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2019-02-01

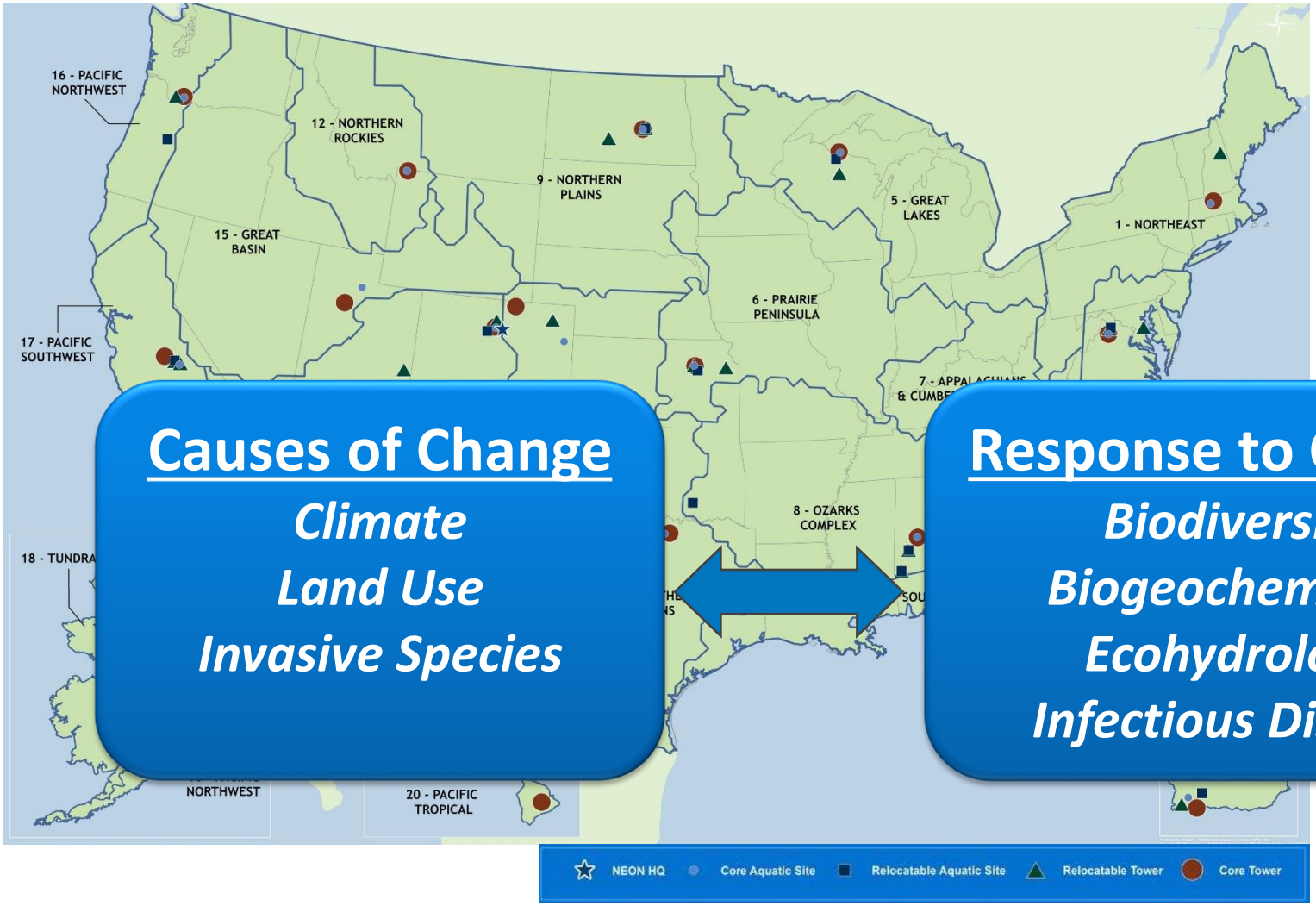
The NEON Terrestrial Observation System: Data and Design

This material is based upon work supported by NSF's National Ecological Observatory Network which is a major facility fully funded by the National Science Foundation

Outline

- NEON domains and sites
- NEON measurement platforms and data products
- TOS Design:
  - Sentinel taxa
  - Spatial design
  - Integration of measurements across scales
  - Temporal integration of sampling
- Toolik site specifics:
  - TOS plots by protocol
  - OS data products
- NEON as a Community Resource
  - Accessing NEON data
  - Assignable Assets
  - Biorepository

NEON Terrestrial and Aquatic Field Sites



81

FIELD SITES

- 47 terrestrial
- 34 aquatic

Causes of Change

Climate

Land Use

Invasive Species

Response to Change

Biodiversity

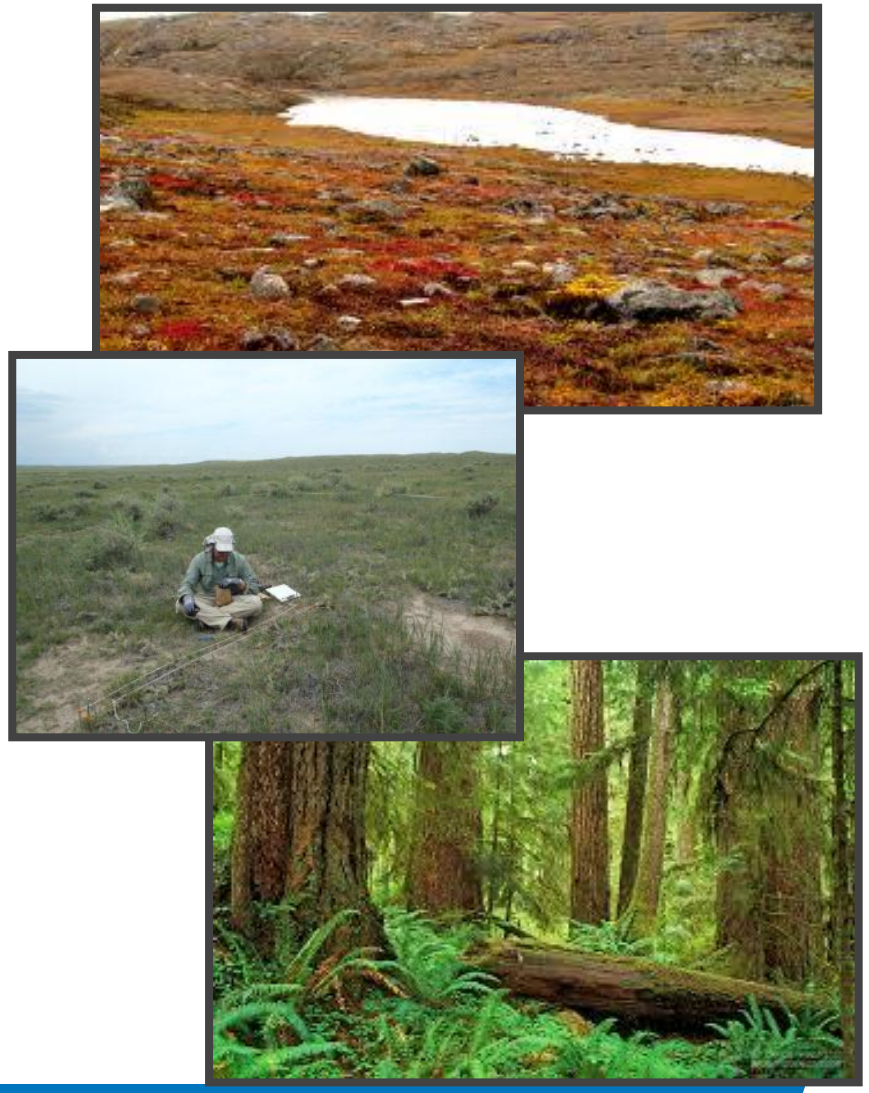
Biogeochemistry

Ecohydrology

Infectious Disease

NEON Terrestrial Field Site Selection

- Minimum of 1 site per domain is managed as ‘wildland’
- Additional sites may address themes that span domains:
  - Invasive species
  - Land Use
  - Nitrogen / dust deposition
  - Woody encroachment
- Collocation with aquatic sites when possible
  - Integrated biogeochemistry measurements



