

The National Ecological Observatory Network (NEON)

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UW Member Representative, NEON Inc.

The Changing Landscape: Climate



1958
(Source: NOAA)

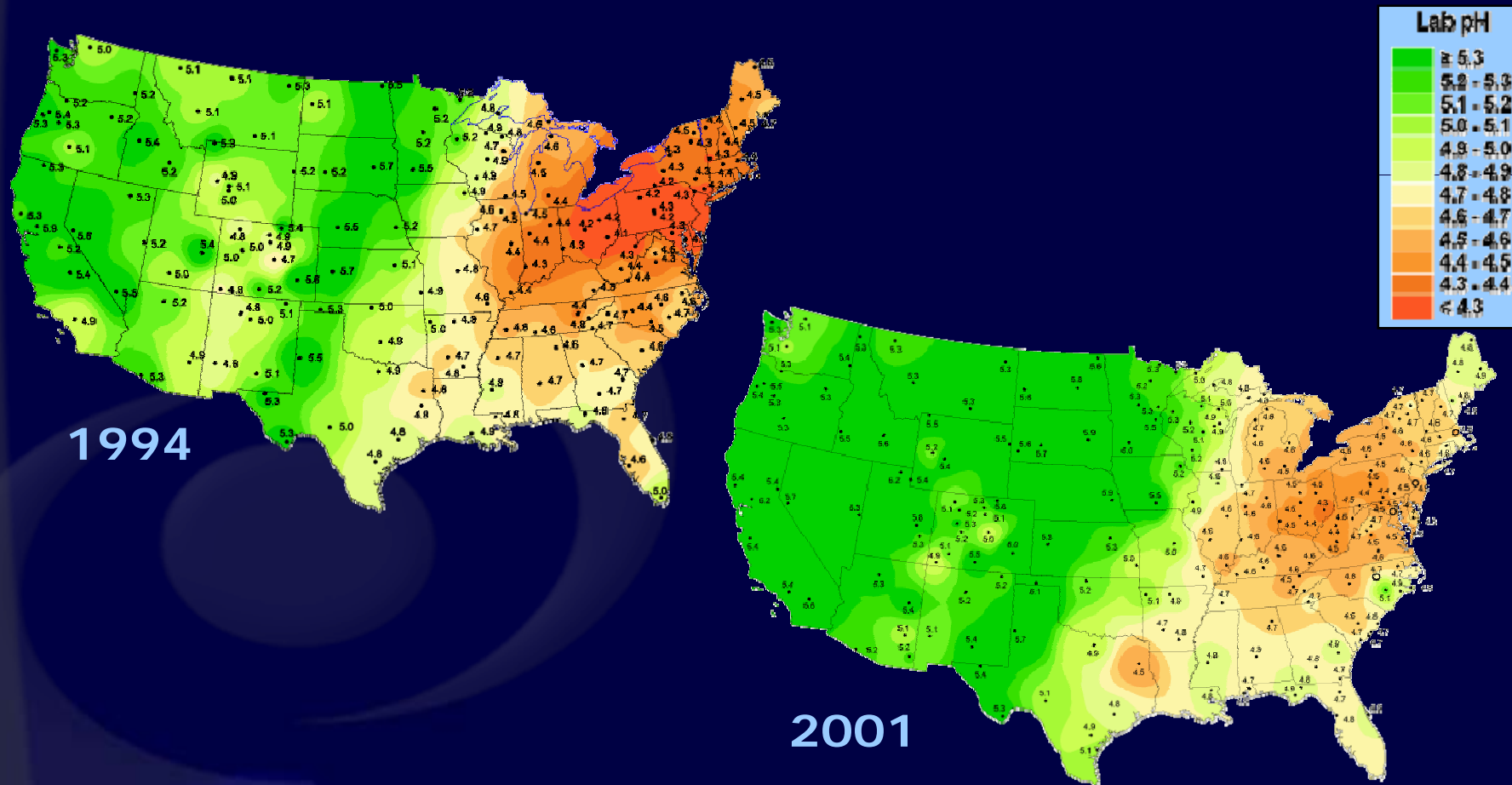
**Portage Glacier
(Kenai Peninsula, AK)**



2001
(Source: John Kalpus)

