Implementation of the SAON Strategy

1. Objective

The Arctic Council (AC) and the International Arctic Science Committee (IASC) have established SAON to lead the facilitation of international collaboration among government agencies, researchers, and northern residents, including indigenous people, and to promote a sustainable, and effectively coordinated circum-Arctic observing system.

In order for SAON to fulfill its vision of supporting robust international observing networks for the Arctic region, SAON must first and foremost describe then develop capacity to facilitate coordination of all Arctic observing and data assets while providing a tangible value-added to the assets themselves. In addition, these very same assets should provide SAON with added value as well. Practical solutions to this two-way value are necessary in order to ensure that the SAON enterprise is indeed providing or at least facilitating integrated benefits to the Arctic community, such as standardized data collection and subsequent science information delivery to regional and global stakeholders.

The foundations of SAON - or what were originally deemed "building blocks"- are existing networks and programs that already provide high quality Arctic observations. During the initial development of SAON, it was revealed that present Arctic observing sites did not adequately cover the Arctic region, observing data are fragmentary and not easily available and only a part of the Arctic observing is funded on a long-term basis.

2. SAON Implementation

In order to achieve this leadership role, the SAON Board has recognized the need to establish two SAON Committees focused on (1) Observations and Networks, and (2) Information and Data Services. These Committees shall address issues that transcend individual Arctic observing and data platforms and all scales of organizational capabilities. The Committees should prepare overall strategies to improve the situation within the Northern areas regarding:

1A) Collection of data/information from Arctic social, economic, health and environmental sciences and observations, including permission to access geographical areas and platforms, and to present financial options for long term funding of platforms and operations.

1B) Establishment of a Circum-Arctic set of early warning indicators (an indicators network), focused initially on indicators of climate change that link to existing and ongoing

Arctic assessments and provide the Arctic community with a status of the health of specific Arctic natural and human systems.

2A) Free and easy access to data and information.

2B) Integration and dissemination of data and information will be provided through a SAON-led Circum-Arctic Information System (CAIS).

2.1 Committee on Observations and Networks (CON)

The Committee, responsible for conducting the implementation related to goals 1A and 1B, above, should give advice to the SAON Board on how to fund, coordinate and expand the scope of arctic observational activities and address the questions of how to ensure sustainability of observational platforms in the Arctic and how easier access to them can be achieved. It should also ensure the promotion of community-based monitoring within SAON and work on best practices for the utilization of traditional knowledge within Arctic observing activities.

Goal 1A

The first task of the Committee will be to develop and implement a plan for the establishment of an inventory and related gap analysis of circum-Arctic observational and monitoring assets. Such an analysis will provide SAON and the broader research and operational communities with a clear understanding and requisite baseline of what observational assets currently exist in the Arctic. Furthermore, it will allow for the development of a more effective plan for sustaining critical Arctic observational systems as well as the development of new systems in order to fill critical gaps in our observational capacity.

Goal 1B

Utilizing existing plans, the committee will develop the plan for the establishment of a Circum-Arctic Indicators Network (CAIN). This indicators network should utilize already ongoing efforts in this exercise, for example the methodology developed by the U.S. Global Change Research Program (USGCRP) for a climate change early warning indicators network (Appendix 1). Along with other assets, it will be also important to engage indigenous peoples and local northern communities in this work. This indicators network plan should be followed by a call for proposals from the SAON Board to the SAON Tasks for the development of a single (or several) proof of concept or pilot studies affiliated with key assessment or other scientific, as well as local investigations currently being conducted (or nearing implementation) within the Arctic. The submitted proposals should be given clear development guidance that includes the accepted network development methodology that should be utilized in the building and deployment of the pilot indicator networks.

2.2 Committee on Information and Data Services (CDIS)

The SAON Vision is that users should have access to free, open and high quality data that will realize pan-Arctic and global value-added services and provide societal benefits. The Committee should give advice to the SAON Board on how to meet this vision from the point of view of information and data services keeping in mind the IASC Statement of Principles and Practices for

Arctic Data Management[1]. When the work involves traditional and local knowledge of Arctic Communities, particular consideration has to be given to sharing practices for sensitive information.

