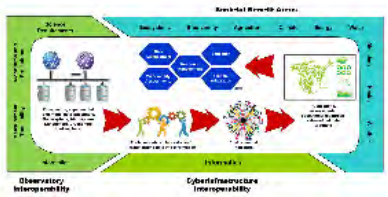
Data and information for food security: A continental-scale approach

Russ Lea, Ph.D.
Chief Executive Officer
National Ecological Observatory Network (NEON), Inc.

2014-04-03 | ICRI 2014



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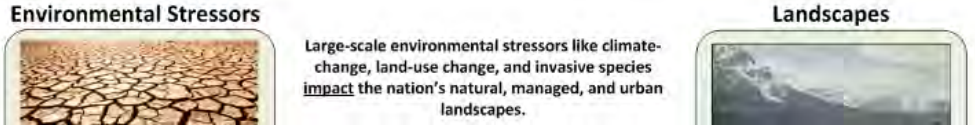

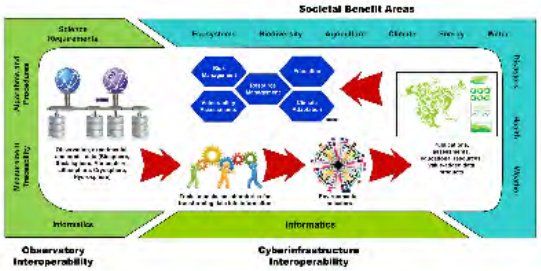

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FP Foreign Policy

THE FOOD ISSUE | INSIDE THE GEOPOLITICS OF A HUNGRY PLANET

THE NEW GEOPOLITICS OF FOOD · STREET EATS · HOW FOOD EXPLAINS THE WORLD

The New Geopolitics of Food

From the Middle East to Madagascar, high prices are spawning land grabs and ousting dictators. Welcome to the 21st-century food wars.

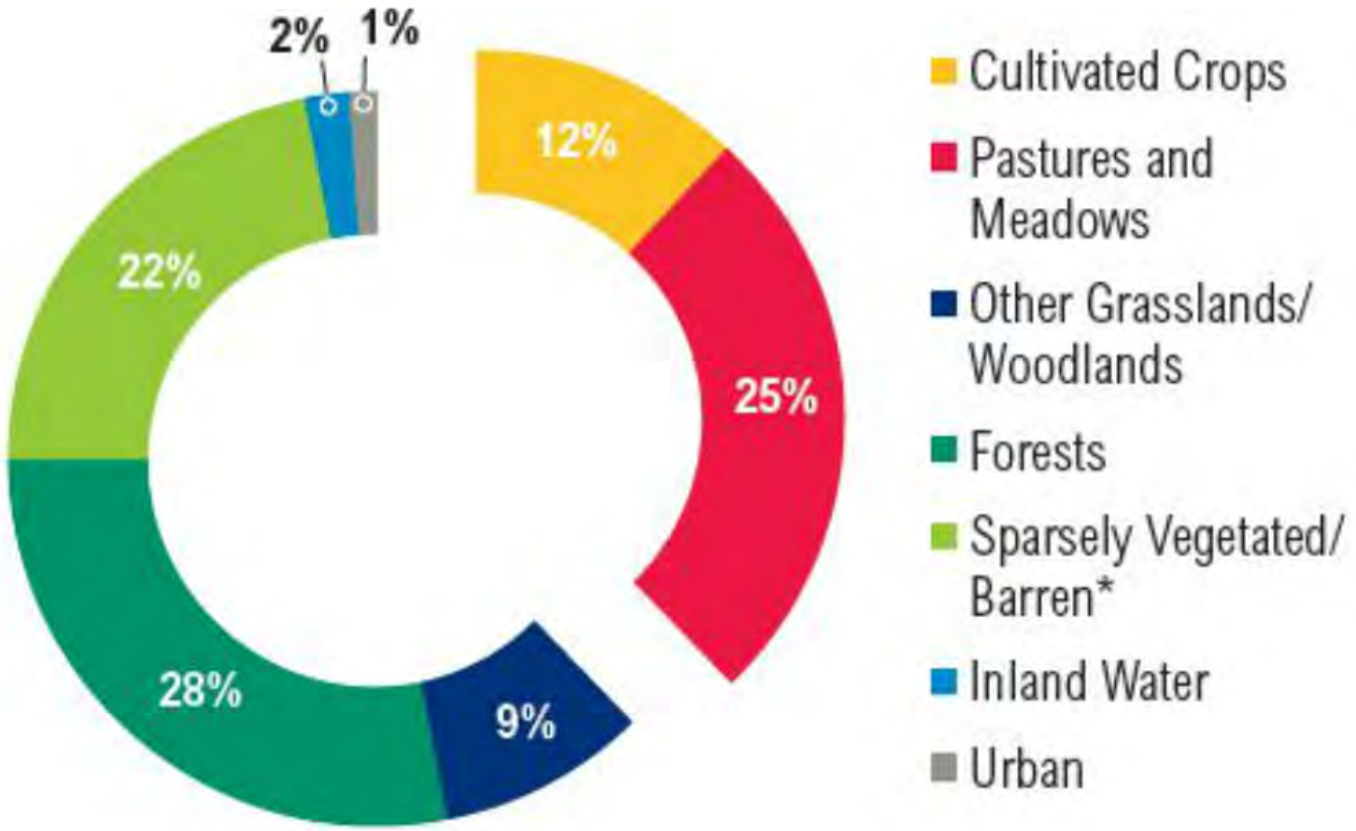
BY LESTER R. BROWN | MAY/JUNE 2011

In the United States, when world wheat prices rise by 75 percent, as they have over the last year, it means the difference between a $2 loaf of bread and a loaf costing maybe $2.10. If, however, you live in New Delhi, those skyrocketing costs really matter: A doubling in the world price of wheat actually means that the wheat you carry home from the market to hand-grind into flour for chapatis costs twice as much. And the same is true with rice. If the world price of rice doubles, so does the price of rice in your neighborhood market in Jakarta. And so does the cost of the bowl of boiled rice on an Indonesian family's dinner table.