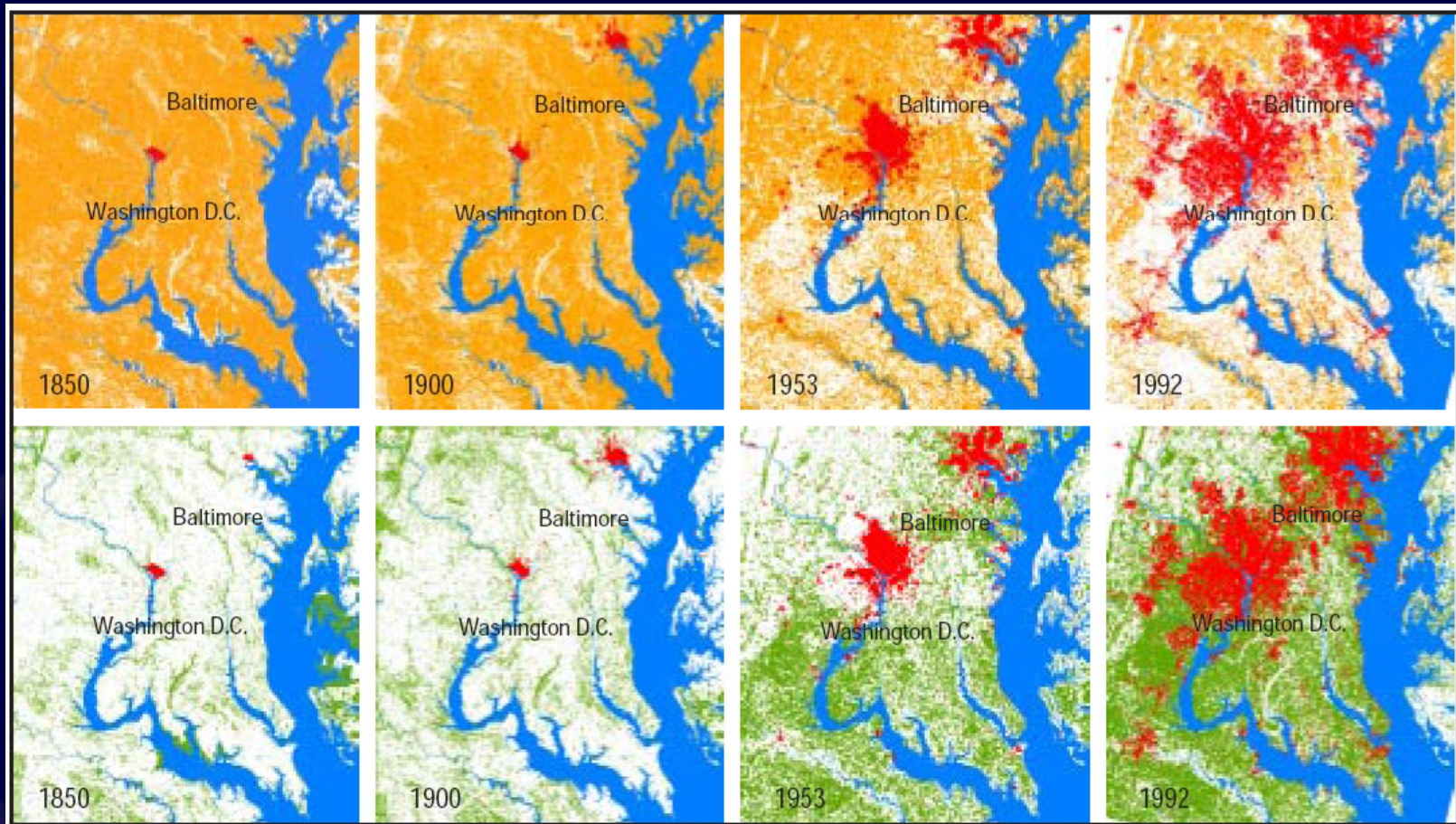
The Changing Landscape: Biogeochemistry

NADP isopleth map of hydrogen ion concentration as pH in 1994 vs 2005



(Source: NADP)

The Changing Landscape: Land Use



(Source: USGS)

NEON Science Vision

Provide the capacity to forecast future states of ecological systems for the advancement of science and the benefit of society.

NEON Science Mission

Identify and understand critical variations and interactions in environmental drivers that will enable forecasting the state of ecological systems for the advancement of science and the benefit of society.