Goal 2A
The CDIS should provide advice and guidance to the SAON Board with respect to implementation of activities, products and infrastructure associated with facilitating free and easy access to all types of Arctic-related information.

Goal 2B
In order to promote free and easy access to Arctic data and information, the CDIS will be responsible for the establishment of an integrated information system; the Circum-Arctic Information System (CAIS). It is highly recommended that the CDIS utilize existing development plans and methodologies for establishing CAIS (Appendix 2)

Furthermore, the CDIS should develop a process for development of a proposal system whereby new or existing SAON Tasks could serve as an effective test bed for a pilot study on CAIS development and implementation. Such a test bed would serve in testing out the CAIS information architecture (including the testing of multiple different components) prior to deployment of the full Arctic-wide system.

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[1]http://www.innovation.ca/sites/default/files/Rome2013/files/IASC%20Statement%20on%20Arctic%20Data%20Management_2013.pdf

APPENDIX 1

The Appendix contains a list of indicator initiatives and systems. These are meant as examples for the work of the CON Committee for the development of a Circum-Arctic Indicators Network (CAIN). The list is followed by a more detailed description of the US National Climate Assessment Indicator System.

Examples of existing indicator initiatives and systems are:

- AMAPs recommended monitoring variables for trends and effects: http://www.amap.no
- Arctic Species Trend Index (produced by CBMP): http://www.caff.is/asti
- Biodiversity Indicators Partnership (UNEP WCMC): http://www.bipindicators.net/
- Canadian Environmental Sustainability Indicators program: http://ec.gc.ca/indicateurs-indicators/default.asp?lang=En

National Climate Assessment Indicator System:

Proposed Implementation of a Pilot Indicator System

Dr. Melissa Kenney and Dr. Tony Janetos

This memo provides an overview of the proposed National Climate Assessment Indicator System, linkages to existing federal priorities (including the President's Climate Action Plan), and the proposed decision and implementation process for the pilot and full launch of the indicators system.

Three Things you Must Know

- The USGCRP, with support from 10 of the 13 U.S. Global Change Research Program (USGCRP) agencies, is leading an effort to identify a first set of physical, societal, and ecological indicators that would inform and support decision-making about climate changes, impacts, vulnerabilities, and responses.
- This effort supports the following existing interagency federal priorities:
  - the four pillars of the strategic plan of the USGCRP in support of the Global Change Research Act (GCRA)
  - foundational product of the National Climate Assessment (NCA) sustained assessment[2];
  - listed as USGCRP Office of Management and Budget (OMB) priority for 2013, 2014, and 2015;
  - included as an activity to fulfill one of the data initiatives and decision tool kit requirements of the President's Climate Action Plan (CAP);
  - supports Executive Orders (EO) 13653, 13514, and 13642[3]; and

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[2] Buizer, James L., Paul Fleming, Sharon L. Hays, Kirstin Dow, Christopher B. Field, David Gustafson, Amy Luers, and Richard H. Moss, Report on Preparing the Nation for Change: Building a Sustained National Climate Assessment Process, National Climate Assessment and Development Advisory Committee, 2013.

[3] EO 13653 of November 1, 2013 "Preparing the United States for the Impacts of Climate Change" (Section 4: Providing Information, Data, and Tools for Climate Change Preparedness and Resilience), EO 13514 of October 5, 2009 "Federal Leadership in Environmental, Energy, and Economic Performance" (Federal Adaptation Plans), EO 13642 of May 9, 2013 "Making Open and Machine Readable the New Default for Government Information"

○ builds on existing or develops new indicator and information system design and products developed through the USGCRP agency programs, participation by agency scientists and managers, and inclusion of indicators in existing Request for Proposals (RFPs).

● The system is currently under development; it will be launched in two phases: a pilot is slated for spring 2014 and a full launch in 2015. Looking ahead, the Indicators Secretariat will require a modest number of dedicated staff, which could be largely drawn as detailees from the agencies themselves, in order to ensure that the system is up-to-date scientifically and continues to provide a useful information service to its audiences.

