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Thank you for your interest.

Brian Wee, Ph.D.

Chief of External Affairs
National Ecological Observatory Network (NEON), Inc.
c/o Smithsonian Institution
1100 Jefferson Drive SW, Suite 3123, MRC 705
Washington, D. C. 20560-0001
http://www.neoninc.org

Phone: <u>202-370-7891</u> Fax: <u>202-204-0128</u>

Skype: bwee.in.dc

Enabling Interoperability between Environmental Observatories

Brian Wee, Ph.D.
Chief of External Affairs
(Congressional and Executive Branch Liaison)
National Ecological Observatory Network (NEON), Inc.

2013-07-11 | Strategic Collaborative Science Program Summit II









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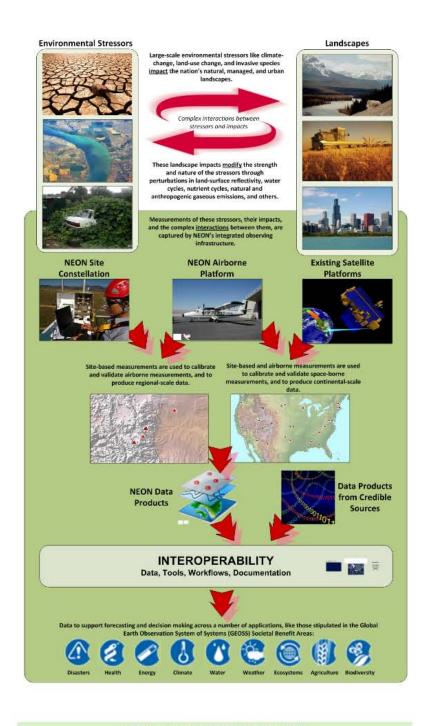
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THE PLANNED LIFETIME OF NEON

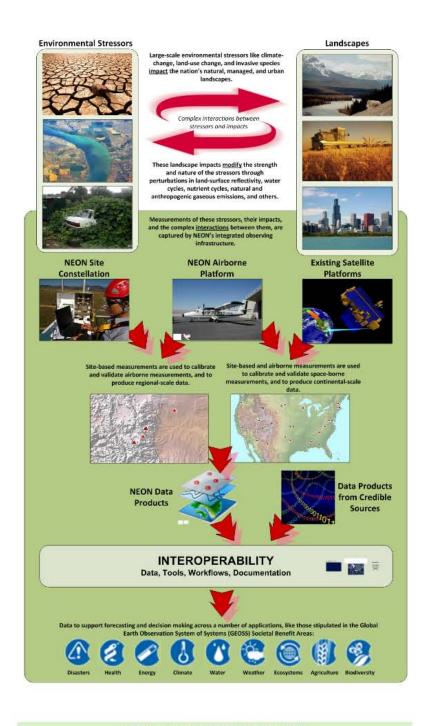
CONCEPT & DESIGN SITES BUILT OUT

DATA COLLECTION

2004-2011

2012 - 2017

2017 - 2046



THE PLANNED LIFETIME OF NEON

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Environmental Stressors



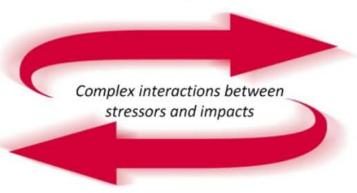




NEON Site Constellation



Large-scale environmental stressors like climatechange, land-use change, and invasive species <u>impact</u> the nation's natural, managed, and urban landscapes.



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 <u>interactions</u> between them, are captured by NEON's integrated observing infrastructure.

NEON Airborne Platform









Existing Satellite Platforms







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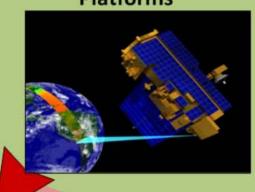
NEON Site
Constellation



NEON Airborne Platform



Existing Satellite Platforms



Site-based measurements are used to calibrate and validate airborne measurements, and to produce regional-scale data.

