John Musinsky
Rommel C. Zulueta

Synergies with the NEON in Alaska

National Ecological Observatory Network

A project sponsored by the National Science Foundation and operated under cooperative agreement by Battelle.

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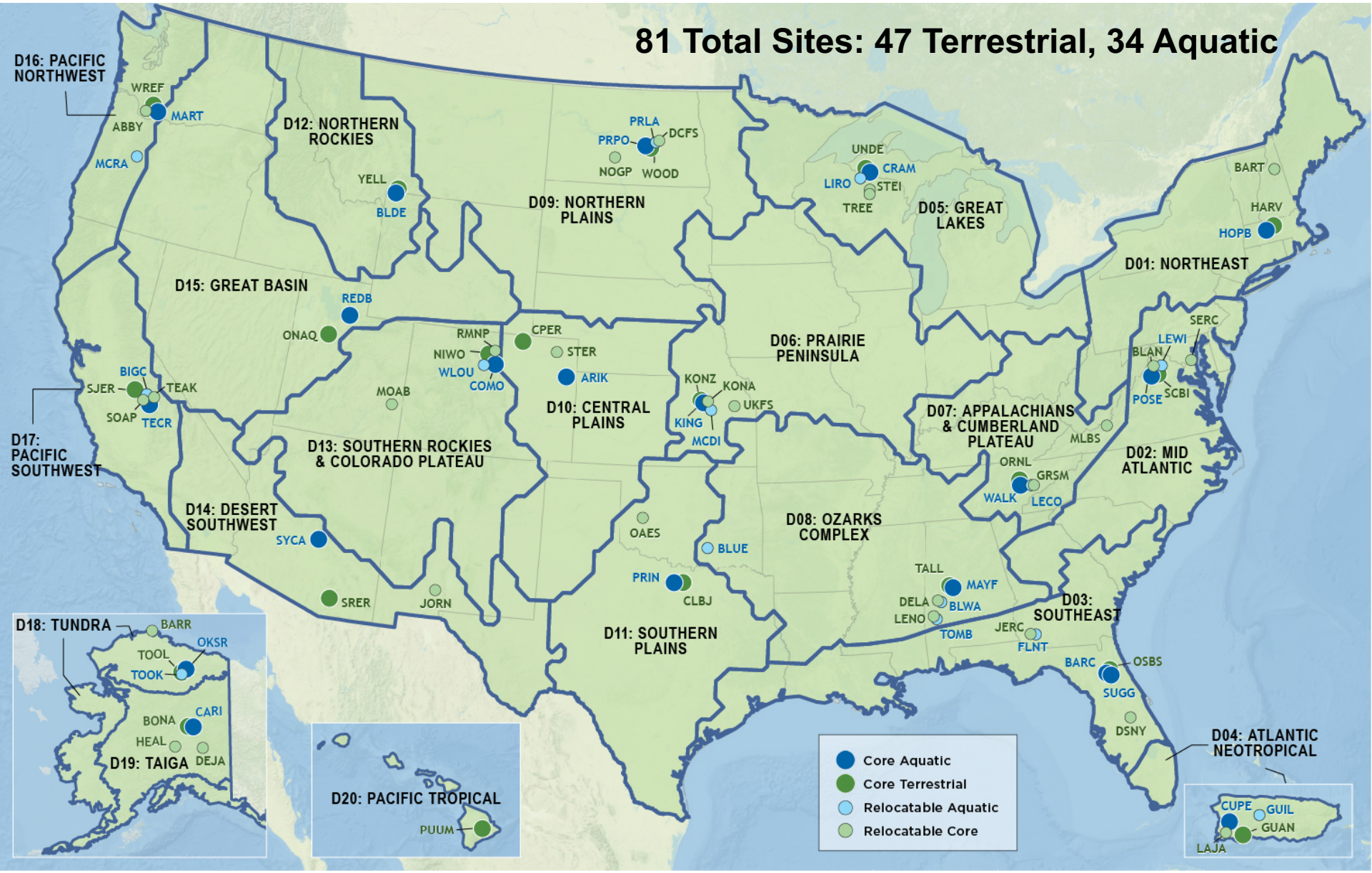
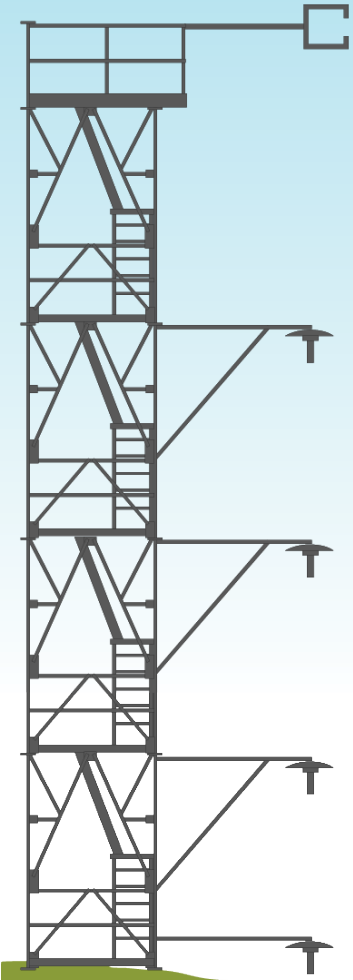
What is NEON?

The National Ecological Observatory Network: Open data to understand how our aquatic and terrestrial ecosystems are changing

- Large science facility funded by the National Science Foundation
- Continental-scale ecological observatory designed to:
  - Collect and distribute data on the drivers of and responses to ecological change
- Collect observations for 30-years
- All data are free and open-access


81 Total Sites: 47 Terrestrial, 34 Aquatic
D16: PACIFIC NORTHWEST
WREF
ABBY
MART
MCRA
D12: NORTHERN ROCKIES
YELL
BLDE
D09: NORTHERN PLAINS
PRLA
PRPO
DCFS
NOGP
WOOD
UNDE
CRAM
LIRO
STEI
TREE
D05: GREAT LAKES
BART
HARV
HOPB
D01: NORTHEAST
D15: GREAT BASIN
REDB
ONAQ
RMNP
NIWO
WLOU
COMO
CPER
STER
ARIK
D06: PRAIRIE PENINSULA
SERC
LEWI
BLAN
POSE
SCBI
BIGC
SJER
TEAK
SOAP
TECR
MOAB
D10: CENTRAL PLAINS
KONZ
KONA
UKFS
KING
MCDI
D07: APPALACHIANS & CUMBERLAND PLATEAU
MLBS
D02: MID ATLANTIC
D17: PACIFIC SOUTHWEST
D13: SOUTHERN ROCKIES & COLORADO PLATEAU
ORNL
GRSM
WALK
LECO
D14: DESERT SOUTHWEST
SYCA
OAES
BLUE
D08: OZARKS COMPLEX
SRER
JORN
PRIN
CLBJ
TALL
MAYF
DELA
BLWA
LENO
TOMB
JERC
FLNT
D03: SOUTHEAST
D11: SOUTHERN PLAINS
BARC
OSBS
SUGG
DSNY
D18: TUNDRA
BARR
OKSR
TOOL
TOOK
BONA
CARI
HEAL
DEJA
D19: TAIGA
D20: PACIFIC TROPICAL
PUUM
Core Aquatic
Core Terrestrial
Relocatable Aquatic
Relocatable Core
D04: ATLANTIC NEOTROPICAL
CUPE
GUIL
GUAN
LAJA