How can the world feed more than 9 billion people by 2050 in a manner that advances economic development and reduces pressure on the environment?

Source: WRI (Searchinger et al 2013)

Figure 1 | **37% of Earth's Landmass (Ex-Antarctica) is Used for Food Production (100% = 13.3 billion hectares)**

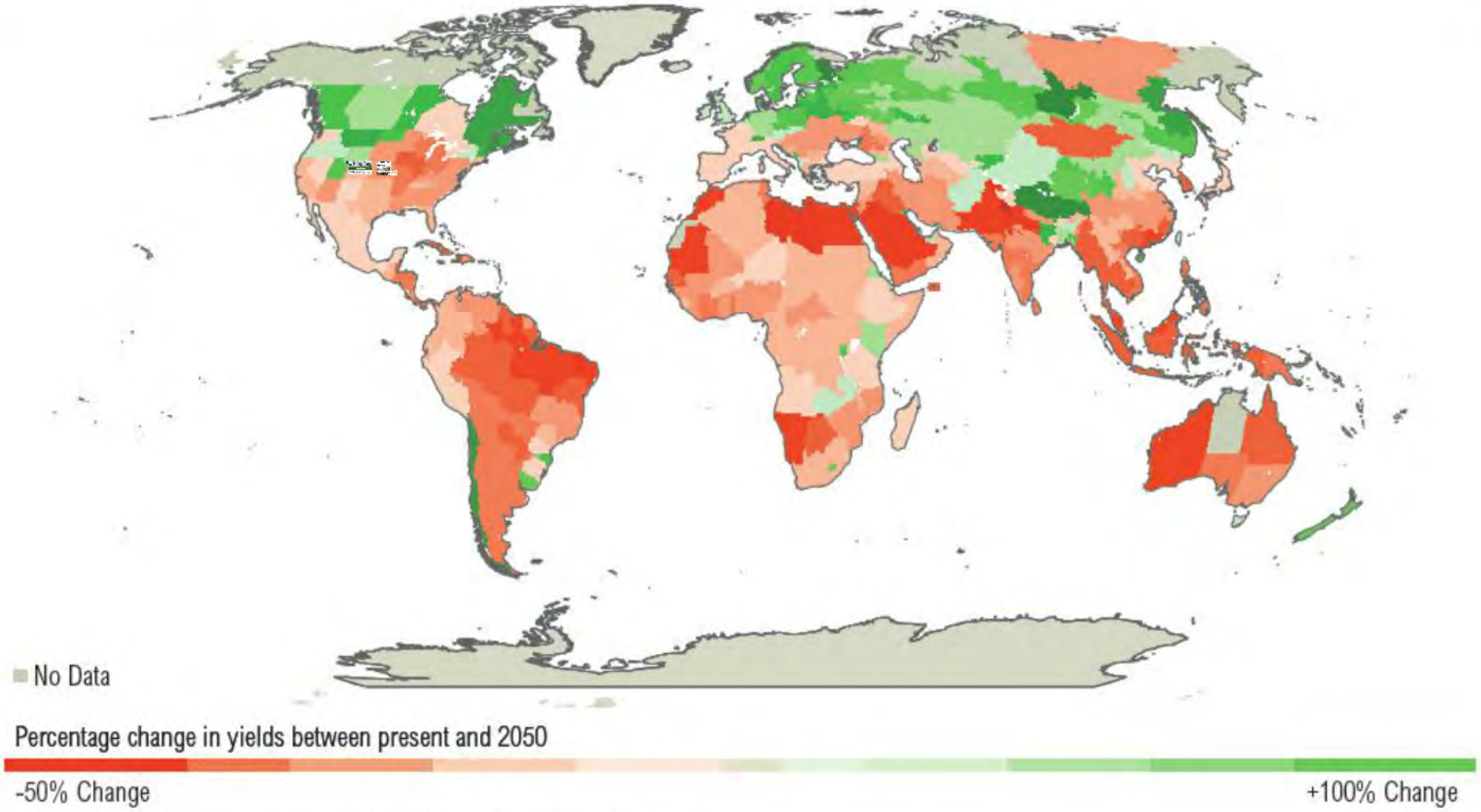


** Permanent ice cover, desert, etc.*

Note: Figures may not equal 100% due to rounding.

Source: FAO. 2011. *The State of the World's Land and Water Resources for Food and Agriculture*. Rome: FAO.