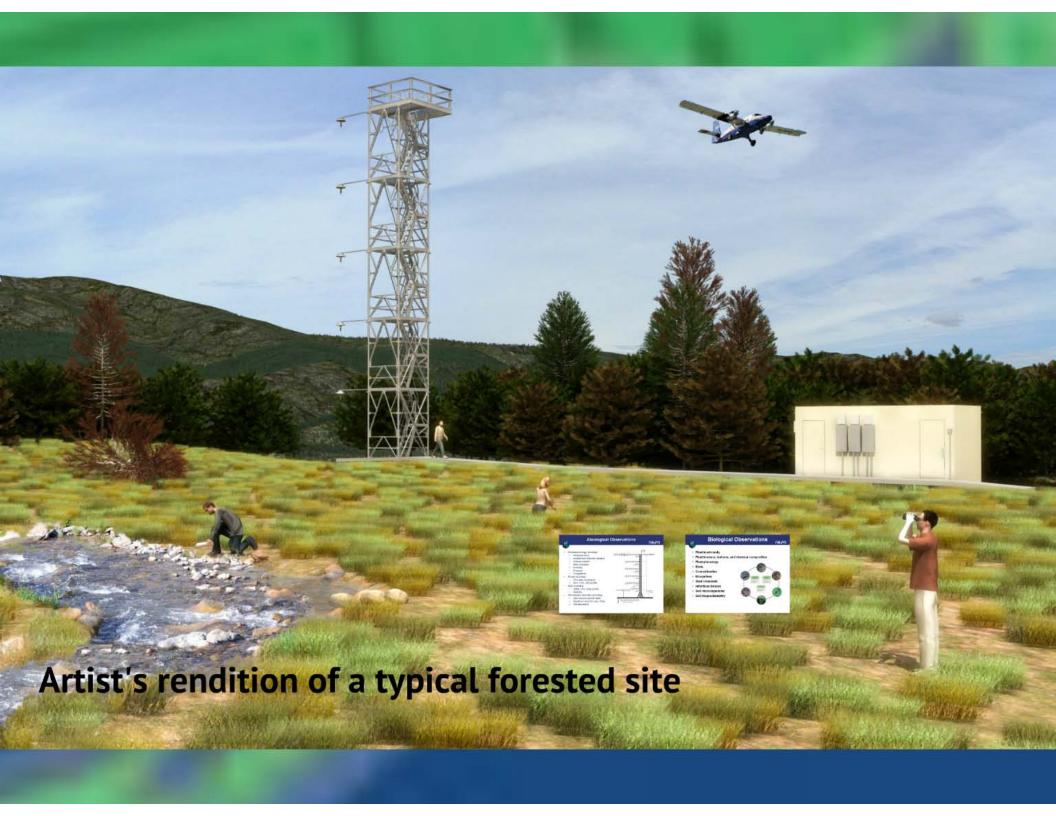


Site-based and airborne measurements are used to calibrate and validate space-borne measurements, and to produce continental-scale data.







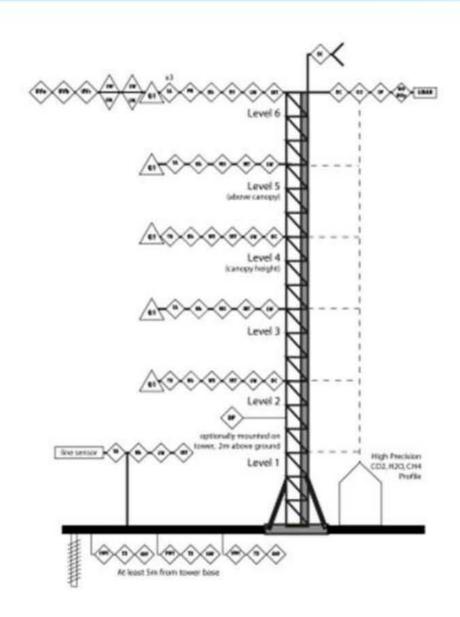


Abiological Observations





- Micrometeorology, including:
 - Air temperature
 - Incident and reflected radiation
 - Diffuse radiation
 - Wind velocities
 - Humidity
 - Pressure
 - Precipitation
- Fluxes, including:
 - CO2 eddy covariance
 - H2O, CO2, CH4 profile
- Soils, including:
 - Water, CO2, temp profile
 - Heat flux
- Atmospheric chemistry, including:
 - Optic aerosol optical depth
 - Reactive N and O3 conc. & flux
 - Wet deposition