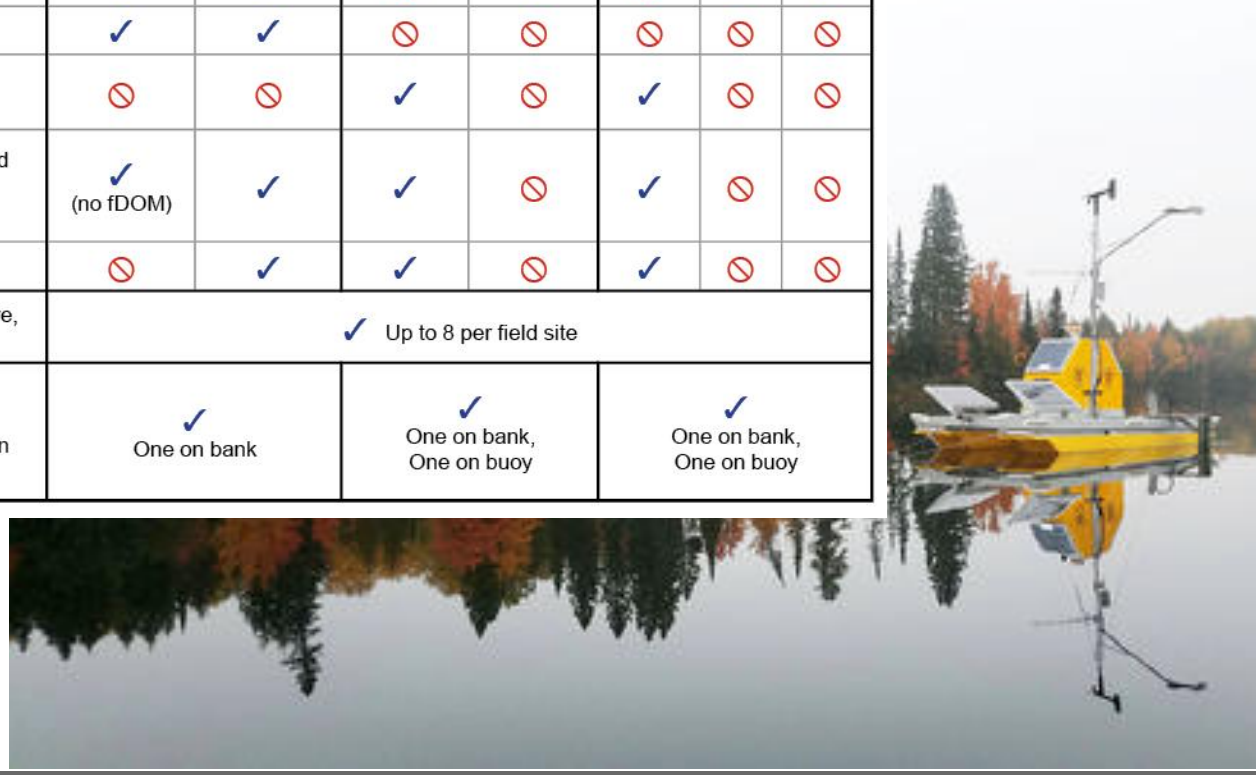
Terrestrial Instrumented Systems



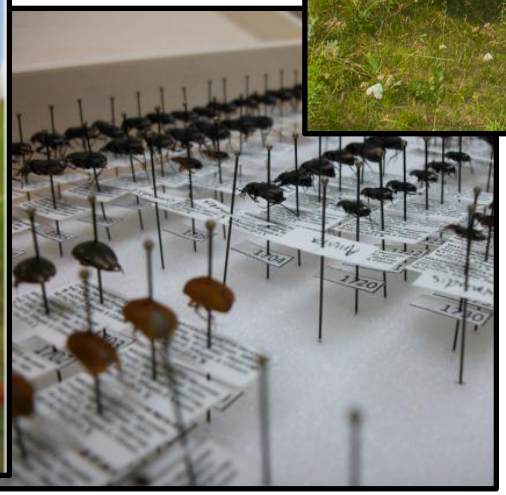
Measurements	Frequency	Tower top	Mid-levels	Near ground surface
CO_2/H_2O concentration & flux	20 Hz	✓		
3D wind speed & direction	20 Hz	✓		
Dust (particulate mass)	2 wks	✓		
Dust (particulate size)	1 Hz	✓		
Aerosol optical depth	30 min	✓		
Secondary precipitation (absence/presence)	when event occurs	✓		
Direct & diffused radiation	1 Hz	✓		
Incident short-wave radiation	1 Hz	✓		
Net short-wave & net long-wave radiation	1 Hz	✓		
Wet deposition chemistry & precipitation isotope	2 wks	✓		
Phenological image & snow depth	15 min	At the tower top & 3 m above ground		
Isotopes in CO_2, ^{13}C concentrations	.5 Hz	✓	✓	✓
Isotopes in H_2O (^{18}O, ^{2}H concentrations)	.5 Hz	✓	✓	✓
CO_2 concentration	1 Hz	✓	✓	✓
H_2O concentration	1 Hz	✓	✓	✓
PAR (Photosynthetically Active Radiation)	1 Hz	✓	✓	✓
Air temperature	1 Hz	✓	✓	✓
Biological temperature	1 Hz		✓	✓
2D wind speed & direction	1 Hz		✓	✓
Barometric pressure	1 Hz	4.95 m above ground		

Aquatic Instrumented Systems

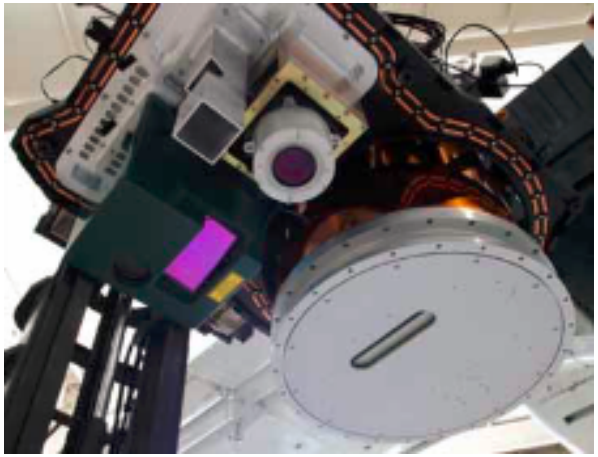
		Streams		Rivers		Lakes		
	Automated Instrument Measurements	Upstream (U)	Downstream (D)	Buoy (B)	Near Shore (NS)	Buoy (B)	Inlet (In)	Outlet (Out)
	PAR at water surface	✓	✓	✓	⊘	✓	⊘	⊘
	PAR below water surface	⊘	⊘	✓	✓	✓	✓	✓
	Elevation of surface water (pressure transducer based)	✓	✓	⊘	✓	⊘	✓	✓
	Temperature in surface water	✓	✓	⊘	⊘	⊘	⊘	⊘
	Temperature at specific depth in surface water (depths vary by site)	⊘	⊘	✓	⊘	✓	⊘	⊘
	Water quality: specific conductivity, chlorophyll a, dissolved oxygen content, pH, turbidity, and fluorescent dissolved organic matter (fDOM)	✓ (no fDOM)	✓	✓	⊘	✓	⊘	⊘
	Nitrate in surface water	⊘	✓	✓	⊘	✓	⊘	⊘
	Groundwater wells: specific conductivity, water temperature, elevation of groundwater	✓ Up to 8 per field site						
M	Meteorological measurements: wind speed and direction, air temperature, barometric pressure, relative humidity, shortwave radiation, and photosynthetically active radiation (PAR)	✓ One on bank		✓ One on bank, One on buoy		✓ One on bank, One on buoy		

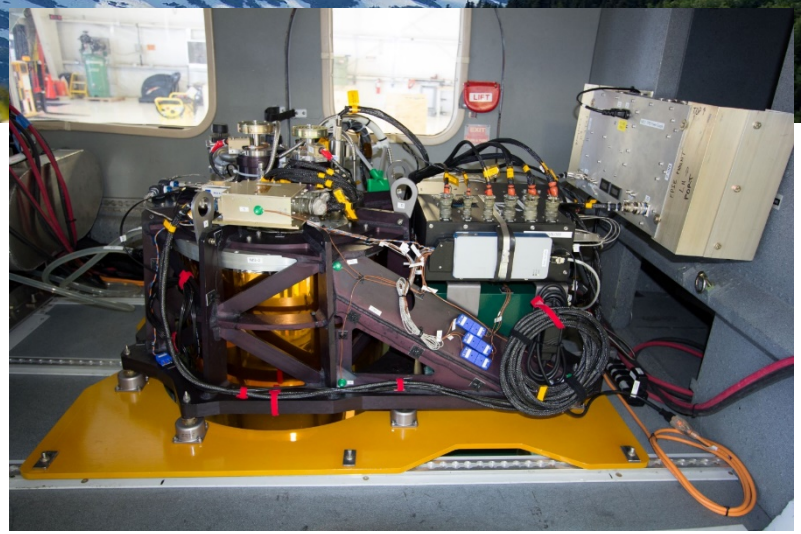


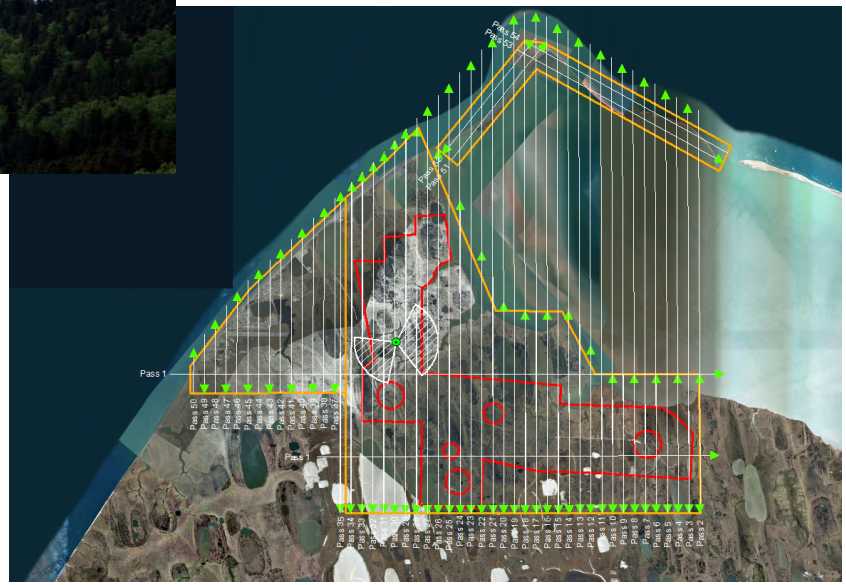
Observation Systems



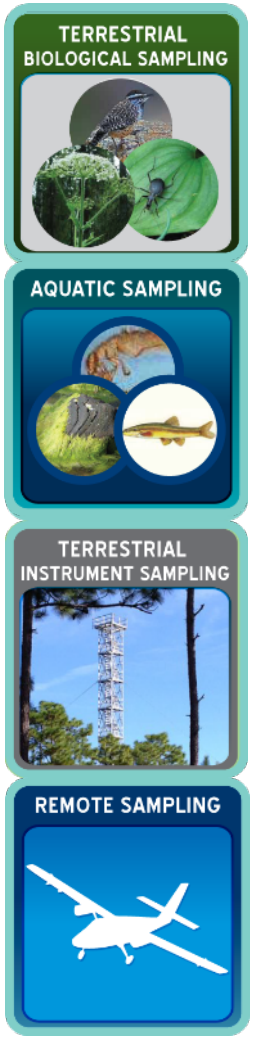
Airborne Observation Platform (AOP)