Figure 2 | **Climate Change is Projected to Impact Crop Yields (3° C World)**



Source: World Bank. 2010. *World Development Report 2010*. Washington, DC: World Bank.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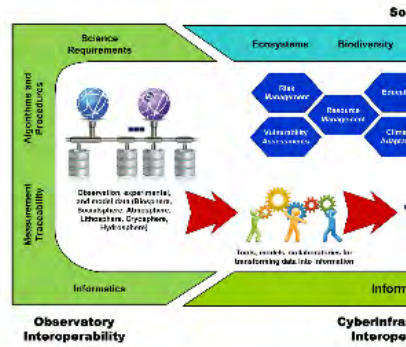
Environmental Stressors
Landscapes
Large-scale environmental stressors like climate-change, land-use change, and invasive species impact the nation's natural, managed, and urban landscapes.
Complex interactions between stressors and impacts
These landscape impacts modify the strength and nature of the stressors through perturbations in land-surface reflectivity, water cycles, nutrient cycles, natural and anthropogenic gaseous emissions, and others.
Measurements of these stressors, their impacts, and the complex interactions between them, are captured by NEON's integrated observing infrastructure.
NEON Site Constellation
NEON Airborne Platform
Existing Satellite Platforms
Site-based measurements are used to calibrate and validate airborne measurements, and to produce regional-scale data.
Site-based and airborne measurements are used to calibrate and validate space-borne measurements, and to produce continental-scale data.
NEON Data Products
Data Products from Credible Sources
INTEROPERABILITY
Data, Tools, Workflows, Documentation
Data to support forecasting and decision making across a number of applications, like those stipulated in the Global Earth Observation System of Systems (GEOSS) Societal Benefit Areas:
Disasters
Health
Energy
Climate
Water
Weather
Ecosystems
Agriculture
Biodiversity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Science Requirements
Ecosystems
Biodiversity
Algorithms and Procedures
Measurement Traceability
Informatics
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Cyberinfra
Interope

Environmental Stressors

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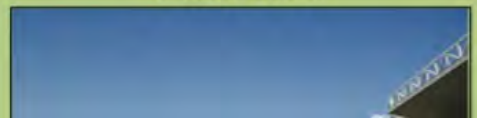
NEON Airborne Platform



Existing Satellite Platforms

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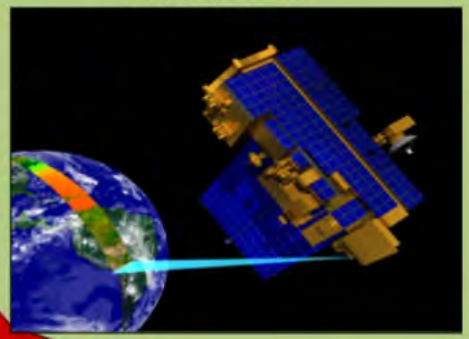

