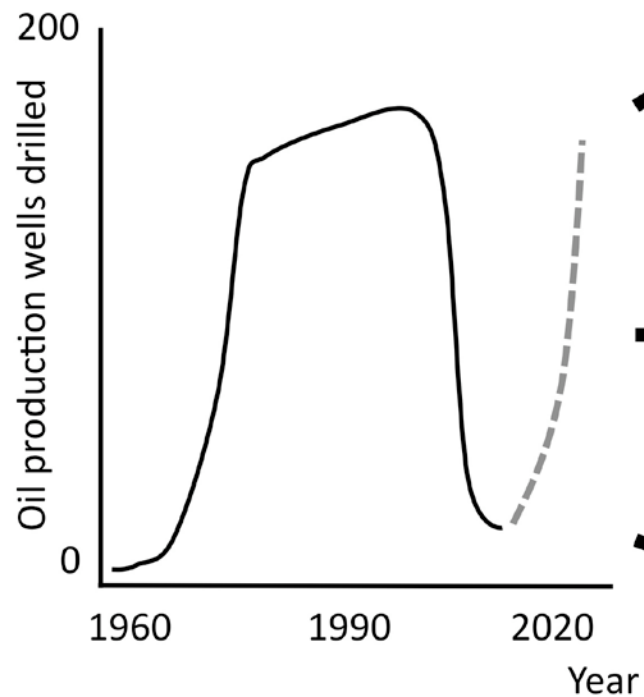


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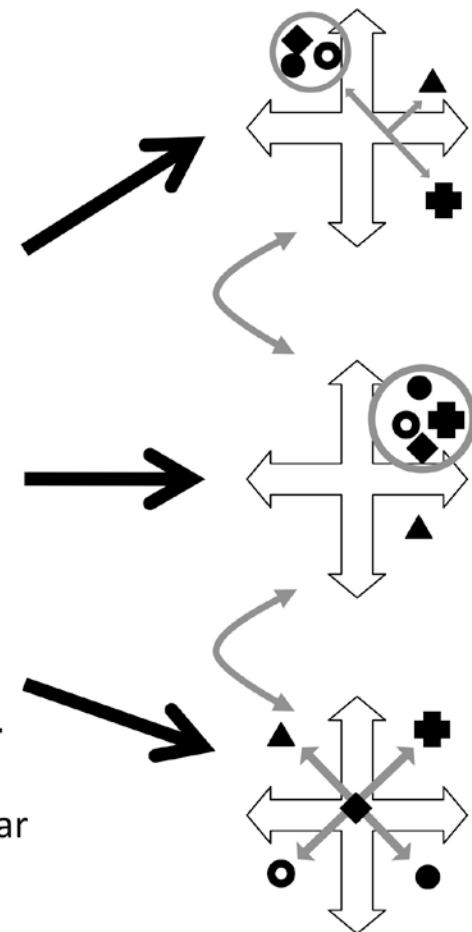
## Present state



## Driver/ indicator



## Futures



- Which variables or key factors do we need to track?

Legal Framework	Arctic Treaty System	Status Quo	Tense Relationships	Armed Conflict	
Global Trade Dynamics	Low Growth	Moderate Growth	High Growth	Industrial Explosion	Collapse of Global Economy
Climate	New Cretaceous Period	Ice Free - Severe Weather	Seasonal Ice - Shippable	Seasonal Ice - Dangerous	New Ice Age
Safety of Other Routes	Increasing Pressure	Stable Increase of Traffic	Stable Demand		
Soc.-Econ. Impact of Climate	Worldwide Loss & Conflict	Regional Loss & Conflict	Gain & Cooperation		
Oil Prices	Unpredictable	Steady Rise, Predictable	Stable	Cheap Oil	
Maj. Arctic Shipping Disasters	Minimal Impact	Moderate Impact	Maximum Impact	No Disaster - No impact	
Windows of Operation	Limited	Moderate	No Limit		
Maritime Insurance Industry	Refusal	Partial	Drive Improvements		
Asian Players	Cooperation	Collaboration	No Market Entry		
Transit Fees	Economic. Viable Fees	Robbery Knights			
Indig. vs. Commerc. Conflict	Wealth - Low Interference	Wealth - trad. life-style loss	No Interference - No Profit	Interference - Conflict	
Arctic Enforcers	Multilat. Military Force	Multilat. Police Force	Unilateral Territorial Protection	Conflicts Between Enforcers	Arctic Privateers
Propulsion Energy	Nuclear Propulsion	SkySails	Hydrogen Based Propulsn.	Fossil Fuels	
New Resource Discovery	Arctic Gold Rush	Weak Demand/Restrictions			
World Trade Patterns	Little Change	Moderate Change	Strong Change		
Regulation in the Arctic	Do As You Wish	Moderate Regulation	EU of the North		
Thermohaline Circ. Weakens	Wild Card	No Wild Card			
Hot Cold War	Wild Card	No Wild Card			

# Key factors: consistency analysis

- Advanced scenario analysis to assess consistency of different scenarios and identify key variables to be tracked (Mueller-Stoffels & Eicken, Nx2020 volume, Chapter 6.7)
- Querying of experts through online tools, with evaluation of a consistency/plausibility matrix of high order

Figure 6.7.2. Robust development in the Arctic raw scenarios. Red: overall most robust bundle without wild card; green: high robustness, consistency, and plausibility; magenta dashed: overall most robust with wild card; yellow dashed: robust and plausible.

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Oil Prices	Unpredictable	Steady Rise, Predictable	Stable	Cheap Oil	

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# Scenarios as a tool for synthesis & action

- *Bodies of knowledge*
  - Scientific
  - Practical
  - Local
  - Indigenous
- *Holders of knowledge*
  - Communities & practitioners
  - Repositories & archives
  - Institutions & frameworks
- *Action: Response to Arctic change*
  - Passive system response
  - Active response through adaptation, mitigation, negation, etc.
- *Scales of action*
  - Local
  - Regional
  - National
  - Global