Background

The USGCRP is leading an effort to identify a first set of physical, societal, and ecological indicators that would inform and support decision-making about our nation's changing climate and its consequences. This system has a strong focus on impact, vulnerability, and response indicators and thus is built around the concept of multiple stressors, where the indicators are related to variability and change in the climate system as described through the conceptual models. The targeted indicators are expected to be useful to the multiple audiences who draw on the NCA and USGCRP research and products to make decisions related to impacts, adaptation, vulnerability, and mitigation associated with climate and global change (e.g., Federal agencies engaged in place-based or sector-based decision-making). These indicators will be tracked as a part of ongoing assessment activities, with adjustments as necessary to adapt to changing conditions and understanding.

Over the past several months, over 150 scientists and practitioners across the federal, academic, and private sectors have been in conversations to develop the scientific basis for the selection of indicators using conceptual models. This is truly an interagency effort where different agencies have provided different kinds and levels of support. DOC NOAA, EPA, USDA, DOE, NASA, DOD USACE, HHS CDC, DOI, DOT, and NSF (10 of the 13 USGCRP agencies) have scientists and practitioners that are serving as team leads or team members on the NCADAC Work Group or one of the 14 technical teams. Additionally, we have had 18 volunteer science policy fellows, detailees, or student interns (ranging from mid-career Ph.D. scientists to honors undergraduates) that have worked with the indicators team to coordinate this effort or conduct research to support the development of the system.

INDICAOR SYSTEM LINKAGES TO CAP AND FEDERAL PRIORITIES

The National Climate Indicator System supports both the Climate Data Initiative and the Toolkit for Climate Resilience called for the in the CAP. Specifically,

● in support of the Climate Resilience Toolkit, Indicators will provide decision-relevant information to support a range of adaptation and energy/mitigation decisions (EO 13653), including decisions in the agencies themselves (e.g., EO 13514), and

● in support of the Climate Data Initiative, Indicators will provide traceability and transparency of the data and indicator methods used across the federal agencies (EO 13642) to support the Indicator System.

Development and implementation of this Indicator System becomes an information service, which features both access to data from known and vetted measurement programs, and access to tools to manipulate data for particular user communities. The next section describes in more detail the elements of the Indicator System that support these federal priorities.

PILOT INDICATOR SYSTEM DESIGN ELEMENTS

The Indicator System is designed for those decision-makers who want to use the best scientific information to make climate-informed decisions, not to convince someone that climate change is happening. Thus, the Indicator System is designed specifically to provide decision support information and tools. Additionally, because these efforts rely on science that crosses the federal agencies, the Indicator System has been designed to give full credit to all the agencies that provided data, analysis, or the indicator product via logos and links to the supporting agency programs on the USGCRP Global Change Information System (GCIS). Below are a few features of the pilot system that are particularly noteworthy:

Vision and Goals for the Indicator System: One of the elements of the vision for the sustained National Climate Assessment (NCA) process is to create a system of indicators that communicate key aspects of the physical climate, climate impacts, vulnerabilities, and preparedness for the purpose of informing both decision makers and the public with scientifically valid information that is useful for decision-making. These indicators will be tracked as a part of ongoing assessment activities, with adjustments as necessary to adapt to changing conditions and understanding.

The goals of the indicator system are to:
- Provide meaningful, authoritative climate-relevant measures about the status, rates, and trends of key physical, ecological, and societal variables and values;
- Inform decisions on management, research, and education at regional to national scales;
- Identify climate-related conditions and impacts to help develop effective mitigation and adaptation measures; and
- Provide analytical tools by which user communities can derive their own indicators for particular purposes.

Goals for the Pilot Indicator System: The Pilot Indicator System will have several specific goals.

- It will provide a low-cost proof of concept for evaluation purposes. Before making more significant investments in the development of a robust end-to-end, interagency Indicator System, we want to evaluate how this system can be created to have the greatest utility for a wide-range of decision-makers.
- The Pilot Indicator System also allows us to engage stakeholders through the NCA roll-out engagement activities to informally assess what kinds of indicators or capabilities that stakeholders would like to have in an Indicator System.
- Additionally, because many of these indicators are multi-stressor, i.e., climate is only one of the stressors that impact the indicator, it is important to rigorously test and evaluate how to best present and communicate the scientific information so that it is useful and appropriately used by decision-makers.