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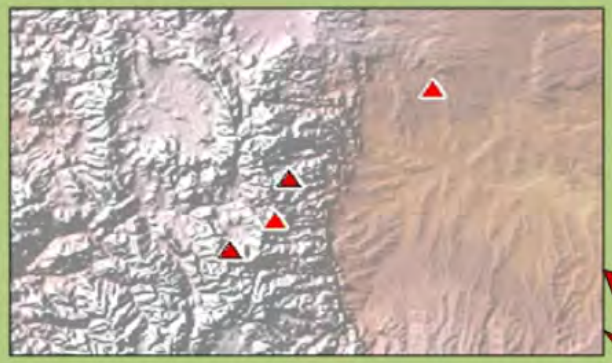
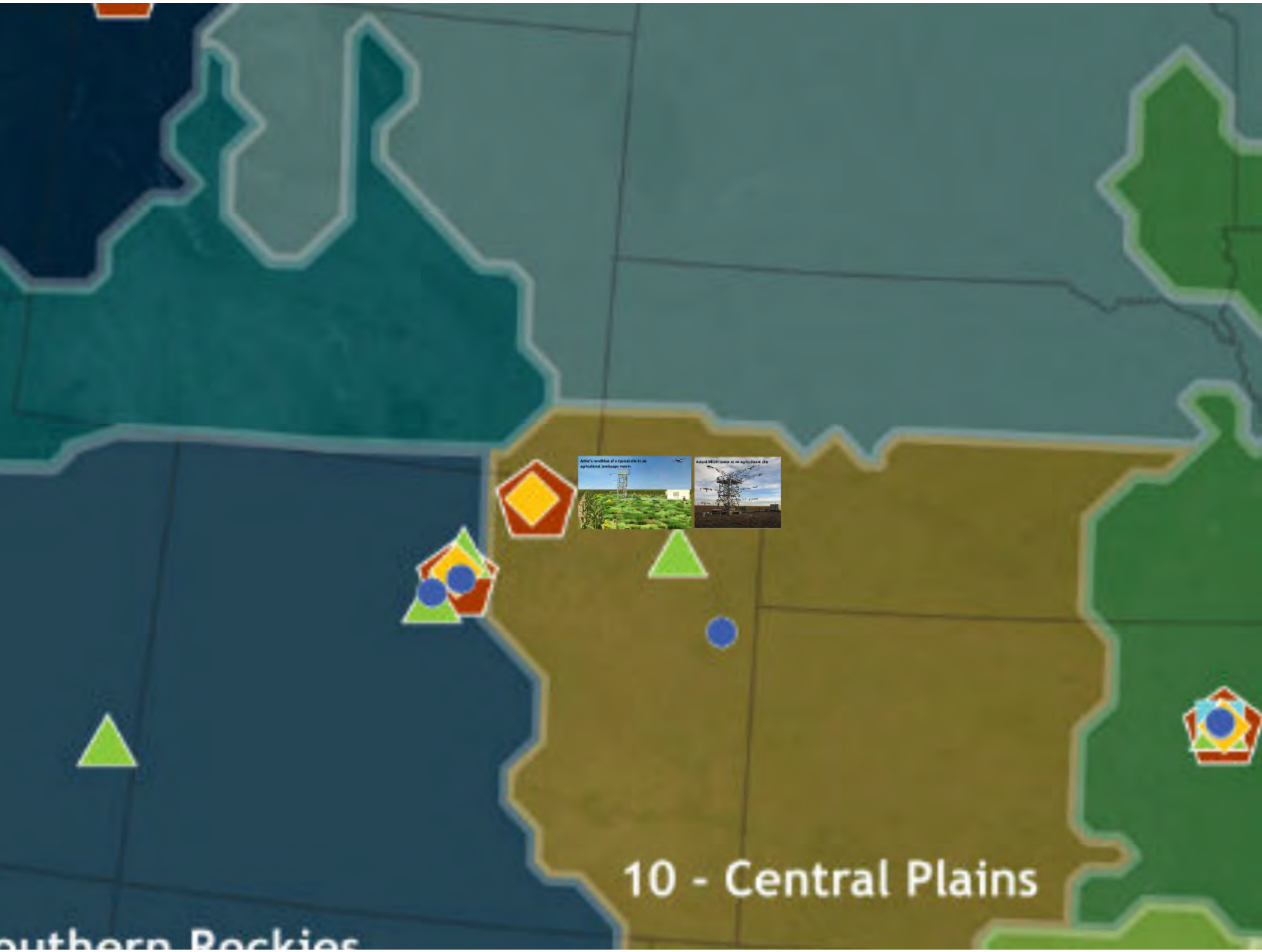
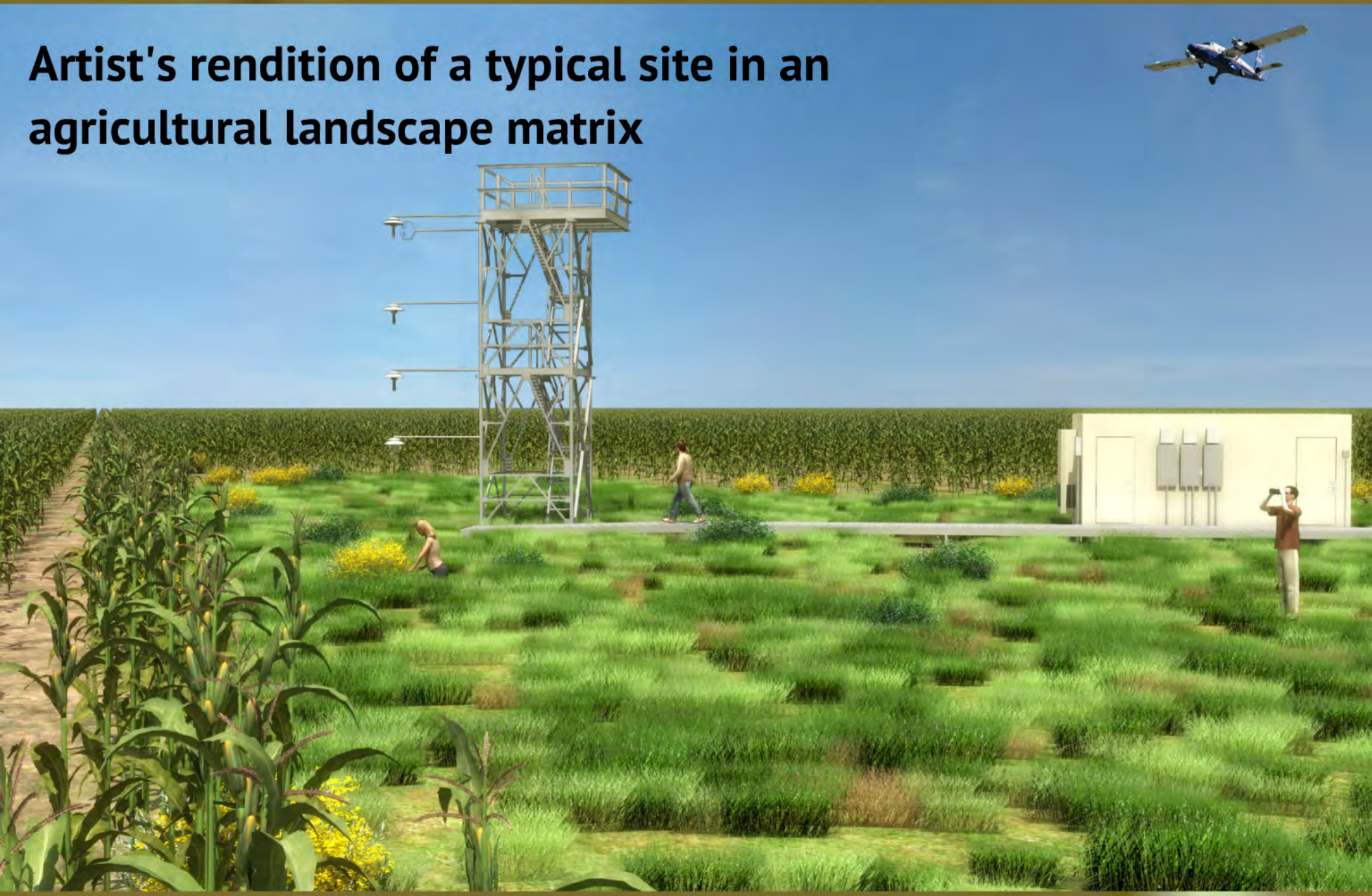


