



neon
Operated by Battelle

Detecting changes in vegetation structure following fires using discrete-return LiDAR

Observatory design

81

Field Sites
(47 Terrestrial
34 Aquatic)

30

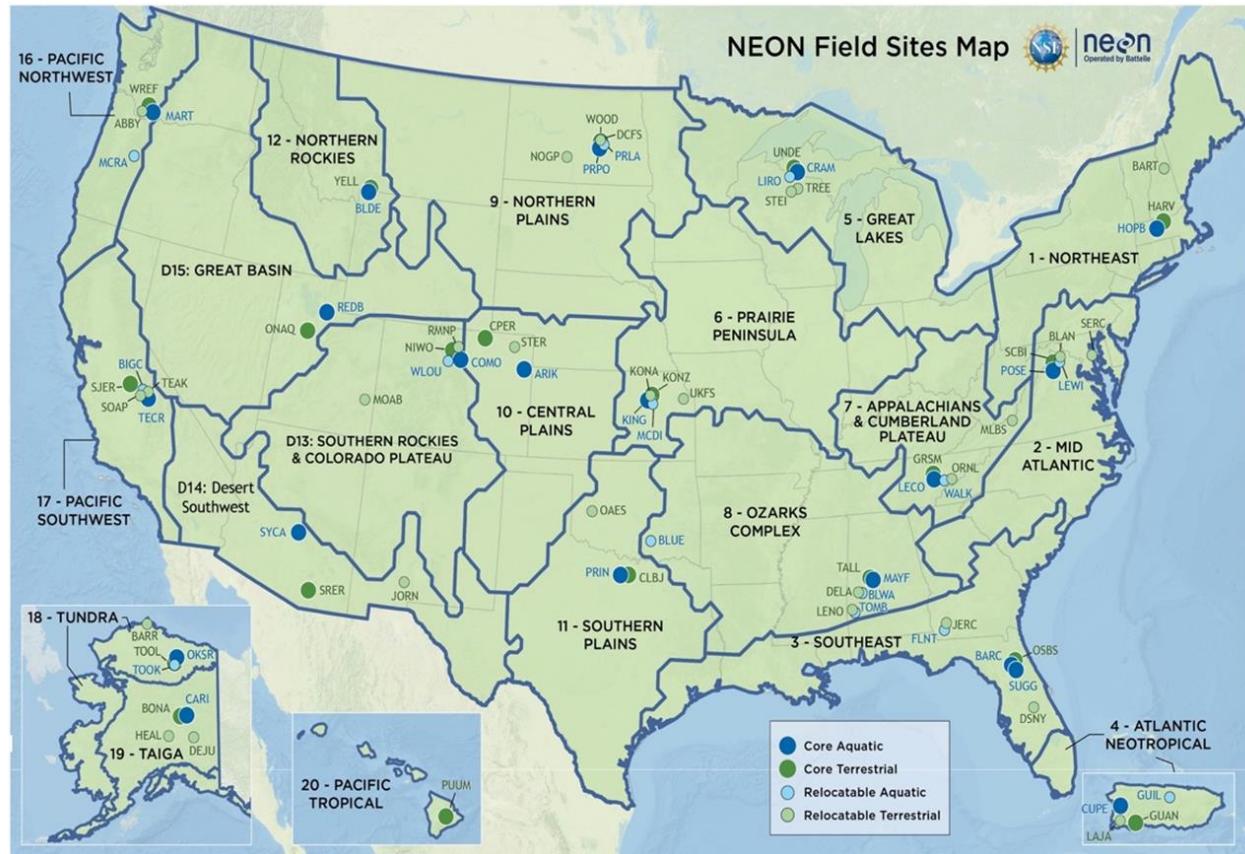
Years
Planned
Operations
(Began 24 May,
2019)

20

Eco-Domains
Across the 48
contiguous states,
Alaska, Hawaii, and
Puerto Rico

>180

Data Products
(Albedo, Leaf Area
Index, CO₂ Flux, CH₄
Concentration, etc)



- Free and open data
- Standardized framework
- Data interoperability for integration with other research networks

