Designing the Human Dimension into an Arctic Observing Network

Human Dimensions of the Arctic System—HARC

www.arcus.org/HARC

HARC was created in 1997 as a component of the Arctic System Science Program (ARCSS) of the National Science Foundation. Within ARCSS the aim of HARC is to better understand the role of humans in the functioning of and interactions among the various physical, biological, and social components of the arctic system and the significance of changes in the arctic system for people in the Arctic and across the globe.

HARC also provides a way to examine the policy implications of ARCSS research through stakeholder collaborations that examine decision making in light of environmental change. HARC seeks to identify the needs of decision makers and to improve the ability of ARCSS researchers to communicate their findings effectively.

Produced by the HARC Science Steering Committee

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"Preparing for the blanket toss, Alaska" (left) photo by Bill Hess

"Beluga harvest by Point Lay villagers, Alaska" (cover) photo by Bill Hess

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What is 'Human Dimensions' Research?

The complex suite of biophysical changes taking place in arctic ice, oceans, land, and atmosphere is driven by an interwoven system of human activities and natural processes. Research on the Human Dimensions (HD) of arctic change addresses this coupled human-natural system and investigates how individuals and societal groups

- contribute to,
- are influenced by, and
- mitigate and respond to

the changes that take place on a local, regional and global level. Human dimensions science therefore draws together many disciplines within the natural and social sciences and uses a wide range of methods and approaches.

Understanding how social systems interact with natural systems (both physical and biological) involves quantitative studies and forms of hypothesis testing and analysis familiar to fields such as atmospheric science, terrestrial ecology, glaciology or ocean biogeochemistry. When scientists study climate-influenced and human-influenced phenomena such as ice roads, river flows, or fish catches, rigorous understanding of all the system drivers (including the role of humans) becomes critical. These are nontrivial challenges for biophysical-human dimensions research.

How HD Research Contributes to System Science

Changes that seem, at first glance, mainly physical often turn out to have human dimensions frameworks. These issues (such as livelihood vulnerabilities, institutional factors, and policy frameworks) must be studied as part of climate change research to assure that mistaken conclusions are not drawn from the data.

For example, an observed trend toward increasing river flows into the Arctic Basin might well reflect climate change. But to an unknown extent, flows vary also with trends in dam construction and reservoirs over the same period of time. Similarly, correlations between fisheries catches across widely separated regions, such as the North Atlantic and North Pacific, might reflect large-scale climatic events connected through the atmosphere. But they certainly also reflect human developments, such as new fishing technologies and markets. In each case, a physical-science analysis remains incomplete until we analyze the human dimensions as well.

"Herding reindeer, Finland" photo by David Klein

A Human Dimensions Observing Network for the Arctic System

To understand and anticipate environmental changes taking place in the Arctic, researchers are designing an Arctic Observation Network in the context of planning for the International Polar Year (IPY) in 2007. Equally rapid and significant changes confront arctic social systems. Some of these societal changes are driven by environmental change; others result from broader cultural and socioeconomic forces, or from complex interactions between environment and society. A Human-Dimensions Arctic Observing Network (HAON) that is analogous to that planned for the physical sciences should be a component of IPY activities. Such a network is essential to understanding common patterns and local variations in the flow of arctic social change, testing hypotheses and developing models about their causes, and developing credible, evidence-based future scenarios and policies useful for supporting decision making under conditions of escalating environmental and social change.