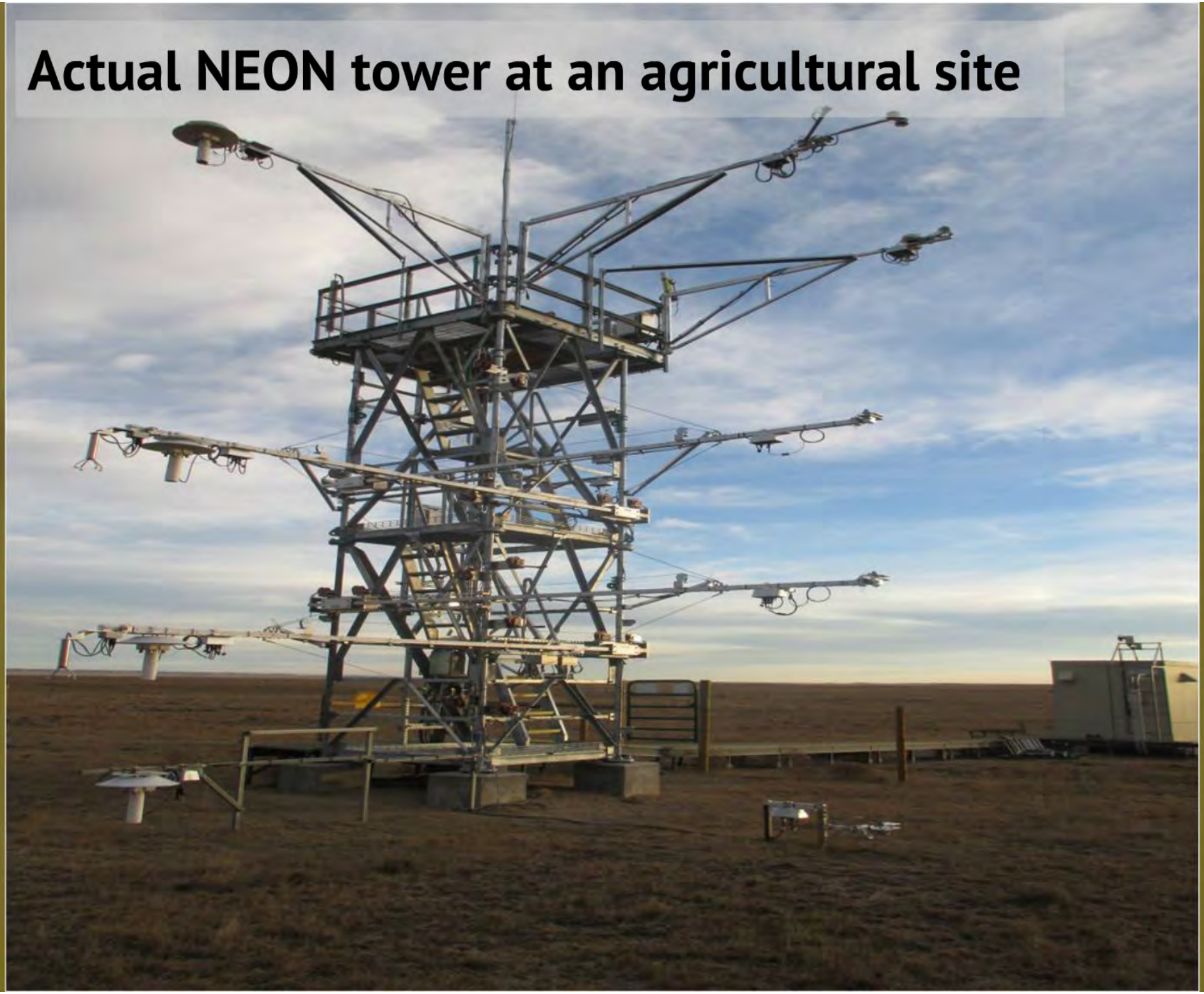

16 - Pacific Northwest
12 - Northern Rockies
9 - Northern Plains
5 - Great Lakes
1 - Northeast
15 - Great Basin
6 - Prairie Peninsula
7 - Appalachians & Cumberland Plateau
2 - Mid Atlantic
17 - Pacific Southwest
10 - Central Plains
13 - Southern Rockies & Colorado Plateau
14 - Desert Southwest
8 - Ozarks Complex
11 - Southern Plains
3 - Southeast
4 - Atlantic Neotropical
18 - Tundra
19 - Taiga
ALASKA
20 - Pacific Tropical
HAWAII
PUERTO RICO
NEON Science Strategy
NEON Core
NEON Relocatable
NEON Aquatic
NEON STREON
LTER Sites


10 - Central Plains

Artist's rendition of a typical site in an agricultural landscape matrix



Actual NEON tower at an agricultural site



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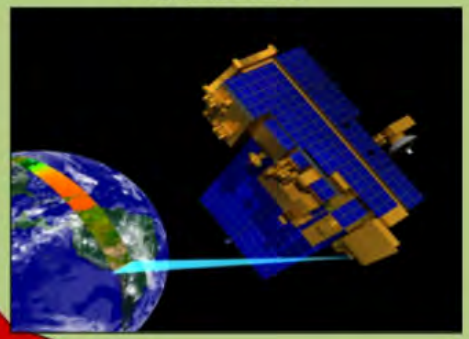

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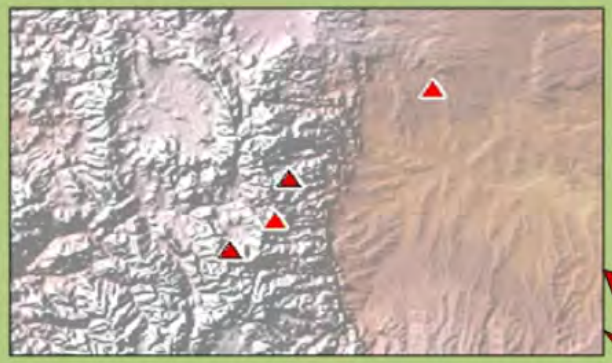

Test Data from Instrument Shake-down Campaign

Spectrometer data overlaid on Lidar point cloud (4x vertical enhancement)

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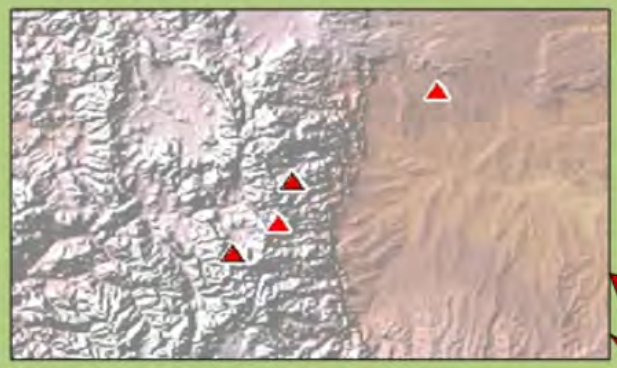