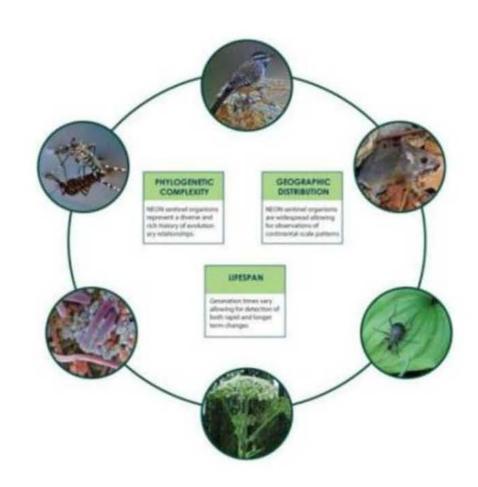


Biological Observations





- Plant biodiversity
- Plant biomass, leaf area, and chemical composition
- Plant phenology
- Birds
- Ground beetles
- Mosquitoes
- Small mammals
- Infectious disease
- Soil microorganisms
- Soil biogeochemistry





Artist's rendition of a typical site with aquatic instrumentation

Aquatic Sensors

In-stream/Lake

Discharge/Height (pressure transducers)

Multisonde: Twater, DO, pH, Conductivity, Turbidity, Chlorophyll

CDOM

N, P

PAR

Near-Stream Meteorology Station

Tair, Barometric pressure

PAR, Net radiation

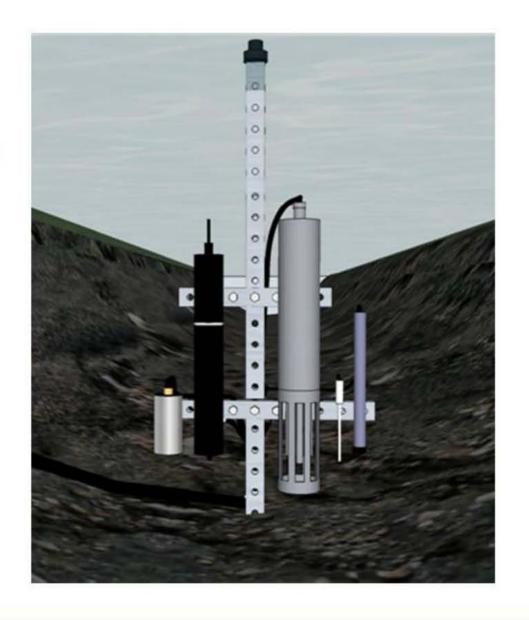
2D wind speed and direction

Camera

Groundwater

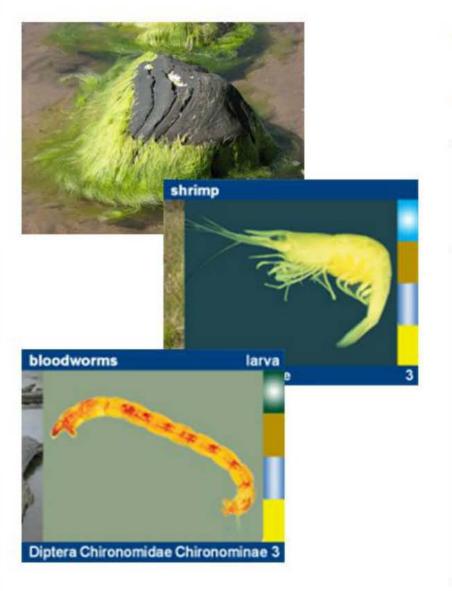
Multisonde: Twater, Water level,

Conductivity





Aquatic Biota



- Fish/top consumer: once per year
- Sampling regime (subject to change):

Measure	# samples/ date	# sampling dates/yr	Total
Stream algae	12	2	24
Pond algae	9	2	18
Macroalgae	5	2	10
Macrophytes	5	2	10
Bryophytes	5	2	10
Benthic invertebrates	3 -12	2	6 - 24
Zooplankton	3 - 9	2	6 - 18











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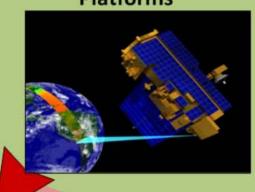
NEON Site
Constellation



