# Indicators to Inform Sustainability Decisions: Prototype of National Climate Indicator System

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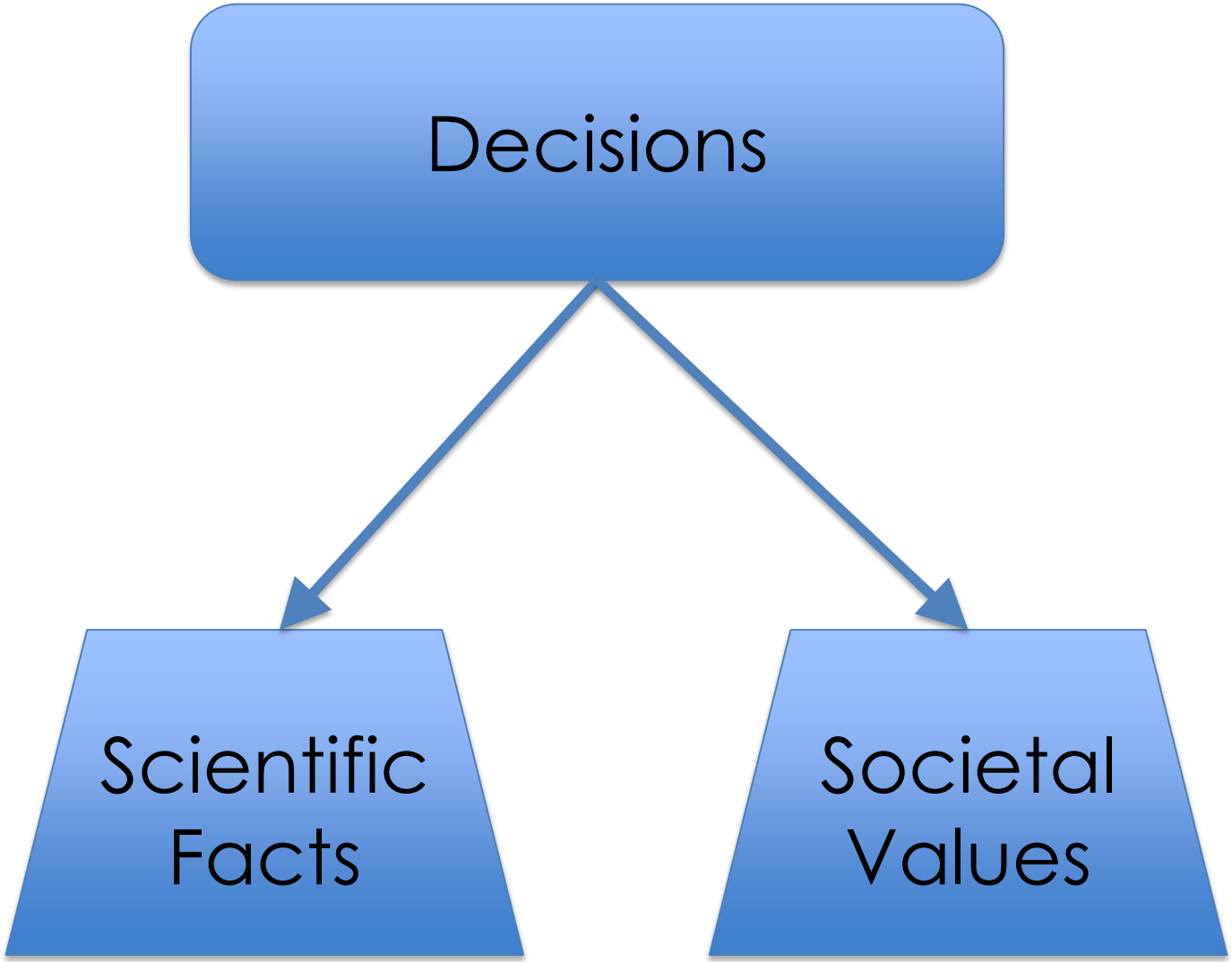
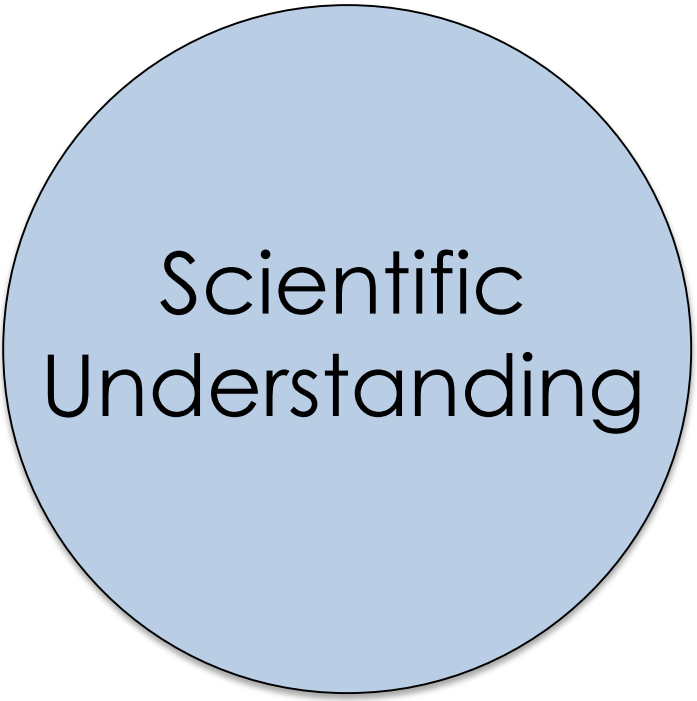
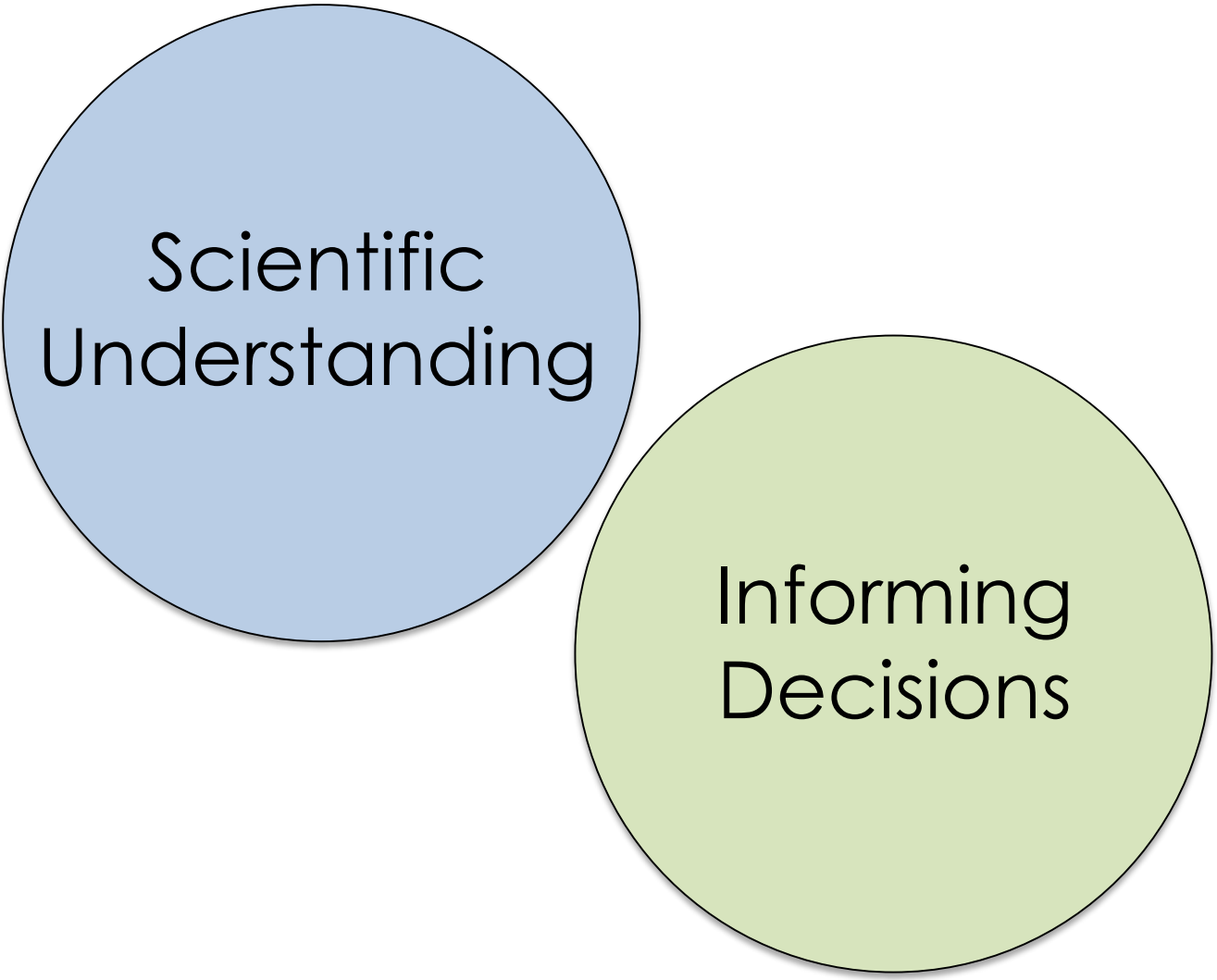
Cooperative Institute for Climate and Satellites - Maryland