Co-located LTER and NEON sites

LTER	NEON
Andrews	McRae Creek (D16 relocatable aquatic)
Arctic	Toolik (D18 core terrestrial) Oksrukuyik Creek (D18 core aquatic) Toolik Lake (D18 relocatable aquatic)
Bonanza Creek	Caribou–Poker Creeks Research Watershed (D19 core terrestrial) Caribou Creek (D18 core aquatic)
Harvard Forest	Harvard Forest (D01 core terrestrial) Lower Hop Brook (D01 core aquatic)*
Jornada Basin	Jornada LTER (D14 relocatable terrestrial)
Konza Prairie	Konza Prairie Biological Station (D06 core terrestrial) Kings Creek (D06 core aquatic) Konza Prairie Biological Station – Relocatable (D06 relocatable terrestrial)
Niwot Ridge	Niwot Ridge Mountain Research Station (D13 core terrestrial) Como Creek (D13 core aquatic)

NEON Data Collection Platforms

Automated instruments

Observational sampling

Airborne remote sensing

- ✓ These three systems collect data within close proximity of each other at each site
- ✓ Standardized methods are used across all sites
- ✓ Aquatic and terrestrial components for instrument and observational sampling

NEON Data Collection Platform: TOS

TOS

42 Data Products

- Beetles
- Birds
- Mosquitoes
- Small Mammals
- Ticks
- Plants
- Soils

Land Use, Cover, Processes

3 Data Themes

Organisms, Populations, Communities

Biogeochemistry

NEON TOS: Biogeochemistry and Organisms

	 Plants	 Soil microbes	 Small mammals	 Mosquitoes	 Birds	 Ground beetles	 Ticks	 Soil
Diversity	✓	✓	✓	✓	✓	✓	✓	
Abundance	✓	✓	✓	✓	✓	✓	✓	
Pathogens			✓	✓			✓	
Phenology	✓			✓			✓	
Pools/fluxes: biogeochemistry	✓							✓
Metabolism		✓						
Productivity & biomass	✓	✓						

