A Prototype Indicators System for U.S. Climate Changes, Impacts, Vulnerabilities, and Responses

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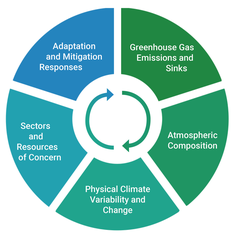
What are indicators?

Indicators consist of sustained measurements or calculations that capture important features of the status, trend, or performance of sectors of interest, such as the economy, agriculture, oceans, and forests.

What is our vision for the indicator system?

An indicator system comprises a set of indicators that are chosen to provide a holistic picture of the issue of interest. We propose the development of a national system of indicators, termed the National Climate Indicator System (NCIS). The vision of the NCIS is a set of physical, ecological, and societal indicators that communicate and inform decisions about key climate changes, impacts, vulnerabilities, and preparedness. The goal of such a system would be to support long-term assessment of the vulnerability of key U.S. sectors to climate change and variability, and to report on response strategies for responding to and coping with change.

Recently, the U.S. Global Change Research Program (USGCRP) released proof-of-concept indicators that were inspired by the recommendations and prototypes developed by our expert teams. The proof-of-concept indicators, by design, include a limited number of indicators, so that feedback from user communities can be explicitly considered as an indicator system is built out. Lessons learned from the prototyping phase and the results of our current evaluation research are useful input to guide a fuller implementation of an indicators system that would synthesize key components across a range of natural systems and human sectors.



Categories of Indicators: Framework for the National Climate Indicator System
Physical, ecological, and societal indicators could fall into different categories of this cyclical framework, which includes the linkages between sources and sinks, impacts, and responses.

How was it developed?

Over 200 scientists and practitioners from Federal agencies, NGOs, academia, and the private sector developed conceptual models, recommended indicators, and identified research priorities. A subset of indicators, which could be immediately implemented, were prototyped for USGCRP.

The large diagram on the right illustrates the iterative process used to create an indicator within the system. Once the process reaches Step 9, research results inform the refinement of the indicator and indicators system.

Want to know more?
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2010
- EPA holds Ecosystems Indicators Workshop

2011
- NASA holds Physical Indicators Workshop
- NASA and NOAA hold Societal Indicators Workshop
- NCADAC creates Indicator Working Group and Sustained Assessment Work Group
- NCADAC approves indicator vision

2012
- Indicator Working Group completes Indicator Technical Input Report
- Indicator Working Group produces Indicator Implementation Plan

2013
- Technical Teams produce Draft Recommendation Reports
- NCADAC releases Sustained Assessment Report

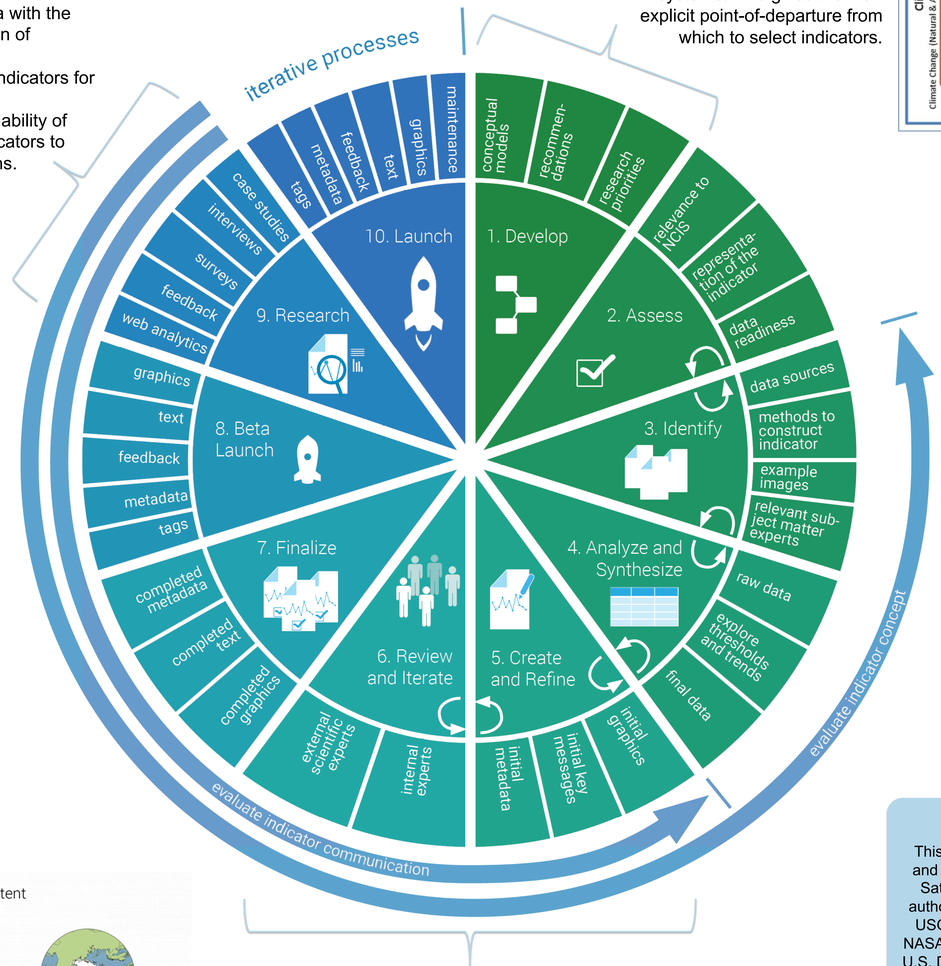
2014
- NCADAC Indicator Working Group chooses indicators to recommend for the NCIS
- NCADAC approves and releases Indicator Work Group Report