Environmental drivers

Biotic

biodiversity
invasives
disease

Abiotic

geochemistry
hydrology
climate

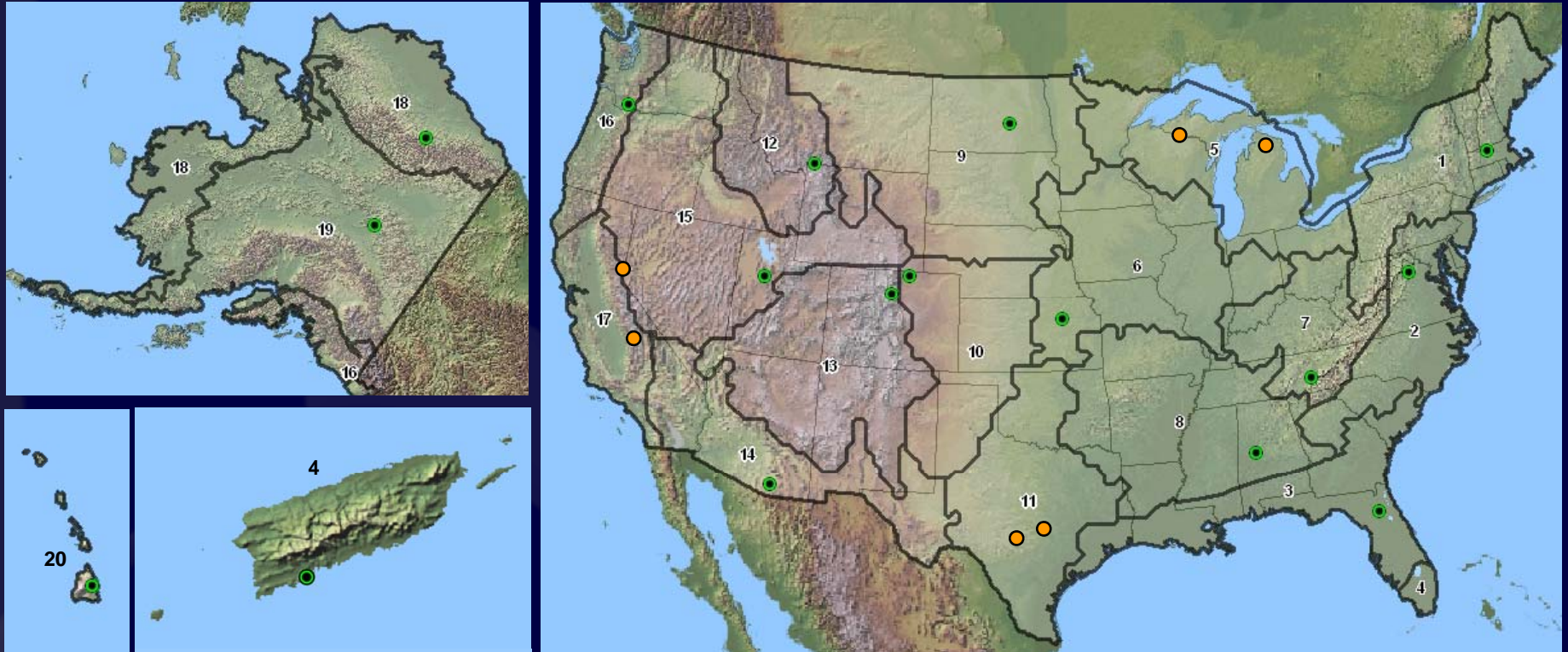
Social

economics
land use
land cover

NEON Education Vision

Prepare society and the scientific community to use NEON data, information, and forecasts in order to understand and effectively address critical ecological questions and issues.

NEON Climate Domains



- Replicated spatial contrasts:
 - Land use
 - Biodiversity – invasives – disease
 - Climate change – ecohydrology – biogeochemistry

Overall Strategy

- Backbone of core wildland sites as controls (30 year life-span)
- Deployment of relocatable scientific assets at pre-determined, scientifically determined
- Opportunistic deployment of assets for unforeseen events
- Use of airborne and space-based instruments to interpolate site specific measurements
- Comprehensive cyberinfrastructure to integrate measurements and deliver data products to the community (scientific, educational, general public)

NEON is different MREFC project

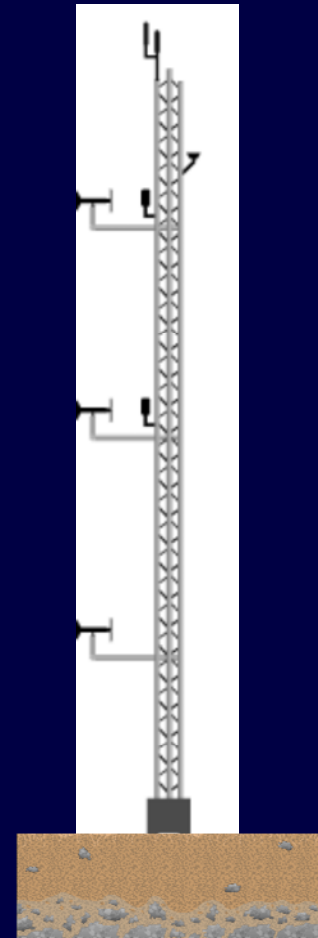
- Broadly distributed (tens of locations)
- Operated and maintained by 501(c)3 (NEON, Inc)
- Evolutionary – new components will be added over time. Users will be able to influence this process. *Going to be much more investment!*
- Fixed and moveable elements
- Selected core sites are going to attract many additional programs!!