Decision Criteria: The NCADAC Indicator Work Group developed a set of decision criteria to detail the overall focus of the system and kinds of indicators that would considered for inclusion in the system. Summarized these criteria include:

- Scientifically defensible
- Link to conceptual framework
- Defined relationship to climate
- Useful for decision-making
- Spatially and temporally scalable indicators

- Build on or augment existing agency efforts
- Current and leading indicators

For the pilot, an additional criterion was imposed which is to focus on those indicators that are already established and scientifically vetted, so that we could develop a low-cost pilot system for evaluation purposes.

How is this Effort Different from Existing Indicator Efforts: This effort is different from existing indicator suites, such as Climate.gov, NASA Key Climate Indicators, and the EPA Climate Indicator Report, because it is designed, in collaboration with 150+ scientists and practitioners, to provide an interagency information system, using indicators, to support decision-making. The use of conceptual models provides a novel approach to identifying key linkages between climate and other stressors upon impacts and vulnerabilities of concern to the nation. Thus, it explicitly focuses on indicators that move beyond traditional physical climate indicator dashboards to additionally include natural and societal indicators. Additionally, this effort is designed to explicitly provide information to decision-makers who need to make climate informed decision across a range of contexts, instead of being designed for communication purposes (i.e., trying to convince people that climate variability and change is happening). Thus, this indicator system helps to translate rigorous scientific information in a format and with the analytical tools to support a range of decision context important to the nation.

Scientific Rigor of the Indicator System and the Indicators Included in the System: Consistent with the recommendations of the National Research Council (NRC), the indicator system has been developed using a conceptual models approach, which provides a systematic basis for development of the system and the inclusion of indicators within it. The Indicator System has both a conceptual model for the entire system (see Figure 1) to identify which kinds of indicators will be include in the system and for each of the physical, natural, and social systems and sectors. The latter was developed by the indicator technical teams to provide a clear scientific justification for the inclusion or exclusion of indicators within the system.
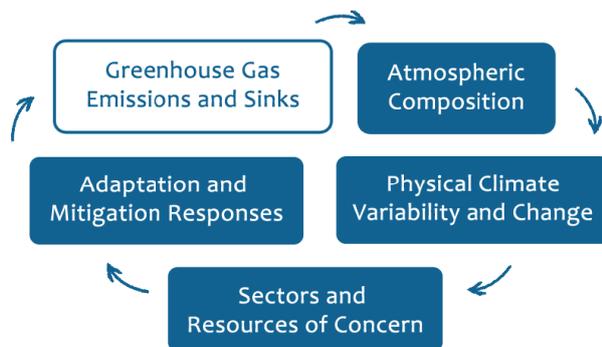

Figure 1. Conceptual Model for the National Climate Indicator System.

The pilot Indicator System proposal includes only those indicators that are established and well vetted through the agencies and scientific community. Indicators that are based on a single peer-reviewed paper or those that are more experimental in nature have *not* been included for the pilot. Throughout the process to move from recommendations to implementation, the scientists who are experts in those indicators will be involved in the development of the GCIS back-end traceability documentation, vetting the graphical representations that will be included in the pilot, and assuring that the text supporting the graphics are scientifically accurate and include the appropriate caveats and assumptions to help decision-makers appropriately apply the information to their particular decision contexts.

Access to Data and Methods: One of the goals of the Indicator System is to provide access to data for decision and policy-making pulling from efforts across the federal agencies, in support of the Open Data Initiative (EO 13642). For the pilot, the indicators will use data that are vetted by agencies or are well-established and reviewed by scientific communities. Though the pilot will include static images and supporting text, for the launch of the system we are developing methods through the GCIS that would allow for dynamic

updating of indicators as new information is available and to build on existing decision support tools to partition data regionally as well as sectorally so that it is useful for a range of decision contexts. The development and access to these analytical tools allows diverse audiences and users from various sectors and interest areas to derive indicators for their own purposes and in support of their decisions.

