

# Developing a System of National Indicators to Track Climate Change Impacts, Vulnerabilities, and Preparedness

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The goals for the NCA indicators 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.

## Decision Criteria (to the extent possible):

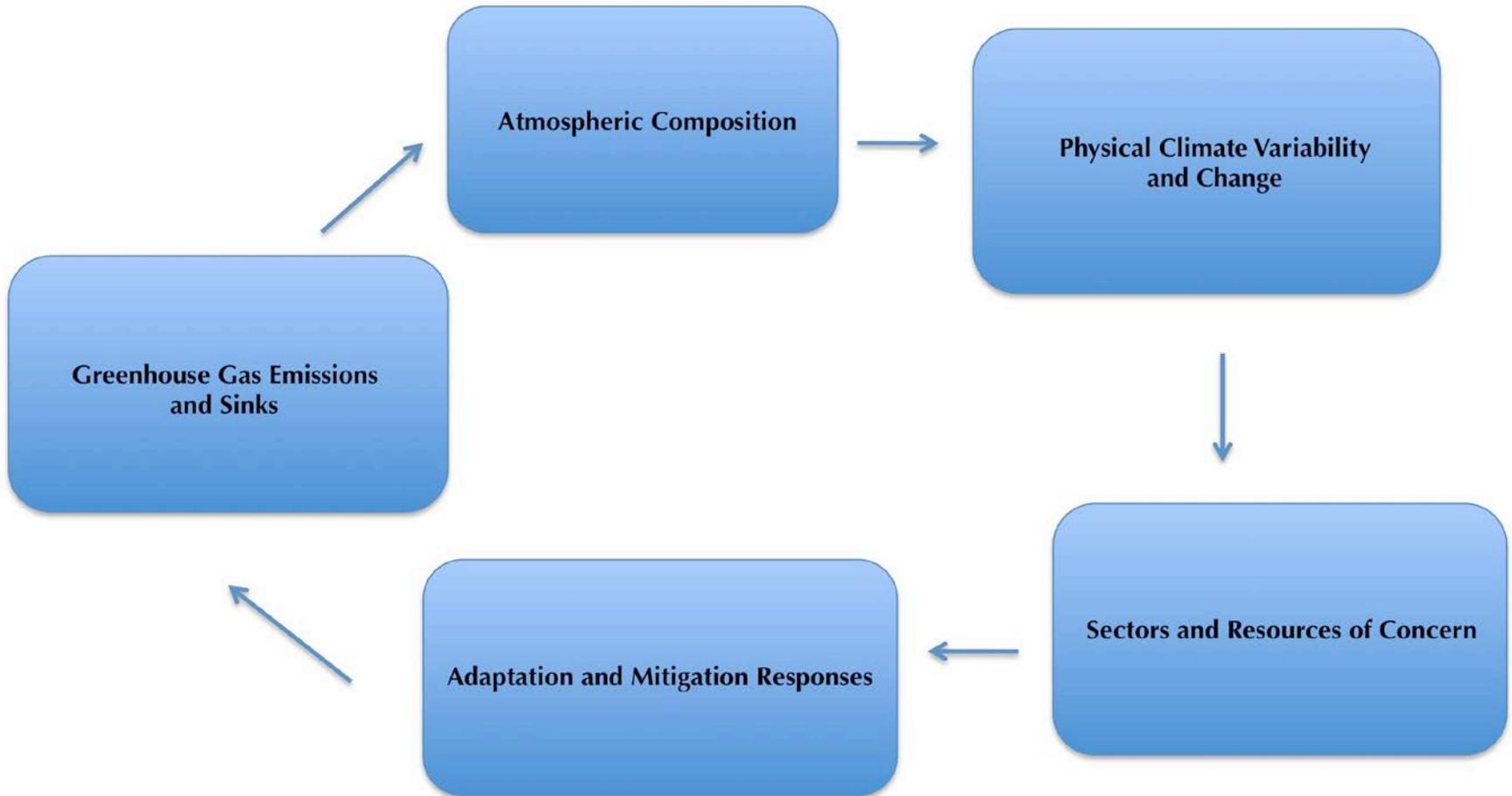
- Scientifically defensible
- Link to conceptual framework
- Defined relationship to climate
- Scalable indicators
- Build on or augment existing agency efforts
- Current and leading indicators

## Process of Establishing Indicators:

- Start with the questions to be addressed by indicators
- Identify stakeholders in diverse institutions
- Engage stakeholders (producers and users) from development to implementation to evaluation
- Prototype indicators to establish priorities for implementation
- New indicators will be assessed and tested on an ongoing basis
- Evaluate the system

- How do we know that climate is changing and how is the climate projected to change in the future?
- What important climate impacts and opportunities are occurring or are predicted to occur in the future?
- How are we preparing for rapid change or extreme events related to climate?
- How are we adapting and mitigating over longer time frames?
- What are our fundamental vulnerabilities and resiliencies to climate variability and change?