Data Acquisition Systems

- FIU: Fundamental Instrument Unit
- FSU: Fundamental Sentinel Unit
- MRP: Mobile Relocatable Platform
 - RTS: Relocatable Tower System
 - RDS: Rapid Deployment System
- AOP: Airborne Observation Platform
- LUAP: Land-use Analysis Package

FIU

- Canopy-height dependent tower
- Meteorological instruments
- Basic air quality instruments
- Location / science question dependent combination of any of the packages:
 - Eddy covariance
 - Advanced air quality
 - Dust sensors
- Aquatic sensor-array
- Canopy microclimate sensor-array
- Soil sensor-array



*Illustration Credit:
Jason C. Fisher*

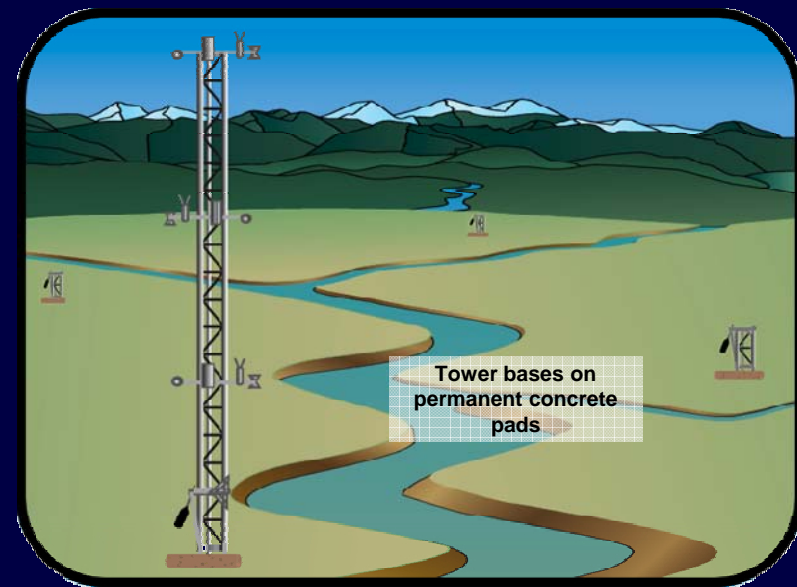
FSU

- Sampling and survey of:
 - Vascular plants
 - Small mammals
 - Birds
 - Fish, Aquatic invertebrates, algae
 - Terrestrial invertebrates
- Bioanalysis of samples:
 - DNA
 - Isotope
 - Pathogens
 - Others



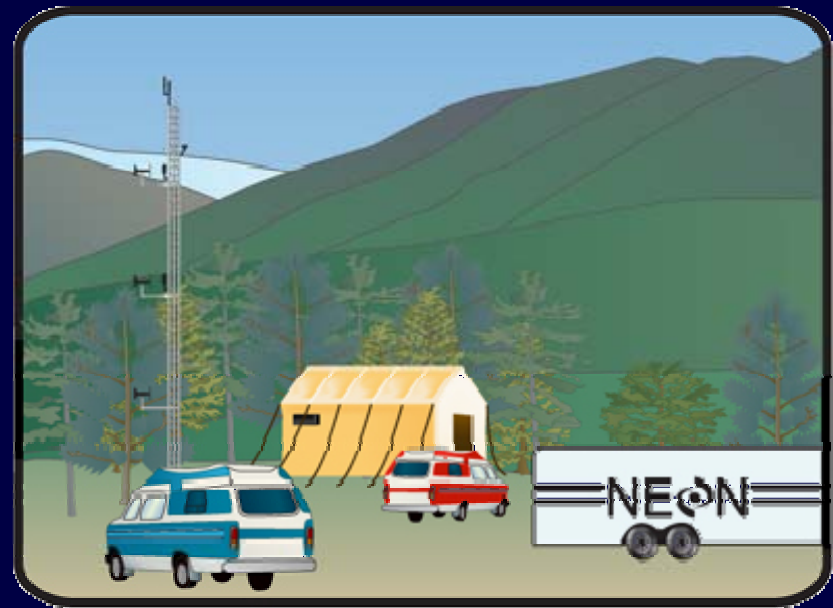
MRP: RTS

- Relocatable Tower System
 - Permanent tower pad
 - Tower base
 - Relocatable tower superstructure with relevant sensor package(s):
 - Eddy covariance
 - Advanced air quality
 - Dust sensors