NEON Integrated Sampling Strategy



Biological Sampling

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

Airborne Observations

- Canopy chemistry
- Canopy moisture
- Leaf area
- Canopy height and structure
- Land cover
- Diversity
- Disturbance

Aquatic Sampling

Sensor measurements

- In-stream/In-lake
- Micrometeorology
- Groundwater

Field Sampling

- Chemistry / Isotopes
- Biological diversity
- Microbes
- Algae
- Aquatic Plants
- Invertebrates
- Fish
- Morphology, Bathymetry
- Riparian canopy

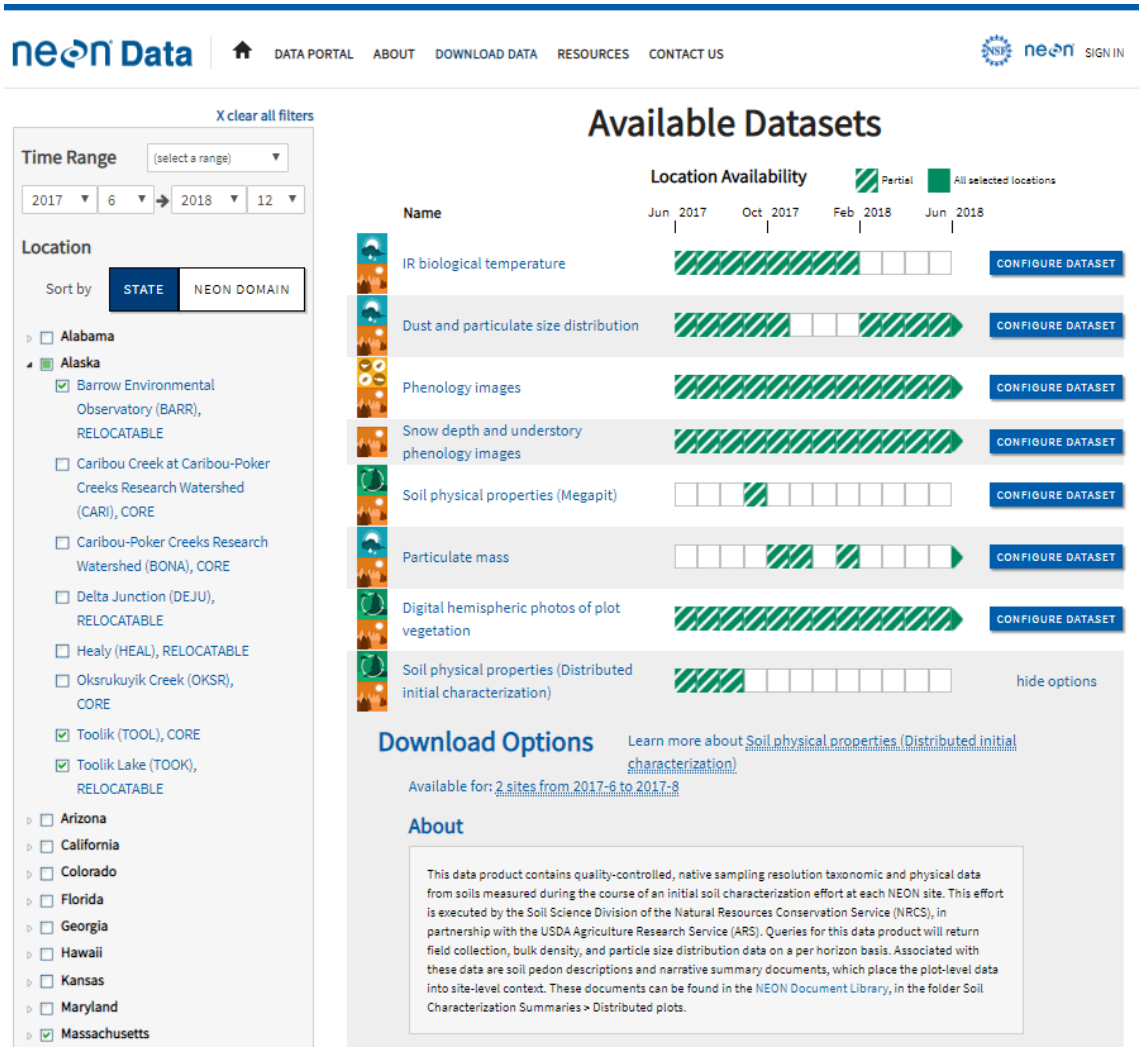
Atmospheric Measurements

- Key climate inputs
- Bioclimatic variables
- Chemical climate inputs
- Carbon cycle changes
- Water & energy balance

Soil Measurements

- Temperature
- Moisture
- CO_2
- Root growth and phenology

NEON Data Portal



NEON will offer approximately 180 Data Products, from Level 1 to Level 4

Free and open-access

data.neonscience.org

NEON Infrastructure Assets

Components of NEON infrastructure available to members of the community to support their own research or other activities

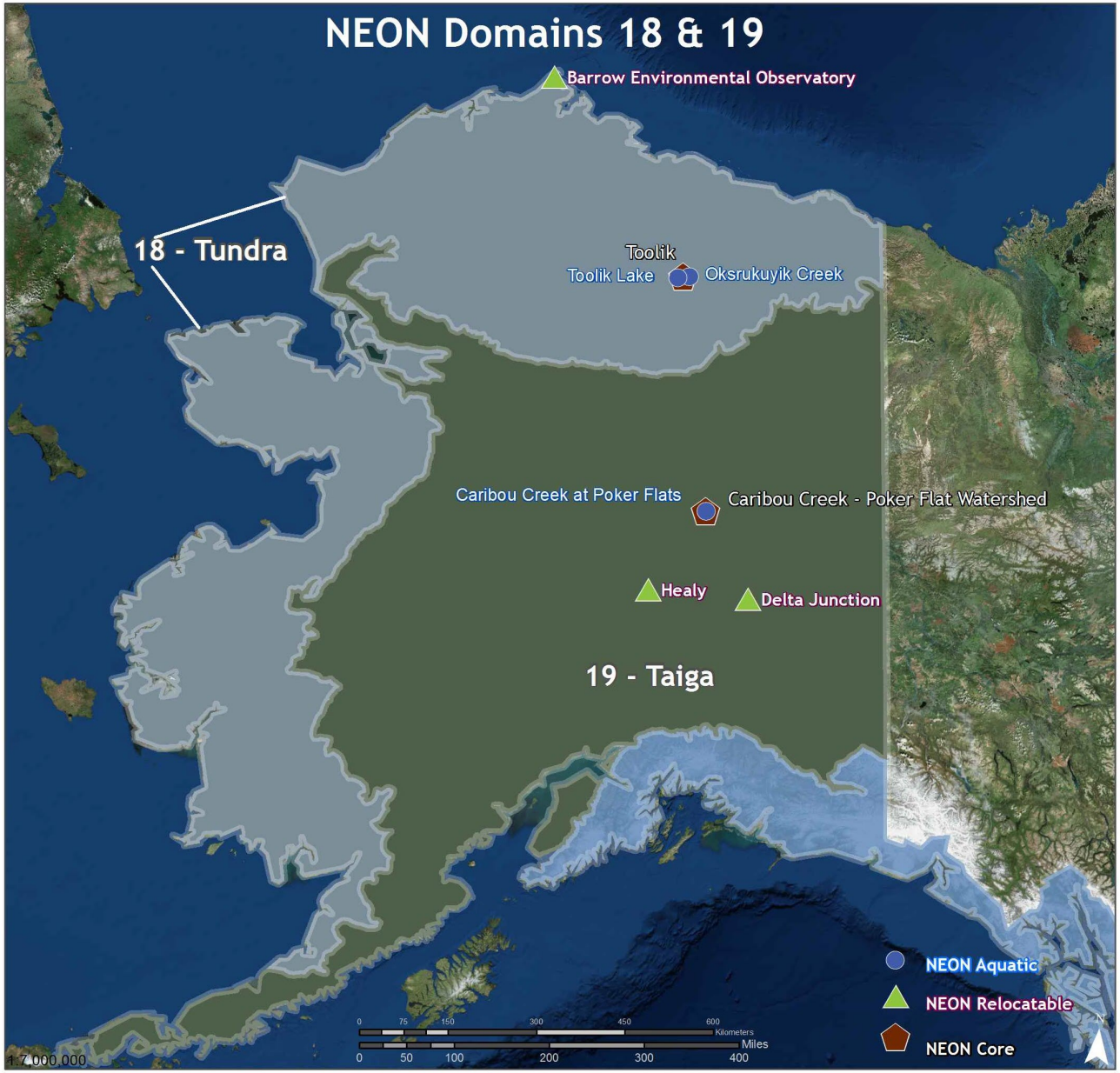
- **Assignable Assets Program**
  - Airborne Observation Platform (AOP)
  - Mobile Deployment Platform (MDP)
  - Sensor Infrastructure (SI)
  - Observational Sampling Infrastructure (OSI)
  - Letters of Support/Collaboration

For more information
www.neonscience.org/assignable-assets

NEON Infrastructure Assets

Components of NEON infrastructure available to members of the community to support their own research or other activities