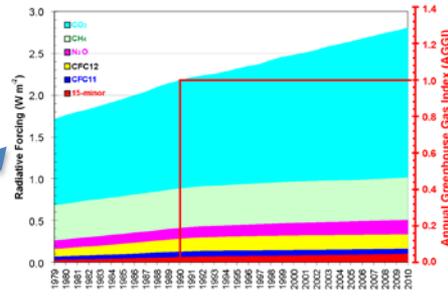
- 3 Indicator Workshops from 2010-2011 on Ecosystems, Physical, and Societal Indicators
- Formation of NCADAC Indicator Work Group (advisory board) in 2011
  - Includes NCADAC members, agency experts, and academics
- Vision recommended by Indicator Work Group approved by NCADAC November 2011
- Submission of Indicator Technical Input Report for the 2013 National Climate Assessment Report (currently being developed into manuscript)
- Development of an implementation plan, including organizational structure, deliverables, and timeline
- Funding from NOAA Technical Assessment Support Unit for a position to direct the effort; volunteer programmatic support of policy interns
- Identification of physical, ecological, and societal team leads
- Finalize Decision Criteria (November 2012)
- Technical Team Leads Established (15 teams) (December 2013)
- Established Indicator Portal (January 2013)
- Technical Teams (150+ members) start meeting (February 2013)



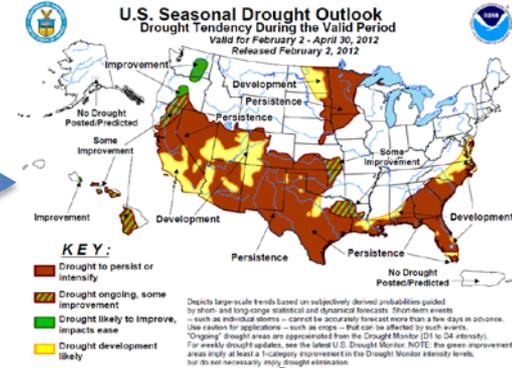
- Choices of indicator inclusion must rely on an underlying conceptual model of drivers, changes, consequences and responses
- Explicitly acknowledge value of decision-making. The system is designed for a range of decision contexts so user preferences must play a role when designing a system that is meant to support the decisions of such users.

- Identify different climate components of concern to users
- Independent of scale
- Indicators can be customized for particular decision contexts

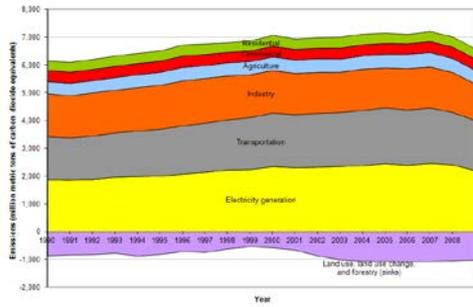
## Aggregated GHG Index



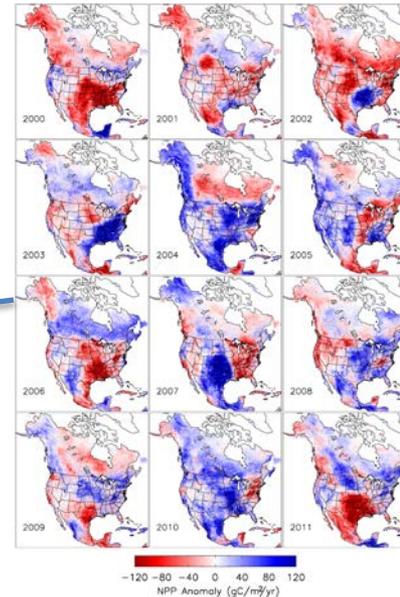
## US Drought Monitor



## U.S. GHG Emissions by Gas



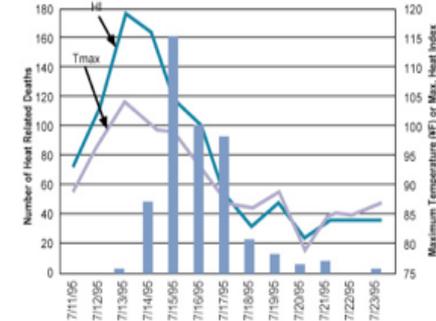
## Net Primary Productivity Anomaly



## Heat Related Deaths

### Heat Related Deaths - Chicago, July 1995

Maximum Temperature and Heat Index



This graph tracks maximum temperature (T<sub>max</sub>), heat index (HI), and heat-related deaths in Chicago each day from July 11 to 23, 1995. The gray line shows maximum daily temperature, the blue line shows the heat index, and the bars indicate number of deaths for the day.