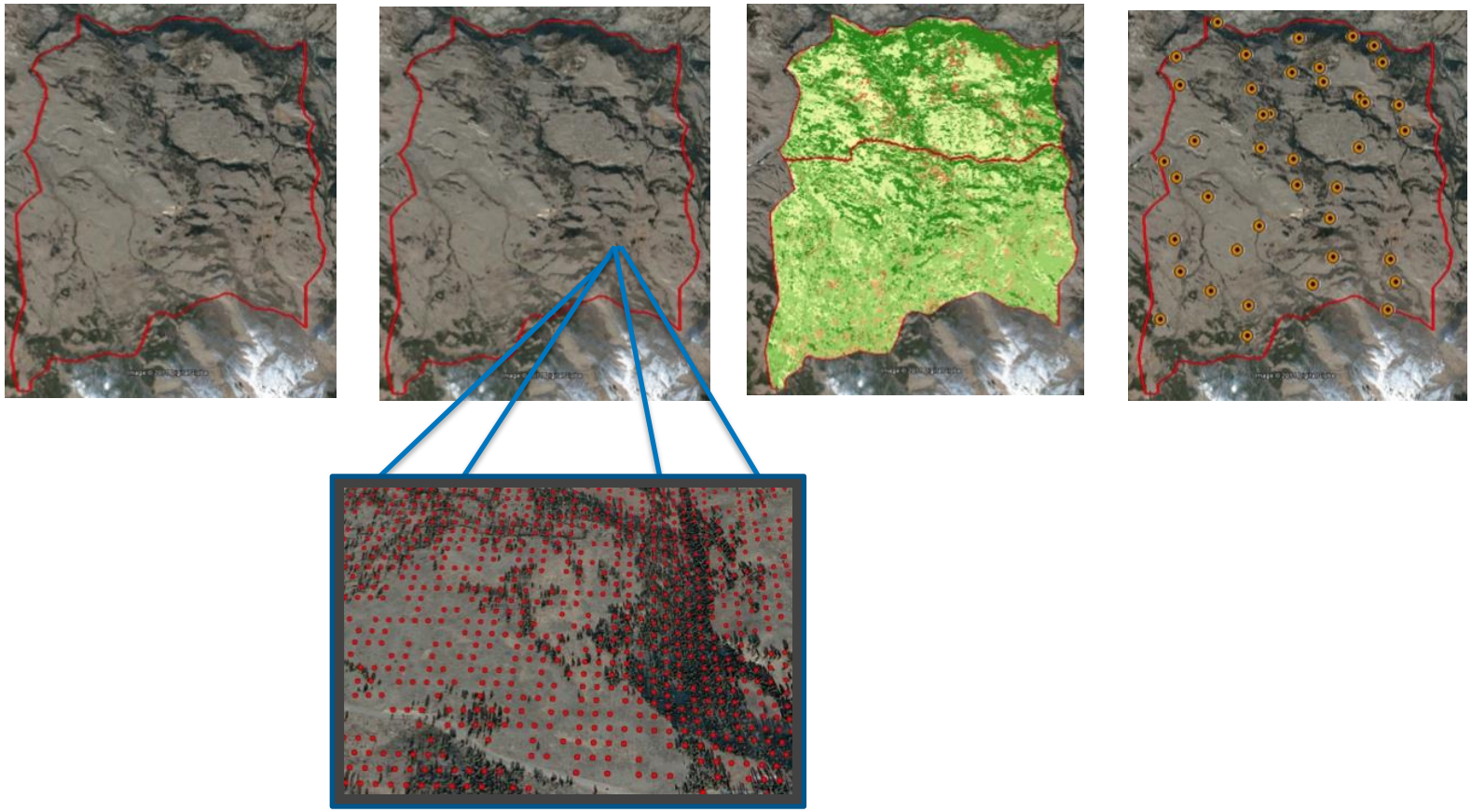
NEON TOS Spatial Design

Site Boundary

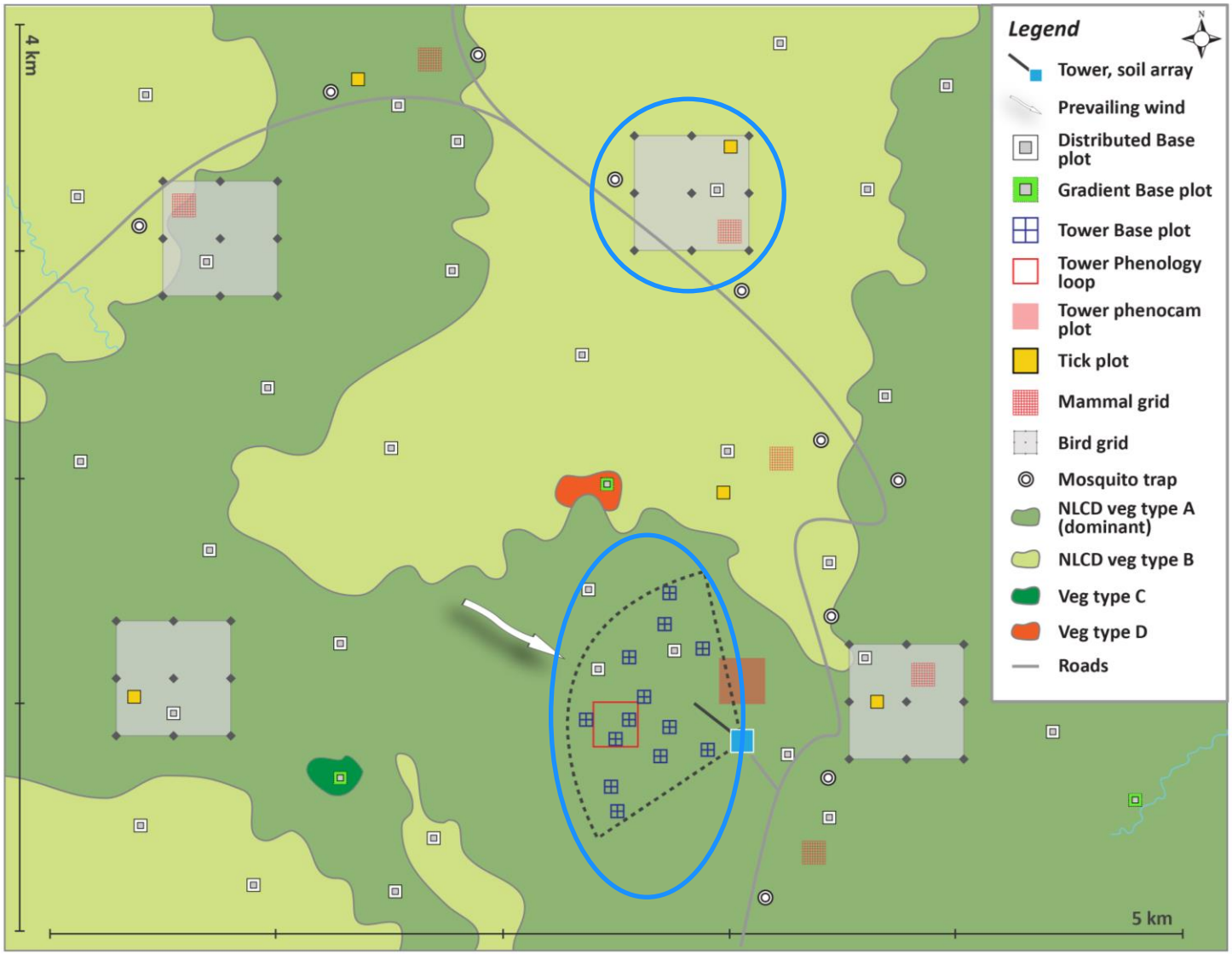
Spatial Balanced and Random Grid

Stratified by Vegetation Type

Study Locations

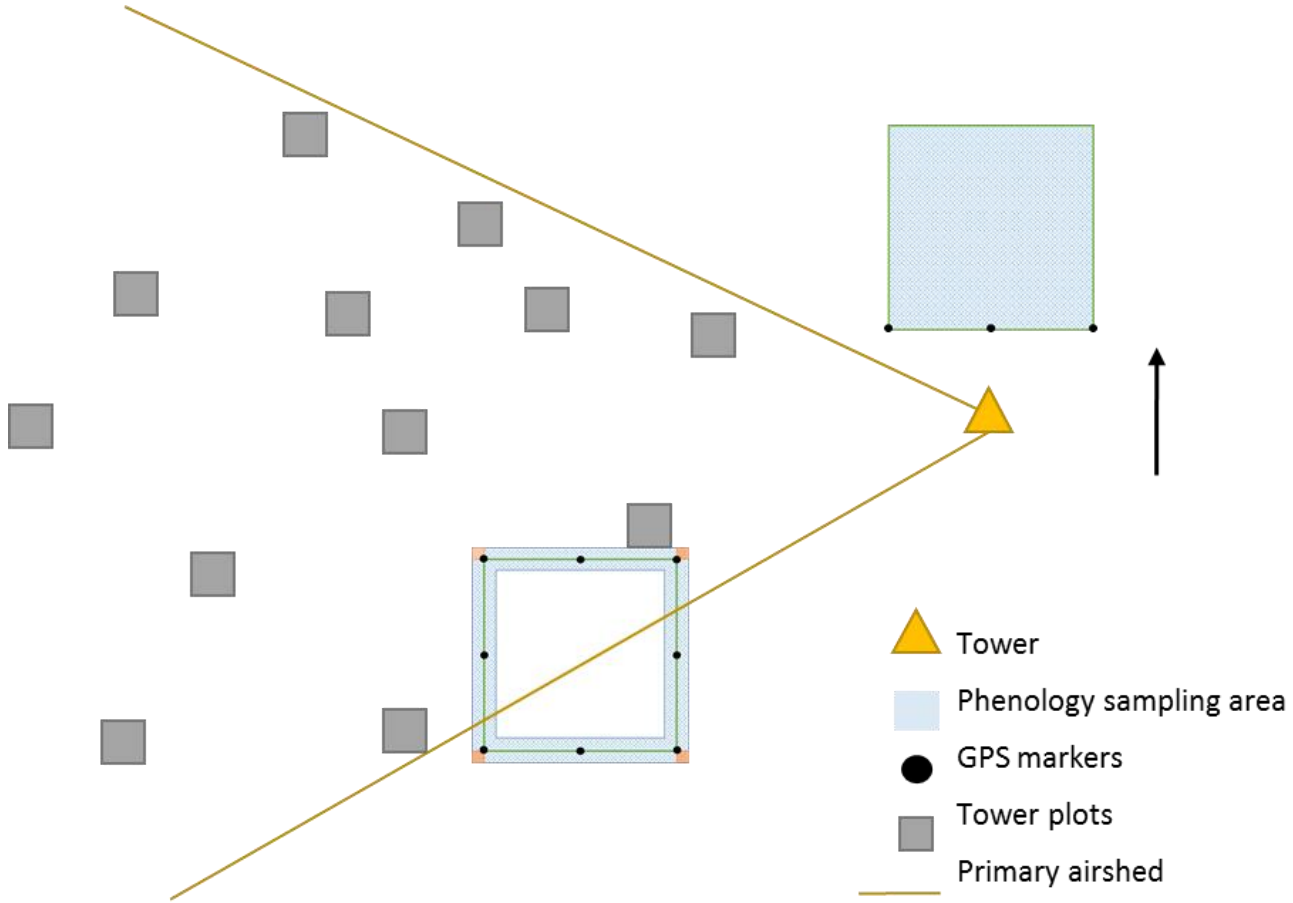


NEON TOS: Collocation Across Scales



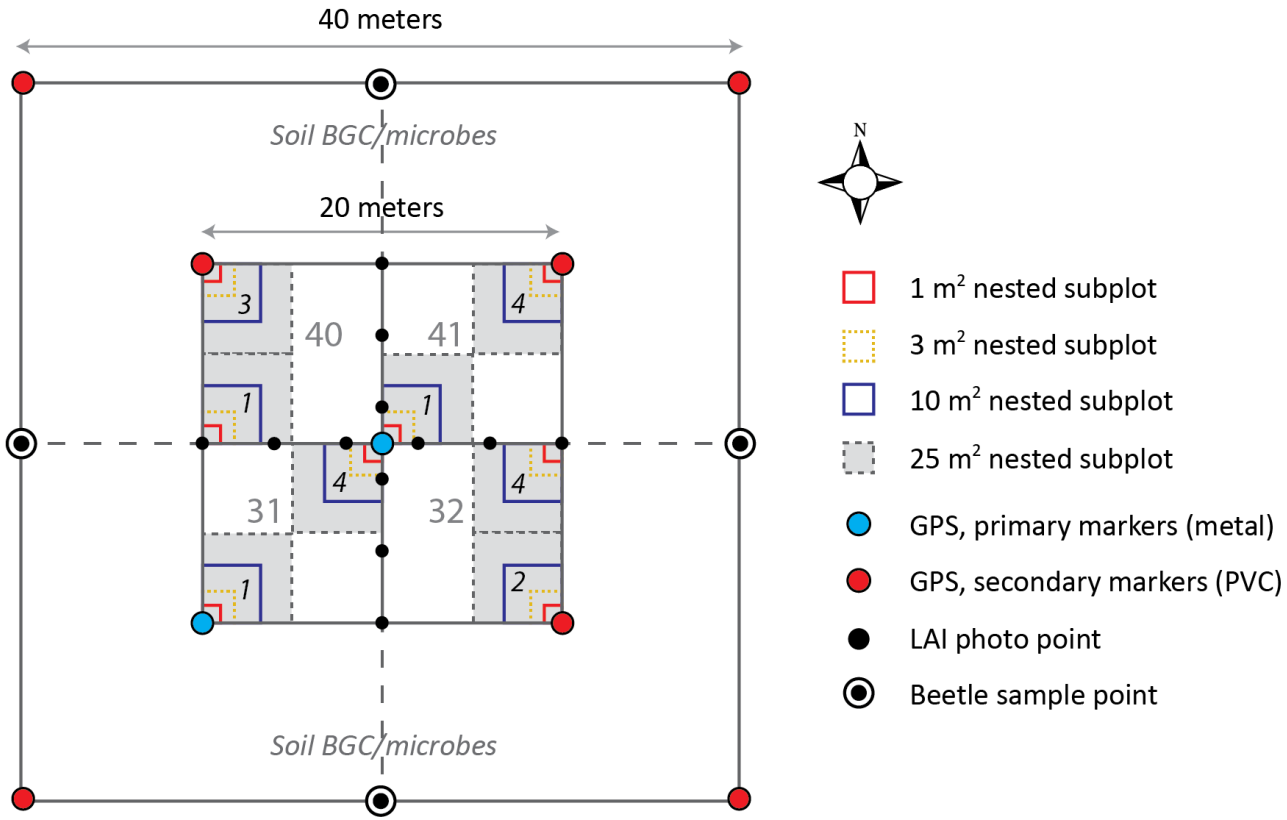
NEON TOS: Collocation Across Scales

Within Habitat: Tower Airshed



NEON TOS: Collocation Across Scales

Within Plot: Distributed Base Plots



NEON TOS: Collocation Across Scales

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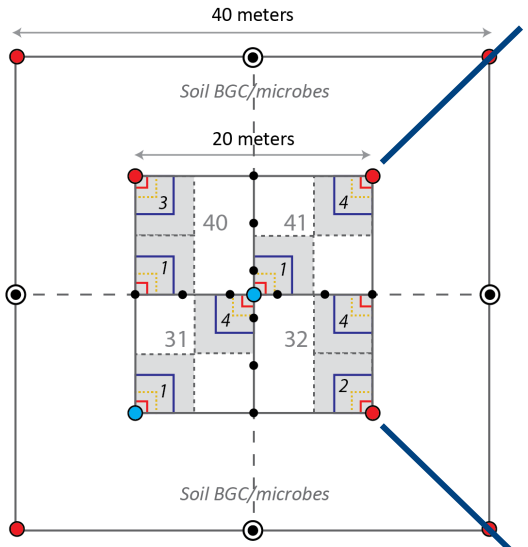


Plot level
- Leaf Area Index
- Species percent cover
- Species richness

Canopy species traits
- Leaf mass per area
- Leaf chemistry (C, N, lignin, chlorophyll, isotopes, others)

Litter production
- Reproductive parts
- Leaves, needles
- Fine woody debris

Tree, sapling, shrub, and liana live woody biomass, and aboveground necromass

Herbaceous biomass

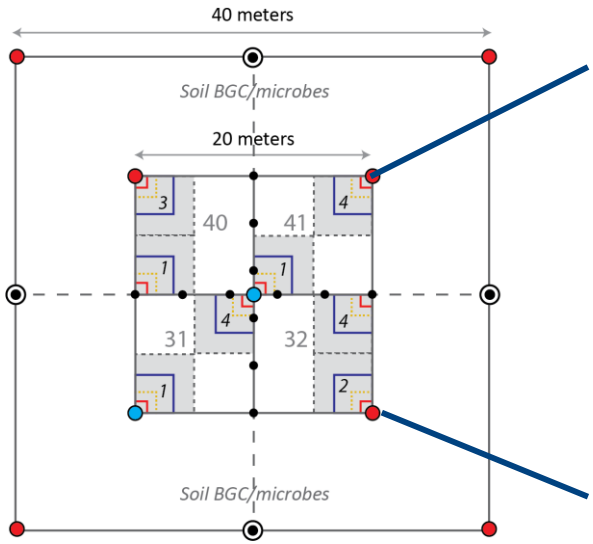
CWD stocks, branchfall

- Soil microbes
- Moisture, pH
- N-min, C & N, isotopes

- Fine root biomass (sampled, ≤ 2 mm)
- Coarse root biomass (sampled, 10 mm ≥ diam > 2 mm)
- Coarse root biomass (allometric)

NEON TOS: Collocation Across Scales

Within Plot: Distributed Base Plots



TOOL Implementation

Plot level
- Leaf Area Index
- Species percent cover
- Species richness

Canopy species traits
- Leaf mass per area
- Leaf chemistry (C, N, lignin, chlorophyll, isotopes, others)

Shrub biomass, and aboveground necromass

Herbaceous biomass

- Soil microbes
- Moisture, pH
- N-min, C & N, isotopes

- Fine root biomass, C & N, isotopes (sampled, ≤ 2 mm)

NEON TOS: Collocation Across Scales

NEON TOS: Collocation Across Scales

Within Sample: Multiple Analyses

Small Mammal Sampling

- Population and community composition data
- Individual rodent data
  - Mass
  - Hind-foot length
  - Sex
  - Pregnancy status, etc.
- Blood analyses (hantavirus)
- Biorepository on request:
  - Hair
  - Fecal
  - Blood