- Field Operations Staff
- Field Site Support
- Field Site Access
- NEON Megapit Soil Archive
  - Managed from NEON HQ
  - www.neonscience.org/request-megapit-soil-samples
- NEON Biorepository
  - Managed by Arizona State University
  - www.neonscience.org/data/neon-biorepository



Domain 18
Tundra

2 Terrestrial Sites
2 Aquatic Sites

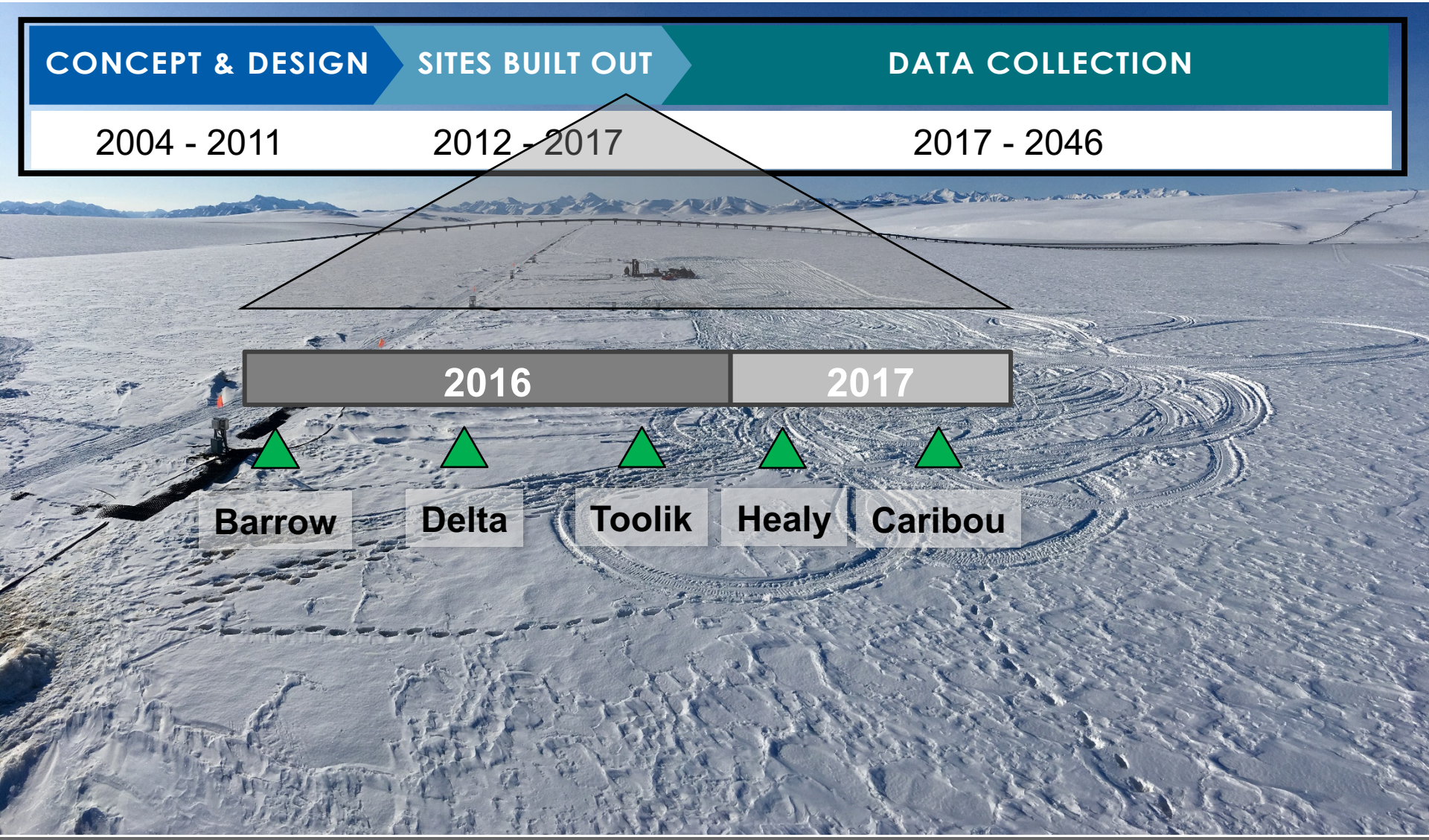
- Barrow
- Toolik

Domain 19
Taiga

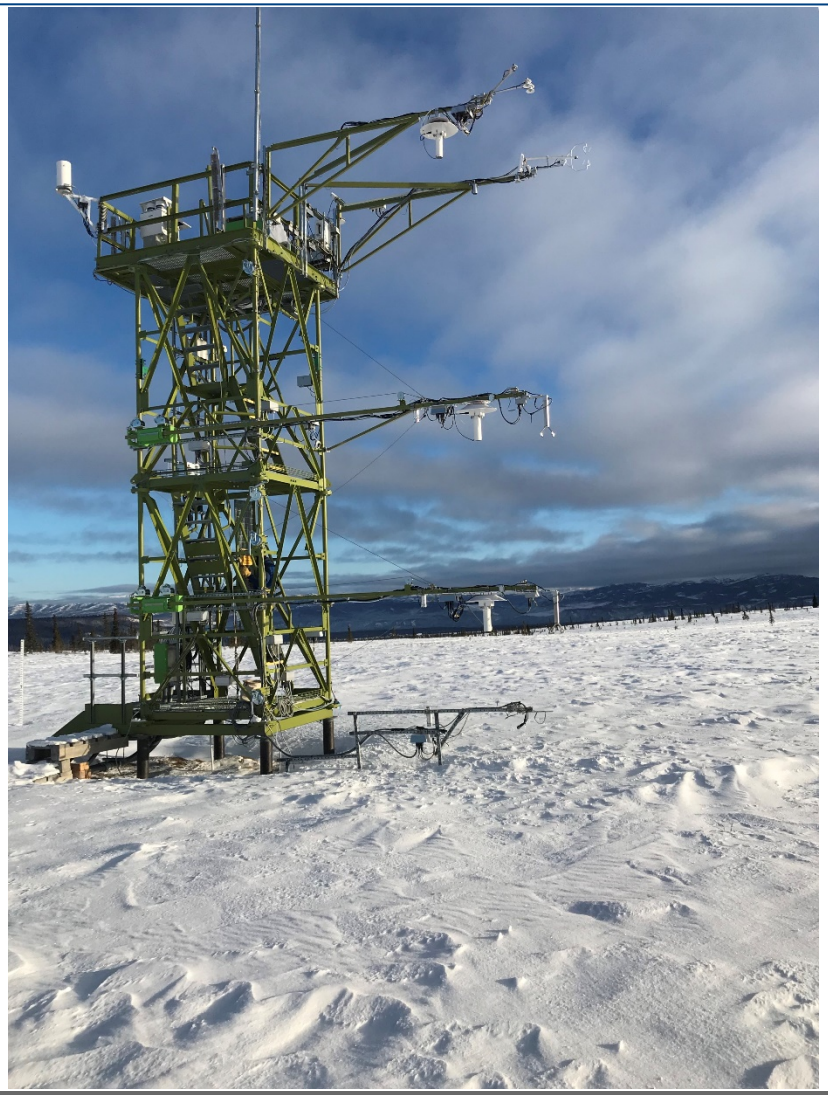
3 Terrestrial Sites
1 Aquatic Sites

- Caribou-Poker Creeks Watershed
- Delta Junction
- Healy

Alaska Historical Timeline



Flux Data Availability



- Barrow (BARR):
  - Sep 2017 to Dec 2018
- Toolik (TOOL):
  - Sep 2017 to Sep 2018
- Caribou-Poker (BONA):
  - Oct 2017 to Feb 2018
- Delta Junction (DEJU):
  - Sep 2017 to Jan 2019
- Healy (HEAL):
  - Aug 2017 to Sep 2018

Airborne Observation Program

Major focus in 2019 on improving data quality from the perspective of flight planning, data collection and data processing

- more accurate forecasting of cloud cover fractions from MODIS
- determination of cloud-free collection probabilities to optimize campaign scheduling
- improved EVI peak greenness windows validated using tower phenocams
- more detailed real-time assessment and reporting of cloud cover
- enhancements to NIS calibration to reduce ghosting, improve spectral consistency, adjust for BRDF effects
- data products improvements

2017 Data Collection Quality Assessment

Domain	Site	>80% LINES CLOUD-FREE	SOLAR ELEVATION	PEAK GREENNESS (YEAR)
D11	CLBJ	Y	Y	Y
	OAES	Y	Y	N
D12	YELL	DNF	DNF	DNF
D13	NIWO	N	Y	N
	MOAB	Y	Y	N
D14	SRER	Y	Y	N
	JORN	Y	Y	Y
D15	ONAQ	Y	Y	Y
D16	WREF	Y	Y	Y
	ABBY	Y	N	Y
D17	SJER	N	Y	Y
	SOAP	Y	Y	Y
	TEAK	Y	Y	Y
D18	TOOL	N	Y	Y
	BARR	Y	N	Y
D19	BONA	N	Y	Y
	DEJU	N	Y	Y
	HEAL	N	Y	Y