NEON sampling design



Automated
Instrument Systems



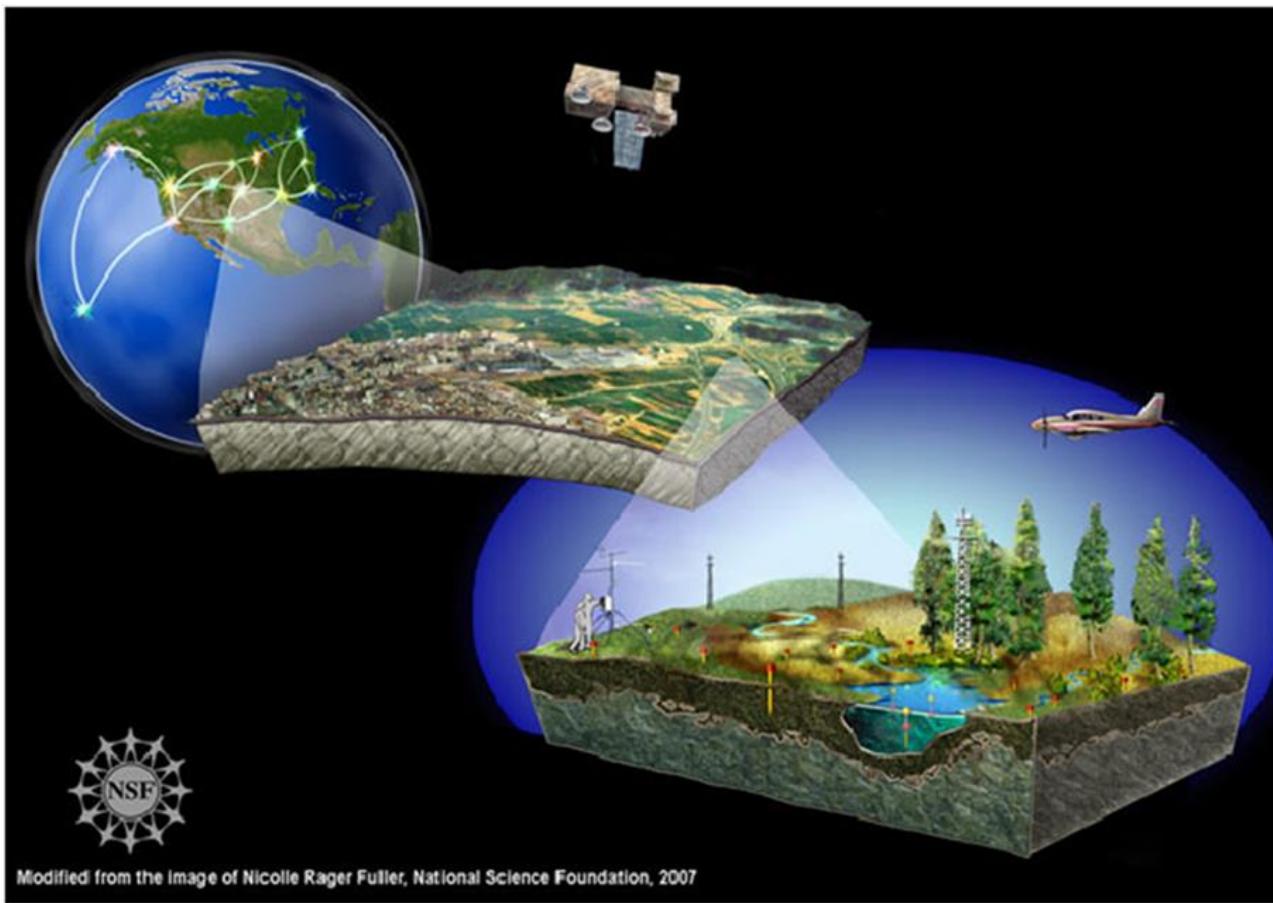
Observational
Sampling



Airborne Observation
Platform



Multi-scale ecological analyses using NEON data

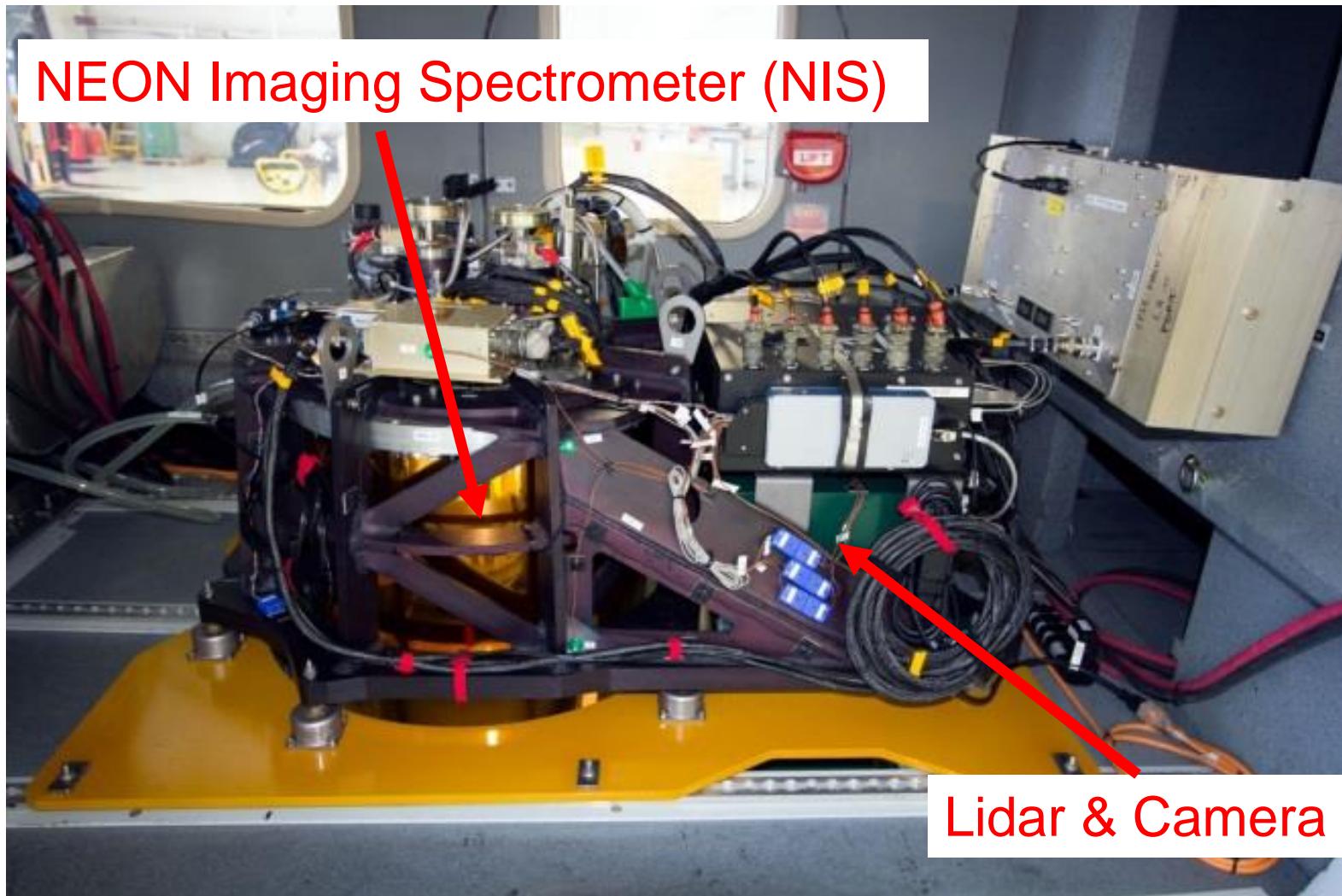


Airborne Observation Platform (AOP)

- Collects airborne remote sensing data
- Covers 'regional scale' ($\sim 100 \text{ km}^2$)
- Data products generated at high spatial resolution ($\leq 1 \text{ m}^2$)
- Waveform Lidar, Imaging Spectrometer and RGB camera