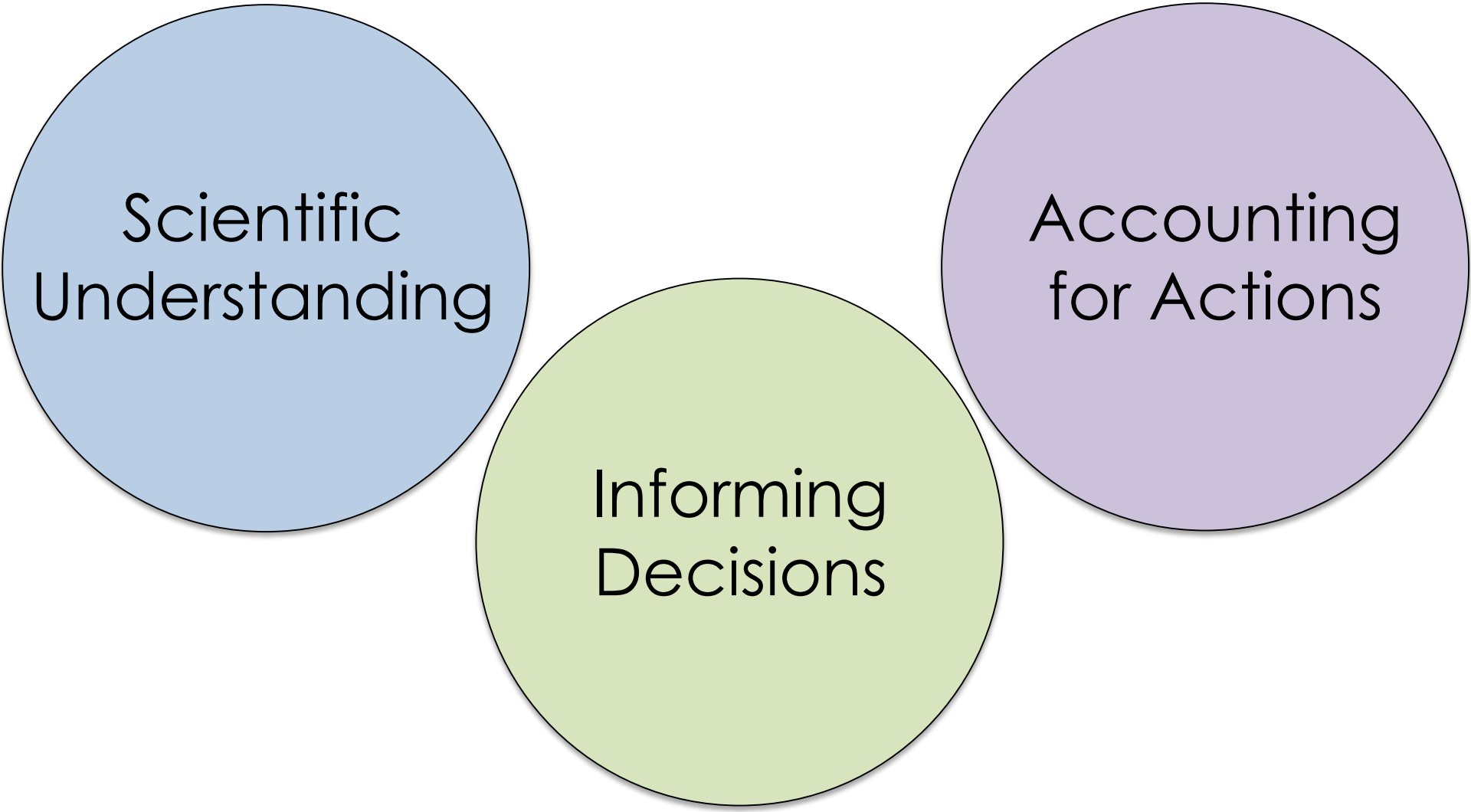
# Indicators are…

observations, modeled data, or aggregations that describe status, rates of change, and/or trends of phenomenon that are critical to track, relative to a baseline of change, for scientific understanding and policy decisions.