Domain	Site	2017	2018	2019
D05	UNDE	N	DNF	
	STEI/TREE	N	DNF	
	CHEQ	N	DNF	
D06	KONZ/KON	Y	Y	
	UKFS	N	Y	
D07	ORNL	N	N	DNF
	GRSM	N	N	DNF
	MLBS	N	N	DNF
D08	TALL	Y	Y	
	DELA	Y	Y	
	LENO	Y	Y	
D09	WOOD/DC	N	DNF	
	NOGP	N	DNF	
D10	CPER	N	DNF	DNF
	RMNP	N	N	DNF
	STER	N	DNF	DNF
D11	CLBJ	Y	Y	Y
	OAES	N	N	Y
D12	YELL	DNF	N	
D13	NIWO	N	N	
	MOAB	N	Y	
D14	SRER	N	N	
	JORN	Y	N	
D15	ONAQ	Y	DNF	
D16	WREF	Y	Y	
	ABBY	N	Y	
D17	SJER	N	Y	Y
	SOAP	Y	Y	
	TEAK	Y	Y	
D18	TOOL	N	N	
	BARR	N	N	
D19	BONA	N	N	
	DEJU	N	N	
	HEAL	N	N	

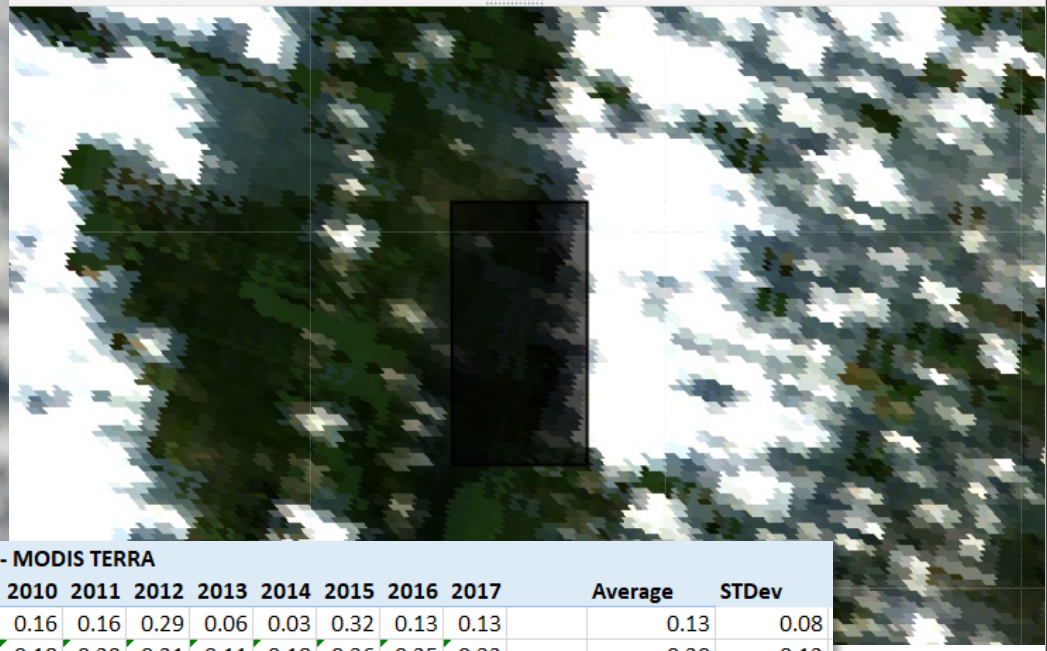
Trade-off between data quality and quantity of sites flown per year

- 2017: 13 of 41 sites met “green” threshold
- 2018: 12 of 33 sites met “green” threshold

Processed 16 years of daily MODIS surface reflectance data per site to estimate average number of days per month with >90% cloud-free conditions

```
//var img = ee.Image('MOD09GA/MOD09GA_005_2013_02_15');
var img = ee.ImageCollection('MODIS/006/MOD09GA')
                .filterDate('2014-08-09');

// Display true color MODIS reflectance image
Map.addLayer(img.select(['sur_refl_b01', 'sur_refl_b04', 'sur_refl_b03']),
        {gain: '0.1, 0.1, 0.1'}, 'MODIS bands 1/4/3');
```



D19 HEAL - PERCENT OF DAYS GREATER THAN 90% CLOUD-FREE - MODIS TERRA

Months	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average	STDev
Jan	0.10	0.06	0.06	0.06	0.16	0.13	0.06	0.13	0.16	0.16	0.29	0.06	0.03	0.32	0.13	0.13	0.13	0.08
Feb	0.21	0.04	0.07	0.18	0.04	0.46	0.14	0.11	0.18	0.29	0.21	0.11	0.18	0.36	0.25	0.32	0.20	0.12
Mar	0.48	0.13	0.13	0.23	0.23	0.13	0.26	0.19	0.26	0.35	0.03	0.26	0.55	0.39	0.29	0.29	0.26	0.13
Apr	0.27	0.13	0.33	0.50	0.20	0.13	0.17	0.27	0.13	0.33	0.50	0.17	0.27	0.10	0.20	0.50	0.26	0.14
May	0.48	0.29	0.23	0.23	0.26	0.19	0.10	0.32	0.23	0.19	0.10	0.42	0.13	0.29	0.26	0.06	0.24	0.11
Jun	0.03	0.27	0.30	0.10	0.13	0.07	0.23	0.07	0.07	0.03	0.07	0.40	0.07	0.17	0.10	0.20	0.14	0.11
Jul	0.06	0.13	0.16	0.26	0.13	0.10	0.19	0.29	0.16	0.06	0.13	0.03	0.13	0.13	0.03	0.13	0.13	0.07
Aug	0.16	0.19	0.65	0.45	0.06	0.19	0.19	0.19	0.13	0.13	0.19	0.16	0.06	0.03	0.13	0.10	0.19	0.15
Sep	0.20	0.30	0.13	0.03	0.23	0.27	0.10	0.33	0.53	0.13	0.13	0.07	0.20	0.10	0.17	0.10	0.19	0.12
Oct	0.06	0.10	0.13	0.10	0.10	0.23	0.26	0.19	0.13	0.13	0.23	0.19	0.29	0.16	0.29	0.13	0.17	0.07
Nov	0.00	0.13	0.00	0.17	0.27	0.07	0.13	0.27	0.00	0.17	0.17	0.10	0.07	0.13	0.07	0.13	0.12	0.08
Dec	0.23	0.10	0.00	0.03	0.16	0.19	0.06	0.16	0.39	0.06	0.19	0.13	0.10	0.32	0.19	0.13	0.15	0.10

Monte Carlos simulations to estimate days required for XX% probability of cloud-free data collection

50% Probability

f	n=1	n=2	n=3	n=4	n=5	n=6	n=7	n=8	n=9
0.05	14	34	54	74	94	None	None	None	None
0.10	7	17	27	37	47	57	67	77	87
0.15	5	11	18	25	31	38	45	51	58
0.20	4	8	13	19	23	29	33	38	44
0.25	3	7	11	15	19	23	27	31	35
0.30	2	6	9	12	16	19	22	26	29
0.35	2	5	8	11	14	16	19	22	25
0.40	2	4	7	9	12	14	17	19	22
0.45	2	4	6	8	11	13	15	17	19
0.50	1	4	6	8	10	12	13	16	17
0.55	1	3	5	7	9	10	12	14	16
0.60	1	3	5	6	8	10	11	13	15
0.65	1	3	4	6	7	9	10	12	14
0.70	1	3	4	5	7	8	10	11	13
0.75	1	2	4	5	6	8	9	10	12
0.80	1	2	3	5	6	7	9	10	11
0.85	1	2	3	4	6	7	8	9	10
0.90	1	2	3	4	5	6	8	9	10
0.95	1	2	3	4	5	6	7	8	9
1.00	1	2	3	4	5	6	7	8	9

62.5% Probability

f	n=1	n=2	n=3	n=4	n=5	n=6	n=7	n=8	n=9
0.05	19	43	64	86	None	None	None	None	None
0.10	10	21	32	43	54	65	76	85	96
0.15	7	14	21	29	36	43	50	57	64
0.20	5	11	16	21	27	32	37	42	48
0.25	4	8	13	17	21	26	30	34	38
0.30	3	7	11	14	18	21	25	28	32
0.35	3	6	9	12	15	18	21	24	27
0.40	2	5	8	11	13	16	18	21	24
0.45	2	5	7	9	12	14	16	19	21
0.50	2	4	6	8	10	13	15	17	19
0.55	2	4	6	8	10	11	13	15	17
0.60	2	3	5	7	9	10	12	14	16
0.65	1	3	5	6	8	10	11	13	14
0.70	1	3	4	6	7	9	10	12	13
0.75	1	3	4	5	7	8	10	11	12
0.80	1	2	4	5	6	8	9	10	12
0.85	1	2	4	5	6	7	8	10	11
0.90	1	2	3	4	6	7	8	9	10
0.95	1	2	3	4	5	6	7	8	9
1.00	1	2	3	4	5	6	7	8	9

