

Belmont Forum: e-Infrastructure Meeting

Paris, France, 28-29 November 2016

(Pan-Arctic Options)

**Nation
State
~30%**

National Interests



**International
Space
~70%**

Common Interests

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Arctic Options → Pan-Arctic Options

Holistic Integration for Arctic Coastal-Marine Sustainability

www.arcticoptions.org / www.panarcticoptions.net

Table 1: Holistic Integration for Arctic Coastal-Marine Sustainability^{1,2}

	<i>Arctic Options</i>	<i>Pan-Arctic Options</i>
Duration	2013-2016	2015-2020
Conceptual Scope	Decision-Support Process to integrate stakeholder perspectives, geospatial data and policy documents to reveal options that contribute to informed decision-making for sustainable infrastructure development in the Arctic Ocean	
Geographic Scope	Arctic High Seas, Bering Strait Region, West Greenland	Pan-Arctic (defined as north of the Arctic Circle) + Bering Strait Region
Infrastructure Options	Governance Options	Built and Governance Options
Funding Nations	France, United States	Canada, China, France, Norway, Russian Federation, United States
Funding Program	<i>ArcSEES (Arctic Science, Engineering, and Education for Sustainability)</i> www.nsf.gov/pubs/2012/nsf12553/nsf12553.htm	<i>Belmont Forum (Arctic Observing and Research for Sustainability)</i> https://igfagcr.org/cra-2014-arctic-observing-and-research-sustainability
Funding	\$2,000,000+	€1,000,000

1 Holistic is international, interdisciplinary and inclusive.

2 Options are practical solutions introduced without advocacy to decision makers, in contrast to recommendations that involve advocacy and often polarizing agendas.

Pan-Arctic Options – e-Infrastructure (Examples)

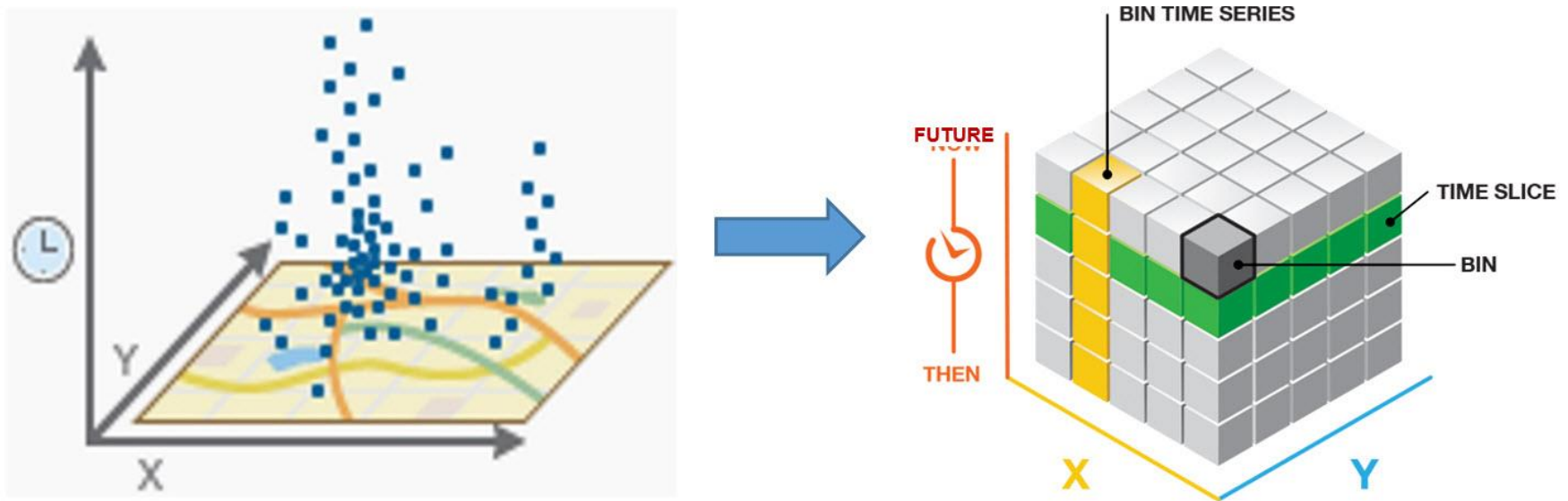
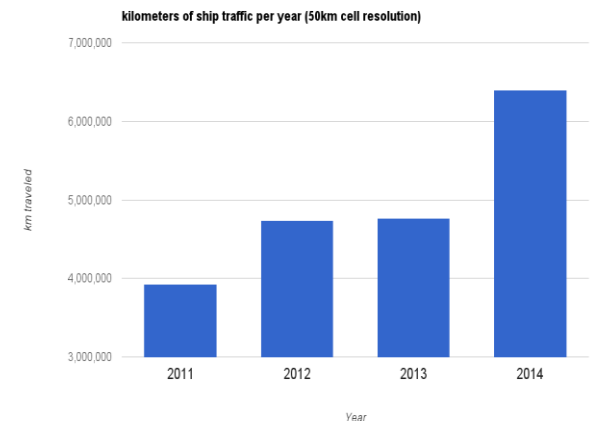
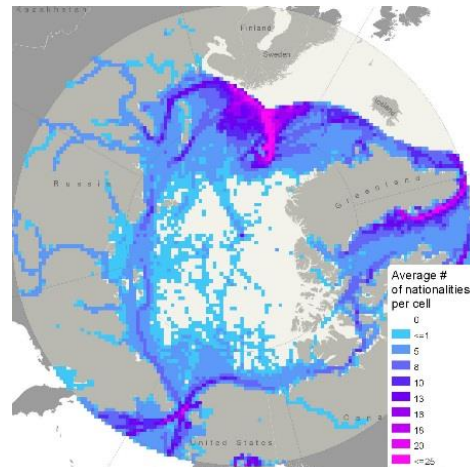
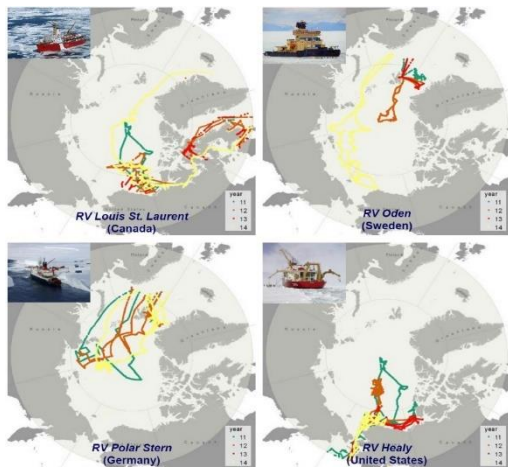