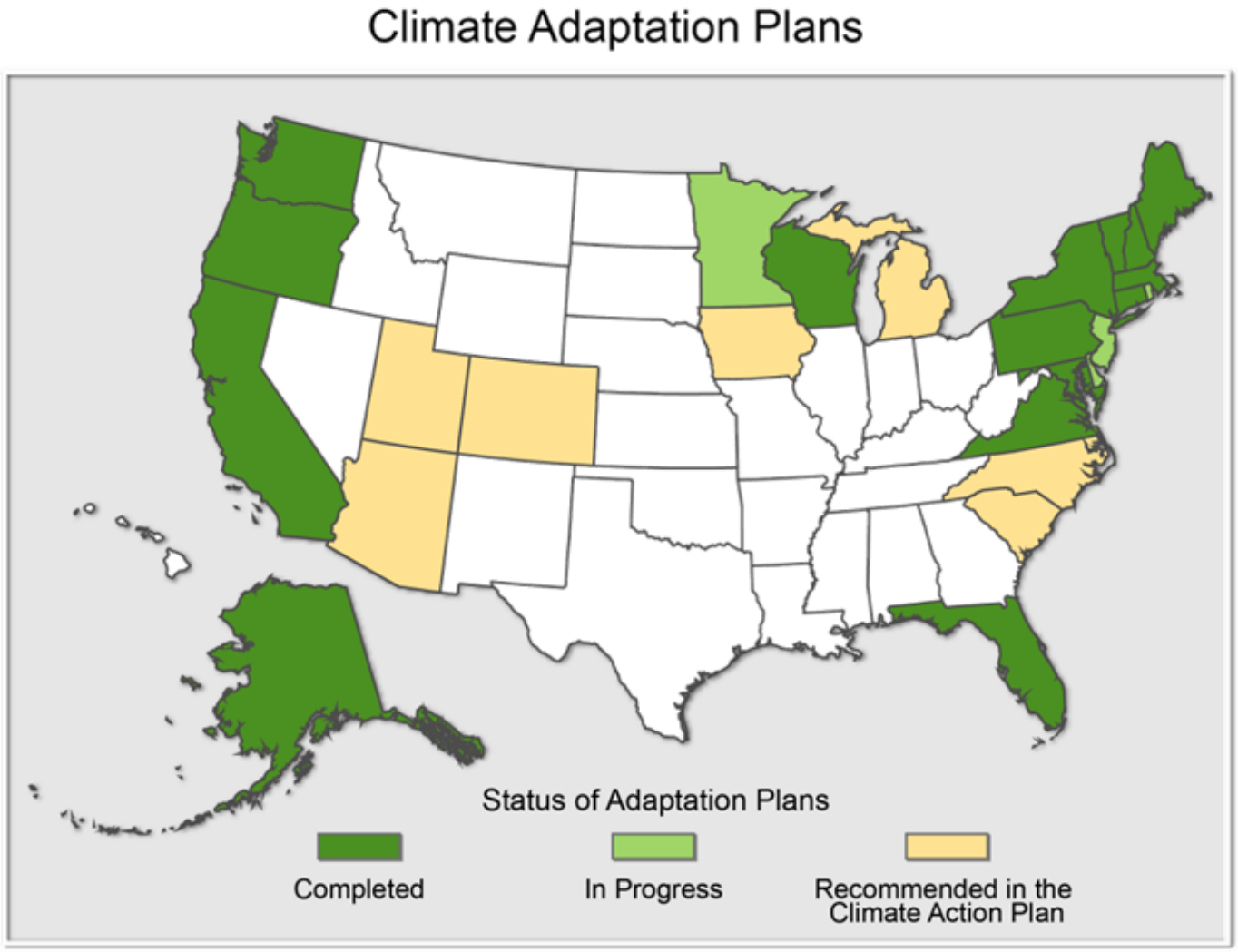

Decisions
Scientific Facts
Societal Values


Scientific
Understanding

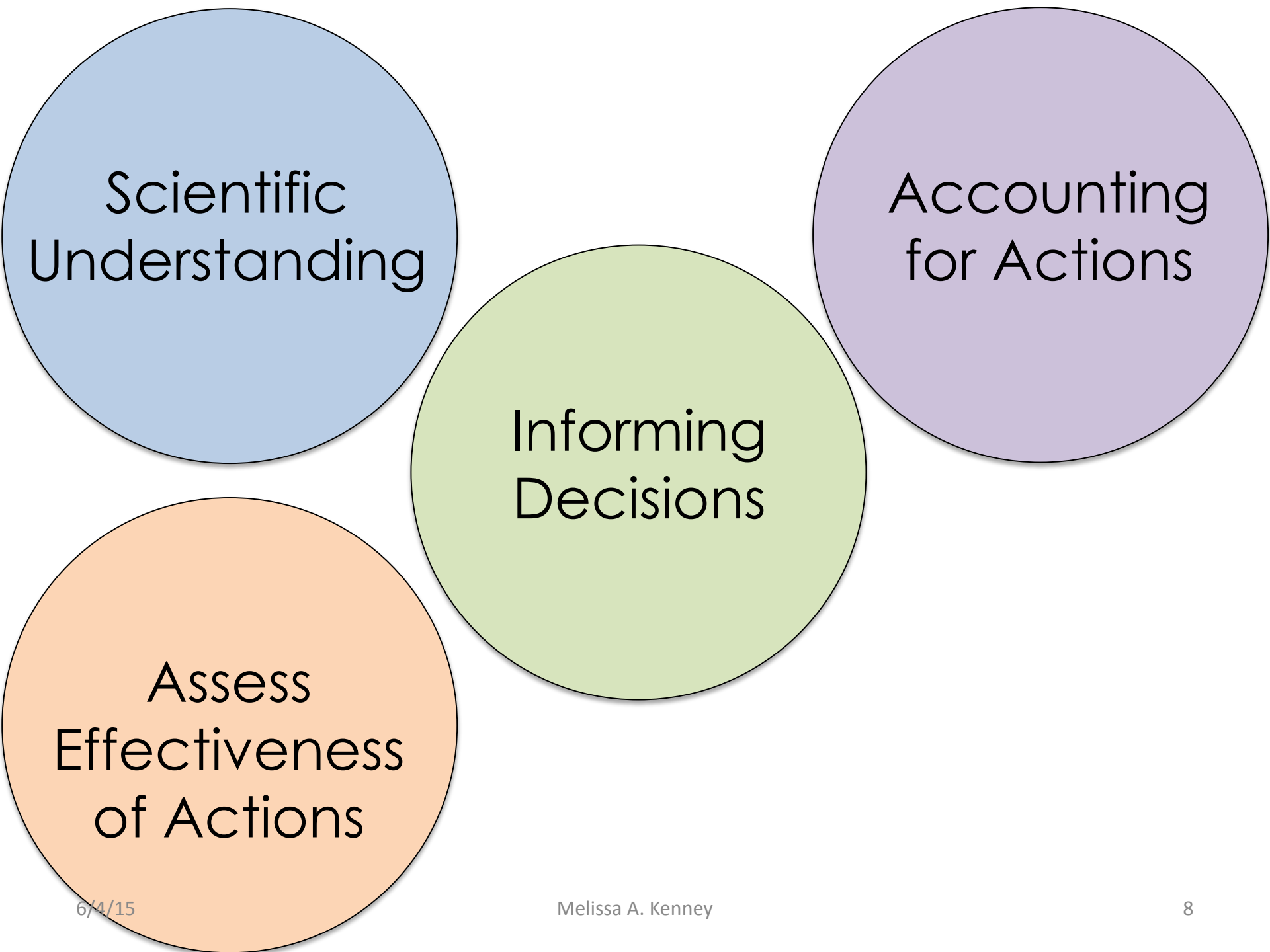

Scientific Understanding
Informing Decisions


Scientific Understanding
Informing Decisions
Accounting for Actions

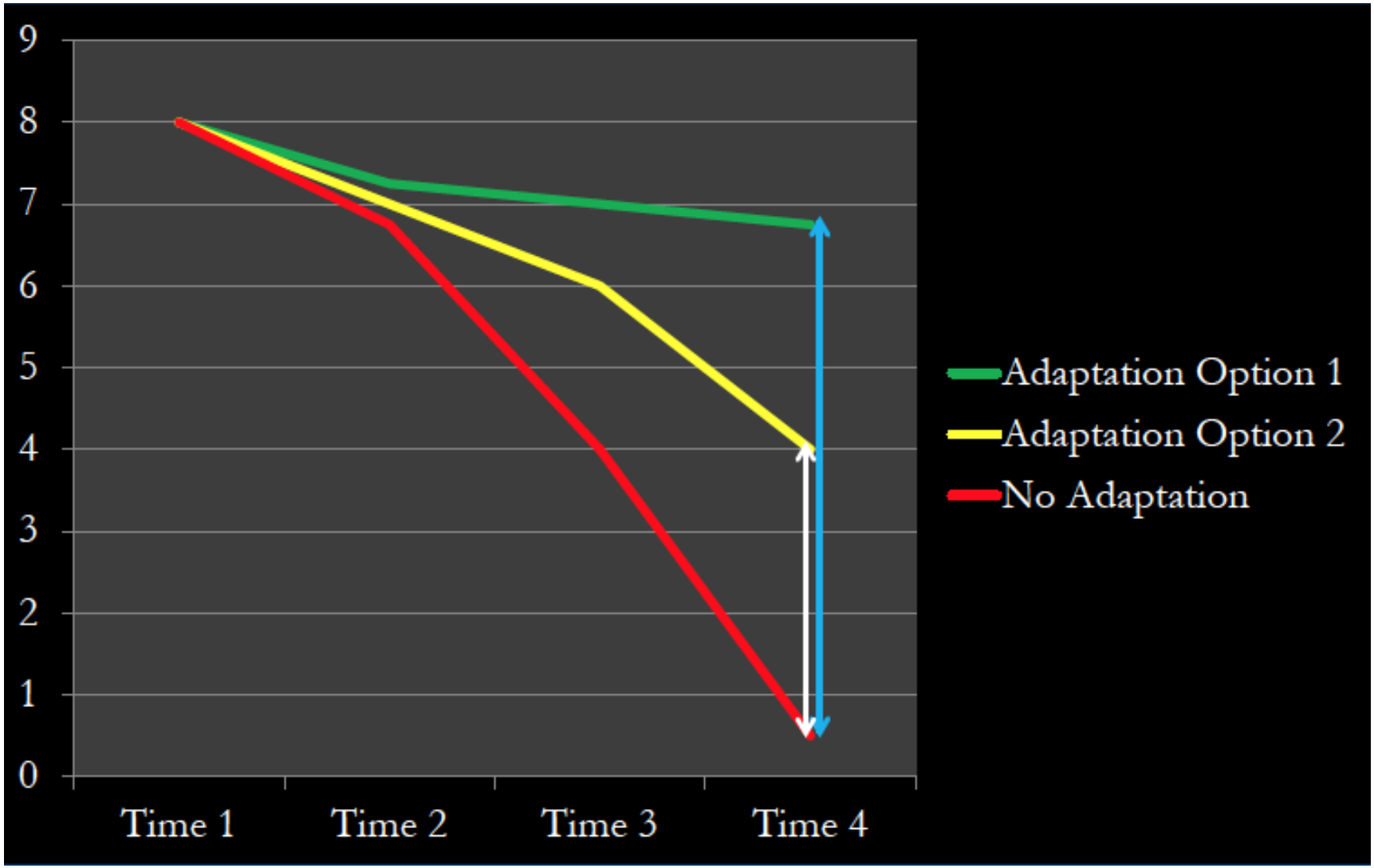
# Adaptation Accounting Indicators



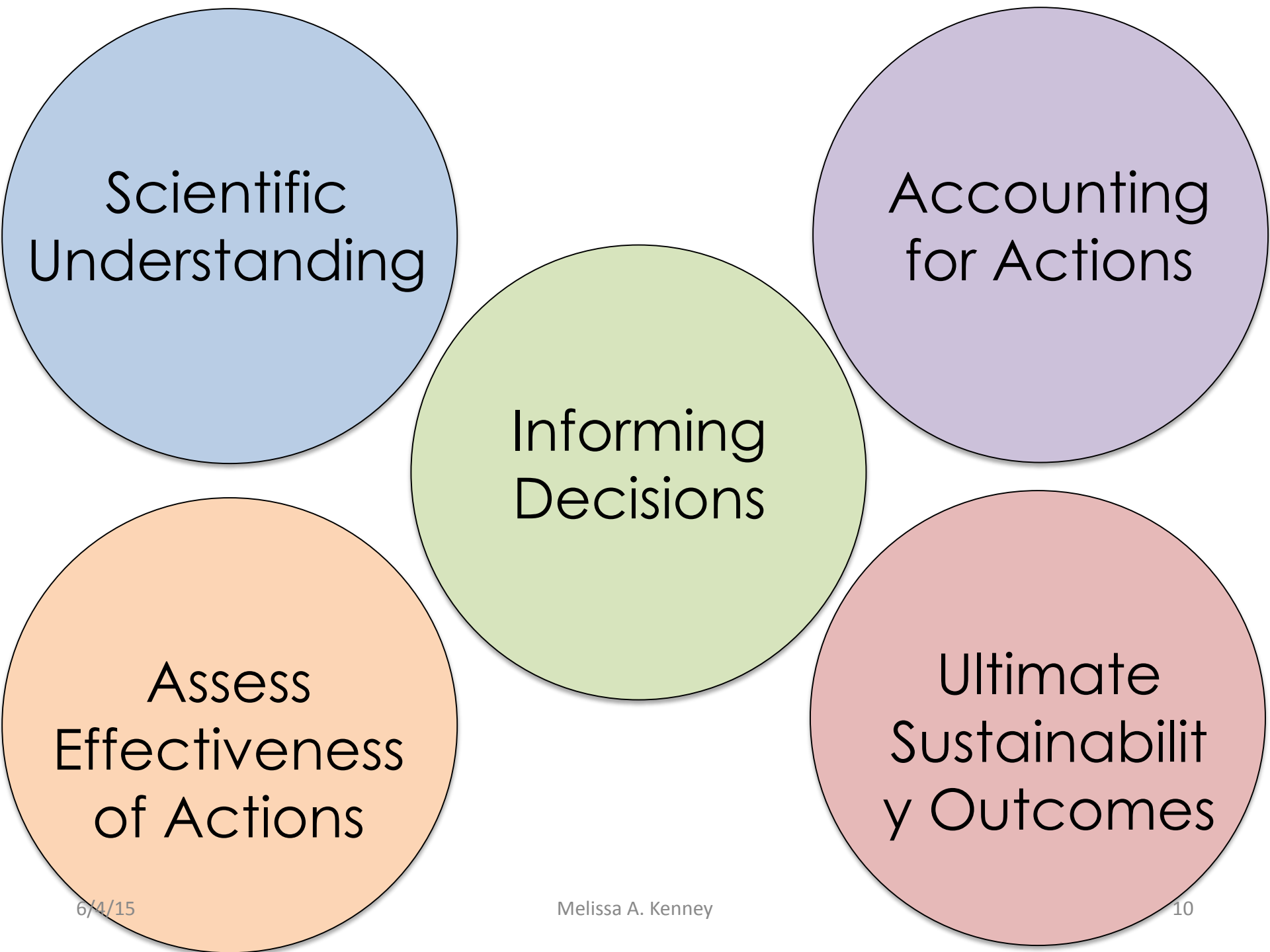

From Draft U.S. National Climate Assessment Report, 2013

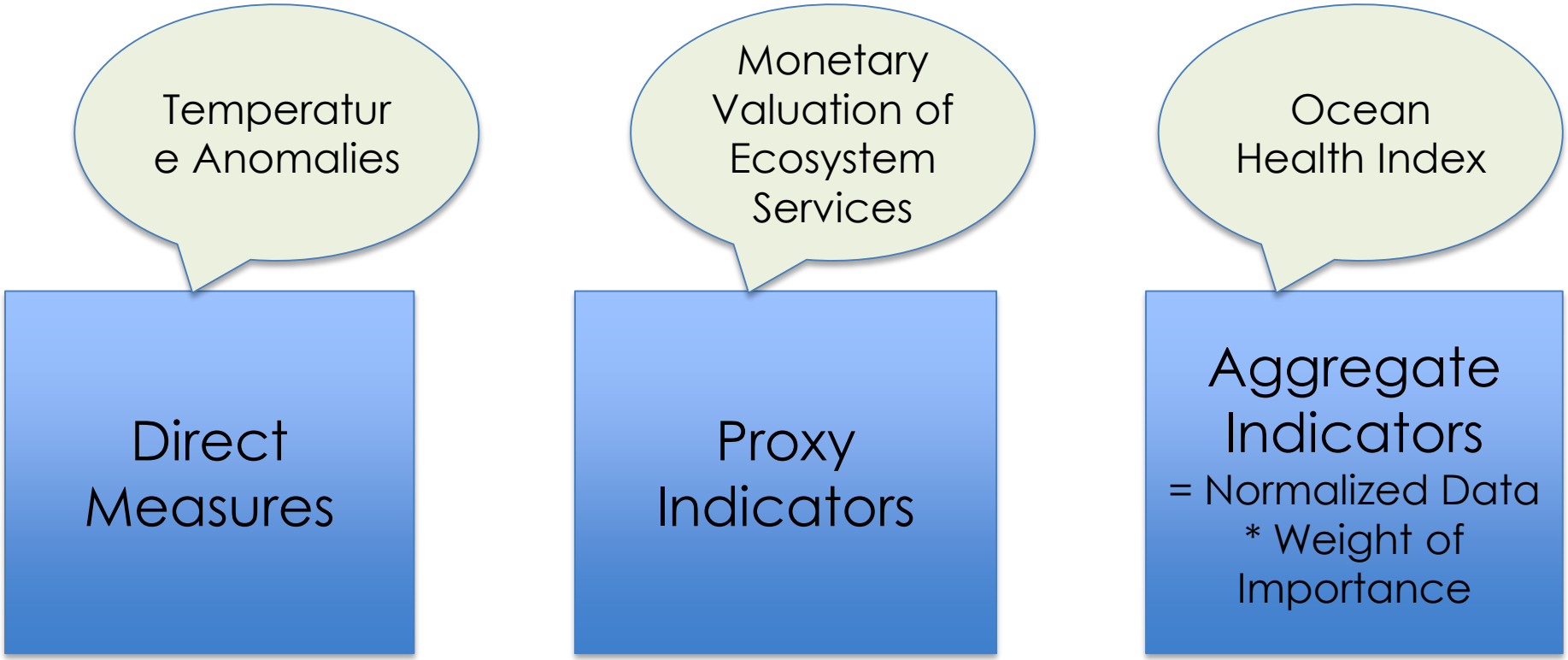

Scientific Understanding
Accounting for Actions
Informing Decisions
Assess Effectiveness of Actions

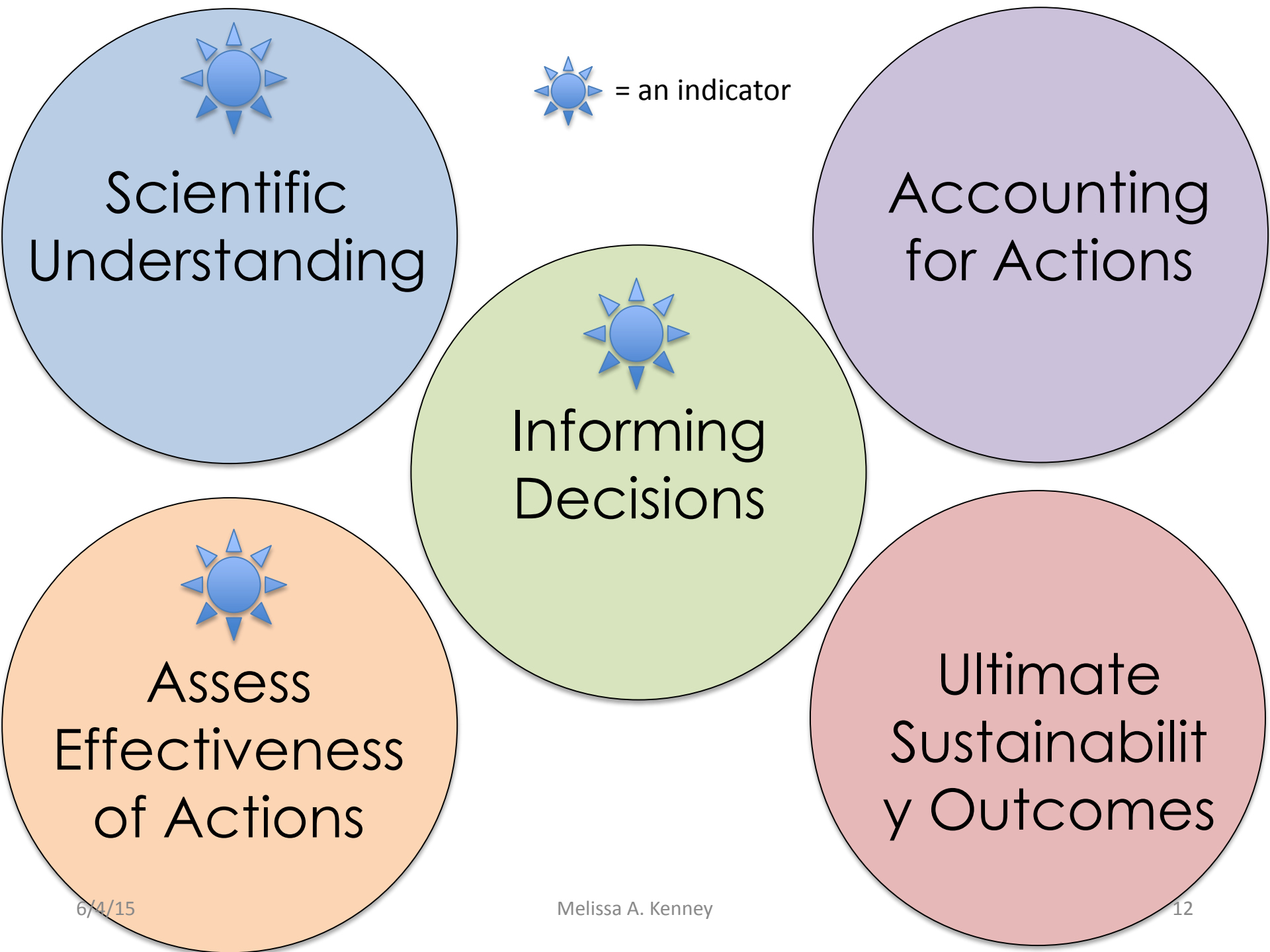
# Adaptation Effectiveness




From Staudt and Stein, 2013


Scientific Understanding
Accounting for Actions