NEON TOS: Collocation Across Scales

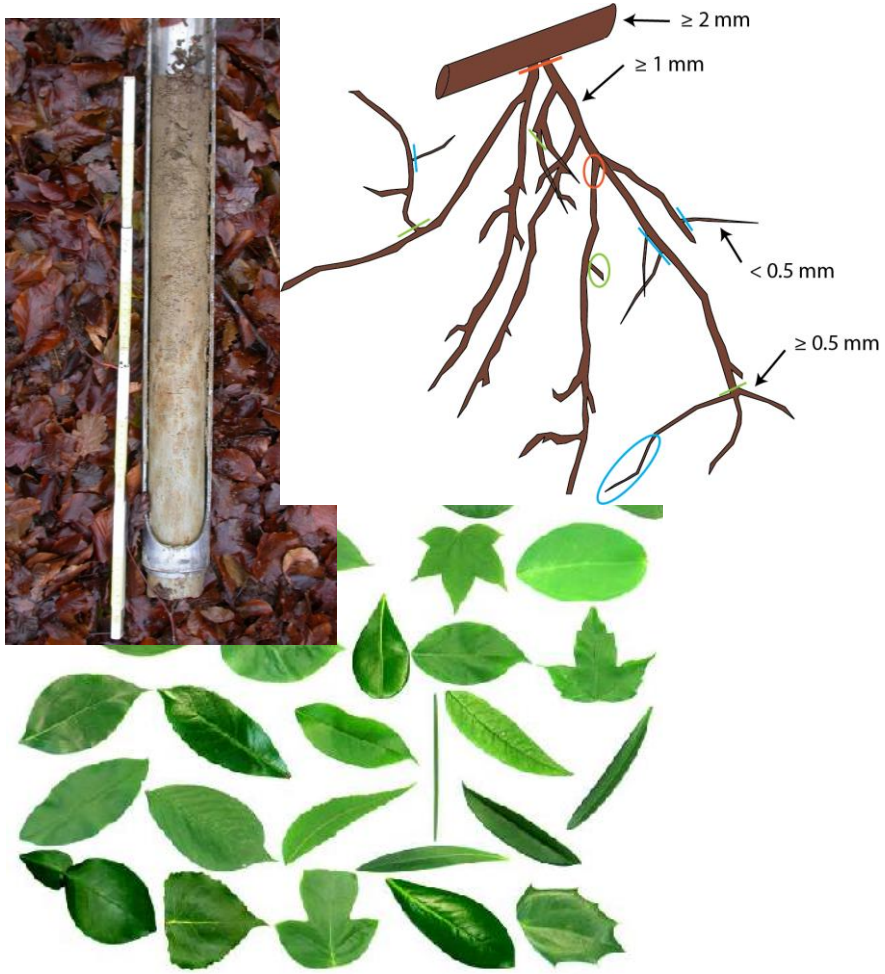
Within Sample: Multiple Analyses

Mosquitos and Ticks

- Population and community composition data
- Pathogen analyses:
  - MOS: alphaviruses, bunyaviruses, flaviviruses
  - TCK: *Borrelia spp.*, *Rickettsia spp.*, others
- Biorepository samples available upon request

NEON TOS: Collocation Across Scales

Within Sample: Multiple Analyses

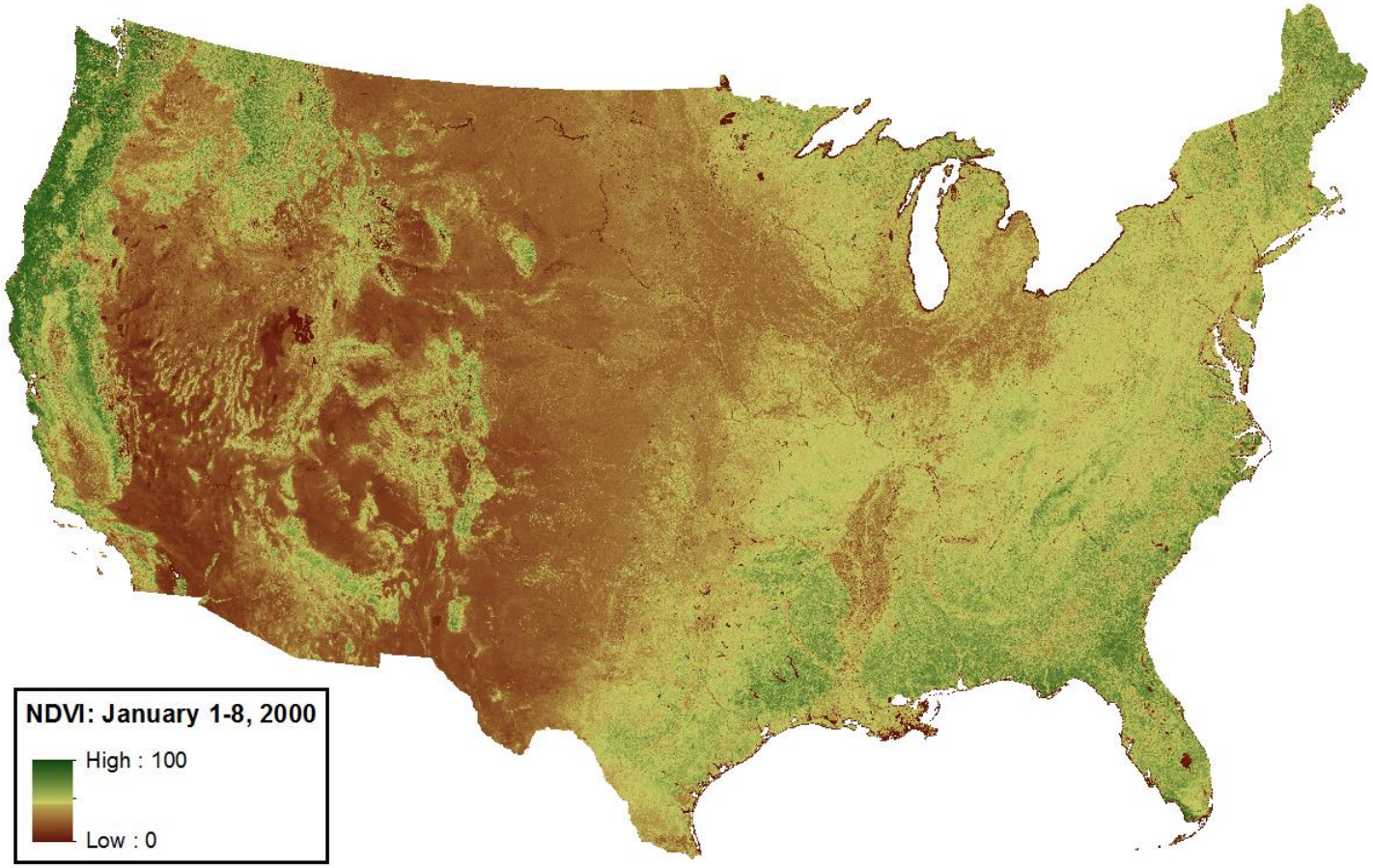


Biogeochemistry

- Canopy Foliage:
  - LMA
  - Chlorophyll, lignin, C & N, isotopes, additional
- Litterfall:
  - Productivity
  - Lignin, C & N, isotopes
- Soil core:
  - Microbial community comp, metagenome, biomass
  - Soil moisture, pH
  - N-trans, C & N, isotopes
- Roots:
  - Biomass x size category
  - C & N, isotopes

NEON TOS: Cross-Site Temporal Coordination

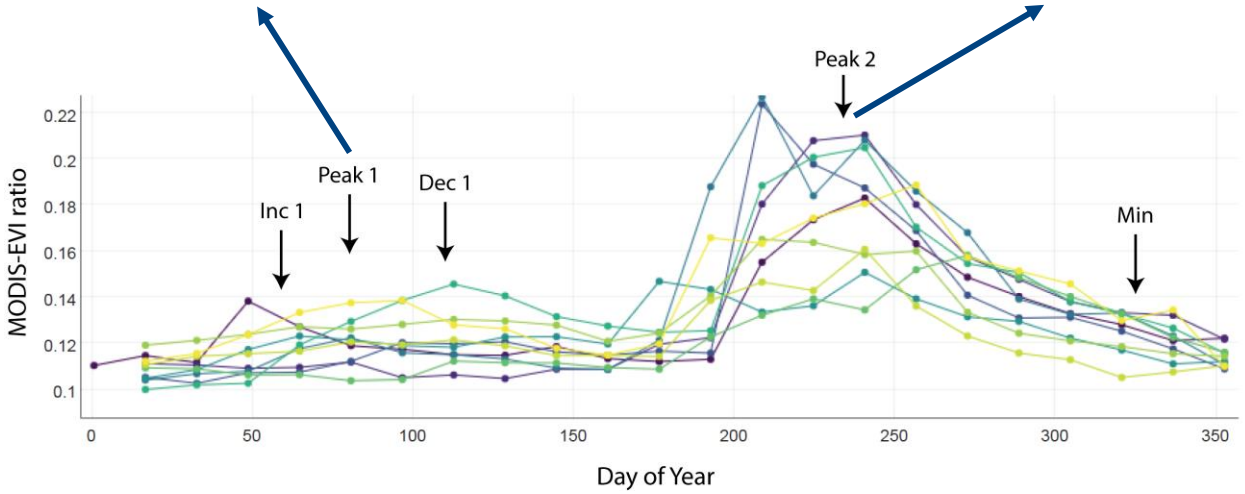
Standardized Measurements and Phenology



NEON TOS: Cross-Site Temporal Coordination

Standardized Measurements and Phenology

D14 Santa Rita MODIS-EVI Phenology (2005-2014)