The analogy with a physical network of weather stations or ocean buoys is not an exact one: a HAON need not necessarily take physical form, but could instead consist of a network of social scientists, citizens and other observers to help make available and accessible arctic HD data already being collected in a common data structure of circumpolar scope. This network could also function to identify data gaps and to collect data as appropriate to fill those gaps. Existing and new data might include:

- The size, composition, well-being and livelihoods of arctic communities. Wide variations can occur between neighboring communities and regions. Detecting, understanding and anticipating such variation is important, as people cope with accelerating change.
- Health and economic statistics. These statistics provide key indicators of human and societal well-being; they can be important for highlighting successes to be emulated, or problems needing to be addressed.
- Data on industrial development, infrastructure, and resource extraction. Changes in sea-ice, permafrost and storm frequency are three environmental factors affecting human activity. HD researchers and natural scientists need to work together to define data sets needed to answer socially relevant questions.
- Global economic and institutional trends. These data provide important information about the larger contexts that affect the nature and range of choices arctic residents may have for coping with environmental change.
- Qualitative data. Data such as historical accounts, interviews or individual life histories are essential for meaning and interpretation. Such data allow triangulation between local knowledge and history, events, and conditions identified through biophysical research. The time-indexed framework of quantitative data provides a way to organize and reference qualitative accounts.

A key role for the human-dimensions observing network would be to perform the kinds of analyses needed to disseminate the data in formats that are accessible, useful, usable, relevant, and timely to the needs of researchers, policy makers, and the public. Delivery would be through a single web portal with multiple links.

"Old dredge near the Taylor Highway, Alaska" photo by Zeb Polly

Designing a HAON

A major design consideration with regard to human-dimensions data is the need for compatibility with natural-science data in order to facilitate integrated research. Geographical coding of arctic communities in a place/year database is one way to do this; human-dimensions data may comprise layers on a map, or time series for analysis alongside environmental data. Algorithms exist for correlating socially defined territories (such as counties) with the grid-cell organization of some physical-science or modeled data, as well. The human-dimensions observing network provides opportunities for addressing not simply human-dimensions questions, but also the challenging questions about relationships between humans and their changing arctic environments.

An important issue to resolve is the design of a suitable data structure to house a circum-arctic HD dataset. One possible structure might be a place/year database, containing time series of social, economic or health indicators for each community and region in the Arctic (or single-time values, where time series do not yet exist). The number of indicators or other variables in such a database would be open-ended, growing with the interests, needs, and information of network participants. Another possibility might be a relational database with several linked tables that include meta-data on units of measurement, data-types (e.g. is the data record an average value or is it an instantaneous point in time?, and/or is it directly measured or from a model?, etc.). Similar large databases that merge geospatial information with time-series data (e.g. hydrological information on stream flow, precipitation, groundwater and water quality), typically employ relational database structures.

Surveys or other targeted information-collection efforts would contribute additional specific variables reflective of specific places. The database would initially, of course, have many empty cells that are gradually filled in. The design would also allow for typologies, or free-form text such as historical and interview accounts, to be attached to place/year records. Thus, the database itself provides a tool for integrating qualitative with quantitative data.

"On Stampede Trail, Alaska" photo by David Klein

Examples of Human Dimensions Observing Networks

Circum-Arctic Rangifer Monitoring and Assessment Network (CARMA)

CARMA is a collaboration among communities, scientists, and governments to exchange information on the environment and the status and use of wild Rangifer populations across the North. As part of the biodiversity monitoring program sponsored by the Arctic Council, CARMA integrates existing community monitoring, climate stations, remote sensing, field studies, socio-economic data, and data on development activity to understand the full impacts of change on the human/Rangifer system. See www.rangifer.net/CARMA

Climate Assessment for the Southwest (CLIMAS)

Like the Arctic, the US Southwest constitutes an extreme environment where climatic variability and change have strong impacts on biophysical and social systems. CLIMAS, funded by NOAA's Office of Global Programs under its Regional Science and Assessment (RISA) program, is widely known for its success in integrating human dimensions and biophysical research into a coherent program to assess climate impacts on the region's natural and human systems and to provide climate information useful for coping with impacts in contexts of multiple stresses. CLIMAS human dimensions researchers include scholars in resource economics, human geography, and anthropology; research activities range from in-depth vulnerability analyses to economic decision making, policy analysis, and institutional analysis. See http://www.ispe.arizona.edu/climas