Informing Decisions
Assess Effectiveness of Actions
Ultimate Sustainabilit y Outcomes

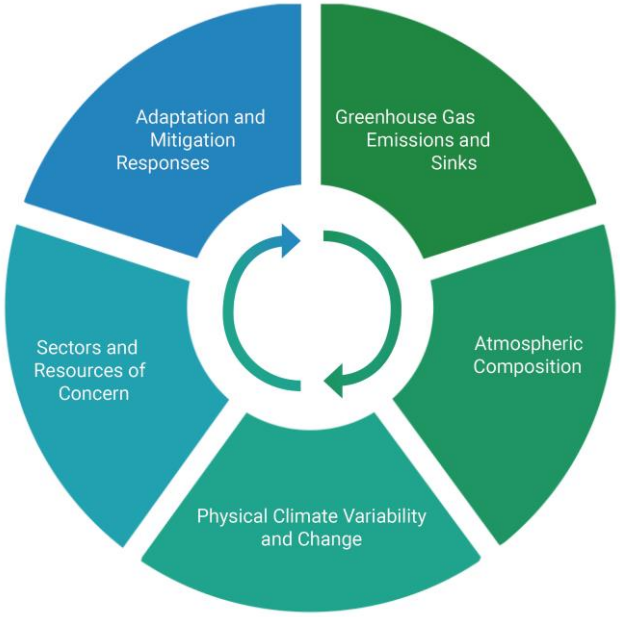

Temperatur e Anomalies
Monetary Valuation of Ecosystem Services
Ocean Health Index
Direct Measures
Proxy Indicators
Aggregate Indicators
= Normalized Data * Weight of Importance


= an indicator
Scientific Understanding
Informing Decisions
Accounting for Actions
Assess Effectiveness of Actions
Ultimate Sustainabilit y Outcomes

# Recommendation: National Climate Indicators System

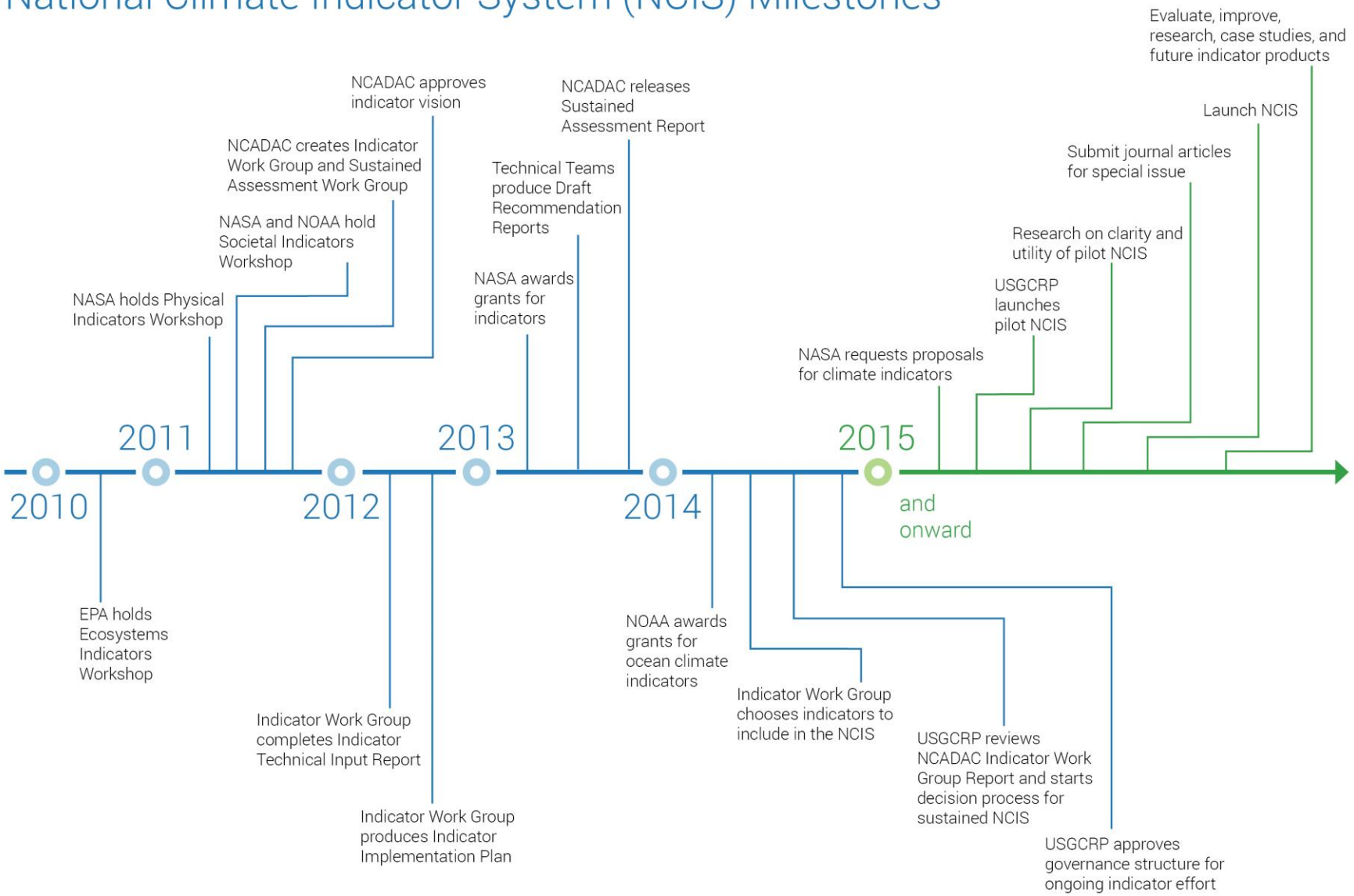
*A system of physical, ecological, and societal indicators that communicate and inform decisions about key aspects of climate changes, impacts, vulnerabilities, and preparedness.*