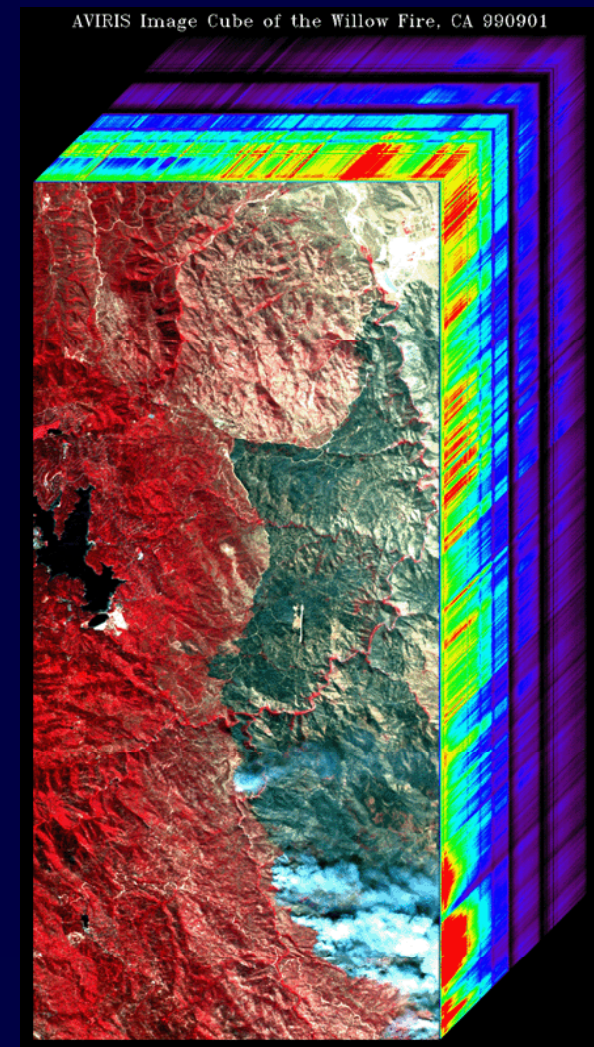
MRP: RDS

- Rapid Deployment System
 - Towing vehicle
 - Trailer to transport one or more of the following modular units:
 - Aquatics, Canopy, Climate, Invasive Species, Education, Soils, Infectious Disease



AOP

- High resolution airborne images of critical ecosystem process and land use characteristics for extrapolating locally calibrated results to regions
- Instrument platform:
 - Imaging spectrometer
 - Altimetric, full waveform or dual mode LIDAR
 - Onboard high resolution position and attitude knowledge