Adaptation and Mitigation Responses

- Indicators of both process and response
- Establishing an independent, representative, and replicable data sets that are reliably collected over a number of years
- Determining a set of common, meaningful metrics across adaptation projects for both process and implementation
  - Projects designed for a range of climate stressors, in diverse locations
- Developing a set of indicators that will show meaningful changes from an established baseline

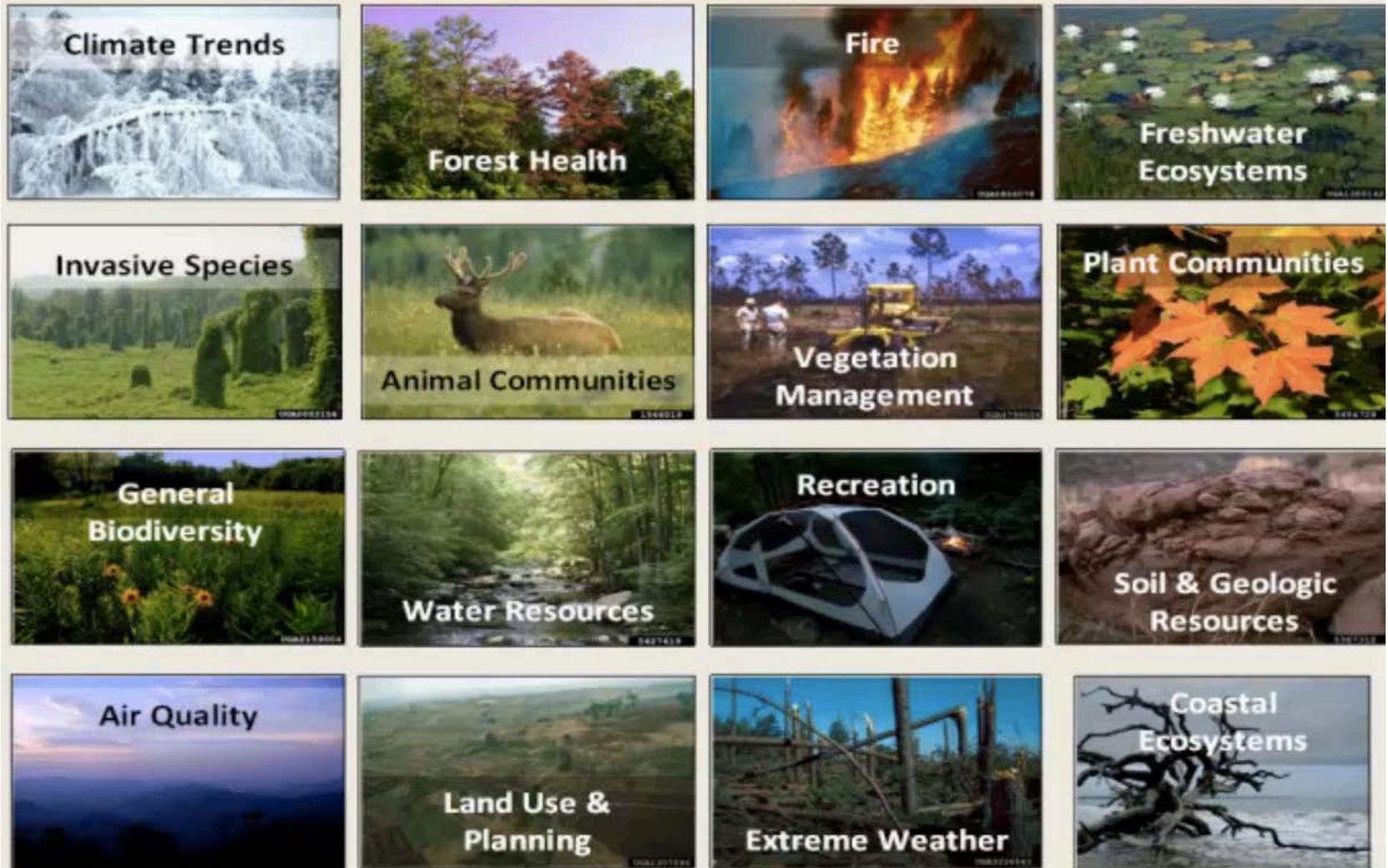
- **GAIN** Index – Global Adaptation Institute – summary scores for nations' readiness; water, food, health and infrastructure
- Tracking Adaptation and Measuring Development (**TAMD** by IIED) – framework to assess development by climate risk management plus long term development and adaptation
- Climate Vulnerability Monitor (**CVM**) – evaluate impacts on society and actions to address them, highlights adaptation measures
- Environmental Performance Index (**EPI**) – indicators for ecosystems & environmental health; natural system indicators include biome protection, critical habitat protection, marine protected areas