FIGURE 2: (left) Three-dimensional system to analyze change in issues, impacts or resources that are measured over space (x-y, latitude-longitude) and time (past to future). **(right)** The ‘space-time cube’ from ESRI (2016) is a geospatial approach that can be applied over time to address ‘big data’ questions with terrabytes of information.



Pan-Arctic Options – e-Infrastructure (Examples)



Next Generation - Simple Discovery Arctic Council Declarations

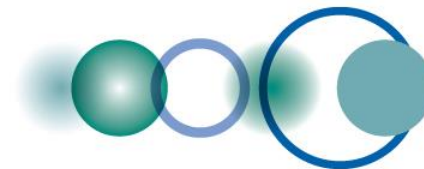


peace | x  All Words ▾

Digital Zoom™ Year Resource Section Page Paragraph **Sentence**

- ▼ 2009
 - ▼ Arctic Council_Tromso Declaration_2009.pdf
 - ▼ 1
 - ▼ Para 5
 - Confirming that in international relations the rule of law is a prerequisite for **peaceful** regional development,
- ▼ 2011
 - ▼ Arctic Council_Nuuk Declaration_2011.pdf
 - ▼ 1
 - ▼ Para 3
 - Recognizing the importance of maintaining **peace**, stability and constructive cooperation in the Arctic,
- ▼ 2013
 - ▼ Arctic Council_Kiruna Declaration_2013.pdf
 - ▼ 3
 - ▼ Para 1
 - Recognizing the importance of maintaining **peace**, stability, and constructive cooperation in the Arctic,
- ▼ 2015
 - ▼ Arctic Council_Iqaluit Declaration_2015.pdf
 - ▼ 2. Reaffirming the commitment to maintain **peace**, stability and constructive cooperation in the