80% Probability

f	n=1	n=2	n=3	n=4	n=5	n=6	n=7	n=8	n=9
0.05	31	59	85	None	None	None	None	None	None
0.10	16	29	42	54	66	79	89	None	None
0.15	10	19	28	36	44	52	60	67	74
0.20	8	14	21	27	33	39	44	50	56
0.25	6	11	17	21	26	31	35	40	44
0.30	5	9	14	18	22	25	29	33	37
0.35	4	8	12	15	18	21	25	28	31
0.40	4	7	10	13	16	19	22	24	27
0.45	3	6	9	11	14	16	19	22	24
0.50	3	5	8	10	12	15	17	19	21
0.55	3	5	7	9	11	13	15	17	19
0.60	2	4	6	8	10	12	14	16	18
0.65	2	4	6	8	9	11	13	14	16
0.70	2	4	5	7	8	10	12	13	15
0.75	2	3	5	6	8	9	11	12	14
0.80	1	3	4	6	7	9	10	11	13
0.85	1	3	4	5	7	8	9	10	12
0.90	1	2	4	5	6	7	8	10	11
0.95	1	2	3	4	6	7	8	9	10
1.00	1	2	3	4	5	6	7	8	9

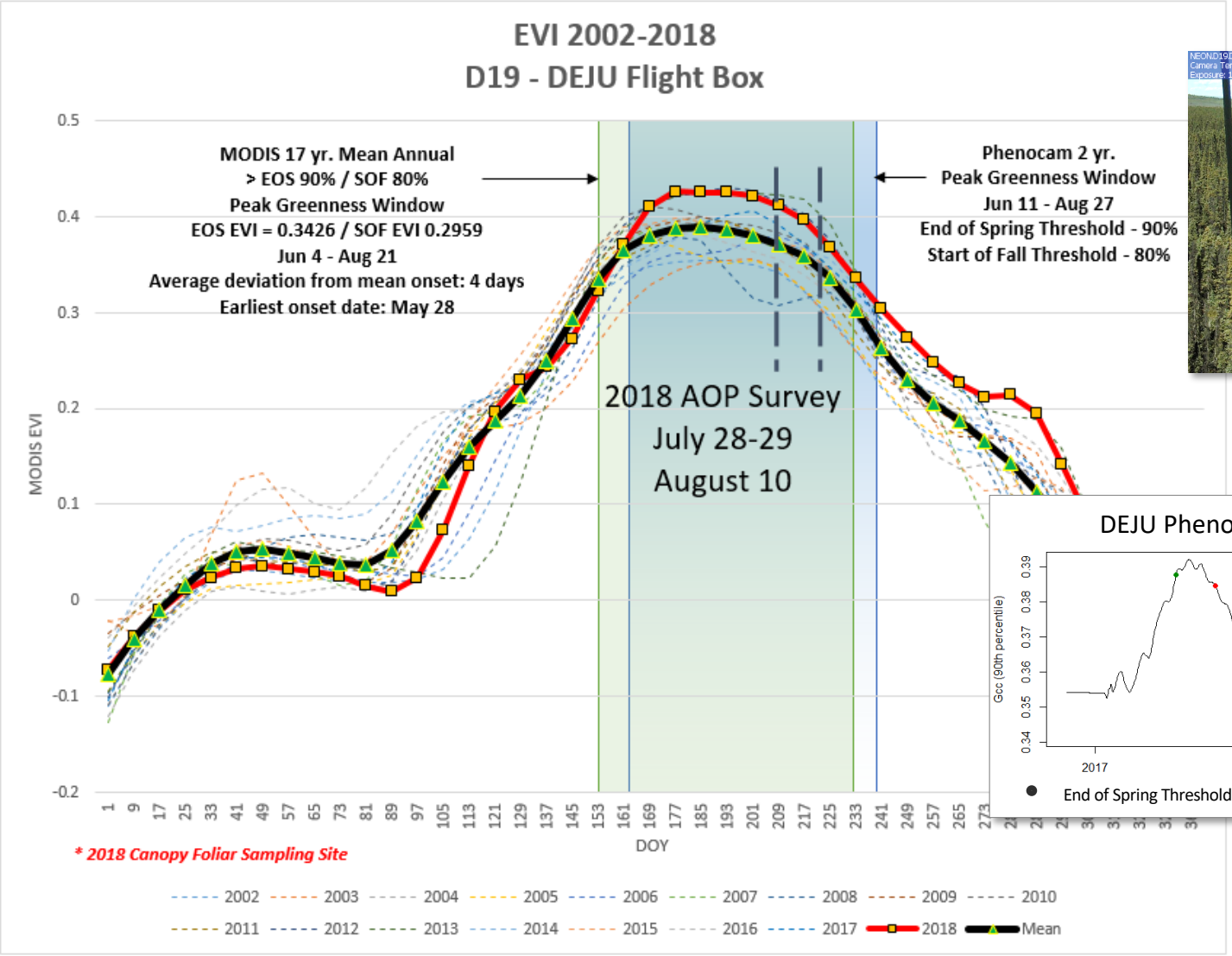
90% Probability

f	n=1	n=2	n=3	n=4	n=5	n=6	n=7	n=8	n=9
0.05	46	77	None	None	None	None	None	None	None
0.10	22	38	51	66	79	91	None	None	None
0.15	15	26	34	43	52	59	69	77	85
0.20	11	19	25	32	39	44	51	56	64
0.25	8	15	20	25	30	35	40	45	50
0.30	7	12	16	21	25	29	33	37	41
0.35	6	10	14	18	21	25	28	32	35
0.40	5	9	12	15	18	22	24	27	30
0.45	4	8	11	13	16	19	21	24	27
0.50	4	7	9	12	14	17	19	21	24
0.55	3	6	8	11	13	15	17	19	21
0.60	3	5	7	9	11	13	15	17	19
0.65	3	5	7	9	10	12	14	16	17
0.70	2	4	6	8	9	11	13	14	16
0.75	2	4	6	7	9	10	12	13	15
0.80	2	3	5	6	8	9	11	12	13
0.85	2	3	5	6	7	9	10	11	12
0.90	1	3	4	5	7	8	9	10	11
0.95	1	2	4	5	6	7	8	9	10
1.00	1	2	3	4	5	6	7	8	9

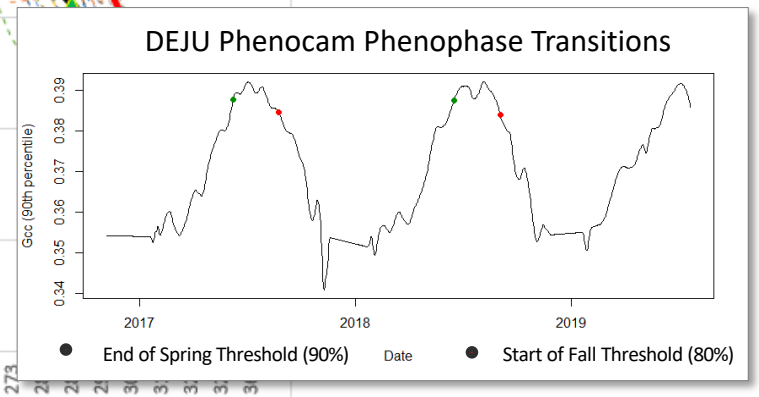
f= percent of days with X% cloud cover per month

n = minimum number of flight days per site w/o contingency

NSF | neon National Ecological Observatory Network | BATTELLE It can be done


EVI 2002-2018
D19 - DEJU Flight Box
MODIS 17 yr. Mean Annual
> EOS 90% / SOF 80%
Peak Greenness Window
EOS EVI = 0.3426 / SOF EVI 0.2959
Jun 4 - Aug 21
Average deviation from mean onset: 4 days
Earliest onset date: May 28
Phenocam 2 yr.
Peak Greenness Window
Jun 11 - Aug 27
End of Spring Threshold - 90%
Start of Fall Threshold - 80%
2018 AOP Survey
July 28-29
August 10
MODIS EVI
DOY
* 2018 Canopy Foliar Sampling Site
2002 2003 2004 2005 2006 2007 2008 2009 2010
2011 2012 2013 2014 2015 2016 2017 2018 Mean

July 29, 2018


DEJU Phenocam Phenophase Transitions
Gcc (90th percentile)
2017
2018
2019
End of Spring Threshold (90%)
Date
Start of Fall Threshold (80%)