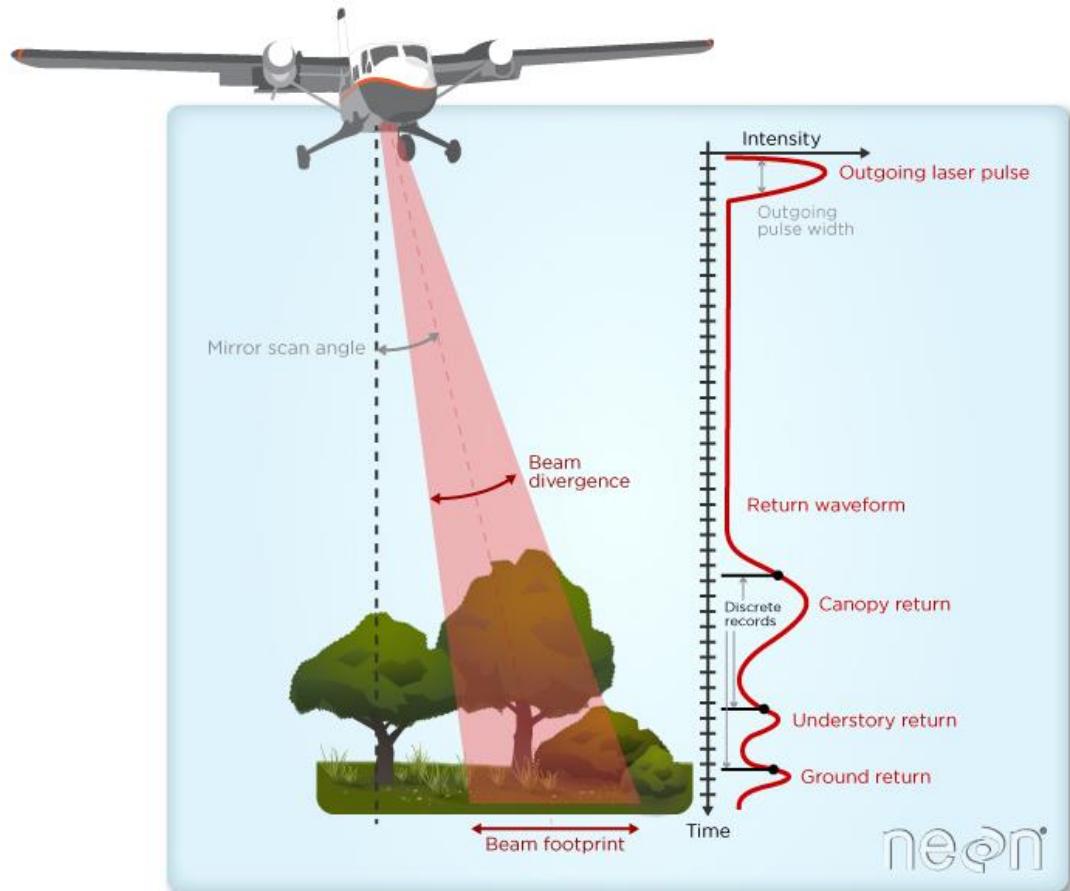


AOP Payloads



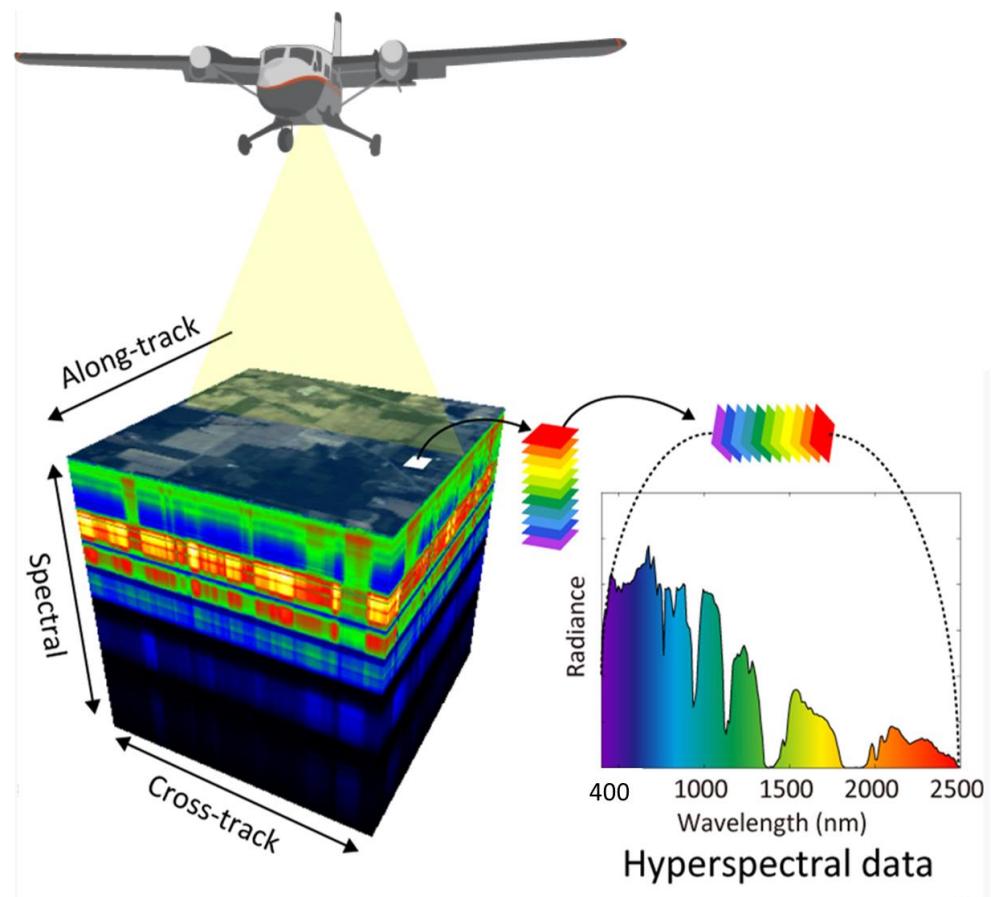
Waveform LiDAR Sensor

- Active-source instrument
 - 1064 nm
- Transmits laser pulses at up to 1000 kHz
- Capable of recording multiple discrete returns per pulse
- Provides structural (3D) information about the landscape



NEON Imaging Spectrometer (NIS)

- Images acquired in pushbroom configuration
 - 34 deg across-track
 - 1 mrad along-track
 - 1000m AGL = 1m² resolution
- Each 1 mrad pixel imaged light is spread into its component wavelengths 380 - 2510 nm
- 5nm spectral sampling interval with <7.5nm FWHM



Digital Camera Sensor

- Commercial instrument delivered with Optech or Riegl lidar system: DiMAC D-8900 or PhaseOne iXA
- Purpose
 - Context for lidar and spectrometer
 - Provides sub-meter sampling of scene @ 1000 m AGL
 - High spatial accuracy