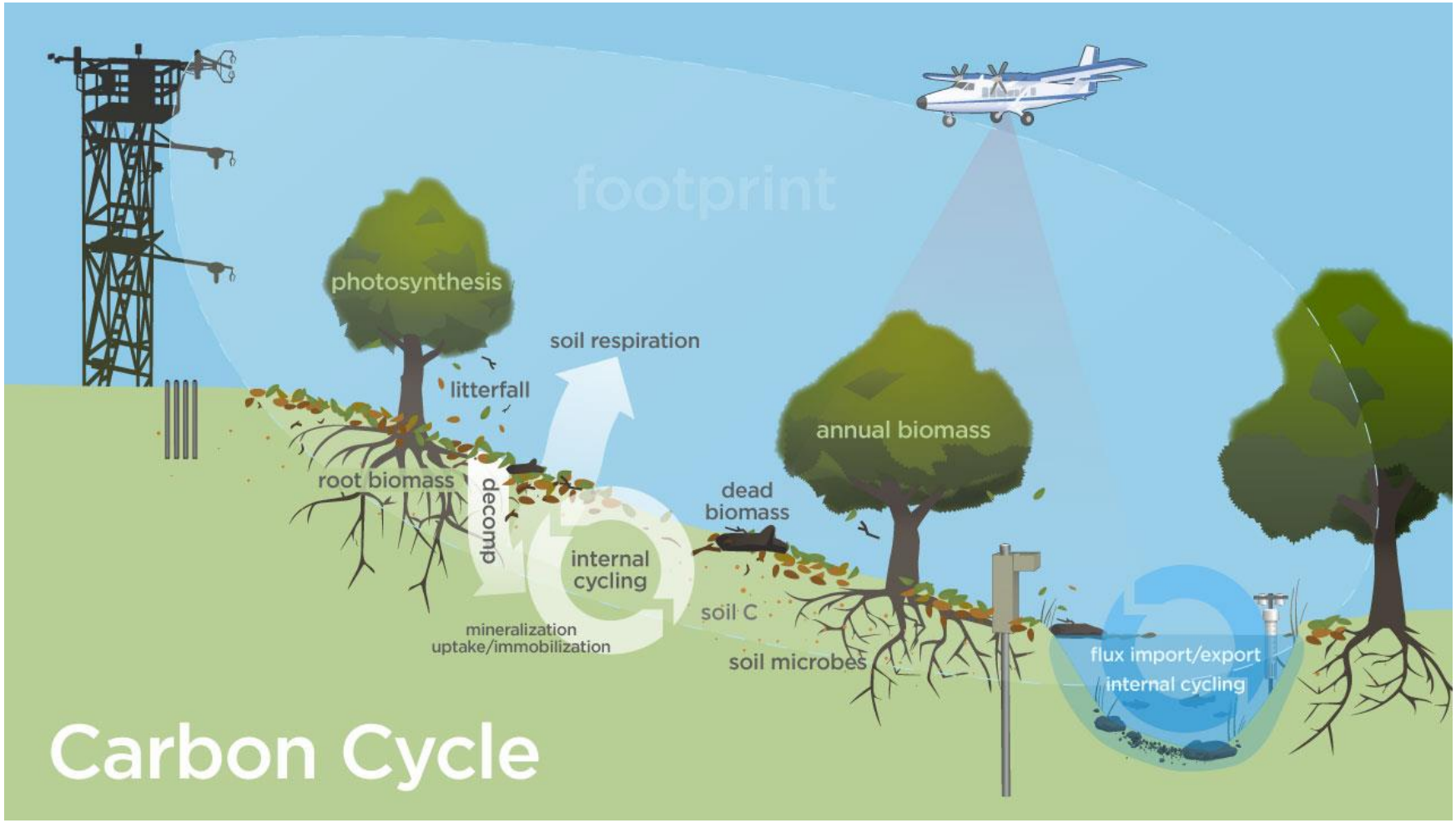
NEON TOS: Protocol Coordination Across Years

Multi-year Synchronization for Plant and Soil Data

Protocol*	Interval (y)	Plot Type	Plot Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
BGB	5	tower	20 or 30†	X					X	
CFC	5	both	16-20	X					X	
DIV	1	distributed	30	X	X	X	X	X	X	X
LAI	5	distributed	20	X					X	
LTR-bgc	5	tower	20 or 30†	X					X	
NTR	5	both	10	X					X	
SLS-bgc	5	both	10	X					X	
SLS-mb	5	both	10	X					X	
CDW	5	distributed	20		X					X
HBP	5	distributed	20		X					X
VST	5	distributed	20		X					X
HBP	1	tower	20 or 30†	X	X	X	X	X	X	X
LAI	1	tower	3	X	X	X	X	X	X	X
LTR	1	tower	20 or 30†	X	X	X	X	X	X	X
VST	1	tower	5-10‡	X	X	X	X	X	X	X
CDW	5	tower	20 or 30†				X			
VST	5	tower	20 or 30†					X		

NEON TOS: Protocol Coordination Across Years

Multi-year Synchronization for Plant and Soil Data



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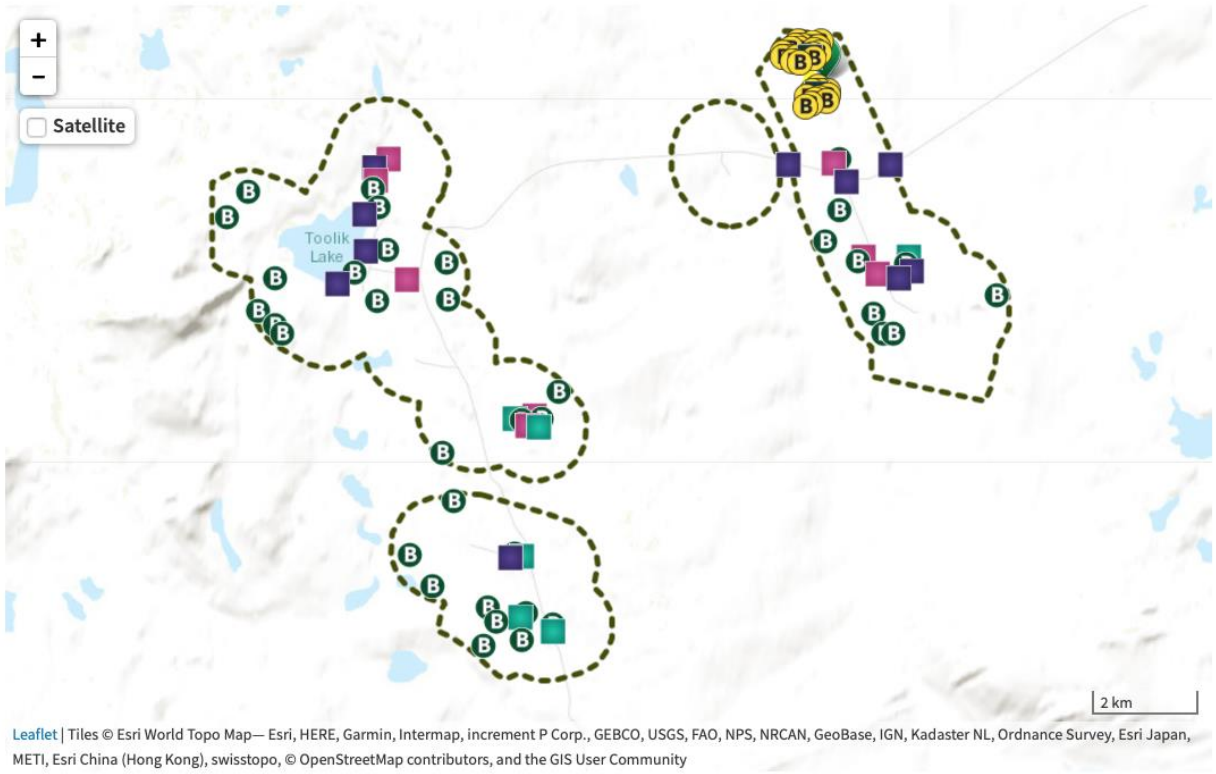
NEON TOS at Toolik: Site Design