NEON Airborne Platform



Existing Satellite Platforms

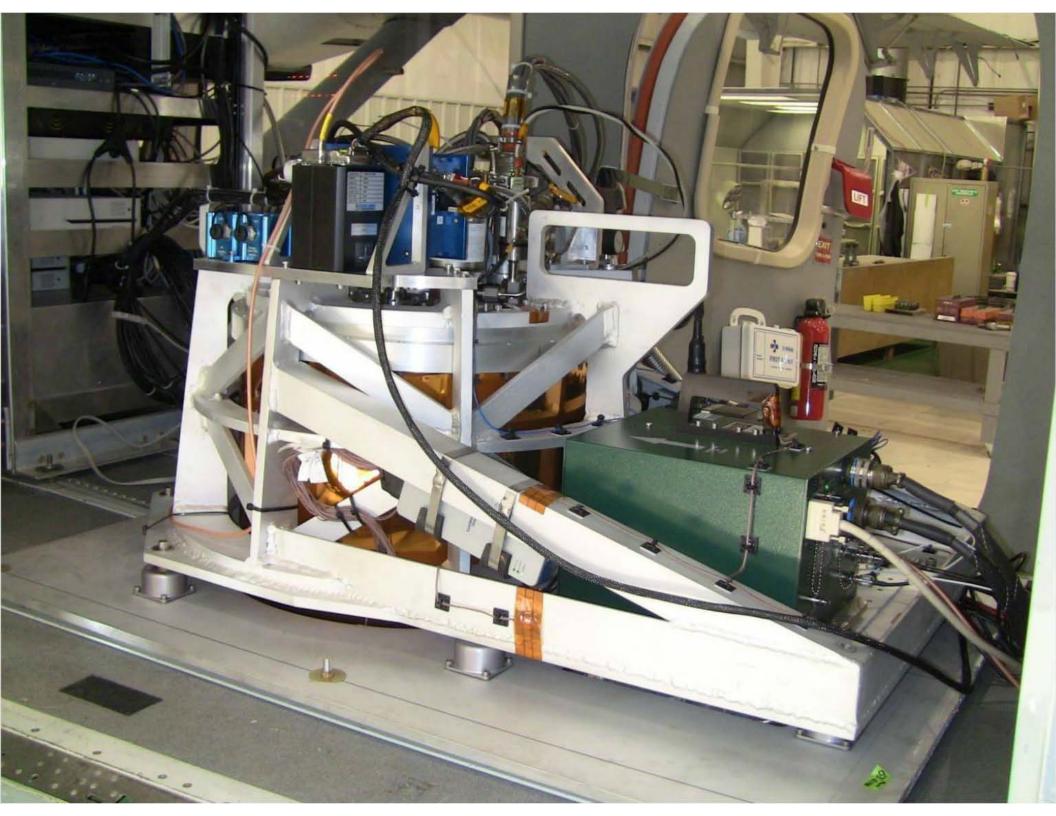


Site-based measurements are used to calibrate and validate airborne measurements, and to produce regional-scale data.



Site-based and airborne measurements are used to calibrate and validate space-borne measurements, and to produce continental-scale data.





Airborne Observations





Spectrometry

- Vegetation biochemistry & biophysical properties
- Cover type & fraction

LiDAR altimetry

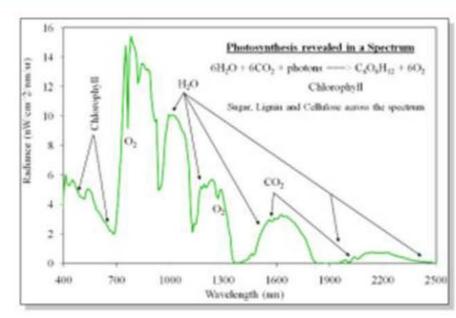
- Vegetation structure
- Sub-canopy topography
- Plant biomass