NEON AOP data products

Level 1

- Spectrometer Orthorectified at-Sensor Radiance
- LiDAR Slant Range Waveform
- Discrete Return LiDAR Point Cloud
- Spectrometer Orthorectified Surface Directional Reflectance
- High-resolution Orthorectified camera imagery

Raw data to physical units

Temporarily Suspended Products

ATBDs (Algorithm Theoretical Basis Documents) describing the process for data product creation

Level 2

- Canopy Water Content
- Canopy Xanthophyll Cycle
- **Canopy Lignin**
- **Canopy Nitrogen**
- Vegetation Indices – Spectrometer
- Albedo - Spectrometer
- LAI - Spectrometer
- fPAR - Spectrometer
- **Total Biomass Map - Spectrometer**

Derived products
e.g. indices

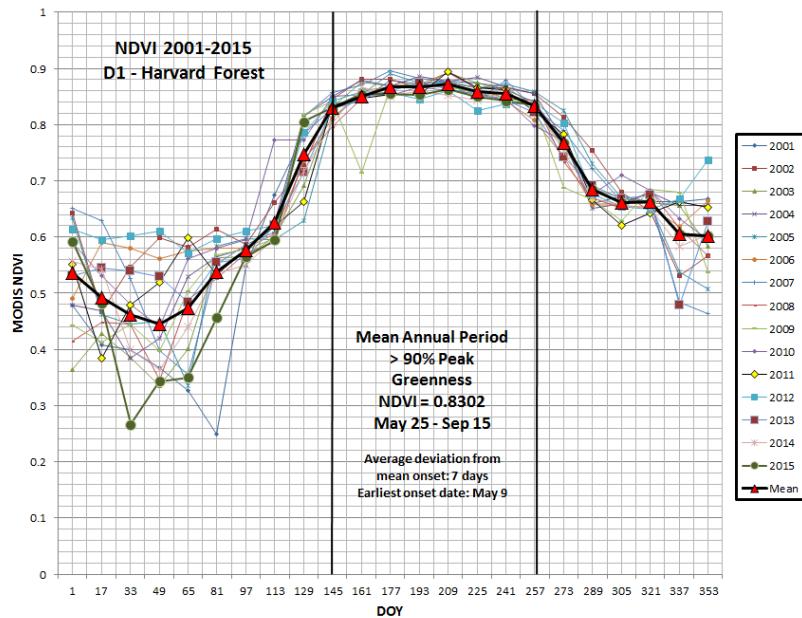
Level 3

- Spectrometer Orthorectified Surface Directional Reflectance
- High-resolution Orthorectified camera imagery mosaic
- Albedo - Spectrometer
- LAI - Spectrometer
- fPAR - Spectrometer
- **Total Biomass Map - Spectrometer**
- **Canopy Nitrogen**
- Canopy Water Content
- Canopy Xanthophyll Cycle
- **Canopy Lignin**
- Vegetation Indices - Spectrometer
- Ecosystem Structure
- Elevation - LiDAR
- Slope and Aspect - LiDAR