Toolik - TOOL

Core Terrestrial | Alaska | D18: Tundra



Map Legend

Click the check boxes to filter results on the map

- NEON Sampling Boundaries
- Tower Airshed Boundary
- Tower Location

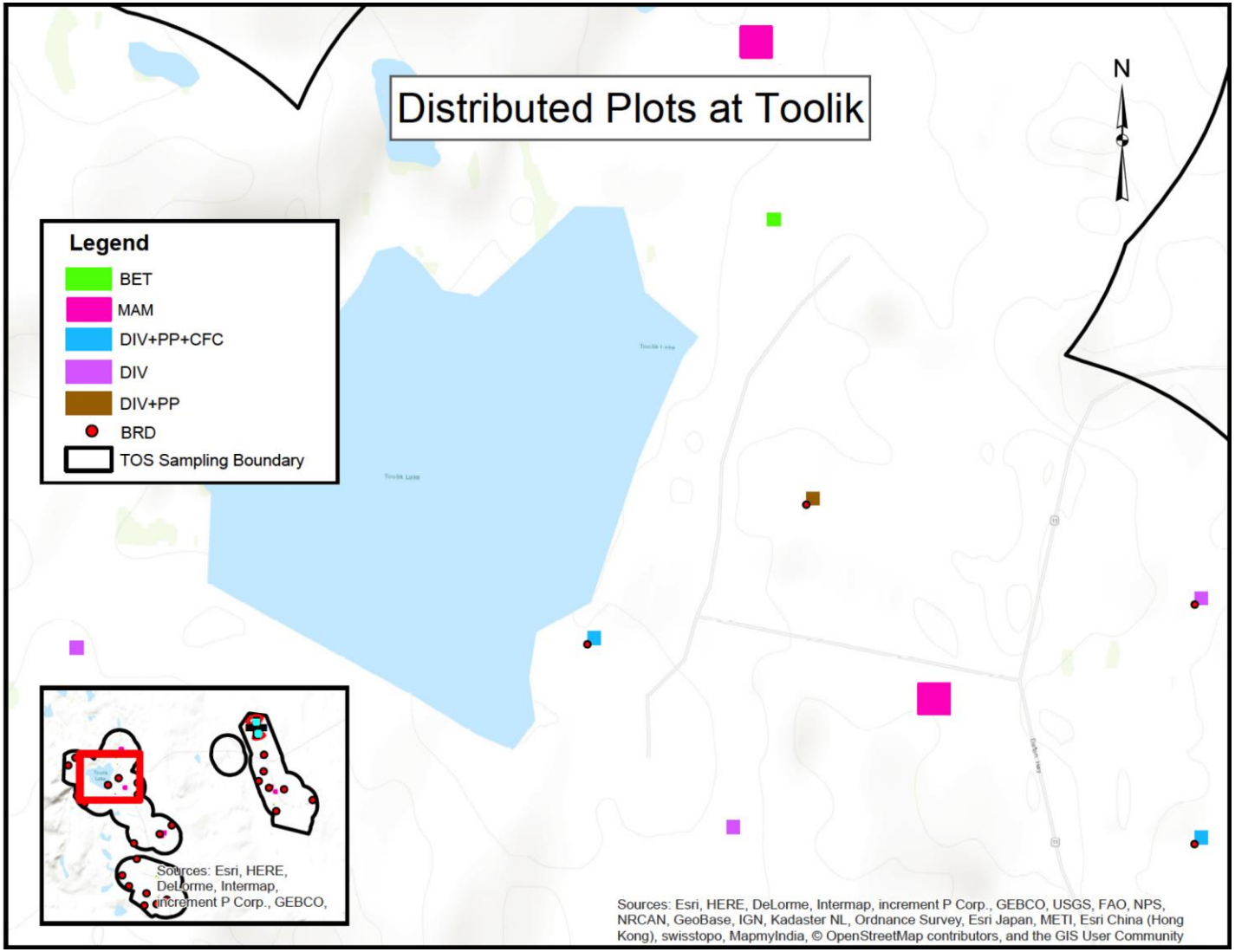
- ✔ Distributed Plot Types
  - ✔ Distributed Base Plot
  - ☐ Distributed Bird Grid
  - ✔ Distributed Mammal Grid
  - ✔ Distributed Mosquito Plot
  - ✔ Distributed Tick Plot
- ✔ Tower Plot Types
  - ✔ Tower Base Plot
  - ✔ Tower Phenology Plot

BROWSE DATA

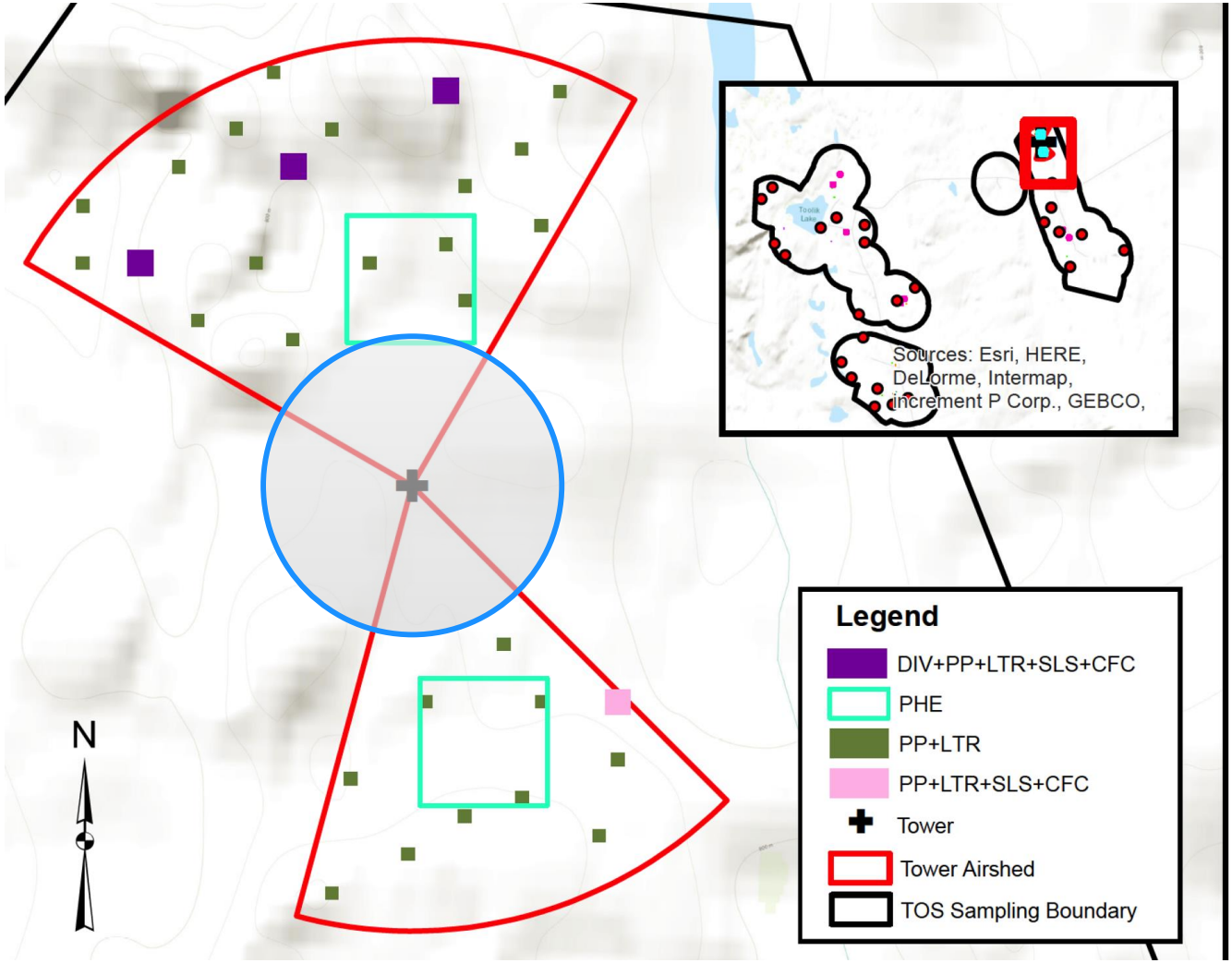
This map depicts the spatial layout of this field site. Please note that some locations may have moved over time due to logistics, safety and science requirements.
This map was updated on January 11, 2019