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- **Australia's** Climate Futures Report – national indicators of effectiveness of existing adaptation plans
- **Germany** – developing measurements of adaptation
- **UK** Government's Adapting to Climate Change Program – working on national adaptation indicators
- Programs that fund adaptation projects, Pilot Programme on Climate Resilience (Strategic Climate Fund), Global Environment Facility, Kyoto Protocol Adaptation Fund
- Various environmental performance metrics

Policy Category	Indicator	Materiality Filter
Biodiversity and Habitat	Marine protected areas	Coastal
	Critical habitat protection	Must have sites designated as 'critical' by the Alliance for Zero Extinction
Forests	Forest Loss	Must have minimum 100 sq. km of forested land
	Forest Growing Stock	Must have minimum 100 sq. km of forested land
	Change in Forest Cover	Must have minimum 100 sq. km of forested land
Fisheries	Coastal shelf fishing pressure	Coastal
	Fish stocks overexploited and collapsed	Coastal
Climate Change	Renewable electricity generation	Must generate above 130 KWH of electricity annually

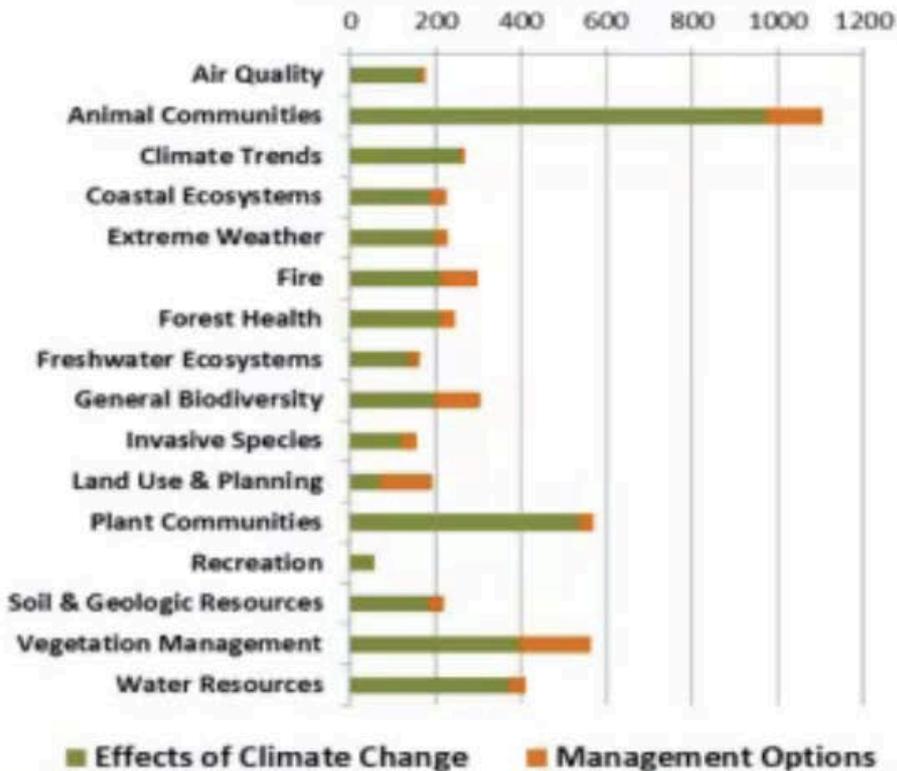
**Figure 2.4** Materiality filters applied to indicators in the 2012 EPI.