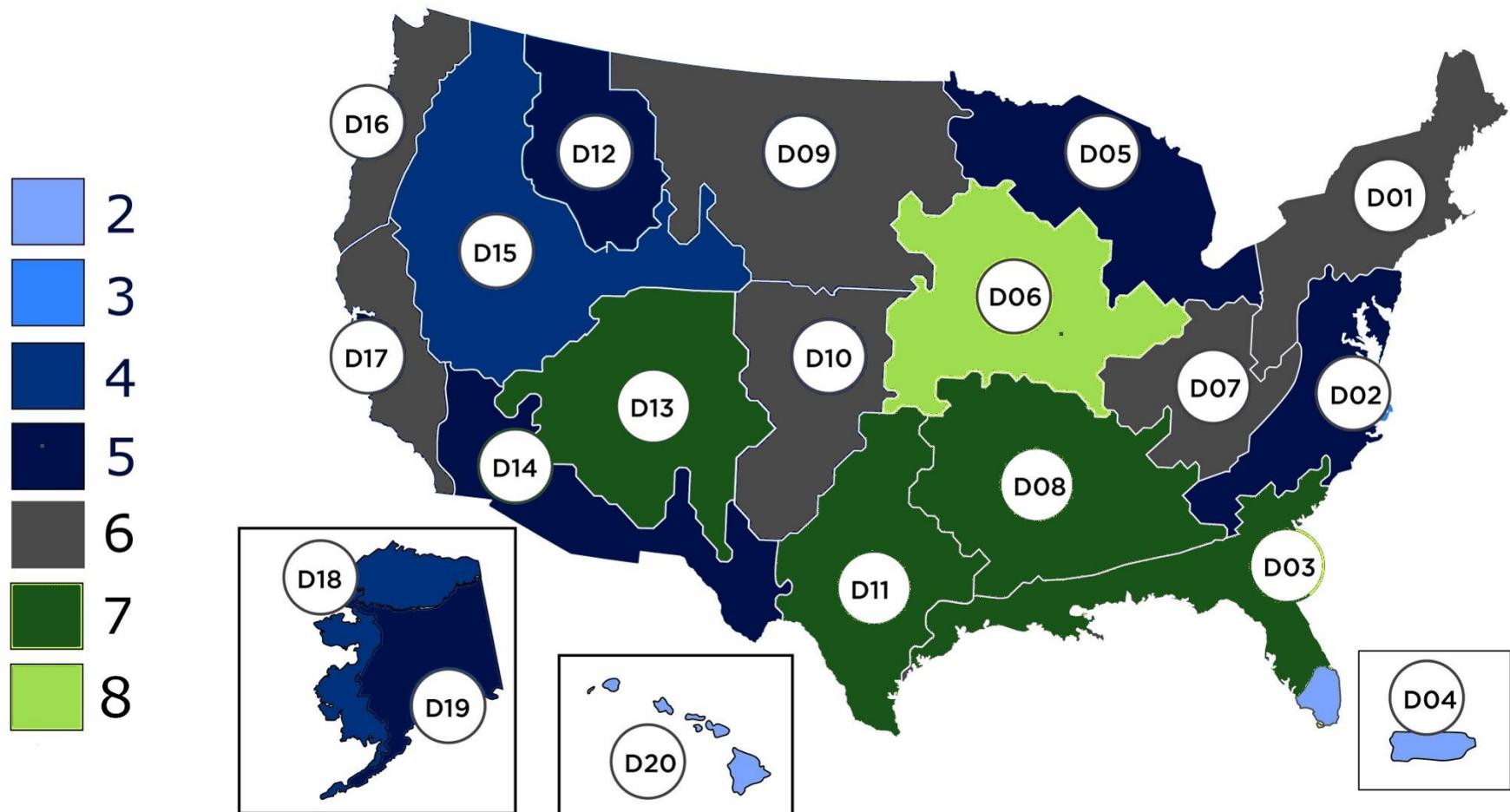
Derived product mosaics

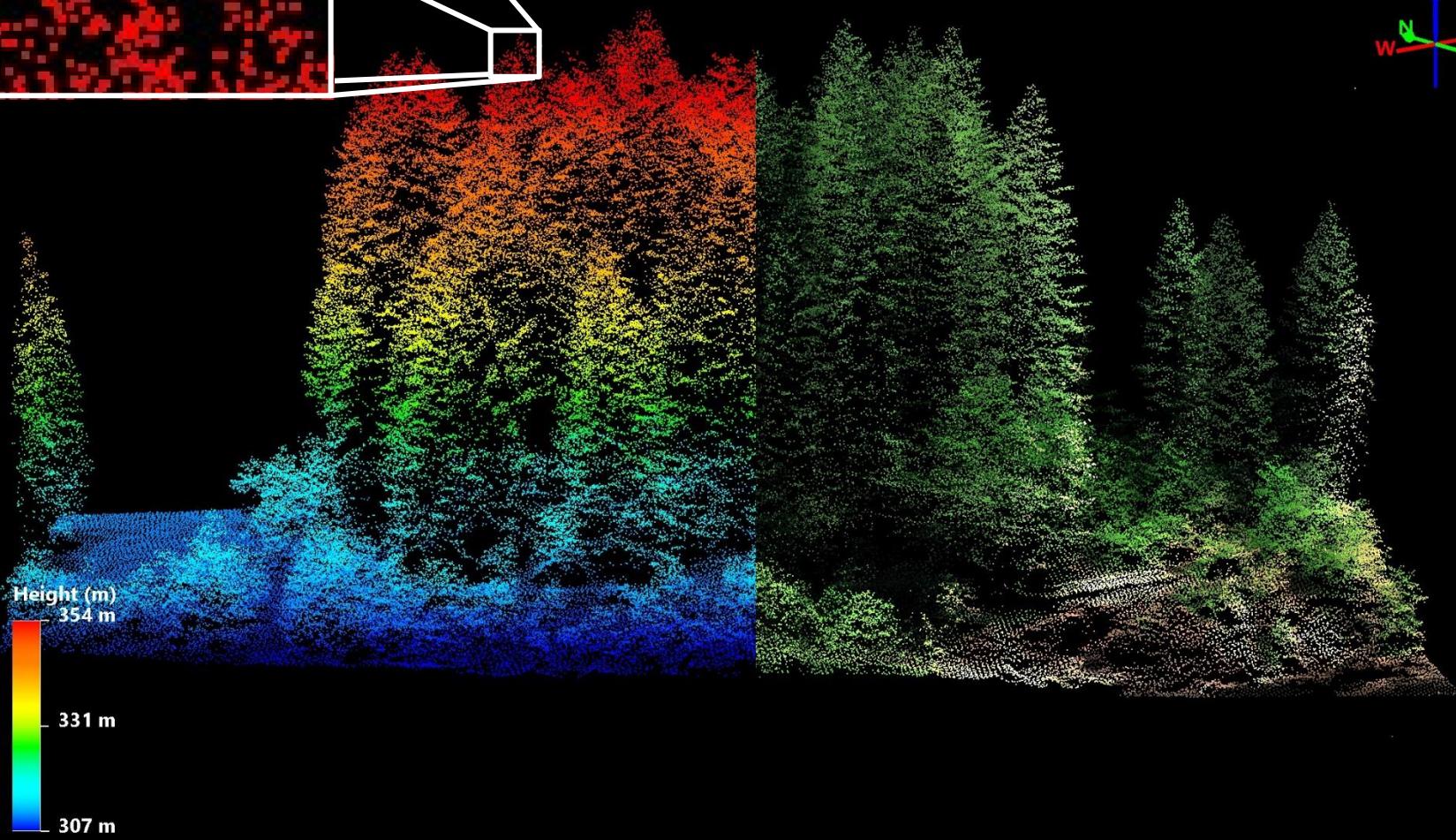
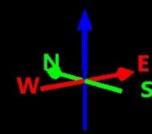
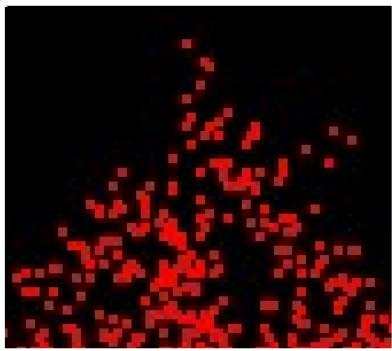
AOP Sampling Collection Requirements