Evaluating the Indicator System: The Indicator System will have the ability to support several types of evaluation, including evaluation of the Indicator System and objective analysis of climate policies, adaptation actions, and mitigation measures.

- The evaluation of the Indicator System will assess which data are actually useful for decision-making audiences, for either mitigation decisions or adaptation decisions. Both "top down" and "bottom up" approaches will be used to improve the Indicator System. Top down approaches include using web analytics and surveys will provide a broad assessment of the effectiveness of individual indicators and the system. Bottom up case studies will be used to engage with decision-makers to better understand how these indicators can be useful in their decision processes and how the system can be modified to better support climate-informed decisions in a range of contexts. This evaluation data will be used to adjust the system accordingly.
- Procedures are being developed to robustly evaluate the pilot system so that data can be used to inform the decision about how to move forward after this first phase of the Indicator System.
- Over time, the Indicator System will be in place to do program evaluation, so it can objectively assess progress of the adaptation and mitigation goals of the CAP, goals of preparing the nation for climate change in EO 13653, and agency adaptation planning in EO 13514.

Evolution of the Indicator System: Indicators can evolve over time as the scientific understanding improves, decision-making needs change, and evaluation data identifies approaches to improve the system. Such evolution in support of improved scientific understanding to support decision-making, highlights the need for research on indicators for both natural and human systems. This approach also allows for incremental development – strategic expansion of the system as the system is shown to be useful and successful, or as agencies want to prioritize and support the development of particular indicators for inclusion in the system.

PROPOSED INDICATOR SYSTEM DECISION AND IMPLEMENTATION PROCESS FOR THE PILOT SYSTEM

The Indicators are being implemented in two phases. The first phase, launched in spring of 2014, is a pilot, with a limited number of indicators for each sector and for global context. The pilot serves in an evaluation mode, to improve our understanding of how indicators are being used by different audiences and how we can more effectively present the indicators and the system. There is a small secretariat, funded by a NOAA CPO CICS-MD grant to Dr. Kenney, to manage the process, work with the agencies on indicator development and documentation, and do the evaluation studies. The implementation of the indicator graphics will be supported through a contract to the National Environmental Modeling and Analysis Center (NEMAC) funded by the NOAA Technical Support Unit (TSU). The NCADAC approves the recommended pilot to the agencies, but the USGCRP must decide what they are able to implement.

To support the research mission of the Indicators program, NASA developed a competitive research opportunity to use NASA-produced data and/or modeling products, in concert with other data sources, to develop and test indicators; June 2013 they announced the support of 14 projects with a total funding of approximately $2.5M for a period of 12-18 months. NOAA has also released an RFP this year focused on data

and indicators for ocean indicators, that was motivated, in part, through the discussions of the Oceans and Coasts Indicators Technical Team.

The second phase is a more complete launch of the Indicator network, with more indicators, and a continual evaluation process so that indicators can be added or removed from the system and we can use a data-driven process to improve the indicator system's utility for decision-makers. Scientific papers describing the Indicators system will be published in a special issue of a journal, and the oversight of the system will need to transition away from the NCADAC to the USGCRP for the long term. Active collaboration with the USGCRP agencies will be critical for continuation of the Indicators network, for updating indicators with new data, for documenting and making data available, and for establishing longer-term continuity. Beyond the first pilot phase, the Indicators Secretariat will require a modest number of dedicated staff, which could be largely drawn as detailees from the agencies themselves, in order to ensure that the system is up-to-date scientifically and continues to provide a useful information service to its audiences.

APPENDIX 2

The Appendix contains a list of Arctic data management initiatives. These are meant as examples for the work of the CDIS Committee for the development of a Circum-Arctic Information System (CAIS). The list is followed by a more detailed description of the US Global Change Information System (GCIS).