<http://arcticcouncil.knohow.co>



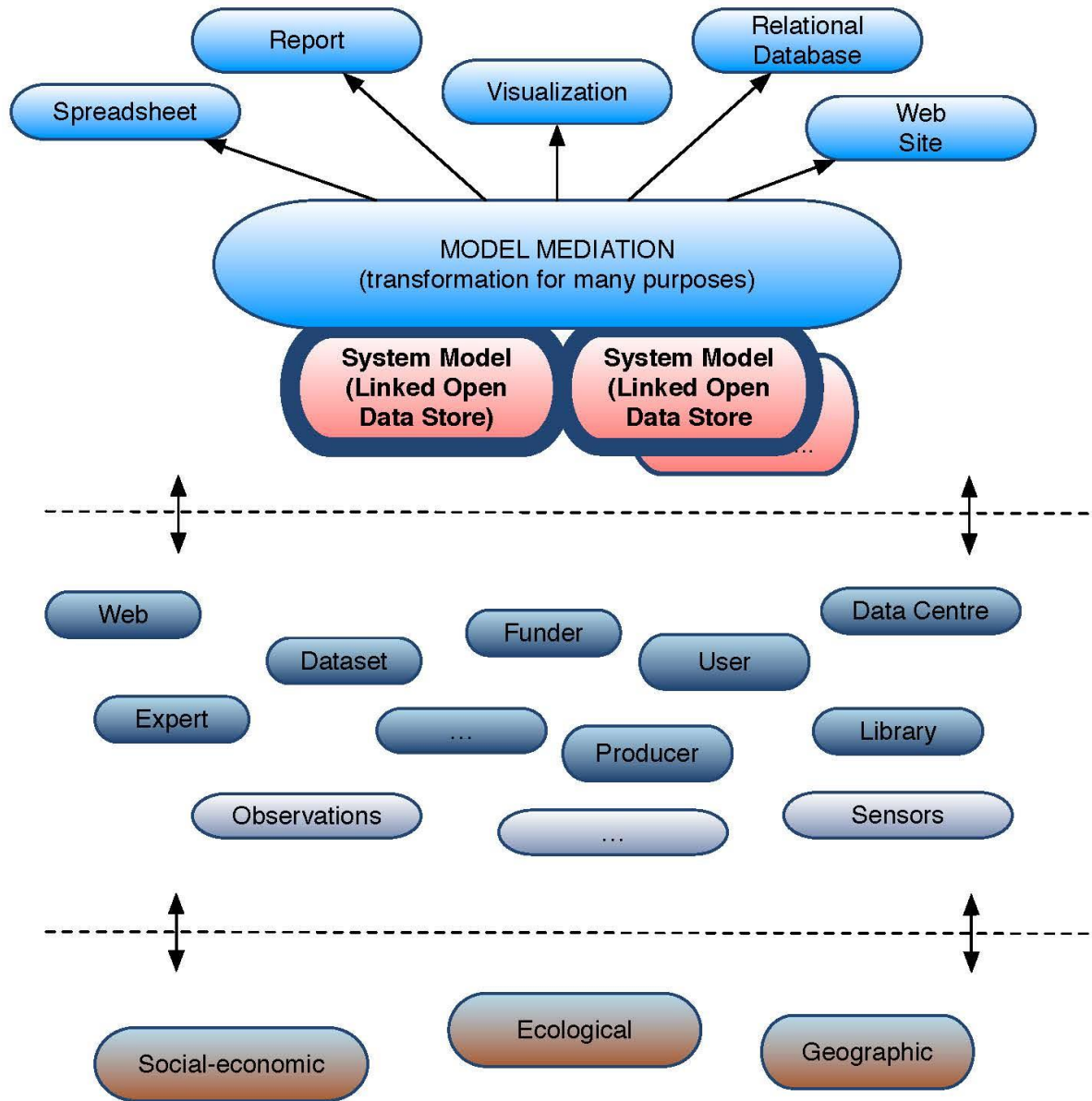
Institutional Interplay

What is the 'Arctic data ecosystem'?