2015 and onward
- USGCRP launches pilot NCIS
- Research on clarity and utility of pilot NCIS
- Submit journal articles for special issue
- Evaluate, improve, research, case studies, and future indicator products

Step 9: Evaluation research of pilot or beta indicators and indicators system

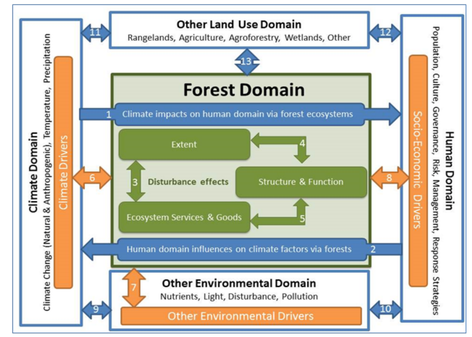
The proposed indicators system is designed to adapt to its users, and thus is undergoing a number of social scientific evaluation studies, including:

- Analysis of data visualizations to optimize for comprehension by non-scientists;
- Web analytics and focus groups to consider combinations of indicators and metadata with the necessary features to improve the design of information systems;
- In-depth case studies to assess use of indicators for specific decision contexts; and
- Surveys on the usability and understandability of indicators and how to best combine indicators to understand systems and inform decisions.

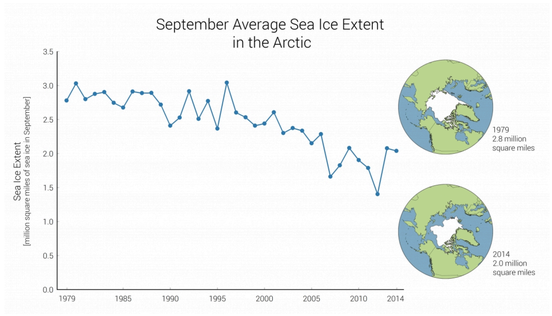


Step 1: Develop

Example *Draft* Forest Technical Team Conceptual Model
Expert teams draft conceptual models in order to organize their thinking on the links between human and environmental systems. This gives them an explicit point-of-departure from which to select indicators.



Technical teams were convened to provide indicator recommendations on 13 topic areas. These teams included: Climate Change and Variability; Water Cycle and Management; Freshwater Ecosystems; Grassland, Rangelands and Pastures; Greenhouse Gases and Mitigation; Oceans and Coasts; Adaptation and Hazards; Agriculture; Forests; Human Health; Phenology and Seasonal Variability; Energy; and Infrastructure.



Source: Final USGCRP indicator developed given recommendations from expert teams.

Steps 5 & 6: Create and Refine; Review and Iterate

Example Pilot Indicator
September Average Sea Ice Extent in the Arctic
Sea ice extent is a measure of the surface area of the ocean covered by sea ice, and declines with rises in air and ocean temperatures. The minimum sea ice extent in the Arctic, measured in September of each year, has decreased by about 40% since 1979.

Acknowledgements

This study was supported by NOAA grant NA14NES4320003 and NA09NES4400006 (Cooperative Institute for Climate and Satellites (CICS)) at the University of Maryland/ESSIC. The authors additionally wish to acknowledge in-kind support of the USGCRP, National Oceanic and Atmospheric Administration, NASA, Environmental Protection Agency, Department of Interior, U.S. Department of Agriculture, U.S. Forest Service, Department of Energy, Centers for Disease Control, Army Corps of Engineers, and National Science Foundation. This work was developed in collaboration with the National Climate Assessment and Development Advisory Committee, Indicators Working Group. The technical team leads are: Derek Arndt, Britta Bierwagen, Nancy Cavallaro, Leon Clarke, Roger Griffis, Patricia Gober, Jerry Hatfield, Linda Heath, Michael McGeehin, Laurie McGilvray, Dennis Ojima, Christa Peters-Lidard, Kathleen Tierney, Jake Weltzin, and Thomas Wilbanks. Input from colleagues associated with USGCRP, particularly Glynis Lough, has been helpful to formulate pragmatic recommendations and processes for consideration by the Federal agencies.