- Template for Assessing Climate Change Impacts & Management Options (**TACCIMO**) – USDA Forest Service – across scales; geospatial, peer-reviewed literature, used in vulnerability assessments, NEPA analysis, and planning.
- Sustained Tools for Assessing & Rating Communities (**STAR**) – community level; help set, manage meet sustainability goals; online tool (paid access)
- Climate Change Vulnerability Index (**CCVI**) – NatureServe – rapid screening of species vulnerability
- Agency work, vulnerability assessments

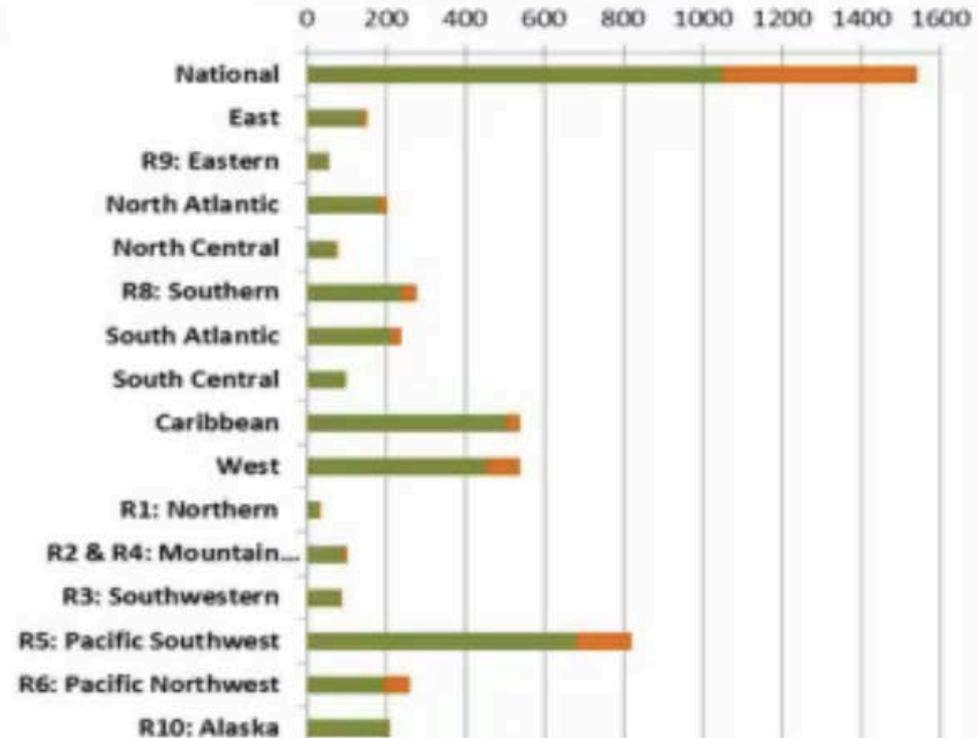


- TACCIMO's current literature content:

Number of Excerpts by Factor



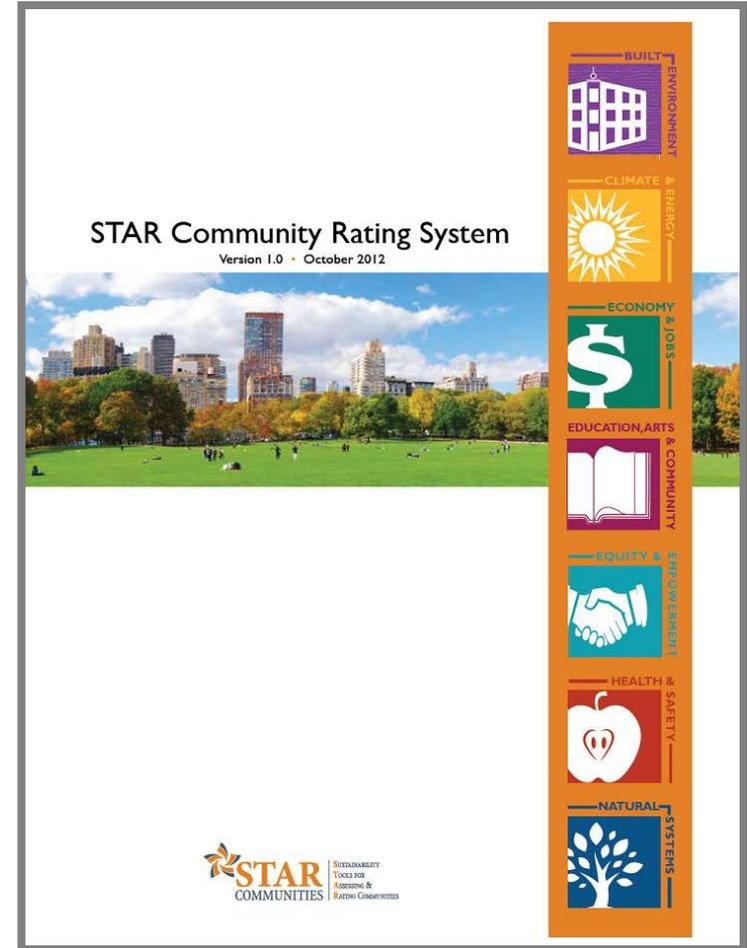
Number of Excerpts by Region



# [www.STARcommunities.org](http://www.STARcommunities.org) STAR Community Rating System

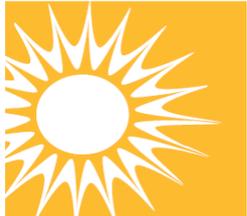
The **STAR Community Rating System** is an active roadmap and measuring system for practical sustainability results.

Released October 1, 2012, the Rating System is the first framework for evaluating the sustainability of U.S. communities.



# Framework of Goals & Objectives

Built Environment	Climate & Energy	Economy & Jobs	Education, Arts & Community	Equity & Empowerment	Health & Safety	Natural Systems
Ambient Noise & Light	Climate Adaptation	Business Retention & Development	Arts & Culture	Civic Engagement	Active Living	Green Infrastructure
Community Water Systems	Greenhouse Gas Mitigation	Green Market Development	Community Cohesion	Civil & Human Rights	Community Health & Health System	Invasive Species
Compact & Complete Communities	Greening the Energy Supply	Local Economy	Educational Opportunity & Attainment	Environmental Justice	Emergency Prevention & Response	Natural Resource Protection
Housing Affordability	Industrial Sector Resource Efficiency	Quality Jobs & Living Wages	Historic Preservation	Equitable Services & Access	Food Access & Nutrition	Outdoor Air Quality
Infill & Redevelopment	Resource Efficient Buildings	Targeted Industry Development	Social & Cultural Diversity	Human Services	Indoor Air Quality	Water in the Environment
Public Spaces	Resource Efficient Public Infrastructure	Workforce Readiness		Poverty Prevention & Alleviation	Natural & Human Hazards	Working Lands
Transportation Choices	Waste Minimization				Safe Communities	