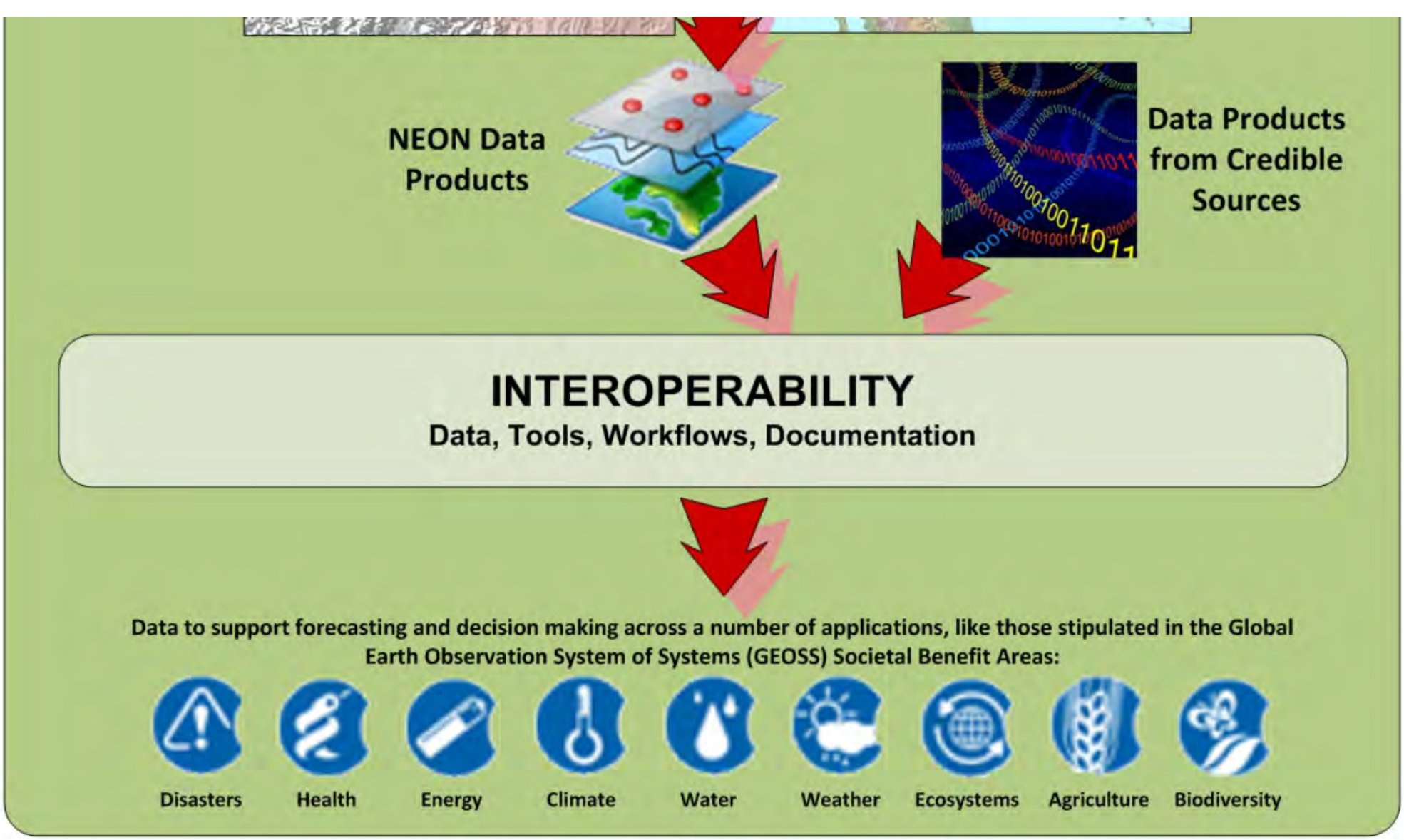
NEON Data Products

Data Products from Credible Sources

INTEROPERABILITY

Data, Tools, Workflows, Documentation

Data to support forecasting and decision making across a number of applications, like those stipulated in the Global Earth Observation System of Systems (GEOSS) Societal Benefit Areas:



