

## **Monitoring Arctic Sustainability: Reinigorating International Efforts to Develop Arctic Sustainability Indicators.**

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The Belmont Forum project “*ASUS: Arctic SUSTainability: A Synthesis of Knowledge*” brings together an international team of experts from seven Arctic countries to develop an interdisciplinary synthesis and assess the state of knowledge about Arctic sustainability and sustainable development. A special domain of this ASUS project is “Monitoring of sustainability and sustainable development”. The aim of this activity is to assess what has been already done in monitoring Arctic sustainability and sustainable development at different scales, what approaches and methods were implemented to delineate and monitor trends, both positive and negative on the way towards sustainability in the Arctic. The focus on creating knowledge infrastructure for multi-scale socially-oriented observations and assessments of Arctic socio-ecological systems sustainability and resilience in changing natural and living environments is of great importance. A design of the suitable monitoring frameworks of sustainable development and resilience of complex socio-ecological systems is one of the project’s goals. In this case sustainable development should be viewed as both the *process* and as an *outcome*.

ASUS monitoring sustainability domain is built on existing knowledge infrastructure by linking with multiple research projects and networks including IPCC, U.S. (*Arctic-FROST; Arctic-COAST, NSF AON*); Canadian (*ReSDA, ArcticNet, CACCON*); Nordic (*ARCSUS, NCM Arctic Cooperation Programme*), and Russian (*IASOS*), as well as integrative Arctic Council projects (*ASI, AHDR, ARR, AMAP*).

ASUS has been working to synthesize knowledge pertaining to biophysical and social observations under an overarching umbrella of social-ecological monitoring. This transdisciplinary, integrated approach is best suited for understanding and managing coupled human-environmental systems. Many biogeophysical, social and integrative observation systems have been established in various Arctic regions under SAON and other long-term monitoring programs. However, attempts to assimilate social and biogeophysical monitoring frameworks with a focus on sustainability indicators are limited. We will develop principles for an integrated monitoring framework of sustainability indicators by combining existing physical, ecological and social observations and by completing methodological and substantive syntheses of these observations. We will consider data interoperability, accuracy and availability and develop strategies to enhance continuous observations and develop suitable frameworks for incorporating community-based monitoring.

One of the main results of the IPY was the start of the local and regional observing projects and networks. Several of them are focused on the land-based resources and social processes: Traditional Indigenous Land Use Areas in the Nenets Autonomous Okrug (*MODIL-NAO*), Circum-Arctic Rangifer Monitoring and Assessment Network (*CARMA*), Reindeer Herders Vulnerability Network Study (*EALAT*), and Monitoring the Human-Rangifer link (*NOMAD*). Some of them such as Sea Ice Knowledge and Use (*SIKU*), Exchange for Local Observations and Knowledge of the Arctic (*ELOKA*), and the Bering Sea Sub-Network (*BSSN*) are oriented toward the sea, ice, marine and coastal resources. The Community Adaptation and Vulnerability in Arctic Regions (*CAVIAR*) has a number of land-focused case studies of reindeer herding and terrestrial resource use, but also incorporates coastal fisheries and other marine resources. Nevertheless, most of these monitoring networks are concentrated on changes in different components of natural environment and their impacts on indigenous people and only few put primary attention to “socio-economic” factors

impacting human capacities (health, demography, education, etc.) and well-being.

A substantial post-IPY progress in social monitoring human conditions resulted in a set of regional and circumpolar studies. We envision using the established indicators framework developed by the Arctic Social Indicators and IASOS projects. ASI indicators measure six domains: (1) Fate control and or the ability to guide one's own destiny; (2) Cultural Wellbeing and Cultural Integrity or belonging to a viable local culture; (3) Contact with nature or interacting closely with the natural world; (4) Material Well-being; (5) Education; (6) Health and Population. Integrated Arctic Socially Observation System (IASOS) network that is developing and practicing the methodology of socially-oriented observations (SOO) is putting main focus on quality of life, human and social capital development in the Arctic.

The Third International Conference on Arctic Research Planning (IASC, 2015) and the IASC/IASSA/Arctic-FROST/ASUS white paper on Arctic sustainability research (see Petrov et al., 2017) identified a number of key priorities for monitoring and understanding sustainability in the Arctic as both a process and an outcome. This study identified a number of priority research themes that respond to key gaps in knowledge, providing valuable and urgently needed contribution to theory and practice. These themes, as relevant to the observation and monitoring, include:

- Continued refinement of integrated sustainability indicators
- Examination of sustainable development as process: analyze success stories and failures, perform longitudinal analysis (both back and forward) of sustainable development
- Investigation of linkages between climate change and sustainable development
- Analysis of the role of institutions in sustainable development
- Examination of sustainable development in urban areas and relationships between rural and urban
- Further analysis of the role of resources, traditional and emerging economies (creative, arts, high tech) as factors and instruments of sustainable development
- Examination of role equity, agency, power and justice along key axes of difference in the Arctic – gender, age and identity.

The research directions advanced by the ASUS and its partners as a part of the ICARP III process have had a substantial follow-up manifested in the new or reinvigorated research activities and projects directly responding to the challenges and needs identified in the ASUS co-sponsored reports. These new efforts will significantly contribute to monitoring of sustainability and sustainable development in the Arctic in the near future.

Among the new monitoring initiatives of Arctic sustainability is the *Arctic Youth and Sustainable Futures* project (NCM). Engaging youth in monitoring Arctic sustainability is critical to explore youth perspectives on this process of establishing a set of sustainability indicators and scenario planning. Involving youth as co-observers and co-researchers in sustainability monitoring process ensures true participation of local young people in both identifying relevant issues and determining appropriate solutions. The project will result in a report to be presented to the Sustainable development Working Group of the Arctic Council.

Another important initiative is the international effort to develop sustainability indicators for Arctic cities under the *PIRE: Promoting Urban Sustainability in the Arctic* (NSF). This project brought together a group of scholars and educators from U.S. and Russia to work on a system of indicators of sustainable development designed to reflect special conditions in Arctic urban areas, especially in Russia. Several workshops have yielded an overall framework for assessing sustainability in urbanized communities, and the work will continue for the next three years.

*The Circum-Arctic Coastal Communities Knowledge Network* (CACCON) has been established to link together various coastal communities with on-going observations that include aspects of resilience, adaptation and sustainability. Coupling with other exiting projects, such as Arctic-COAST, ELOKA and Smart Ice, CACCON is building a community of scholars, community members and Indigenous knowledge holders to provide sustained and comprehensive observations of biogeophysical and social processes on the Arctic coast. CACCON operates as a distributed

network of local (community or regional) knowledge centers exchanging information: data, technical capacity, adaptation strategies, or other types of knowledge within the community or with peer communities in the circumpolar north.

ASUS in cooperation with mentioned above initiatives may significantly add to Arctic observing and assessment processes, and will ultimately produce a list of indicators targeting current and near-term priorities for observing networks and systems. It will help to identify societally significant socio-economic environmental variables to improve the capacity of observational networks in the Arctic.

The data from key sustainability monitoring sites will help to identify main indicators for on-going observations at the local scale. Such network of key sustainability monitoring sites is now under discussion within the ASUS project. It is envisioned to include here such monitoring sites as: in Russia (Evenkia, Murmansk region, Yakutia and Chukotka); in the USA (North Slope and Bering Strait regions), in Greenland (Nuuk and Kujalleq), in Canada (Yukon, NWT and Nunatsiavut), and in Norway (Finnmark).

The synthesis of local and regional observation frameworks will be critical in developing the instruments for socially significant observations at the national, circumpolar and global scales.

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