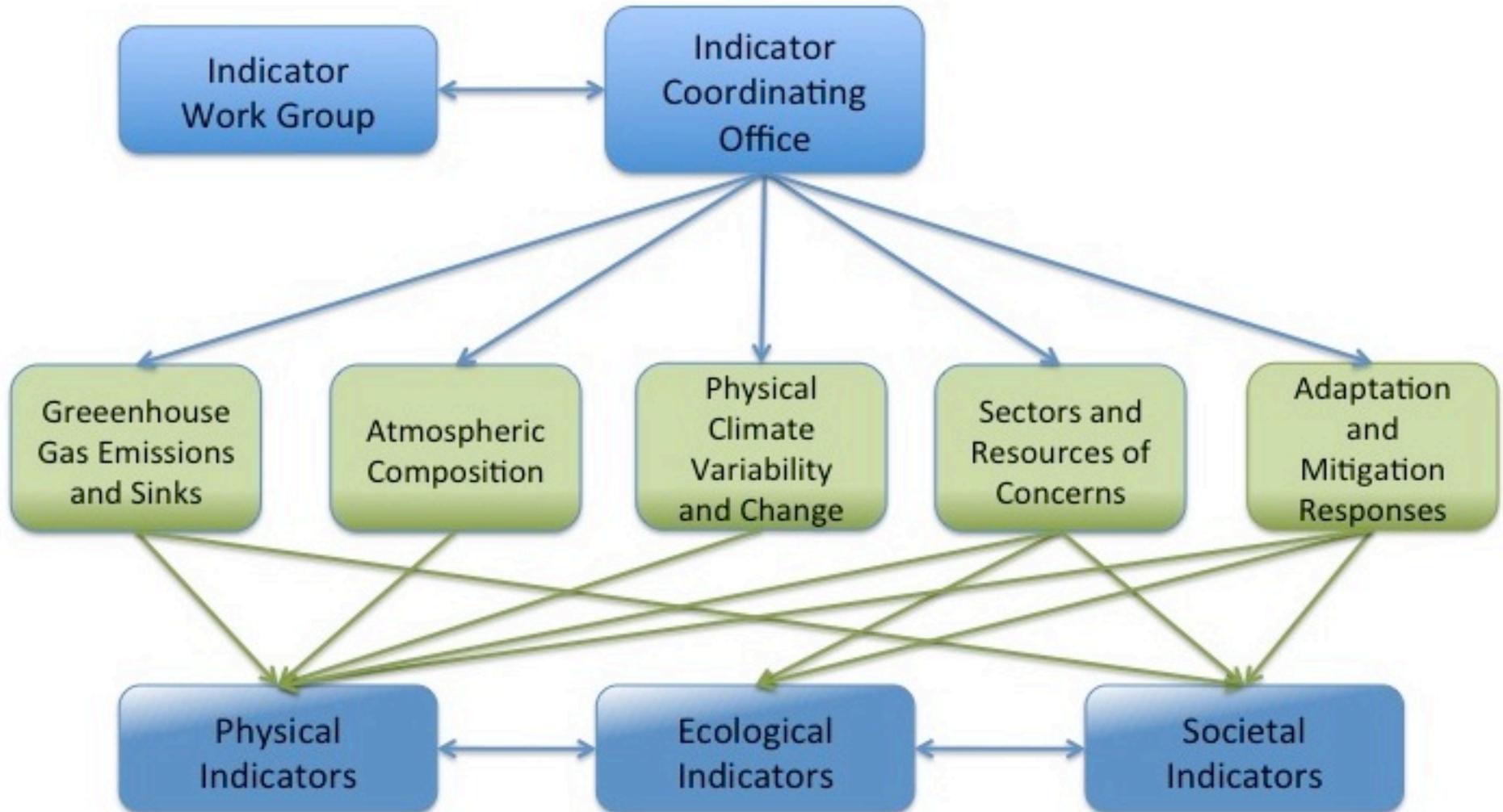


# Climate Adaptation: Outcome

- Demonstration of Outcome requires at least 2 vulnerability assessments
- Recommended evaluation strategy for assessing reductions in vulnerability:

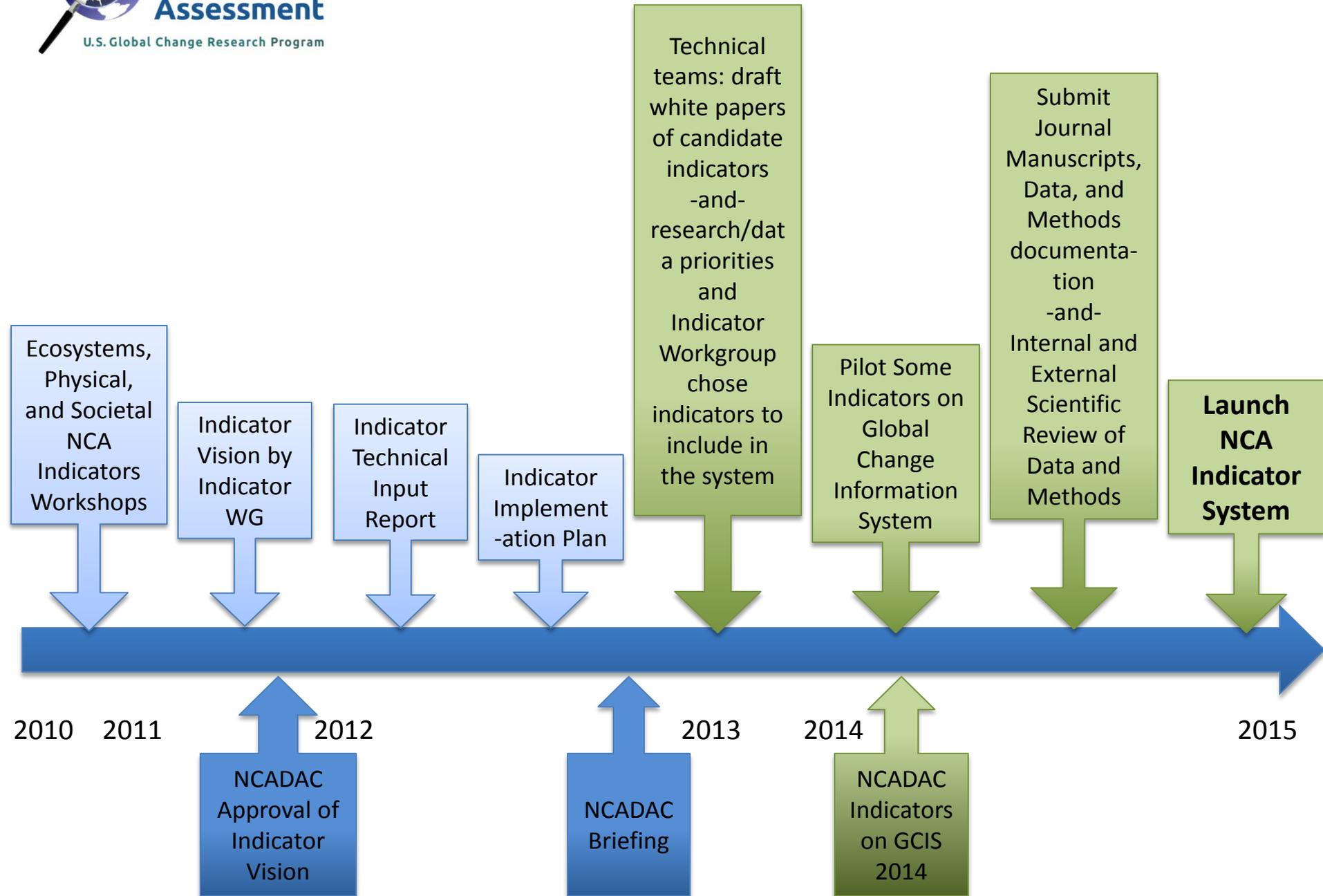
Vulnerability, Sensitivity and Adaptive Capacity Rankings