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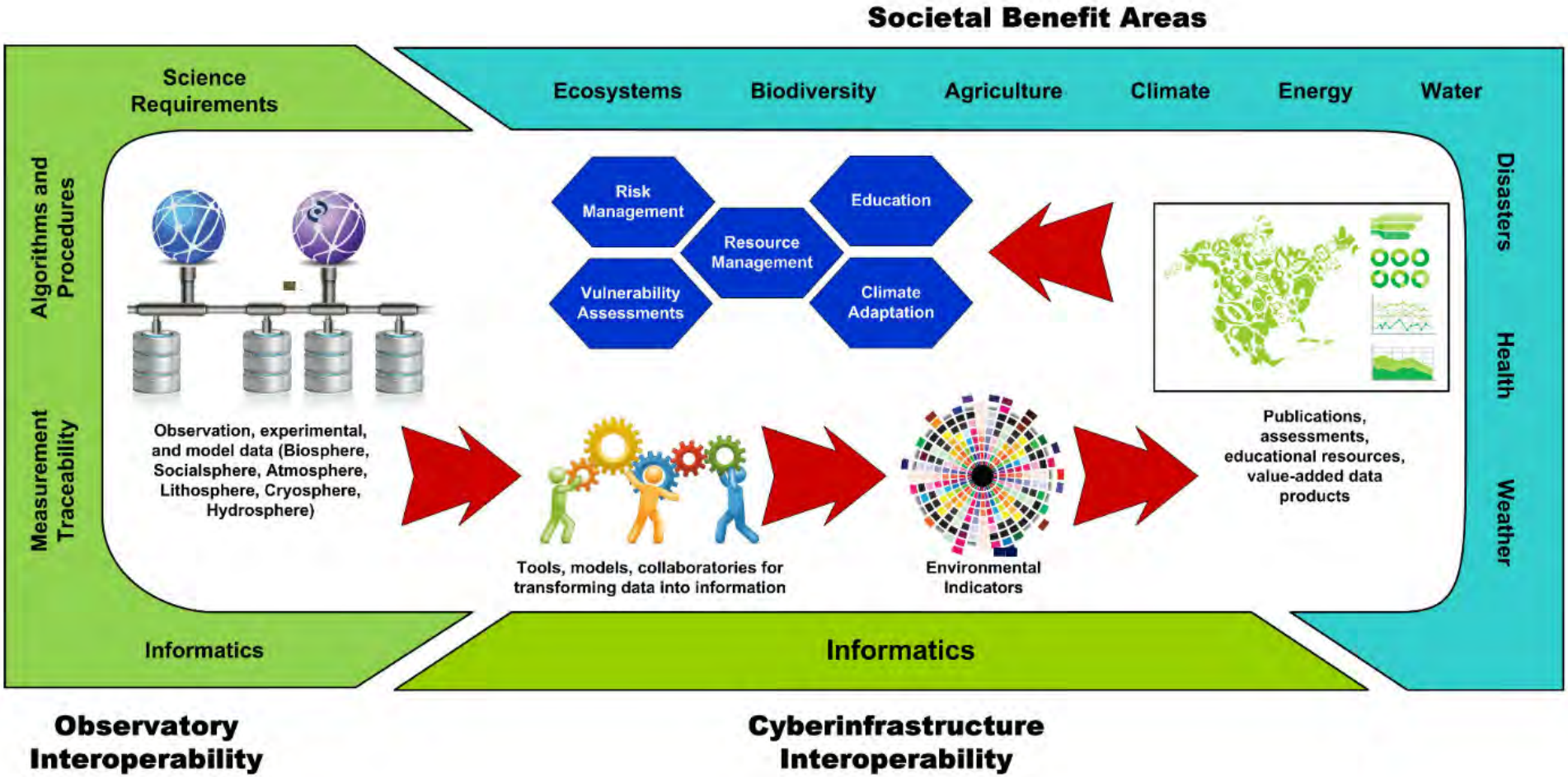
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Measurement Traceability
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Weather
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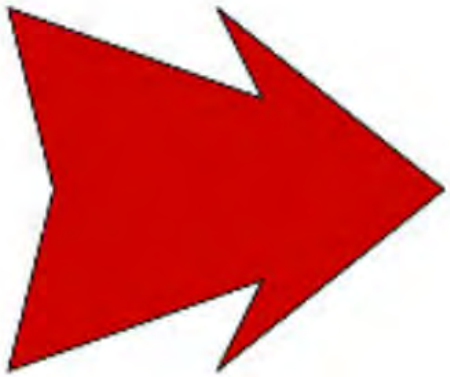

Tools, mod

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USDA – NEON Connection: LTAR

- "*Hoping to emulate the success and ambition of ecological research networks, such as NEON, the U.S. Department of Agriculture (USDA) is creating a network of long-term agricultural research sites.*" **Science, September 2012**
- Long-term Agroecosystem Research (LTAR) network
- As of January 2014: 18 sites across the United States

USDA

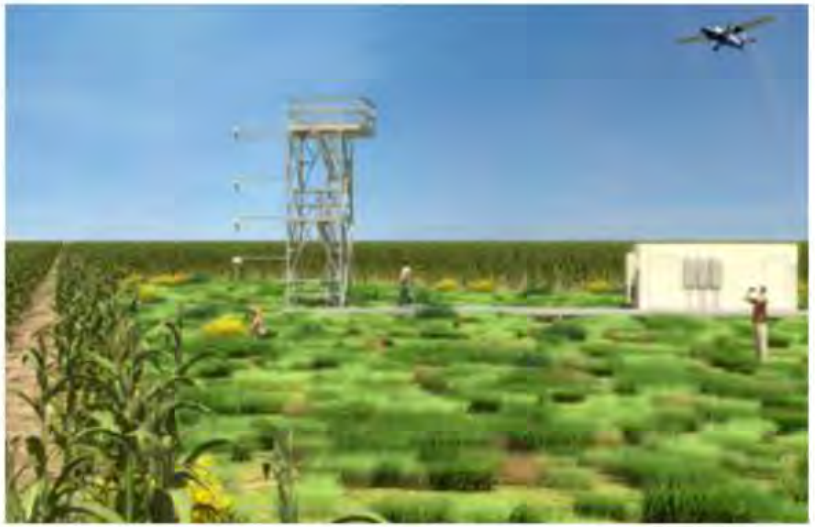
neon
National Ecological Observatory Network