- Provide meaningful, authoritative climate-relevant measures about the status, rates, and trends of key physical, ecological, and societal variables and values;
- Inform decisions at multiple scales
- Identify climate-related conditions and impacts
- Provide analytical tools by which user communities can derive their own indicators for particular purposes.

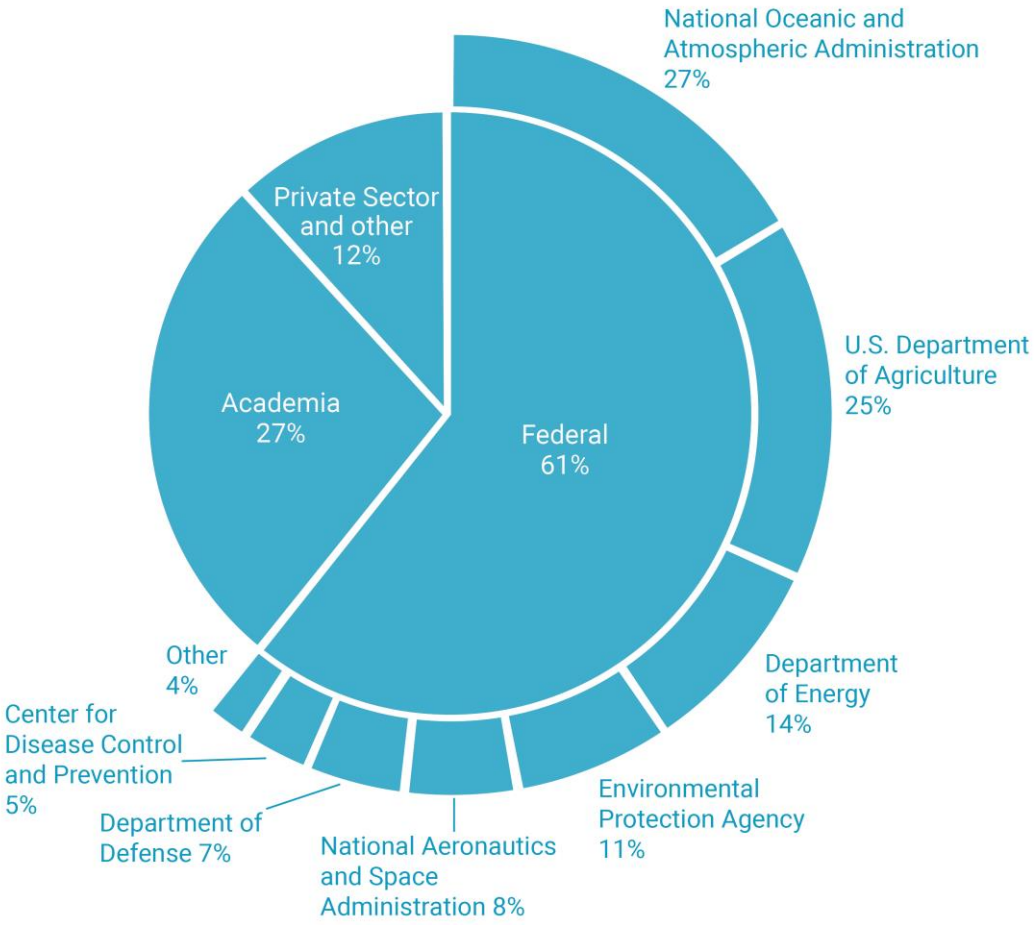



**Categories of Indicators: Framework for the National Climate Assessment Indicator System**

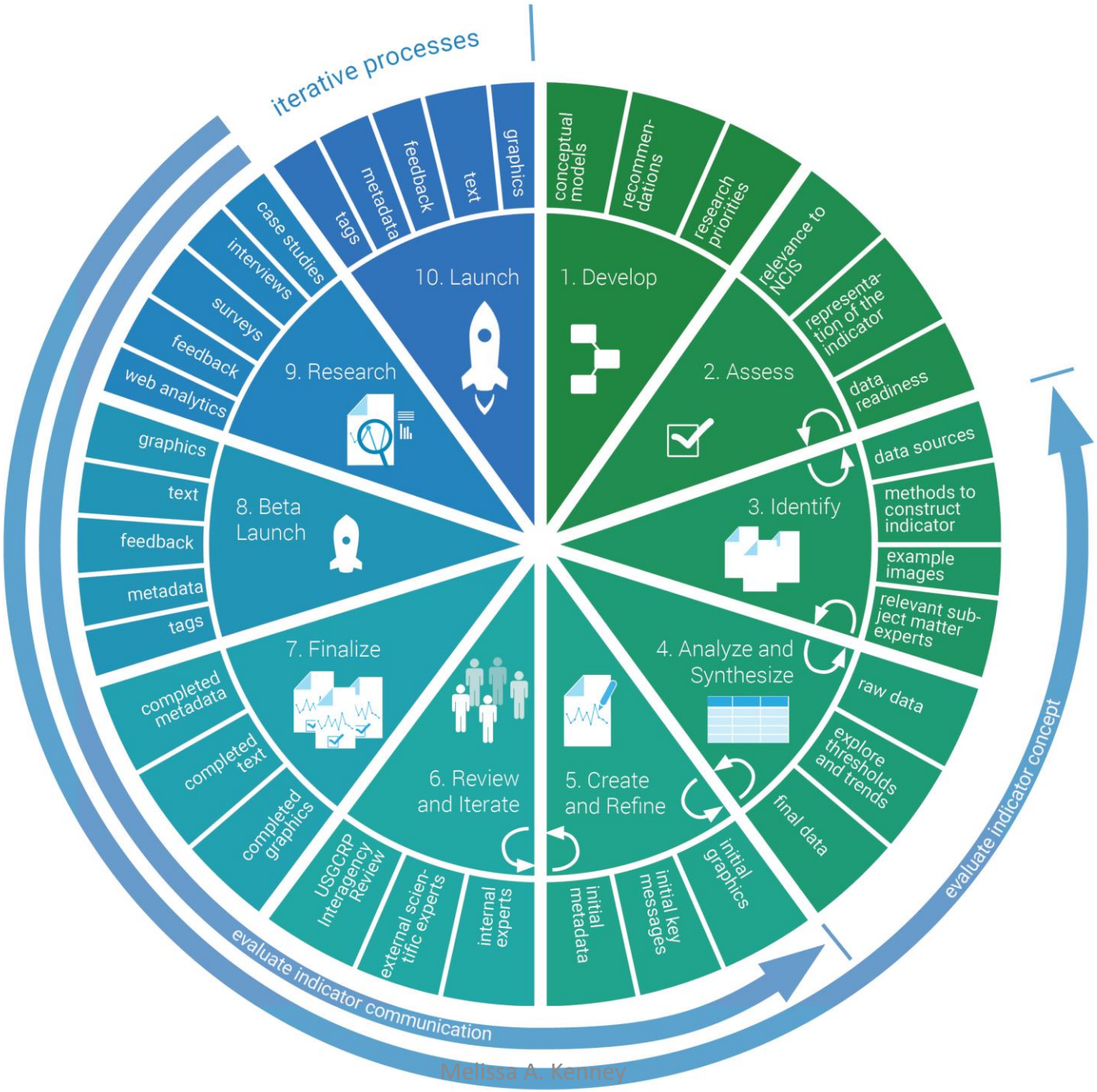
# National Climate Indicator System (NCIS) Milestones