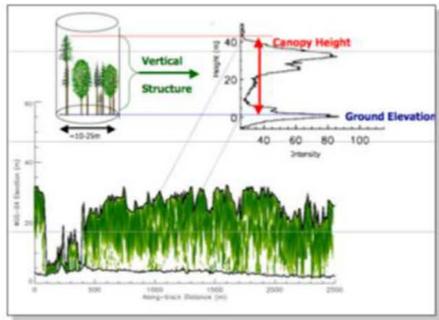
High resolution photography

Land use & land cover



3 X Twin Otter aircraft

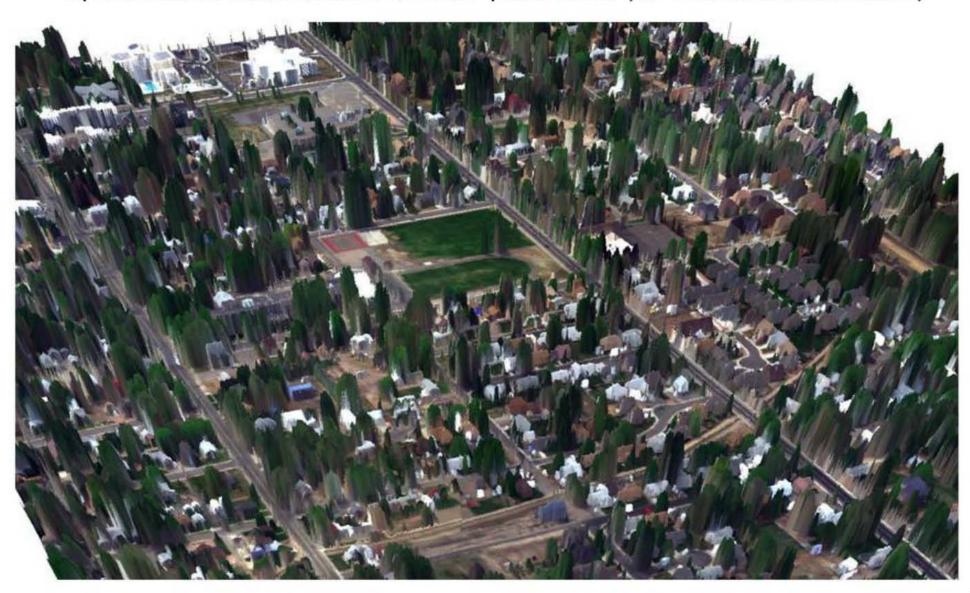




Test Data from Instrument Shake-down Campaign



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







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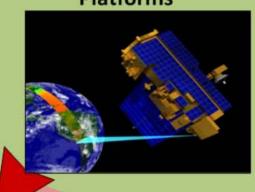
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mirastructure.

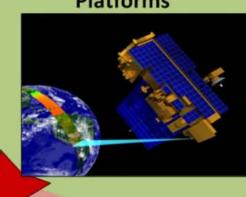
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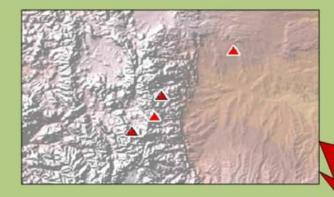


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NEON Data Products



Data Products from Credible Sources

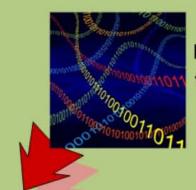
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NEON Data Products



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:















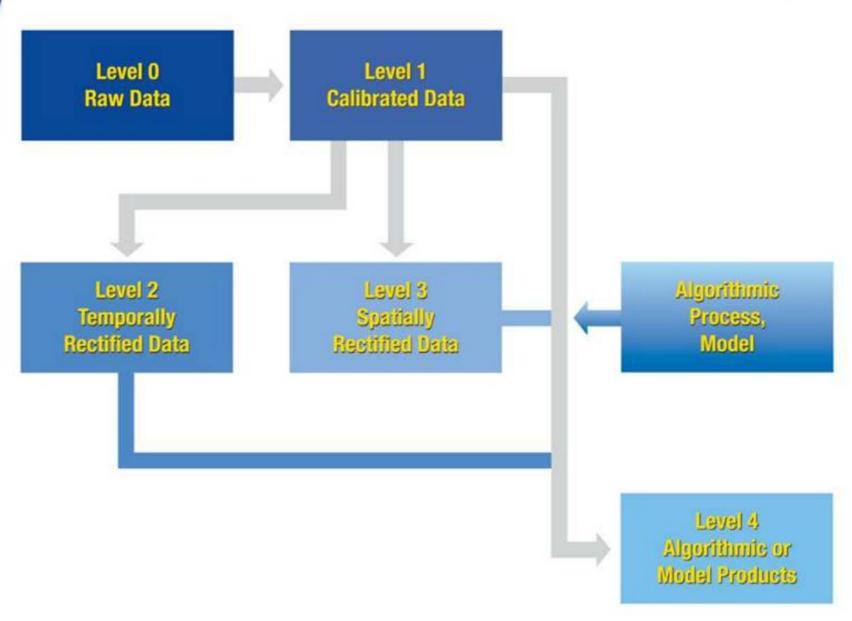




NEON Data Products



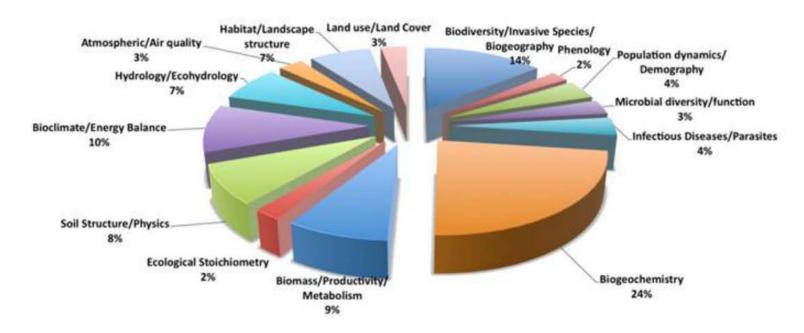




Data Product Breakdown







- ~ 1600 Level 0 data products (primary observations)
 - Raw voltages from sensors
 - Captured flora/fauna
 - External DNA analysis
 - Raw LiDAR returns
- ~ 540 Level 1 data (QA/C, minimally processed)
 - One-minute average air temperature
 - Site-level species demography
 - Georectified, radiometrically-corrected LiDAR

- ~ 75 Level 2 (rectified) & Level 3 (common gridded)
 - Gridded canopy nitrogen estimate (L3)
 - Gap-filled one-minute air temp (L2)
- ~ 120 Level 4 (high-level, cross-subsystem integrative)
 - Net ecosystem exchange
 - o Canopy nitrogen
 - Microbial diversity
 - Aquatic nutrient flux





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Health



Energy





Climate



Water



Weather



Ecosystems



Agriculture



Biodiversity

THE PLANNED LIFETIME OF NEON

CONCEPT & DESIGN

SITES BUILT OUT

DATA COLLECTION

Integration with US National Assets

"... collaboration in monitoring could rapidly improve the information base available for assessment and management.... recommendations should be developed for

recommendations should be developed for integrating the existing monitoring networks with the help of state-of-the art informatics"

- US President's Countillat Advisors on Science and Technology's IPCAST; 2011 report on "Sestaining Environmental Capital"









Interoperability:

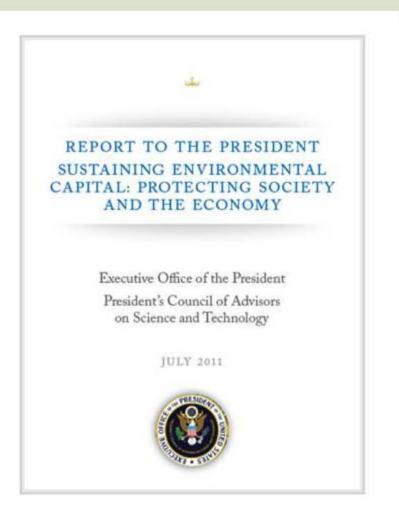
The new word for "collaboration" in environmental research infrastructure?

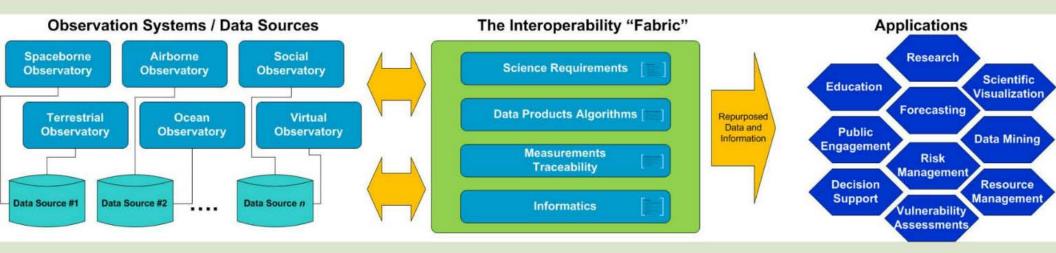
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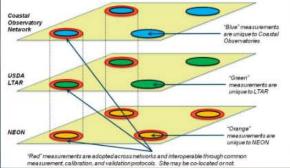