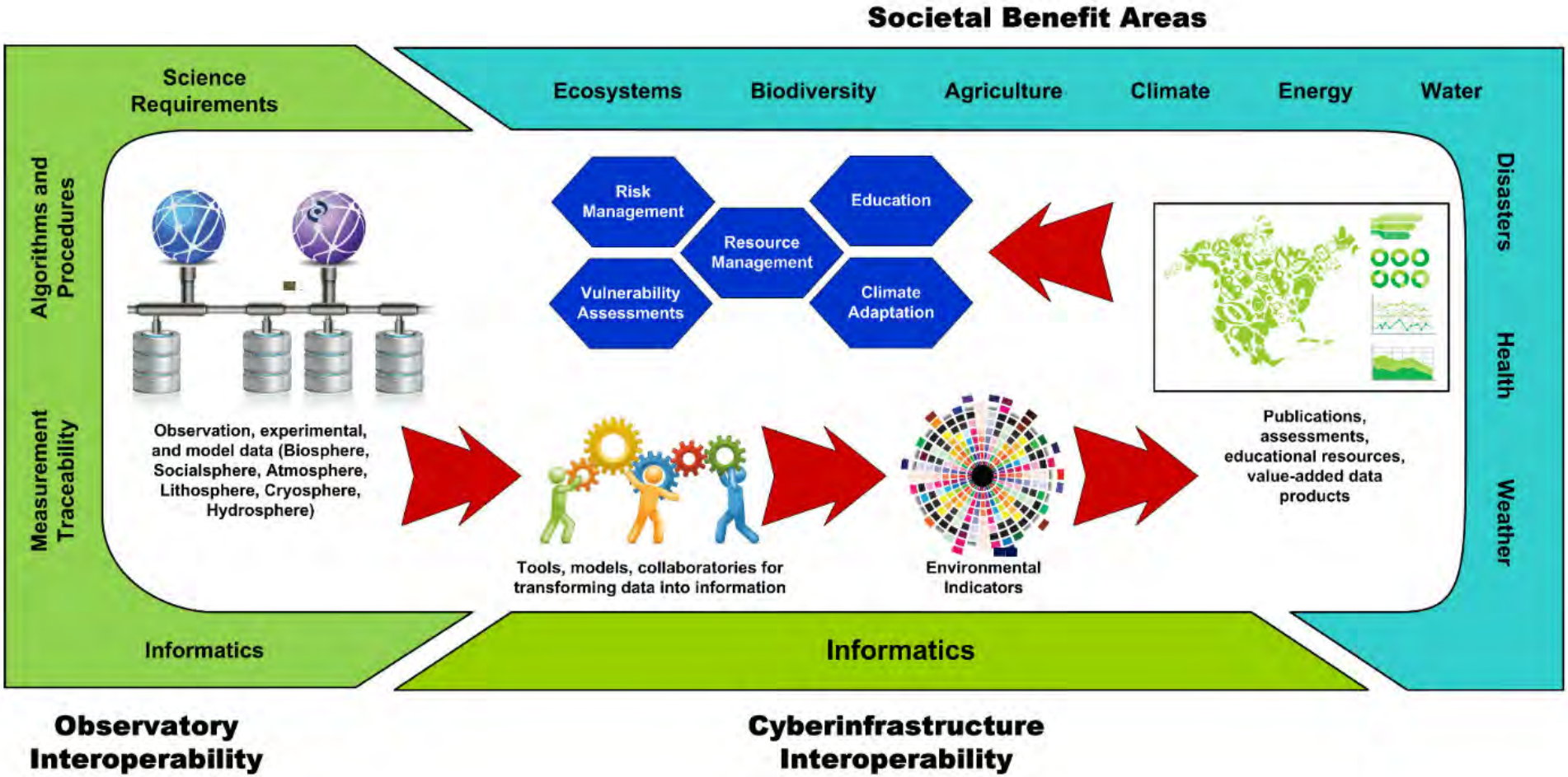
USDA LTAR will help the US…

- …understand how key agricultural system components **interact at larger scales**
- …anticipate the environmental effects of **shifting agricultural practices**;
- …improve the **effectiveness** of conservation programs;
- …identify the broader **societal benefits** of modern agriculture (e.g., bio-energy production; carbon sequestration).

LTAR – NEON Interoperability Approach

- NEON: 7 agriculture-themed terrestrial sites
- LTAR-NEON sites:
  - Three co-located
  - Three others in close proximity
- Strategy:
  - Common measurements
  - Comparable protocols
  - Discoverable data

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Environmental
Indicators

US Global Change Research Program

- **Coordinates** US federal research to better understand and prepare the nation for global change
- **Assess** the state of scientific knowledge and US readiness to respond to global change
- **Communicate** research findings to inform, educate, and engage the global community

United States
Global Change
Research Program

USGCRP National Climate Indicator System

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

Agricultural Indicators

Indicator suites (currently in development) *may* include:

1. State of soil resources
2. Crop and livestock distribution
3. Pest distribution
4. Net economic impacts

NEON data are relevant to these indicator suites

Societal Ben

Ecosystems **Biodiversity** **Agriculture**

US Response to Climate Change

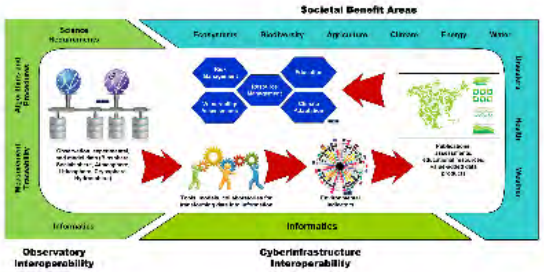
- June 2013: President Obama announces **Climate Action Plan** (CAP) as a response to the threat of climate change
- February 2014: USDA announces Regional Climate Hubs as part of CAP
- March 2014: White House launches **Climate Data Initiative** under CAP
  - Climate.data.gov: open government data
  - Foster public-private partnerships around data
  - To eventually include food-security related data and resources

USDA Regional Climate Hubs

- Seven locations to translate science and research into information for:
  - Farmers
  - Ranchers
  - Forest landowners
- To address increasing risks like:
  - Fires
  - Invasive species
  - Floods, droughts

USDA, NOAA, DOI, NEON

- Similar regional hubs to translate science into action exists for:
  - NOAA
  - The US Department of Interior
- NEON's partnership with these hubs revolves around open data and information



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