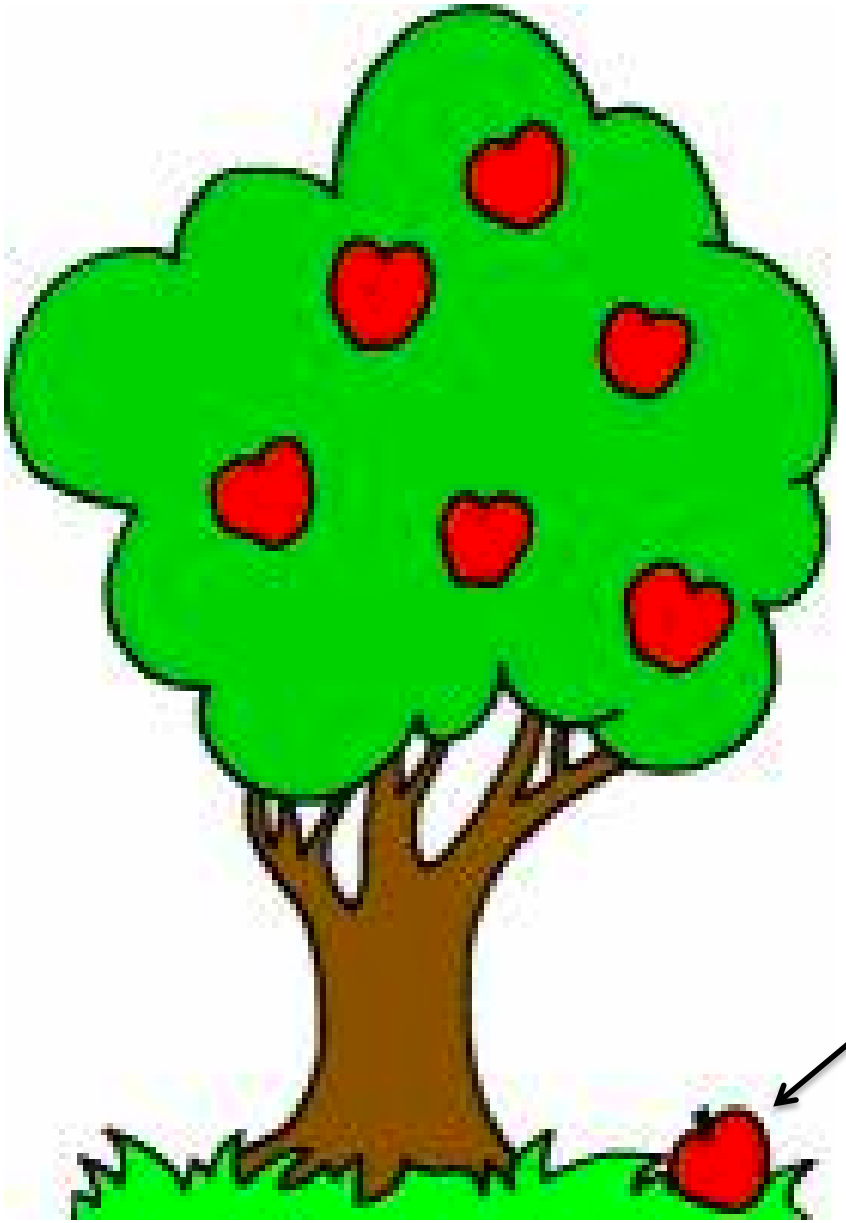


# Multidisciplinary teams = 200+ scientists



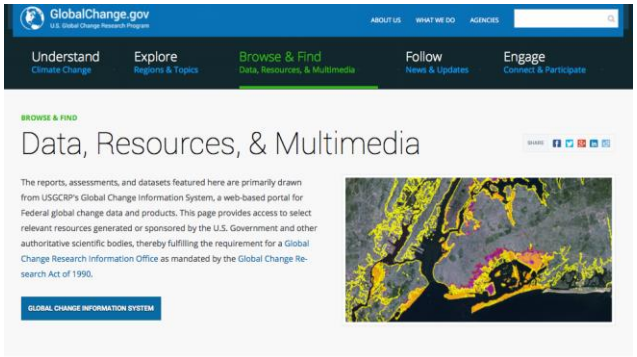

- **NCADAC Indicator Work Group**
- Atmospheric Composition and Physical Climate
- Water Cycle and Management
- Oceans and Coasts
- Forests
- Grasslands, Rangelands, and Pastures
- Agriculture
- Energy
- Infrastructure
- Health
- Phenology and Seasonal Timing
- Freshwater Ecosystems
- Mitigation and Greenhouse Gases
- Adaptation and Hazards
- Biodiversity


iterative processes
1. Develop
conceptual models
recommen-dations
research priorities
2. Assess
relevance to NCIS
representa-tion of the indicator
data readiness
3. Identify
data sources
methods to construct indicator
example images
relevant sub-ject matter experts
4. Analyze and Synthesize
raw data
explore thresholds and trends
final data
5. Create and Refine
initial graphics
initial key messages
initial metadata
6. Review and Iterate
internal experts
external scien-tific experts
USGCRP Interagency Review
7. Finalize
completed graphics
completed text
completed metadata
8. Beta Launch
graphics
text
feedback
metadata
tags
9. Research
web analytics
feedback
surveys
interviews
case studies
10. Launch
tags
metadata
feedback
text
graphics
evaluate indicator communication
evaluate indicator concept

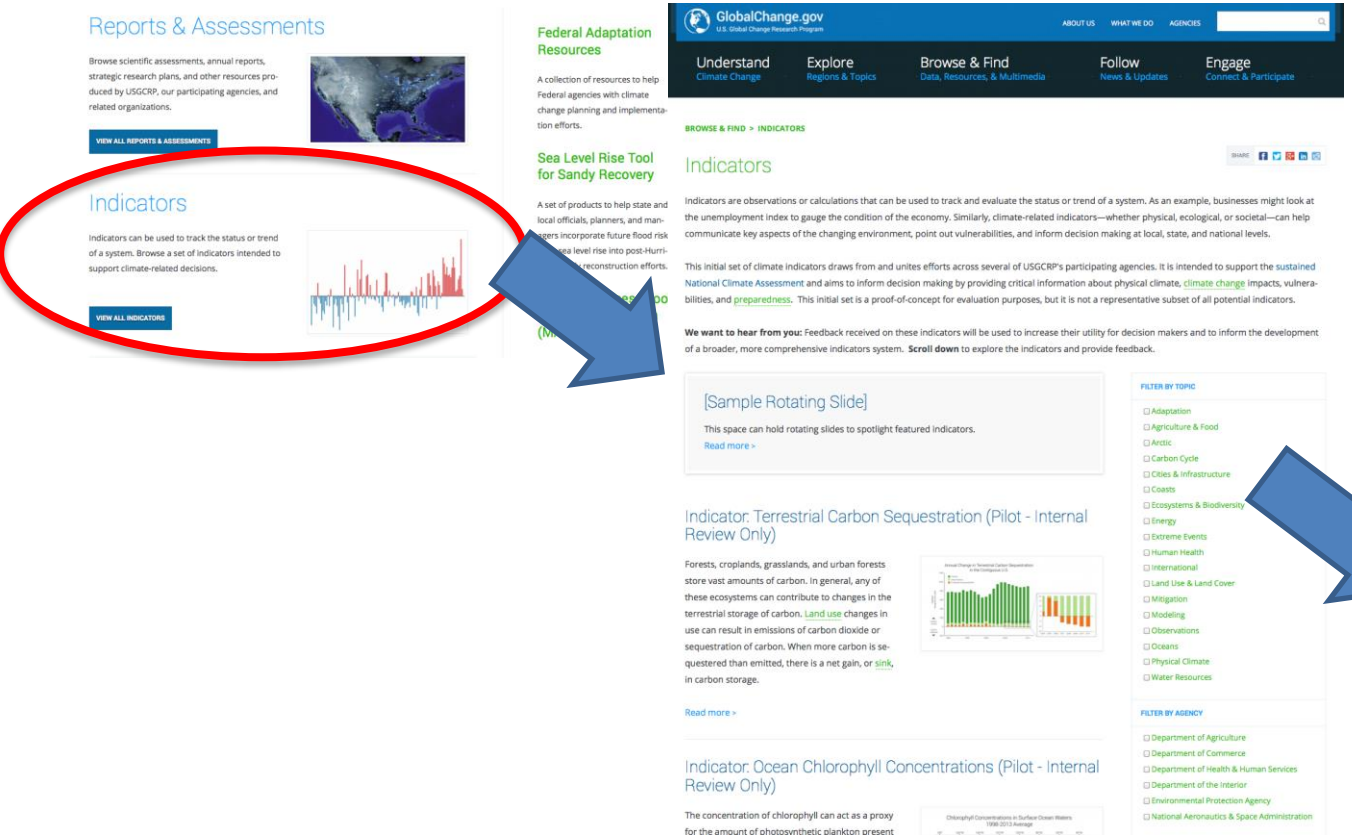


**Prototype Indicators**

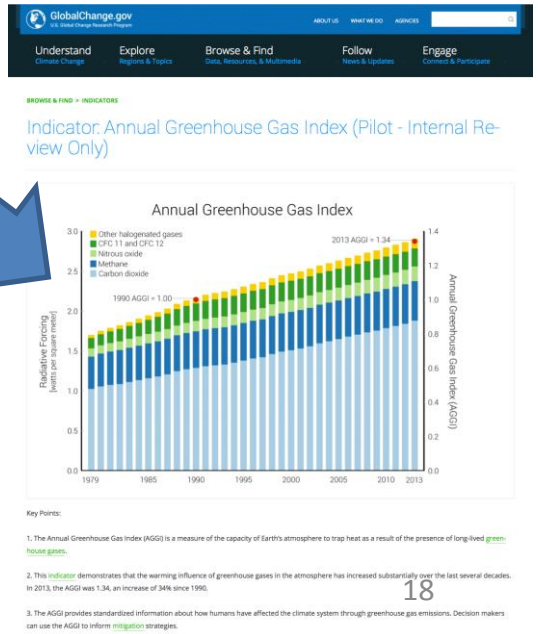
# Indicators system link within "Browse and Find" section