Sensitivity Ranking		Adaptive Capacity Ranking		Vulnerability Index	
S-0	System will not be affected by the impact	AC-0	System is not able to accommodate or adjust to impact	PO	Potential Opportunity
S-1	System will be minimally affected by the impact	AC-1	System is minimally able to accommodate or adjust to impact	V-1	Low Vulnerability
S-2	System will be somewhat affected by the impact	AC-2	System is somewhat able to accommodate or adjust to impact	V-2	Medium-Low Vulnerability
S-3	System will be largely affected by the impact	AC-3	System is mostly able to accommodate or adjust to impact	V-3	Medium Vulnerability
S-4	System will be greatly affected by the impact	AC-4	System is able to accommodate or adjust to impact in a beneficial way	V-4	Medium-High Vulnerability
				V-5	High Vulnerability



- Melissa Kenney, Lead PI for USGCRP National Climate Assessment Indicators System (Univ. of MD)
- Tony Janetos, Chair Indicators Work Group (DOE PNNL JGCRI)
- Deke Arndt, Co-chair Indicators WG and Chair Physical Indicators (NOAA NCDC)
- Bob Chen, Co-chair Indicators WG and Co-chair Societal Indicators (Columbia Univ, NASA CIESIN)
- Richard Pouyat, Chair Ecological Indicators (USDA USFS)
- Roger Griffis, Oceans and Coastal Team Co-lead (NOAA)
- Laurie Mcgilvary, Oceans and Coastal Team Co-lead (NOAA)
- Britta Bierwagen, Freshwater Ecosystems Team Lead (EPA ORD)
- Dennis Ojima, Grassland Team Lead (Colorado State Univ.)
- Nancy Cavallaro, Grassland Team Co-lead (USDA NIFA)
- Jake Weltzin, Phenology Team Lead (USGS NPN)
- Mike McGeehin, Health Team Lead (RTI International)
- Tom Wilbanks, Energy and Infrastructure Team Lead (ORNL)
- Leon Clarke, Mitigation and GHG Team Lead (DOE PNNL JGCRI)
- Jerry Hatfield, Agriculture Team Lead (USDA)
- Linda Heath, Forest Team Lead (USDA - USFS)
- Pending – Adaptation and Hazards technical team leads

- Submit articles to *Climatic Change* and *Nature Climate Change* from the Indicators Technical Input Report (early 2013)
- **DUE: Technical teams recommendations (June 2013)**
  - **conceptual model, matrix of indicator recommendations, research priorities**
- Indicator WG recommends indicators for initial system (Summer 2013)
- Documentation on each of the indicators (end 2013)
- Inclusion of pilot indicators in GCIS release (March 2014)
- NCADAC, internal, and external review of the system – data and methods (2014)
- **Launch indicator system on GCIS (2015)**
  - Special Issue of journal (prospectus to *PNAS*) on the Indicator System (publish in 2015 with release of indicator system)
  - Evaluate and improve the indicator system; pilot indicators from research findings



**Indicators:** If you have an indicator that should be considered as a candidate in the NCA Indicator System, please send a short summary description and the supporting information.

**Experts:** If you would like to be considered on a technical team to vet candidate indicators for the system, please send a short summary of your indicators expertise and your CV.

**Policy Interns:** If you are interested in a policy internship, please send short description of your interest and your CV.

Email: [indicators@usgcrp.gov](mailto:indicators@usgcrp.gov)

<http://assessment.globalchange.gov>