- Clear skies
- Nominal AOP flying altitude = 1000 m AGL
 - collect data at the scale of individual plants
- Minimum 10 km x 10 km box
 - collect regional scale area around NEON sites
- Fly at peak 'greenness'
 - consistency between annual collections
- Fly N-S lines when solar angles are above 40°



2013 – 2023 AOP collections





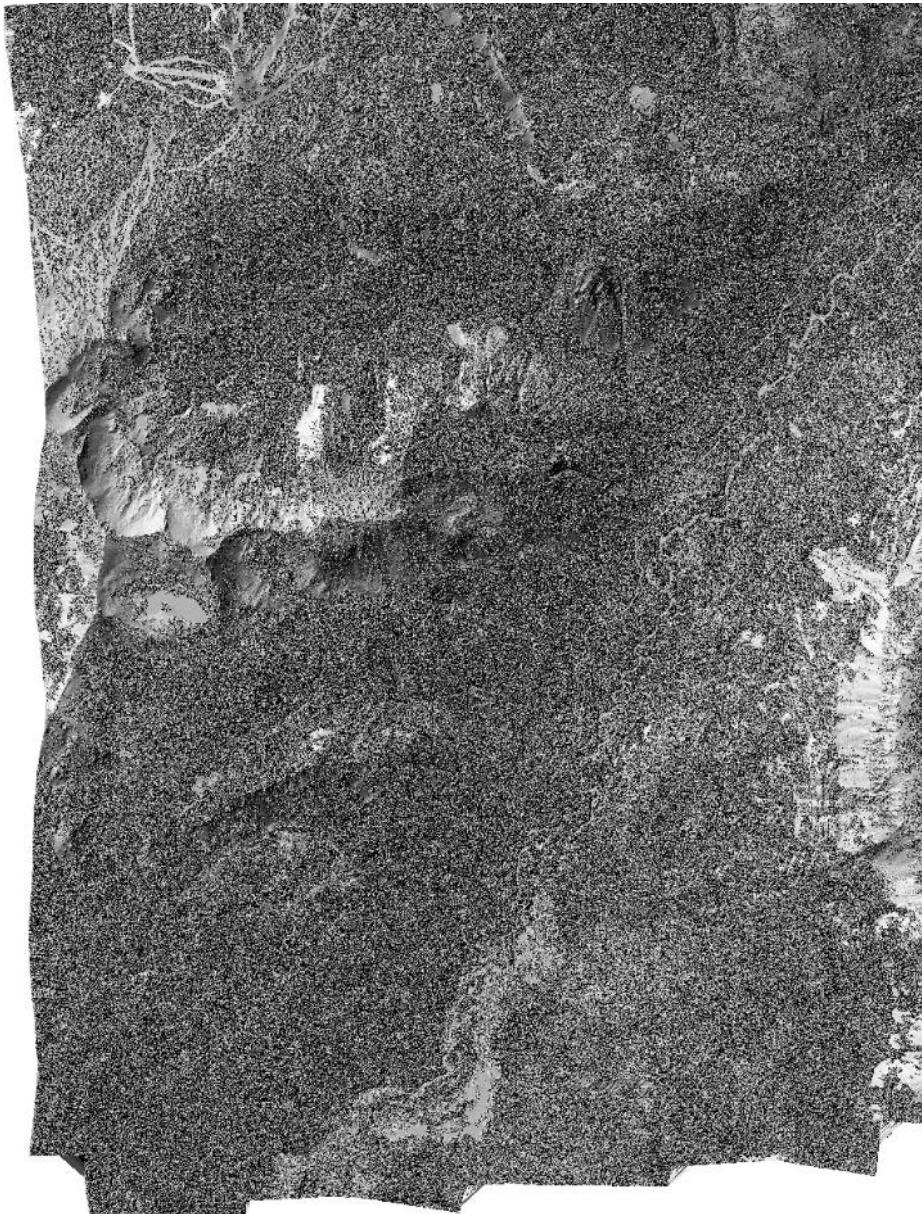
Height (m)