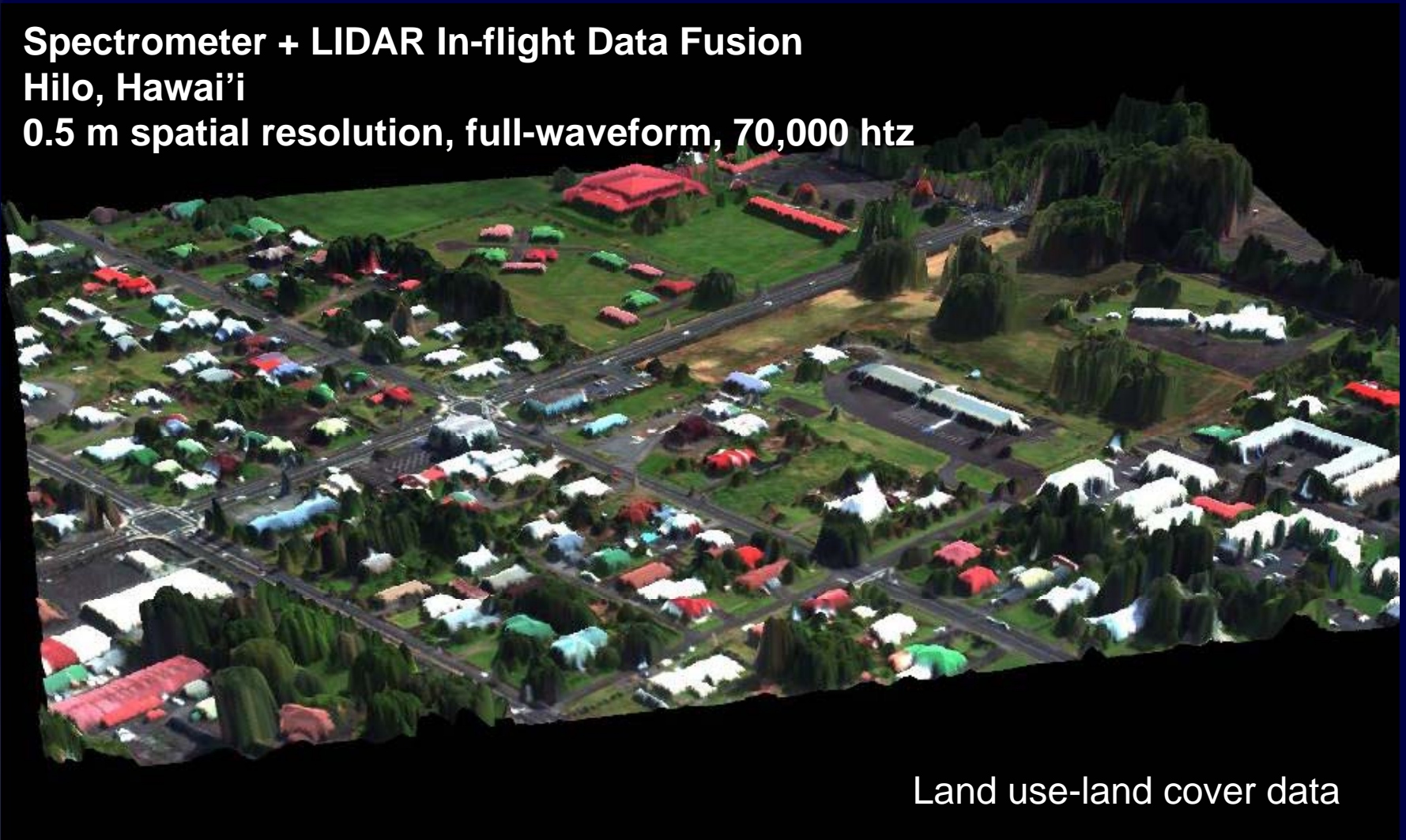


Carnegie Airborne Observatory (Alpha)

Spectrometer + LIDAR In-flight Data Fusion

Hilo, Hawai'i

0.5 m spatial resolution, full-waveform, 70,000 htz



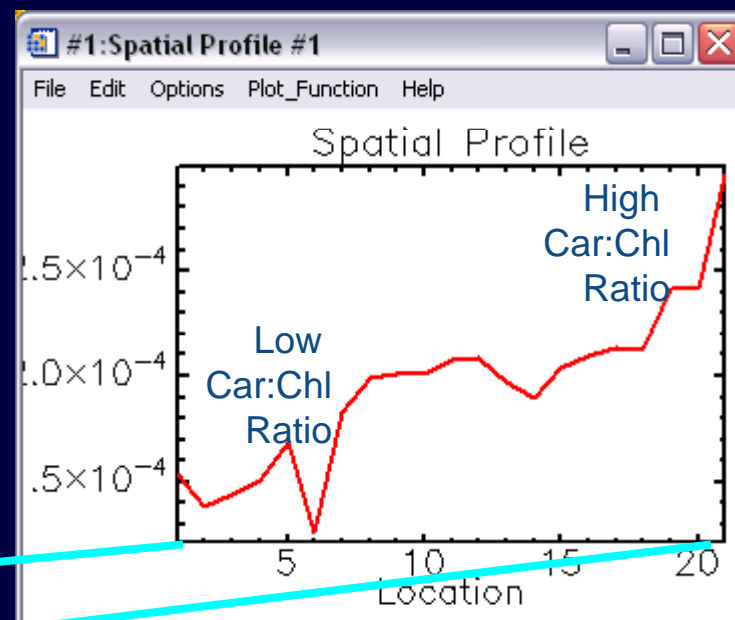
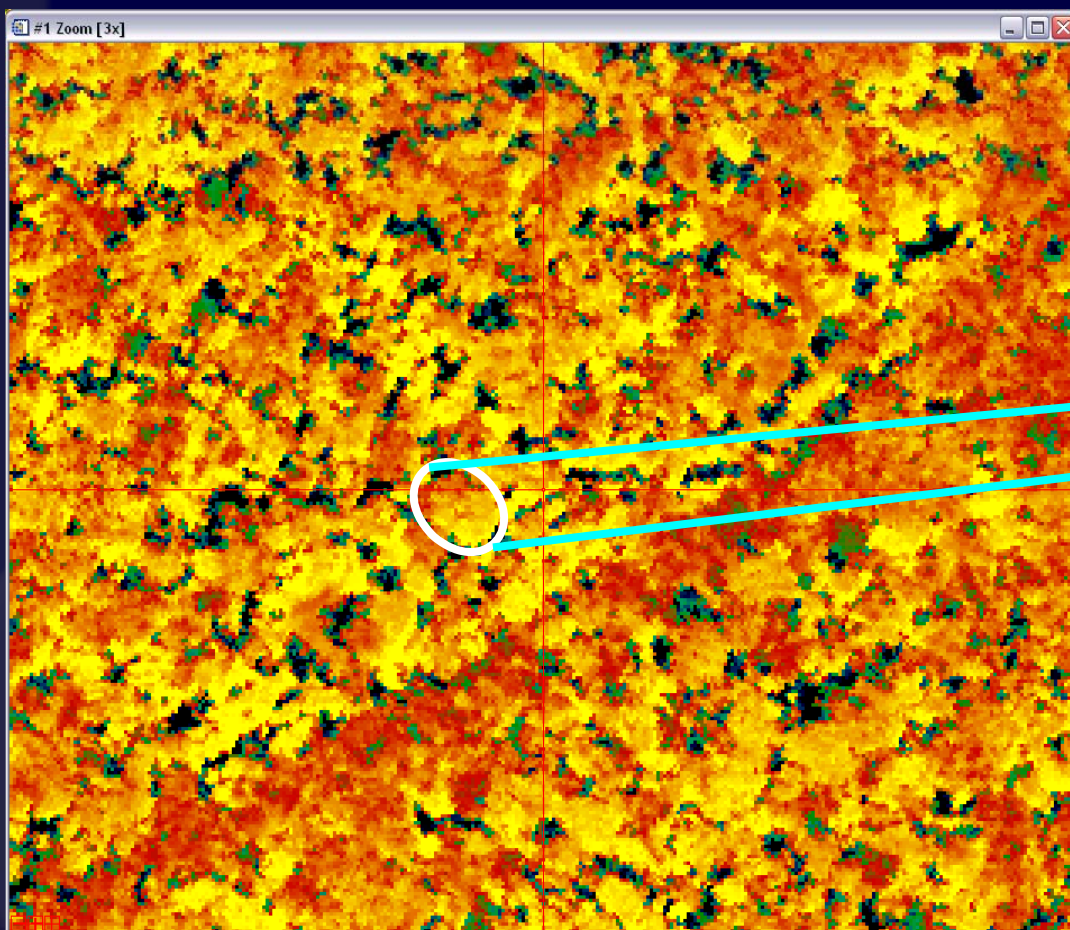
Land use-land cover data