Appendix B in the document *Data Management for Arctic Observing* (Peter L. Pulsifer, Lynn Yarmey, Øystein Godøy, Julie Friddell, Warwick F. Vincent, Taco DeBruin, Mark A. Parsons, http://www.arcticobservingsummit.org/pdf/status_of_the_current_observing_system.pdf) provides a list of Arctic data management initiatives. The list covers (among other things) these initiatives:

- Advanced Cooperative Arctic Data and Information System (ACADIS)
- AMAP's Thematic Data Centers on contaminants in the Arctic: ICES and NILU
- Canadian Polar Data Network/ Polar Data Catalogue
- Circumpolar Biodiversity Monitoring Program/Arctic Biodiversity Data Service (ABDS)
- Exchange for Local Observations and Knowledge of the Arctic (ELOKA)
- Global Earth Observation System of Systems (GEOSS)
- International Arctic System for Observing the Atmosphere (IASOA,
- International Ice Charting Working Group (IICWG,
- International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT)
- IPYDIS
- NASAs Global Change Master Directory
- Norwegian Program with contributions from the Norwegian Polar Institute, the Institute of Marine Research, and the Norwegian Meteorological Institute.
- Scientific Committee on Antarctic Research (SCAR – note Antarctic)
- WMO Global Cryosphere Watch (GCW)

Global Change Information System (GCIS)

High Level Requirements

Background:

The Global Change Information System (GCIS) is intended to eventually become a unified web based source of authoritative, accessible, usable and timely information about climate and global change for use by scientists, decision makers, and the public.

An initial version of the GCIS is being constructed to serve the needs of the Third National Climate Assessment (NCA). It will support the requirements of the NCA under the Information Quality Act (IQA) and provide reasonable transparency and supporting information used in the assessment process. The first phase of the GCIS will be ready to serve the Third NCA at the time it is approved for release to the public.

Some definitions and descriptions of organizations involved in the GCIS:
> USGCRP/NCO - The USGCRP National Coordination Office.
> GCIS/NCO - The GCIS staff that are part of the USGCRP NCO.
> NCA/NCO - The NCA organization and staff that are part of the USGCRP NCO.
> NCA/TSU - The Technical Support Unit of the NCA, based at the NOAA National Climatic Data Center.

The current USGCRP web presence is at URL http://globalchange.gov. It includes programmatic information and several other major systems, including the library (GCRIO), the MATCH health metadata system, and the Review and Comment System. This web site will be redesigned so that it still incorporates the major elements from the current site, but also integrates the new content of the NCA and will serve as the initial front-end to the GCIS. The new web site is referred to as "globalchange.gov 2.0."

Some of the information served by the web site will take the form of Portable Document Format (PDF) documents that can be downloaded from the web site for off-line reading, and some will take the form of HyperText Markup Language (HTML) pages that are served as typical web pages. Where appropriate, the PDF files will be annotated with links directly into relevant web pages with more information. For example, when reading the PDF document of an NCA chapter with a figure in it, selecting an icon next to the figure will direct the reader's web browser to a specific web page on globalchange.gov with more information about that figure.

The NCA itself is composed of a set of PDF documents, nominally 1 PDF file per chapter, appendix, with some extra front matter and ancillary documents. The PDF files representing the actual NCA report will be prepared by the NCA/TSU and delivered into the GCIS. They will include links to the globalchange.gov web site.

The NCA report itself includes several significant elements beyond the narrative content:
> a) Authors, including both Convening Lead Authors (CLA) and Lead Authors (LA) and their affiliations
> b) Key Messages - These are listed both for individual chapters, and also summarized in a set of "Report Findings" in the Executive Summary.
> c) Figures - These are often composed of separate "panels" or "sub-figures", referred to individually as "images". Figures typically have titles and captions.
> d) Images - The individual maps, charts, tables, diagrams, photographs, etc. that make up figures included in publications or reports.
> e) Traceable Accounts - Each Key Message is supported by a Traceable Account that describes the process for developing that message, including a description of the evidence base, a description of new information and remaining uncertainties, and an assessment of confidence based on that evidence.
> f) References
> g) Appendices

A Highlights Document is also being developed by the NCA/TSU and will be directly served as one or more PDF files.

As noted, the narrative chapter content of the NCA will be distributed as PDF documents, but globalchange.gov will also include HTML web pages for the NCA content itself:

a) Each individual chapter

b) Appendices

c) Chapter Summaries - These could include a brief abstract/summary introducing the chapter, and also will include the Authors, Key Messages, Figures/Images and References from the chapter. Additional information from the highlights document can be incorporated as appropriate.