## Indicators system landing page




## Individual indicator



Indicator graphic with downloadable high-resolution version →

Key Points →

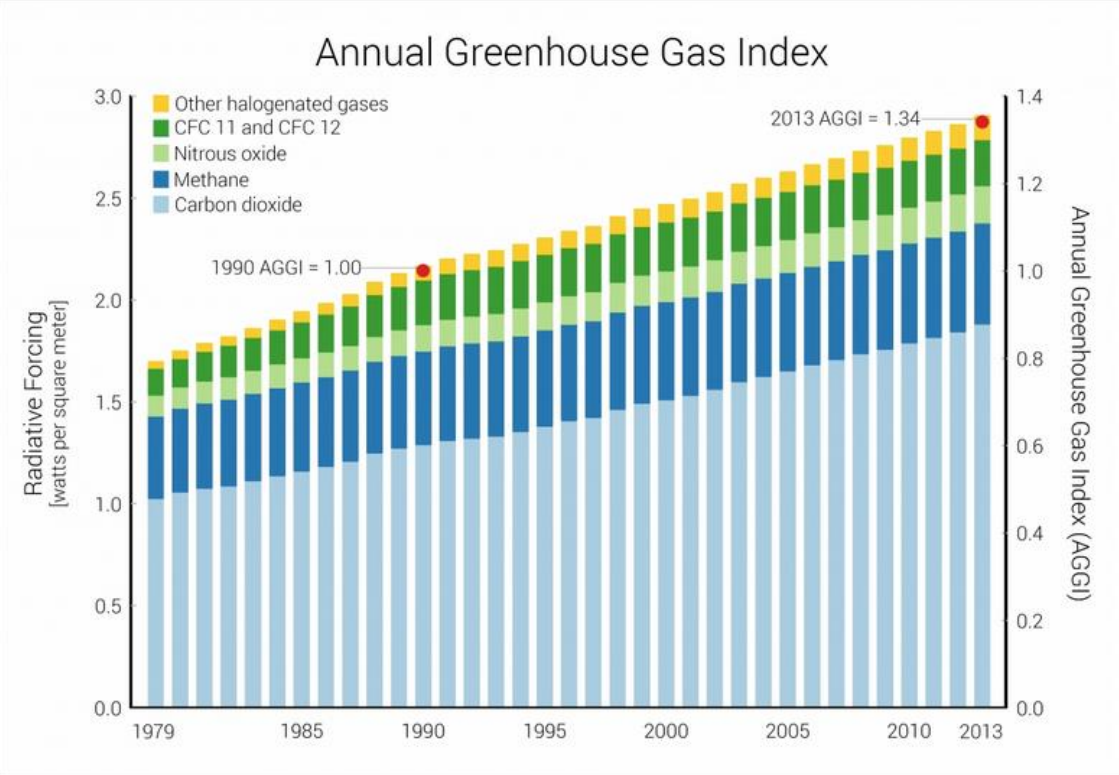
GlobalChange.gov
U.S. Global Change Research Program

ABOUT USGCRP | WHAT WE DO | AGENCIES

Understand Climate Change | Explore Regions & Topics | Browse & Find Resources, Data, & Multimedia | Follow News & Updates | Engage Connect & Participate

BROWSE & FIND > INDICATORS

# Indicator: Annual Greenhouse Gas Index




Key Points:

1. The Annual Greenhouse Gas Index (AGGI) is a measure of the capacity of Earth's atmosphere to trap heat as a result of the presence of long-lived greenhouse gases. The AGGI provides standardized information about how human activity has affected the climate system through greenhouse gas emissions.

2. This indicator demonstrates that the warming influence of greenhouse gases in the atmosphere has increased substantially over the last several decades. In 2013, the AGGI was 1.34, an increase of 34% since 1990.

3. The AGGI can inform decisions about mitigation strategies.

Full summary text expands on Key Points →

Full Summary:

Radiative forcing (shown on the left vertical axis) is the change in the amount of solar radiation, or energy from the sun, that is trapped by the atmosphere and remains near Earth. When radiative forcing is greater than zero, it has a warming effect; when it is less than zero, it has a cooling effect. In this indicator, radiative forcing from long-lived greenhouse gases is shown relative to the year 1750. The AGGI (shown on the right vertical axis) is an index of radiative forcing normalized to the year 1990; it shows how the warming influence of greenhouse gases in the atmosphere has increased since that year.

This indicator demonstrates the change in radiative forcing resulting from changing concentrations of the following greenhouse gases: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), chlorofluorocarbons (CFC-11 and CFC-12), and a set of 15 minor, long-lived halogenated gases. The National Oceanic and Atmospheric Administration (NOAA) Global Monitoring Division provides high-precision measurements of the abundance and distribution of long-lived greenhouse gases that are used to calculate global average concentrations. Radiative forcing for each gas is computed from these concentrations, and total radiative forcing for all gases is used to calculate the AGGI.

The AGGI shows that the warming influence of long-lived greenhouse gases in the atmosphere increased by 34% between 1990 and 2013. Carbon dioxide is currently the largest contributor to radiative forcing. Radiative forcing from methane increased between 2007 and 2013 after having been nearly constant from 1999 to 2006. Owing to the Montreal Protocol, an international agreement signed in 1987, CFCs have been decreasing since the mid- to late 1990s after a long period of increase. However, CFC replacements (many of the "other halogenated gases" in the graph) have been increasing since the phase-out of CFCs.

Fundamentally, the AGGI is a measure of what human activity has already done to affect the climate system through greenhouse gas emissions. It provides quantitative information in a simplified, standardized format that decision makers can use to inform mitigation strategies.

## About this resource

Topics for sorting →
Federal agencies →
Link to GCIS metadata →

| | |
|---|---|
| **Topics:** | Physical Climate, Observations, Mitigation, International, Carbon Cycle, Energy |
| **Contributors:** | National Oceanic and Atmospheric Administration Earth System Research Laboratory |
| **More info:** | View metadata in GCIS |

Feedback Module →

| | | | |
|---|---|---|---|
| Do you understand the indicator image? | Yes | No | To some extent |
| Is the indicator clearly explained? | Yes | No | To some extent |
| Is this indicator relevant to decisions you make about climate change, such as planning, resource management, or policy making? | Yes | No | To some extent |

PROVIDE MORE FEEDBACK

# Structure of an Indicator in Global Change Information System (GCIS; metadata network)

**Globalchange.gov**

GCIS

**Indicator**

- Figure
- Text summary

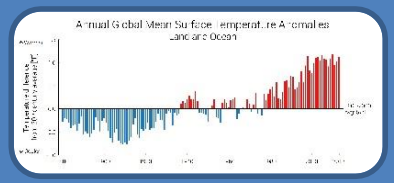
**Contributors**

- Point of Contact (e.g. Deke Arndt)
- Data provider (e.g. NOAA)

**Figure**

Can be multiple images, in pilot we have one image per figure

**Image**



**Dataset**

e.g. USHCN temperature data

**Activity**

e.g. 20th century average calculated to produce baseline for anomaly, converted C to F

data.globalchange.gov/

# Decision-making Elements and Outcomes


**Decision support PROCESSES include...**

- Framework for decision-making
- Co-production of knowledge
- Assessments of impacts and vulnerabilities
- Boundary processes to link scientists and decision makers

**Decision support TOOLS include...**

- Scenarios and scenario planning
- Data management and visualization
- Comparative tradeoff methods
- Integrated assessment models
- Data management systems

**Effective Decision-Making**

***Process Outcomes:***
Strengthen relationships and build trust among participants

***Decision Outcomes:***
Consensus about problems, objectives, and options for action

**Short-term outcomes include...**

- More relevant information
- Insights
- Assessment of significance of uncertainties
- Clearer tradeoffs
- Stronger accountability

*U.S. National Climate Assessment (2014) http://nca2014.globalchange.gov/*


WAIT! WE NEED TO CONSIDER ALL OUR STAKEHOLDERS!
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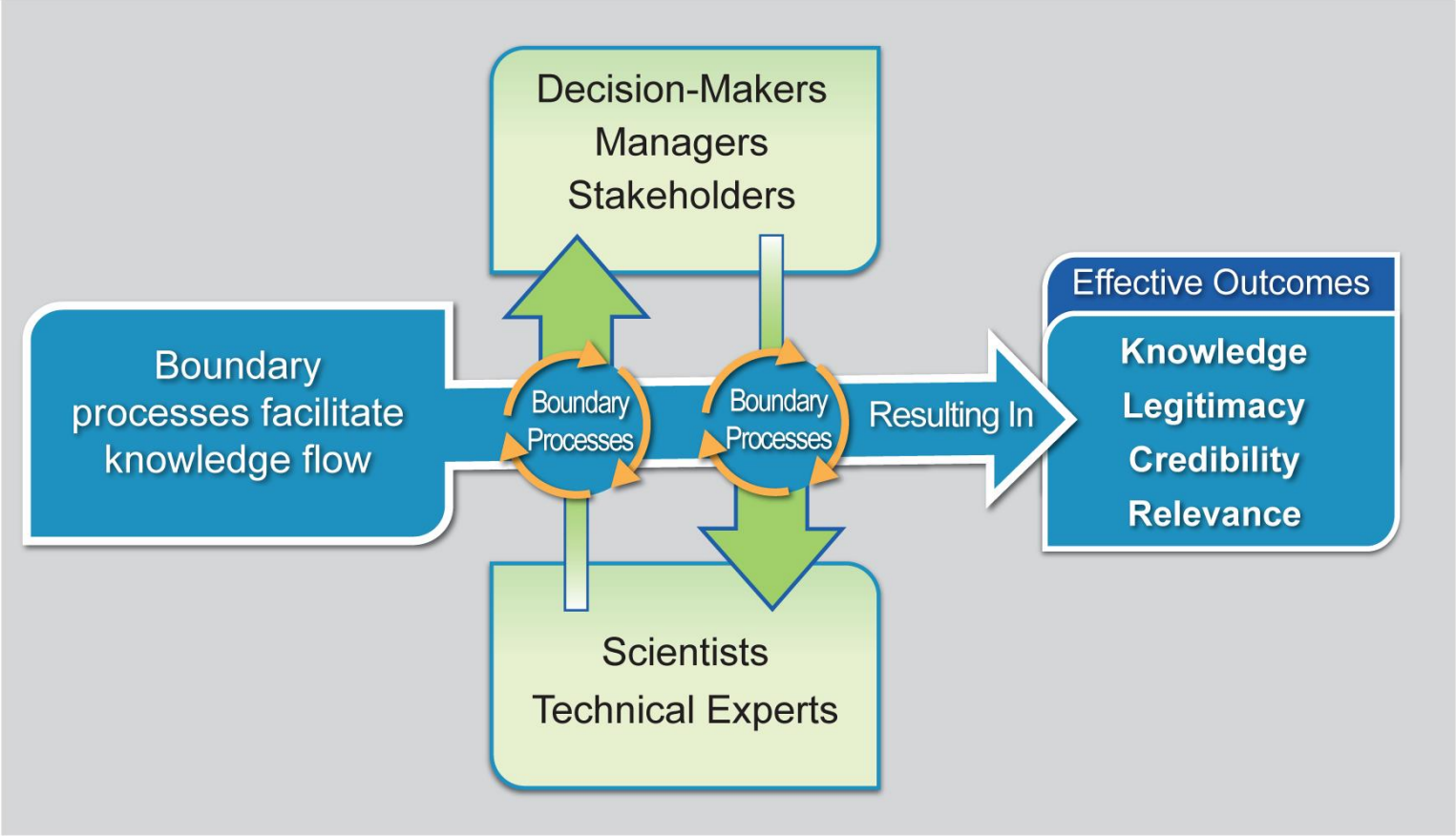
OXFORD CREATIVITY