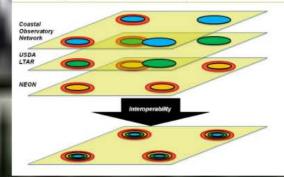




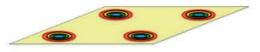
Stacking Environmental Observatories



Collapsing the Observatory Stack

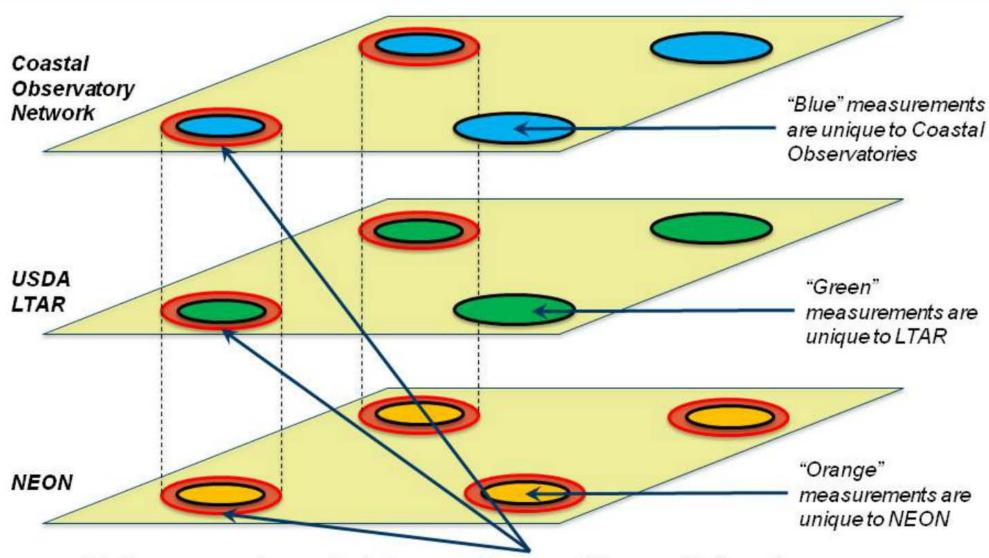


Observatory Integration



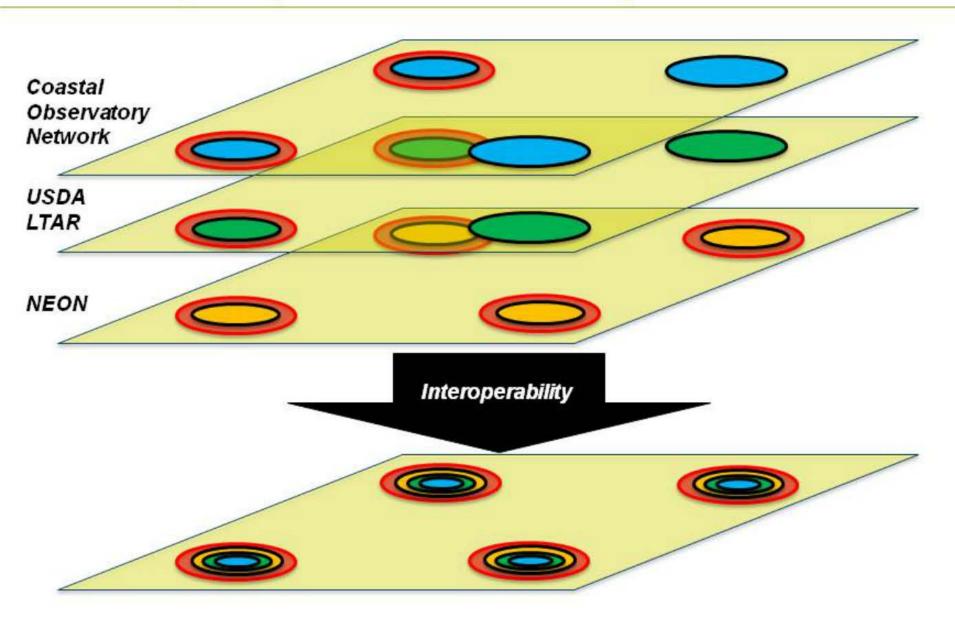
- Users should not need to worry about where the data comes from: it should appear seamless.
- Co-location and common variables across Observatories enable estimation of variables at locations where they are not explicitly measured (via models).
- Assuming that uncertainties can be quantified and documented, this model can be extended to include citizen science data.

Stacking Environmental Observatories

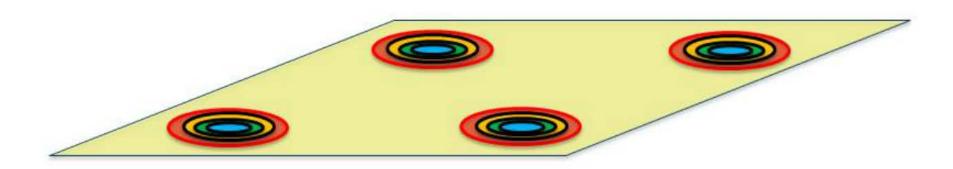


"Red" measurements are adopted across networks and interoperable through common measurement, calibration, and validation protocols. Site may be co-located or not.