Domain	Site	EVI Start Peak Greenness	EVI End Peak Greenness	Avg. Percent Days 0-10% Cloud-free	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4	GUAN	9/4/20	11/28/20	GUAN	0.17	0.15	0.07	0.05	0.04	0.05	0.06	0.05	0.11	0.14	0.16	0.17
4	LAJA	8/28/20	11/13/20	LAJA	0.28	0.22	0.12	0.07	0.03	0.03	0.05	0.06	0.09	0.12	0.21	0.31
5	UNDE	6/5/20	8/26/20	UNDE	0.02	0.04	0.11	0.19	0.21	0.22	0.18	0.20	0.30	0.19	0.11	0.01
5	STEI-CHEQ	6/2/20	8/26/20	STEI-CHEQ	0.05	0.12	0.25	0.30	0.25	0.23	0.24	0.26	0.34	0.26	0.20	0.04
5	STEI/TREE	6/4/20	8/26/20	STEI/TREE	0.06	0.21	0.26	0.29	0.25	0.20	0.23	0.23	0.33	0.25	0.16	0.03
6	KONZ/KON	5/25/20	8/6/20	KONZ/KONA	0.33	0.35	0.33	0.34	0.33	0.40	0.40	0.42	0.48	0.48	0.43	0.30
6	UKFS	5/27/20	8/29/20	UKFS	0.36	0.35	0.31	0.32	0.32	0.36	0.38	0.39	0.46	0.45	0.39	0.33
7a	ORNL	4/29/20	8/5/20	ORNL	0.25	0.22	0.29	0.31	0.23	0.21	0.14	0.23	0.37	0.37	0.37	0.25
7a	MLBS	5/29/20	8/27/20	MLBS	0.10	0.08	0.20	0.25	0.14	0.10	0.06	0.06	0.19	0.29	0.28	0.11
7a	GRSM	5/21/20	8/16/20	GRSM	0.19	0.18	0.17	0.24	0.14	0.07	0.04	0.05	0.14	0.31	0.35	0.22
8	TALL	4/30/20	8/1/20	TALL	0.37	0.31	0.34	0.37	0.28	0.18	0.13	0.23	0.36	0.47	0.45	0.31
8	DELA	4/22/20	8/27/20	DELA	0.37	0.32	0.34	0.36	0.30	0.18	0.11	0.25	0.34	0.46	0.44	0.32
8	LENO	4/22/20	8/16/20	LENO	0.39	0.32	0.35	0.35	0.28	0.18	0.12	0.22	0.31	0.47	0.48	0.30
9	WOOD	6/12/20	8/13/20	WOOD/DCFS	0.25	0.20	0.17	0.29	0.30	0.28	0.39	0.39	0.43	0.33	0.22	0.14
9	NOGP	5/31/20	7/29/20	NOGP	0.24	0.29	0.25	0.32	0.34	0.33	0.46	0.46	0.49	0.34	0.30	0.19
10a	CPER	5/21/20	6/26/20	CPER	0.31	0.31	0.40	0.34	0.32	0.53	0.53	0.54	0.57	0.49	0.45	0.30
10b	STER	7/25/20	8/16/20	STER	0.27	0.31	0.35	0.38	0.42	0.58	0.63	0.60	0.61	0.52	0.40	0.27
10b	RMNP	6/20/20	7/31/20	RMNP	0.02	0.03	0.11	0.13	0.14	0.29	0.22	0.23	0.34	0.35	0.16	0.04
11	CLBJ	4/25/20	8/3/20	CLBJ	0.47	0.45	0.41	0.41	0.36	0.37	0.44	0.45	0.44	0.51	0.52	0.43
11	OAES	4/9/20	5/10/20	OAES	0.53	0.47	0.45	0.46	0.42	0.44	0.52	0.49	0.54	0.52	0.57	0.46
12	YELL	6/6/20	8/3/20	YELL	0.03	0.09	0.11	0.08	0.10	0.26	0.46	0.40	0.43	0.20	0.05	0.02
13	NIWO	6/28/20	8/5/20	NIWO	0.00	0.00	0.00	0.00	0.06	0.07	0.06	0.12	0.18	0.06	0.00	0.00
13	MOAB	4/25/20	9/29/20	MOAB	0.42	0.42	0.54	0.48	0.52	0.71	0.60	0.55	0.61	0.62	0.58	0.39
14	SRER	8/1/20	9/1/20	SRER	0.60	0.57	0.67	0.76	0.79	0.78	0.41	0.43	0.55	0.71	0.68	0.56
14	JORN	8/4/20	9/18/20	JORN	0.62	0.66	0.66	0.71	0.73	0.77	0.57	0.61	0.59	0.69	0.70	0.56
15	ONAQ	4/24/20	6/13/20	ONAQ	0.20	0.17	0.16	0.20	0.32	0.53	0.49	0.47	0.53	0.44	0.30	0.18
16	WREF	6/5/20	8/15/20	WREF	0.07	0.13	0.09	0.14	0.19	0.27	0.59	0.53	0.45	0.29	0.12	0.07
16	ABBY	6/8/20	8/9/20	ABBY	0.11	0.16	0.09	0.13	0.17	0.23	0.48	0.43	0.39	0.26	0.14	0.09
17a	SJER	2/19/20	4/5/20	SJER	0.36	0.42	0.50	0.55	0.71	0.86	0.91	0.90	0.87	0.77	0.56	0.37
17b	SOAP	5/25/20	7/15/20	SOAP	0.43	0.37	0.37	0.35	0.54	0.77	0.83	0.85	0.79	0.65	0.50	0.37
17b	TEAK	6/20/20	8/24/20	TEAK	0.22	0.19	0.15	0.16	0.28	0.58	0.67	0.70	0.64	0.60	0.42	0.17
18	TOOL	6/20/20	8/5/20	TOOL	0.31	0.36	0.31	0.40	0.40	0.37	0.28	0.23	0.21	0.26	0.27	0.11
18	BARR	7/4/20	8/19/20	BARO	0.08	0.11	0.07	0.18	0.19	0.16	0.26	0.13	0.04	0.01	0.11	0.00
19	DEJU	6/4/20	8/21/20	DEJU	0.10	0.21	0.43	0.25	0.25	0.23	0.20	0.20	0.22	0.18	0.12	0.10
19	BONA	6/1/20	8/28/20	BONA	0.22	0.16	0.45	0.40	0.24	0.21	0.14	0.19	0.26	0.13	0.12	0.25
19	HEAL	6/10/20	8/4/20	HEAL	0.13	0.20	0.26	0.26	0.24	0.14	0.13	0.19	0.19	0.17	0.12	0.15
20	OLAA	6/29/19	8/14/19	OLAA	0.24	0.15	0.09	0.04	0.05	0.05	0.05	0.05	0.04	0.05	0.09	0.15

Percent Cloud-free Days per Month with Peak Greenness Windows (EVI)

2020 Campaign Schedule - High-Quality Spectrometer Data

90% Cloud-free Probability at Foliar Sampling Sites / 62% at non-FS Sites

Payload	Domain	Core Site	FBO Name	Departure FBO	Destination FBO	FBO-FBO Transit Distance (nm)	FBO-FBO Transit Hrs @ 135 kts	Cooling Days	FBO-FBO Transit Days	Transit Days + cooling (rounded up)	Domain Latest Start Peak Greenness	Domain Earliest End Peak Greenness	Domain Flight Days	No Fly Days (flight days/8)	Days per Domain	Start Julian Day	End Julian Day	Domain Surveys Start Date	Domain Surveys End Date	Cummulative Flight Hours
3		BLDR	Boulder Mu	KGJT	KBDU	163	1.2	0	0.2	1	n/a	n/a	1	0	1	89	89	30-Mar	30-Mar	1.21
3		BLDR	Boulder Mu	KBDU	KSPS	485	3.59	0	0.6	1	n/a	n/a	18	0	18	90	107	31-Mar	17-Apr	52.80
3	11	CLBJ	Wichita Fall	KSPS	KCHO	1004	7.44	0	1.2	2	25-Apr	10-May	10	2	12	109	120	19-Apr	30-Apr	76.81
3	02	SCBI	Charlottesv	KCHO	KBIS	1112	8.24	2	3.4	4	13-May	23-Aug	30	4	34	123	156	3-May	5-Jun	107.88
3	09	WOOD	Bismark Mu	KBIS	KBZN	438	3.25	0	0.5	1	12-Jun	29-Jul	17	3	20	163	182	12-Jun	1-Jul	127.31
3	12	YELL	Gallatin Fie	KBZN	KHIO	497	3.68	0	0.6	1	6-Jun	3-Aug	11	2	13	184	196	3-Jul	15-Jul	147.90
3	16	WREF	Hillsboro Ai	KHIO	KBDU	845	6.26	0	1.0	2	8-Jun	9-Aug	12	2	14	198	211	17-Jul	30-Jul	179.94
3	10b	RMNP	Boulder Mu	KBDU	KTUS	550	4.07	0	0.7	1	20-Jun	31-Jul	15	2	17	214	230	2-Aug	18-Aug	192.54
3	14	SRER	Tucson	KTUS	KBDU	550	4.07	0	0.7	1	4-Aug	1-Sep	16	2	18	232	249	20-Aug	6-Sep	225.02
3		BLDR	Boulder Mu	KBDU	KGJT	163	1.21	0	0.2	1	n/a	n/a	8	0	8	251	258	8-Sep	15-Sep	241.23
			Subtotal			**5807**	**43.02**	**2**	**9.3**	**15**			**137**	**17**	**155**	**166**				**241.23**
2		BLDR	Boulder Mu	KGJT	KBDU	163	1.21	0	0.2	1	n/a	n/a	1	0	1	107	107	17-Apr	17-Apr	1.21
2		BLDR	Boulder Mu	KBDU	KBDU	0	0.00	0	0.0	0	n/a	n/a	17	0	17	108	124	18-Apr	4-May	33.21
2	10a	CPER	Boulder Mu	KBDU	KRHI	769	5.70	0	0.9	1	21-May	7-Jun	12	2	14	125	138	5-May	18-May	52.81
2	05	UNDE	Rhinelande	KRHI	PASC	2421	17.93	2	5.0	5	5-Jun	26-Aug	26	4	30	140	169	20-May	18-Jun	85.29
2	18	TOOL	Deadhorse	PASC	KBIS	2092	15.50	2	4.6	5	4-Jul	5-Aug	28	4	32	177	208	26-Jun	27-Jul	133.98
2	01	HARV	Nashua	KASH	KBDU	1515	11.22	2	3.9	4	27-May	24-Aug	32	4	36	214	249	2-Aug	6-Sep	162.77
		BLDR	Boulder Mu	KBDU	KGJT	163	1.21	0	0.2	1	n/a	n/a	8	0	8	254	261	11-Sep	18-Sep	178.98
			Subtotal			**7123**	**52.76**	**6**	**14.8**	**17**			**124**	**14**	**139**	**151**				**178.98**
															Total days	**317**		**Total engine hrs**		**420.21**