The initial release of the GCIS will include 1 or more demonstration pages for the "NCA Indicators System." The full Indicators system will be developed later for full release and integration into GCIS in 2015, but these initial pages will present several proposed indicators and show the possibilities for the full system.

As a proof of concept, the GCIS prototype will also start developing "Derived Content" pages. These will be initially constructed using content derived directly from the NCA, but they are distinct from the NCA and will change over time to incorporate new information. They will also link to supplemental information such as videos illustrating key concepts. Such pages could include "Adaptation" or "Health", areas where USGCRP working groups are providing new materials and products under the USGCRP aegis and logo.

In support of the traceability goal for the NCA, the NCA/NCO and NCA/TSU are also capturing provenance information about the figures and key messages of the NCA. These include traditional references, but also more specific creation and derivation information such as who created a figure, which data were used to create them, and the sources of the data. The GCIS will not host the data themselves, but instead link to agency data centers responsible for the long term stewardship of the data.

Requirements:

The GCIS, including the globalchange.gov 2.0 web site, will be released coincident with the Third NCA and will meet the following requirements:

1. Serve Global Change Information Content

    1.1 Distribute the Third National Climate Assessment Report

        1.1.1 The GCIS shall distribute the PDF documents representing the NCA:

            1.1.1.1 Chapters

            1.1.1.2 Traceable Accounts

            1.1.1.3 Chapter Appendices

            1.1.1.4 Highlights Document

        1.1.2 The GCIS shall serve NCA HTML web pages:

            1.1.2.1 Narrative content of the chapters of the NCA.

            1.1.2.2 Chapter Summaries - 1 chapter summary page per NCA chapter.

            1.1.2.3 Chapter Appendices

            1.1.2.4 Highlights pages derived from the highlights document

        1.1.3 The GCIS shall serve web pages with metadata about various elements:

            1.1.3.1 People

              1.1.3.2 Organizations

              1.1.3.3 Figures

              1.1.3.4 Images

              1.1.3.5 Key Messages

              1.1.3.6 Traceable Accounts

              1.1.3.7 References

              1.1.3.8 Data sets

    1.2 The GCIS shall serve Derived Content pages.

        1.3 Transition content from globalchange.gov 1.1

      1.3.1 USGCRP Programmatic Information

      1.3.2 Program News aggregation

      1.3.2 Library (i.e. GCRIO)

            1.3.3 MATCH

            1.3.4 Review and Comment System

            1.3.5 Scenarios Server

            1.3.6 NCA2

            1.3.7 NCA Author Collaboration Site (password limited, not public)

        1.4 The GCIS shall serve the preliminary Indicators demonstration pages.

2. Provide a Structured Data Server (SDS) storing metadata about GCIS elements.

    2.1 For each GCIS element, the SDS shall assign a persistent, resolvable identifier (URI) for the element.

    2.2 The SDS shall serve metadata about each element through a well documented RESTful[4] application programming interface (API), both to the globalchange.gov web server, and read/only directly to the public.

    2.3 The SDS shall present an ontology representing the formal data model for the organization of the structured information.

    2.4 The SDS shall encode the GCIS elements as the resources and relationships represented in their metadata in the Resource Description Framework (RDF).

    2.5 The SDS shall provide a read/only SPARQL end-point serving an RDF triple-store to search and explore the structured information.

3. Provide a web server (globalchange.gov) to serve GCIS information.

    3.1 globalchange.gov shall index the content and allow users to search content by keyword.

    3.2 globalchange.gov shall provide interfaces and process workflows for trusted parties to upload and edit content on the web site.

    3.3 globalchange.gov shall provide social media information sharing capabilities.

    3.4 globalchange.gov will be based on the Content Management System Drupal 7.

4. Provide internet hosting for the GCIS, including the globalchange.gov web server and the components of the Structured Data Server.

    4.1 GCIS hosting and servers shall comply with federal requirements for security.

    4.2 GCIS hosting and servers shall comply with federal requirements for accessibility.

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[4] https://en.wikipedia.org/wiki/Representational_state_transfer