354 m

331 m

307 m

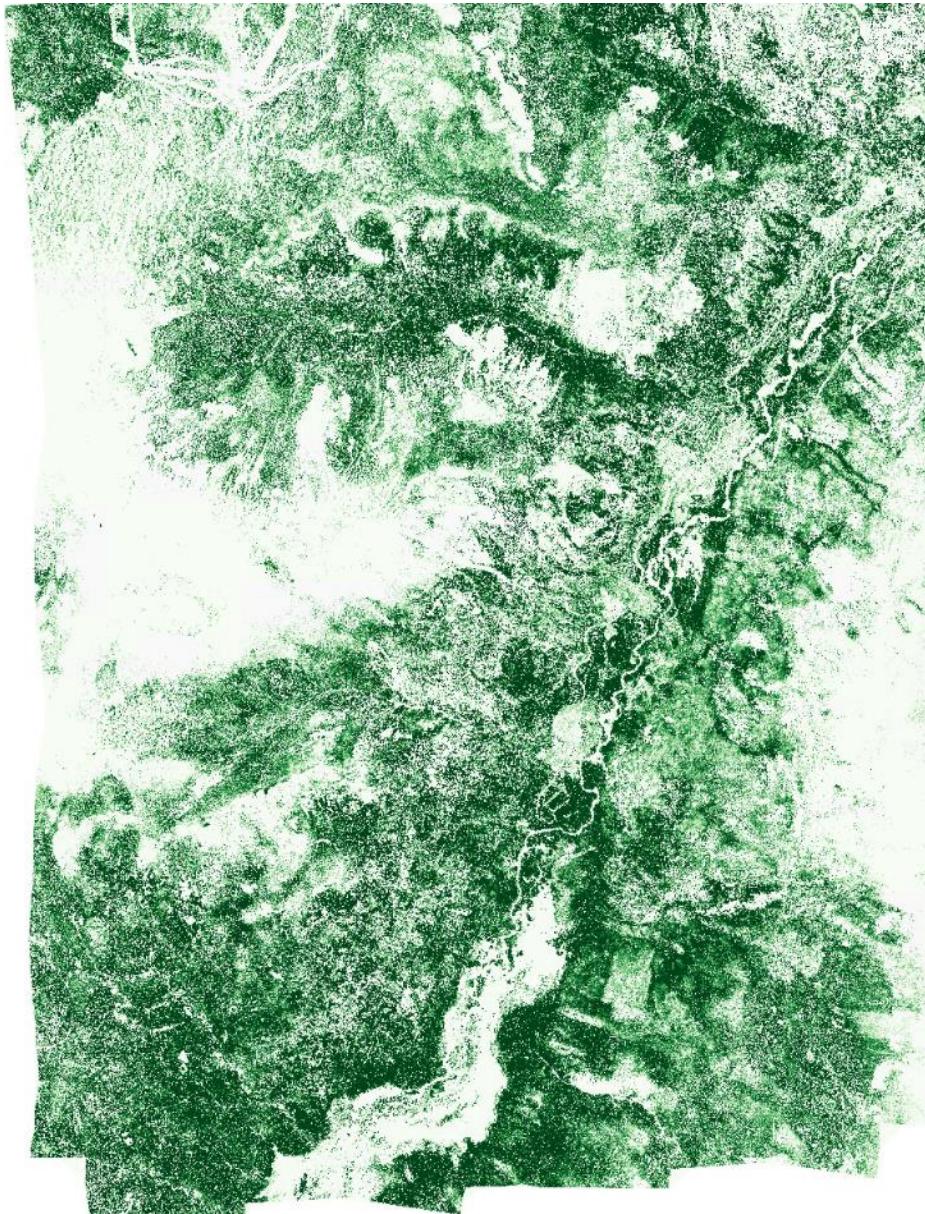
DSM



DTM



CHM



> 25 m

0 m



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