STATES ²	ARCTIC ORGANIZATION ^{3,4}																		
	AC ⁵	AEC ⁶	ACGF	AMEC	BEAC ⁷	FARO	IASC	MOPP	NACG	NAFO ⁸	NC	NEAF ⁸	NF	OSPA	PB	SAR	SCAP ⁸	SPIT	NATO ⁹
Austria						X												X	
Canada	X	X	X		X	X	X	X	X	X		X	X		X	X	X	X	X
China	X					X	X											X	
Denmark ^{10,11}	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X
Estonia ¹⁰									X									X	X
Finland ¹⁰	X	X	X		X	X	X	X	X		X			X		X	X	X	
France ¹⁰	X				X	X	X		X	X				X				X	X
Iceland	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X	X
Japan	X				X	X	X			X			X					X	
Norway	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Poland ¹⁰	X				X	X	X		X									X	X
Russian Federation	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	
Spain ¹⁰	X						X		X					X				X	X
Sweden ¹⁰	X	X	X		X	X	X	X	X		X			X		X	X	X	
United Kingdom ¹⁰	X			X	X	X	X		X					X				X	X
United States	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X
Number of States	20	8	8	4	15	19	21	8	20	12	5	7	5	15	5	8	8	43	28

AC (1996 Arctic Council); AEC (2014; Arctic Economic Council); AMEC (1996 Arctic Military Environmental Cooperation Programme); ACGF (2015 Arctic Coast Guard Forum); BEAC (1993 Barents Euro-Arctic Council); FARO (1998 Forum of Arctic Research Operators); IASC (1990 International Arctic Science Committee); MOPP (2013 Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic); NACG (2007 North Atlantic Coast Guard Forum); NAFO (1978 Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries); NATO (1949 North Atlantic Treaty); NC (1952 Nordic Council); NEAF (1980 Convention on Future Multilateral Cooperation in North-East Atlantic Fisheries); NF (1991 Northern Forum); OSPA (1992 Convention for the Protection of the Marine Environment of the North-East Atlantic); PB (1973 Agreement on the Conservation of Polar Bears); SAR (2011 Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic); SCAP (1994 Standing Committee of the Conference of Arctic Parliamentarians), SPIT (1920 Treaty Concerning the Archipelago of Spitsbergen, and Protocol)

DATA E-COSYSTEM CONCEPT



Data E-cosystems

A simple “linked open data” approach to create many models, from simple to complex, that serve many purposes

Ecosystems of Data

User-defined and/or community-defined data collections for decision-making

“Real-World”

Evidence, observations and records for sustainability

DATA E-COSYSTEM CONCEPT

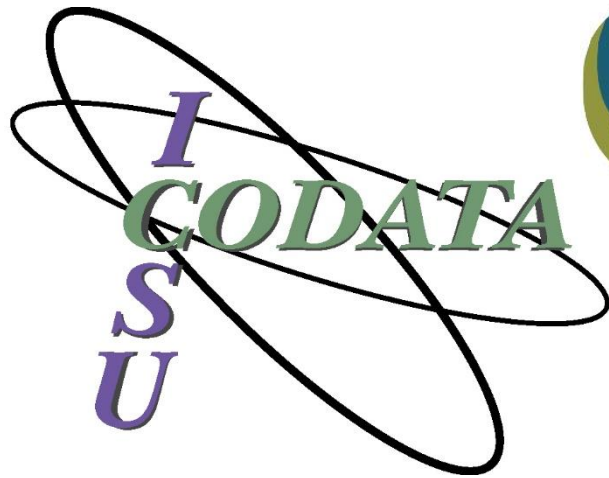
INFORMATION MANAGEMENT – KNOWLEDGE DISCOVERY

Data E-cosystem Elements / Operations

Systems: Ecosystems – Communities – Populations – Boundaries

Interactions: Keystone Species – Competition – Predation – Mutualism

(USER-DEFINED)



PAN-ARCTIC
OPTIONS



futureearth
research for global sustainability

WORLD DATA SYSTEM



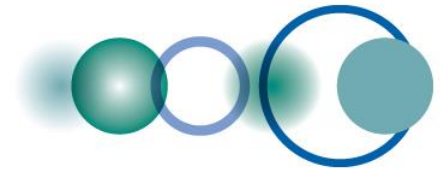
International Institute for
Applied Systems Analysis