Collapsing the Observatory Stack



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NEON and ICOS

NEON - National Ecological Observatory Network - US

"...to enable understanding and forecasting of the impacts of climate change, land use change and Invasive species on continental-scale ecology by providing infrastructure to support research, education and environmental management in these areas."

7 grand challenge areas single supporting agency – National Science Foundation

ICOS - Integrated Carbon Observing System - EU

"A research infrastructure dedicated to high precision observations of greenhouse gases fluxes and their attribution"

EU structure 17 member countries,

Terrestrial, Atmospheric, and Oceanic environments each with individual funding commitments includes Coordination Office, Thematic centers, and Central Analytical Lab

Using the ERIC mechanism for governance - not yet ratified

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NEON and CoopEUS



Initiated July 2011

EU FP7 activity to map the bioinformatics / data interoperability / data harmonization among EU and US (NSF GEO and BIO) Observatories.

Hank Loescher | NEON
Tim Ahren | IRIS | Earthscope
Chuck Meertens | UNAVCO | Earthscope
Tony Van Eyken | SRI | AMISR
Bob Weller | WHOI | OOI
John Orcutt UCSD | Scripps | OOI

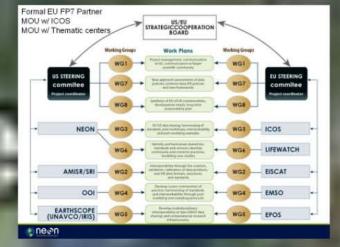








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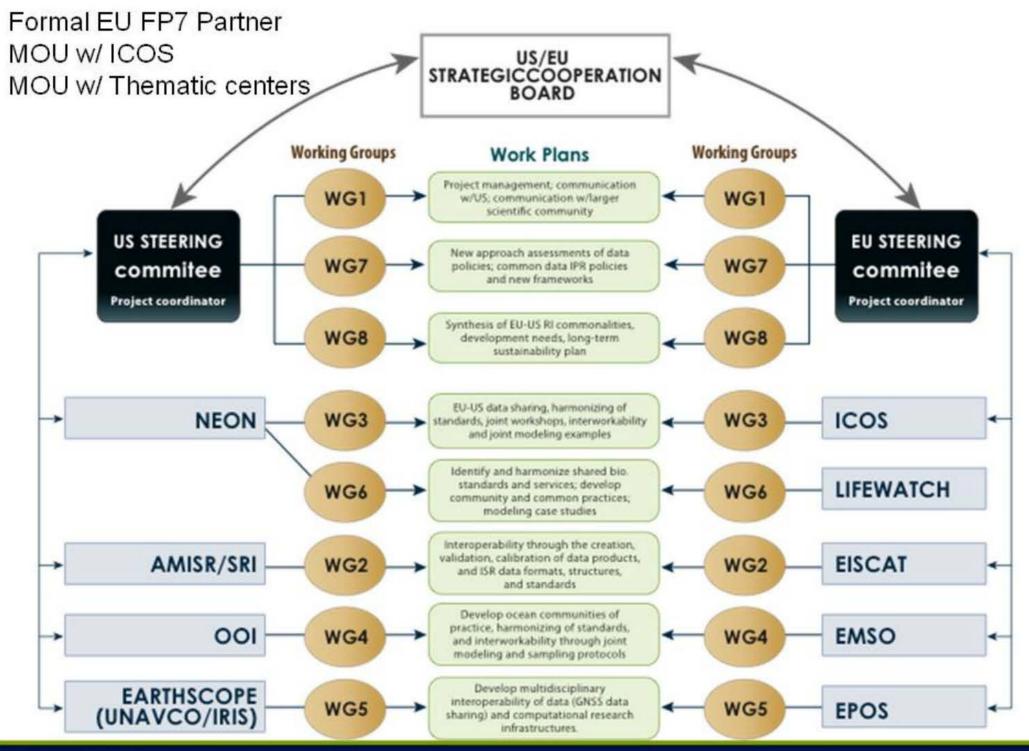






THE SCRIPPS RESEARCH INSTITUTE







Interoperability:

The new word for "collaboration" in environmental research infrastructure?

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Health



Energy





Climate



Water



Weather



Ecosystems



Agriculture



Biodiversity

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Disasters

Health

Energy

Climate

Water

Weather **Ecosystems**

Agriculture

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