https://www.neonscience.org/field-sites/field-sites-map/TOOL

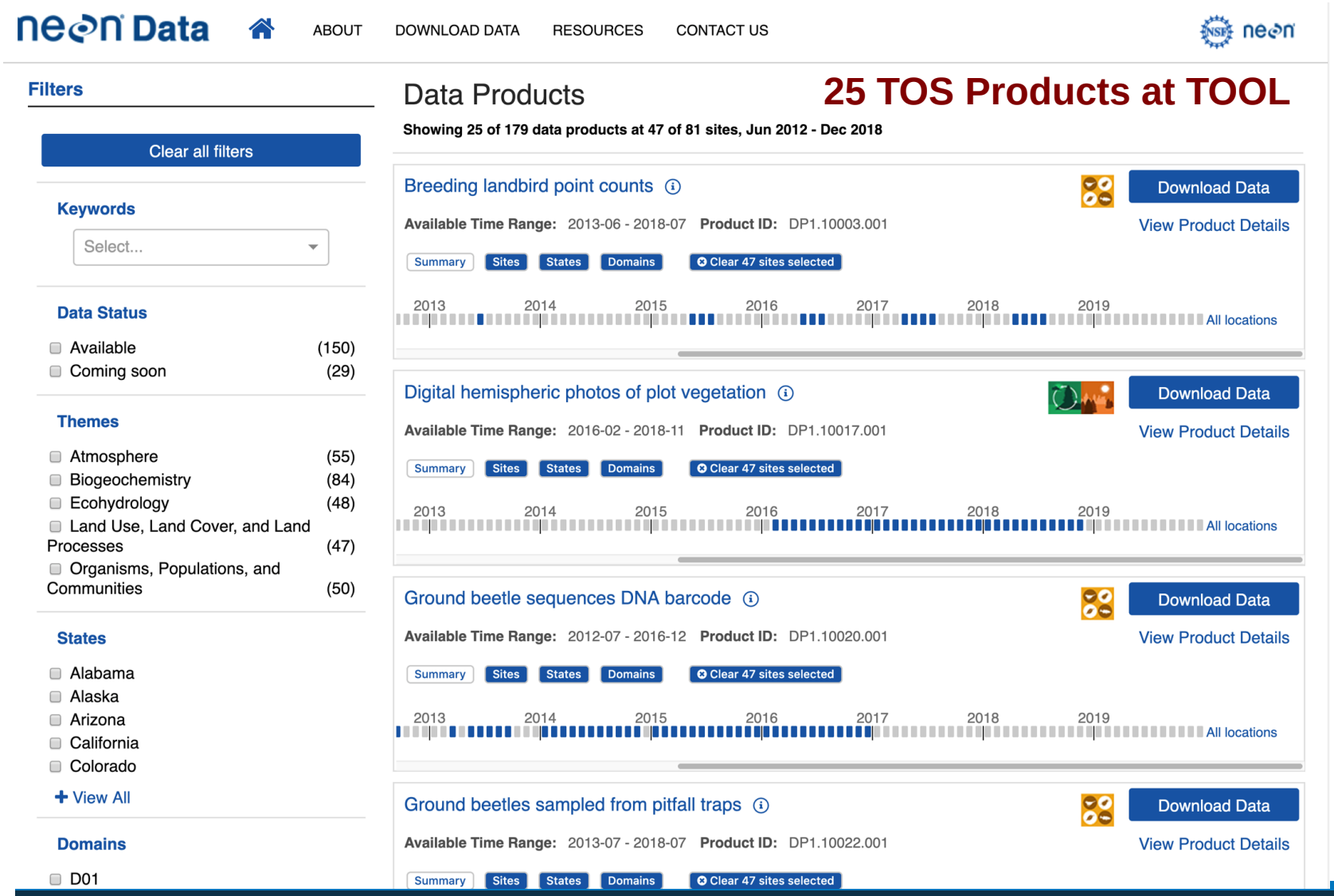
NEON TOS at Toolik: Distributed Plots



NEON TOS at Toolik: Tower Airshed



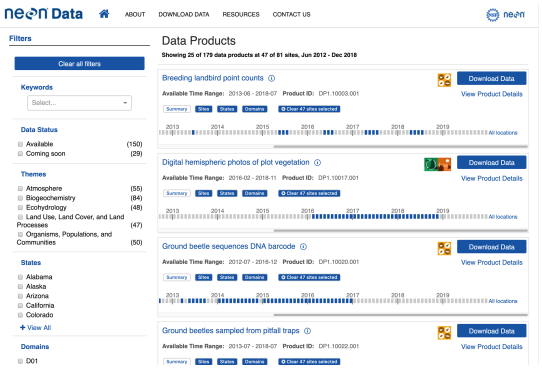
NEON TOS at Toolik: Data Products



http://data.neonscience.org/static/browse.html

NEON as a Community Resource

Data Portal



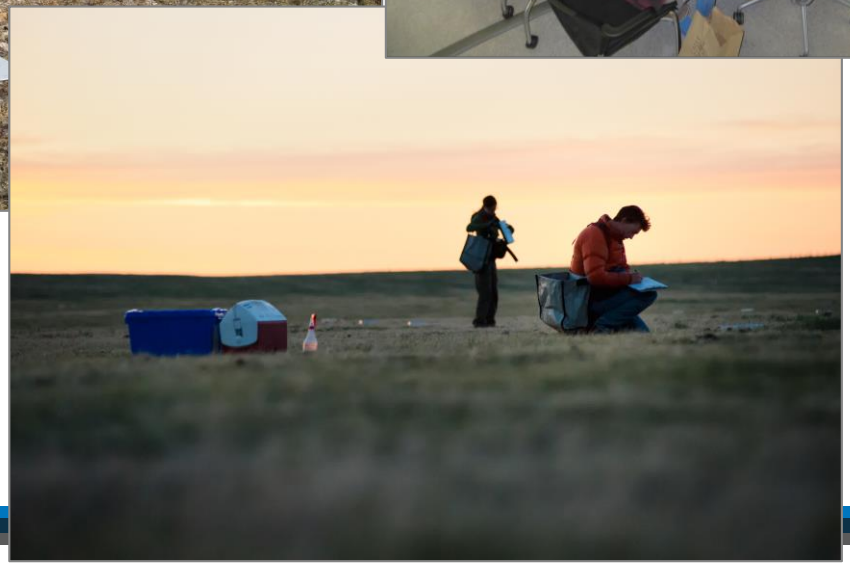
Biorepository

Assignable Assets

http://data.neonscience.org/static/browse.html

NEON as a Community Resource

Questions?



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