EU-PolarNet

ARCTIC DATA COMMITTEE

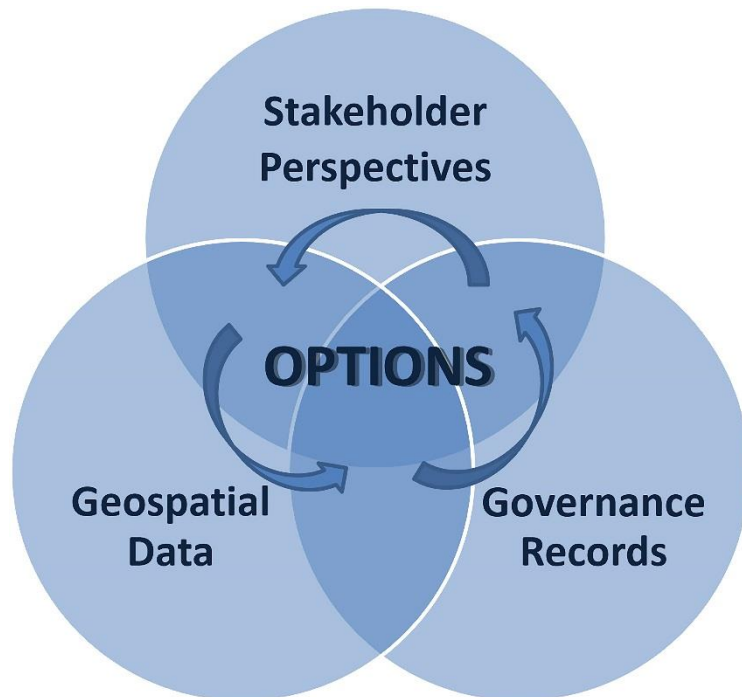




Sustainable Infrastructure Development

How do data, information and observing systems contribute to Arctic sustainability?

Decision-Support Process



Sustainable infrastructure involves the combination of fixed, mobile and other built assets (including communications, research, observing and information systems) PLUS regulatory, policy and other governance mechanisms (including insurance).

Decision-Making with Relevant Time Scales

ICSU *Future Earth*

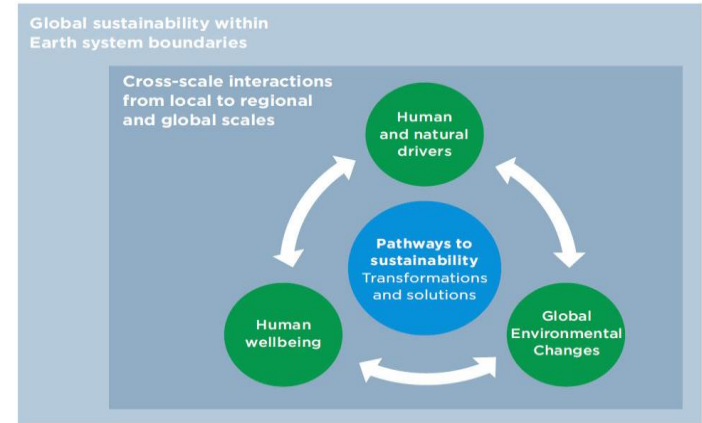
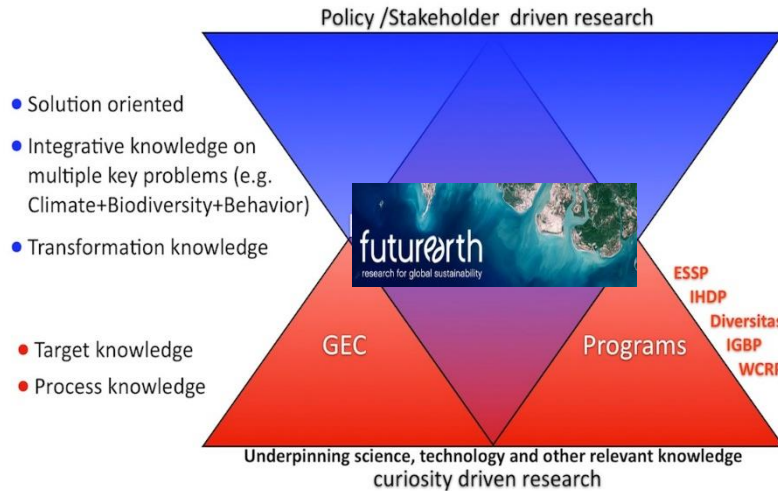


Figure 1: Schematics of the Future Earth conceptual framework

UN *Sustainable Development Goals*