## Boundary Processes Linking Decision-Makers and Scientific/Technical Experts

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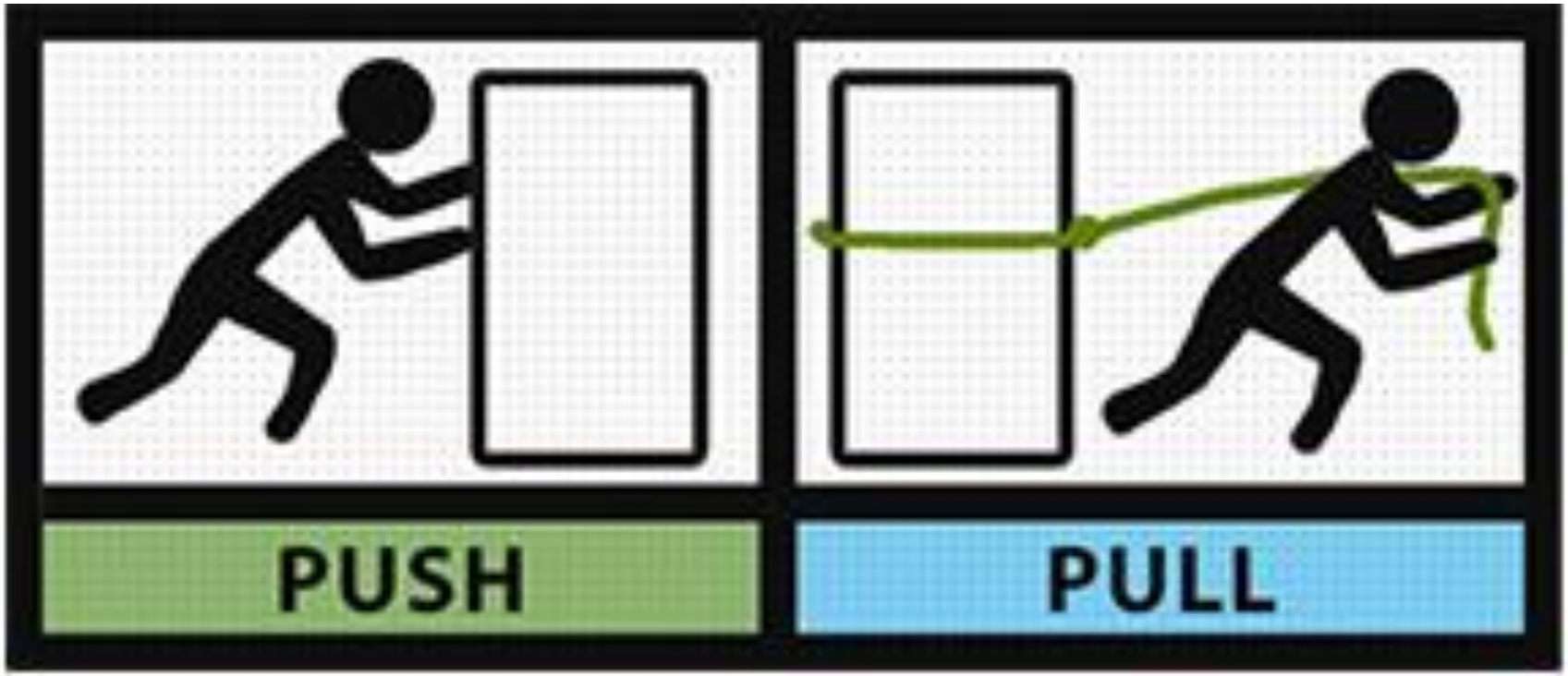
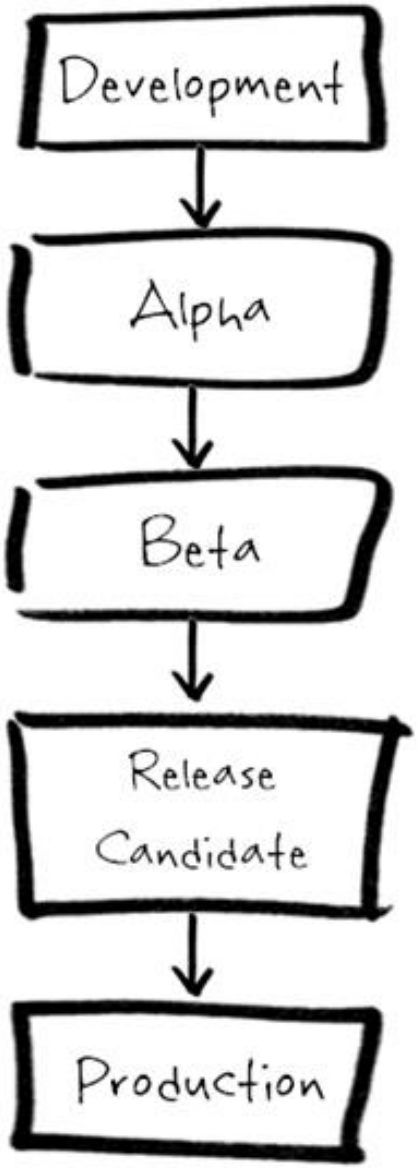
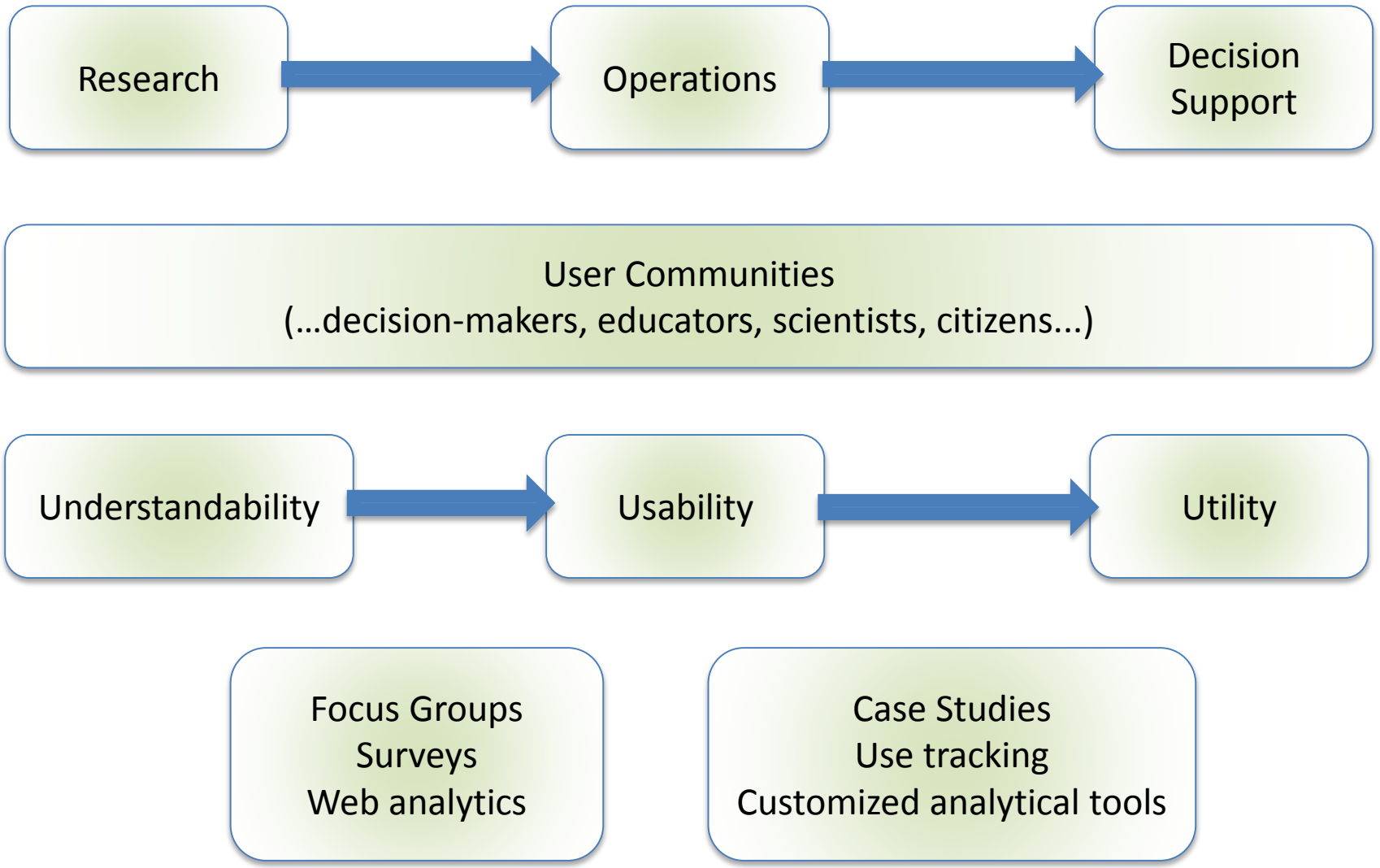

PUSH
PULL

# Iterative User-focused Design and Development




Using a software development model allows the development of indicators and decision support products given scientific assessments of understandability, usability, and utility (defined for multiple purposes).

# Co-creation: Design and Redesign



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  - Do indicators constrain or expand decision structuring?
  - Case studies addressing spatial and temporal scalability and impacts on conceptual framing
  - Guidance of a small set of indicators of change -> measured across projects and landscapes to assess whether we're more sustainable and broadly inform decisions

# Funding and In-kind Support

Major funding to Kenney's research team from the NOAA Climate Program Office for development of recommendations, prototype, and initial evaluative social science research. Additional essential support throughout process from U.S. Global Change Research Program and 13 associated agencies.

globalchange.gov

U.S. Global Change Research Program

Email: **kenney@umd.edu**

**http://www.globalchange.gov/explore/indicators**