Carnegie Airborne Observatory (Alpha)

CAO Test Flight – Nov 12, 2006

Laupahoehoe Rainforest Reserve, Hilo, Hawai'i

Top-of-canopy Carotenoid Pigments → Light-use Efficiency
Analysis crown-by-crown (sunlit vs. shaded sides of crowns)



Car:Chl ratio inversely proportional to
carbon uptake efficiency (LUE)

Ecosystem process parameters
For scaling

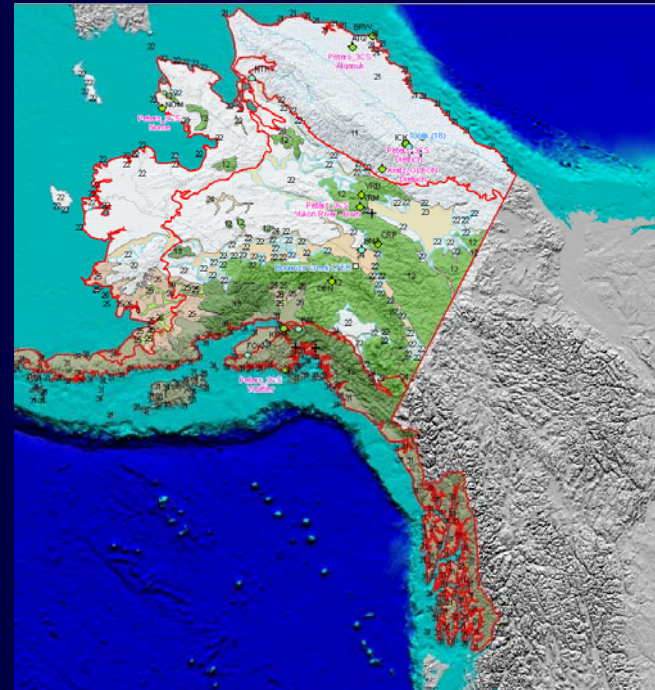
LUAP

To provide access to data at the site to national scale:

- Land-use / land-cover (LULC) context of NEON observations,
- On the socio-economic context of the LULC.

The LUAP offers ecologists whose primary expertise is not in geospatial analysis:

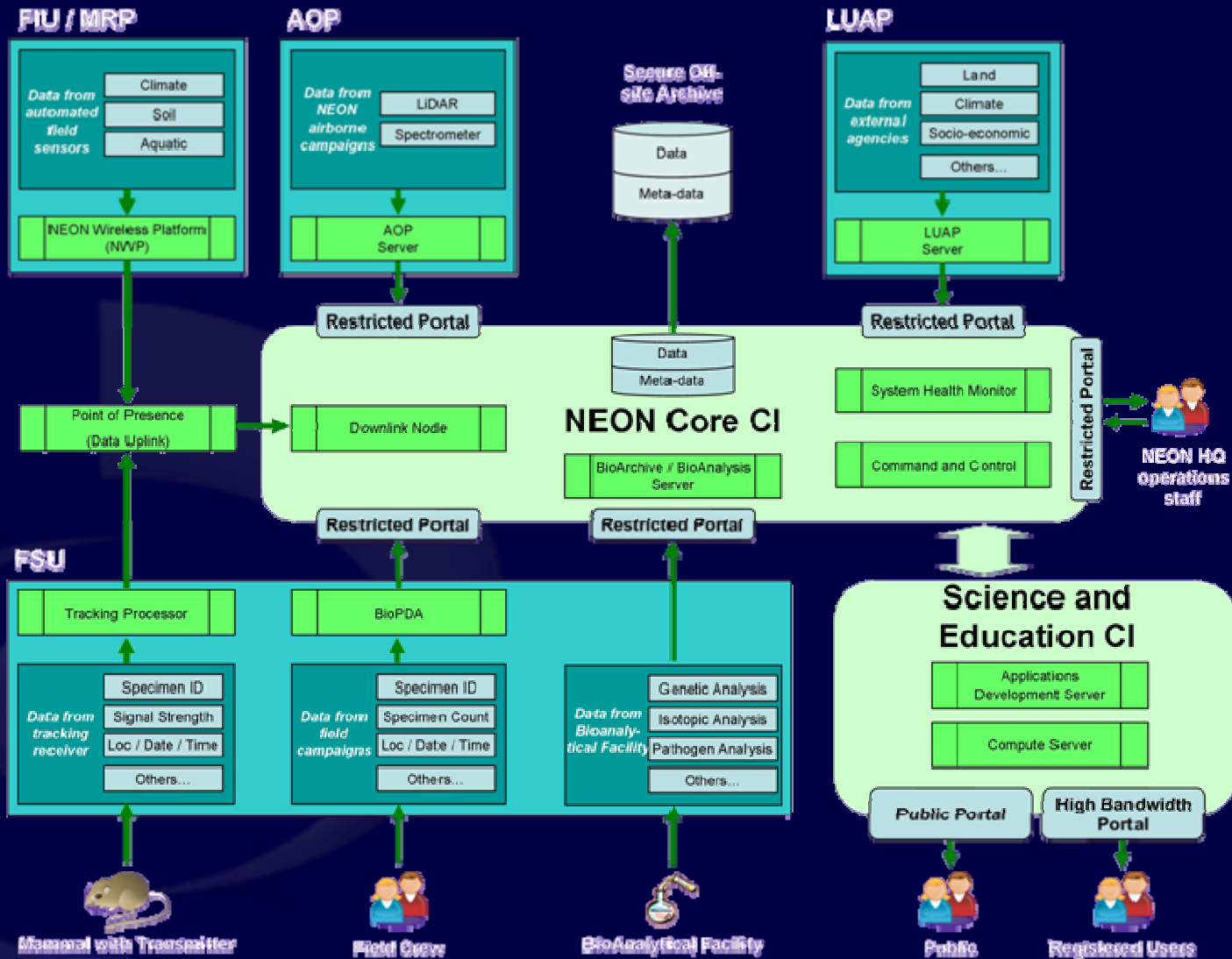
- Spatially extensive datasets in a number of standard spatial / temporal resolutions,
- A web interface that supports the exploration and discovery of multiple related geospatial datasets.



LUAP Initial Data Set

- Elevation, slope and other surface characteristics
- Climate data
- Soils information
- Land cover information
- Natural vegetation distribution
- Animal distributions
- Hydrologic features (streams, wetland and watershed areas)
- Natural/protected areas catalog
- Special areas information e.g. beach front characteristics
- Chemical and physical water and soil quality measurements
- Habitat fragmentation indices

NEON System Architecture



WHERE IS NEON!?

- We have been “planning” NEON forever, or so it seems (actively talking for >8 yrs)
- NEON, Inc. is 2 years old, currently has about \$26 million in regular NSF program funds
- Should complete final Project Execution Plan in fall of 2009
 - Approval by Nat Sci Bd and NSF
- First MREFC construction funding in FY 2011? Maybe sooner!

NEON is excellent fit with scientific priorities of the Obama administration

- **Environmental monitoring is a scientific priority**
- **Could accelerate development of some elements of NEON (aerial, cyberinfrastructure)**
- **First NEON MREFC funding in FY 09?**

NEON is third major programmatic increment in ecological funding by NSF

- International Biological Program
 - 1968 to 1974, converted to Ecosystem
- Long Term Ecological Research (LTER)
 - 1980 to present (and growing!)
- NEON – 30 year lifespan
- UW “missed the boat” on LTER, must be a major player in NEON if it intends to be a leader in terrestrial ecological science

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UW is uniquely positioned to utilize and influence development of NEON

- Primary academic institution associated with the selected core site (Wind River)
- UW staff in place who interface with NEON program and personnel
- College of the Environment
- *But must assess potential of fit of NEON, determine course of action, and invest if it is to realize that potential*

***Long-term data sets are the
currency of ecological science!***

**Networked long-term data sets are
even more powerful.**

- * Models are nothing but complex hypotheses;
data are required to both formulate good
hypotheses and to test those hypotheses.**

*Do we – at UW – want to just
be passive recipients of
whatever data sets NEON
chooses to collect
--or do we want to actively
influence choices that are
made re. what & where/when?*

Some things UW should do --

- Maintain and strengthen the on-site interface with NEON at Wind River
 - this is where the main intersection between UW and NEON occurs and most opportunities will arise
- Scope potential interactions, develop plan, invest by implementing the plan
- Recruit mid-career ecosystem scientist to provide energetic leadership at UW