Orange donotes domains where deployments have been truncated due to limited payload availability

Yellow denotes domains with at least one site flown outside of peak greenness due to limited payload availability

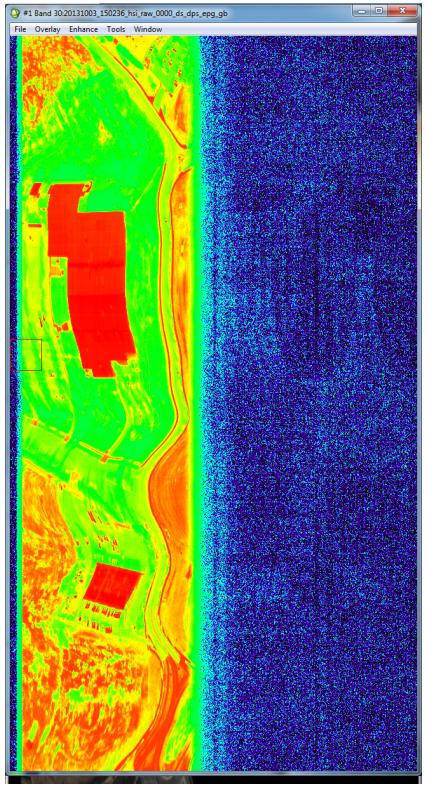
Purple denotes domains where foliar sampling occurs

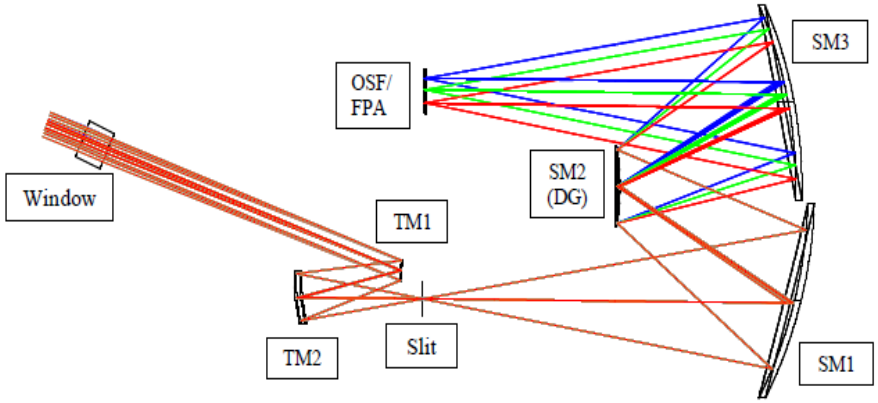
Not flown: D03, D04, D06, D07, D08, D13, D15, D17, D19 and D20

Able to survey 10 domains (50% of network) with two payloads

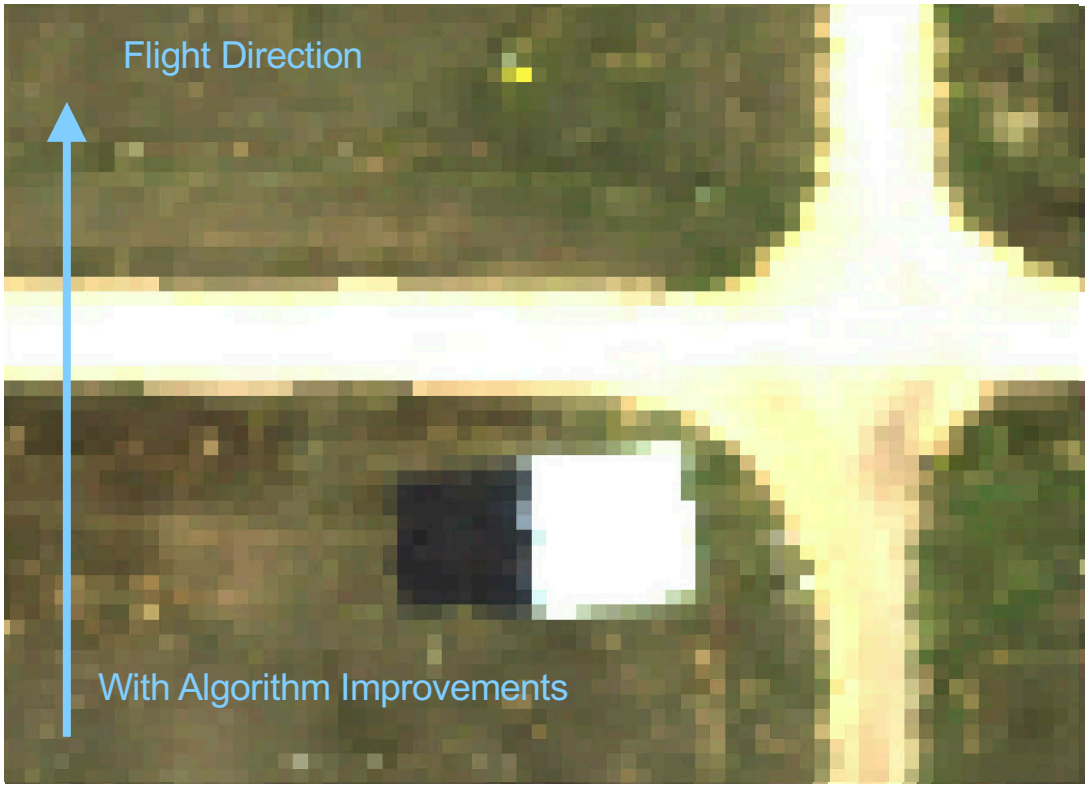
Improved Spectrometer Calibration

DFS-DPS-EPG-Ghost

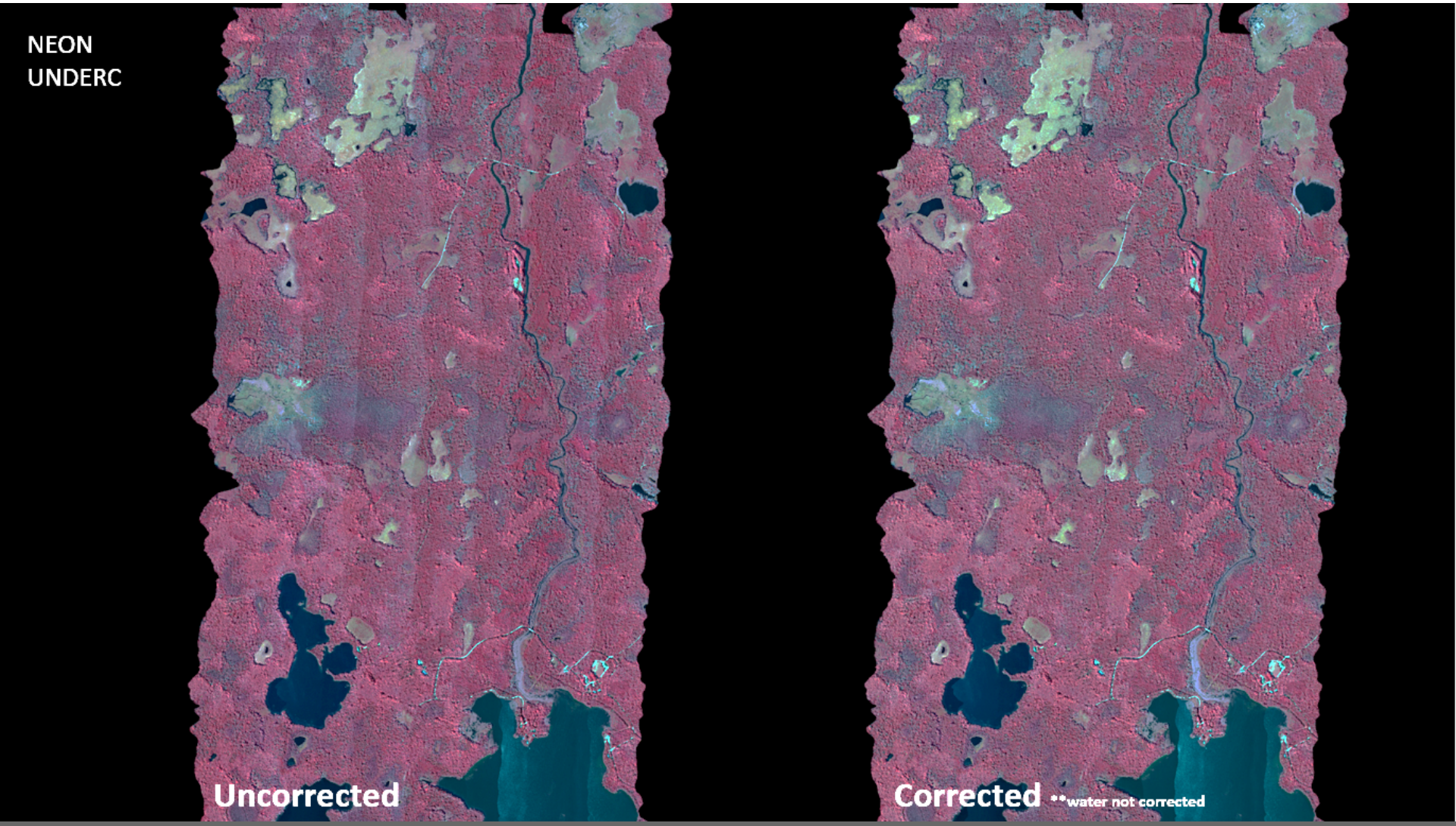




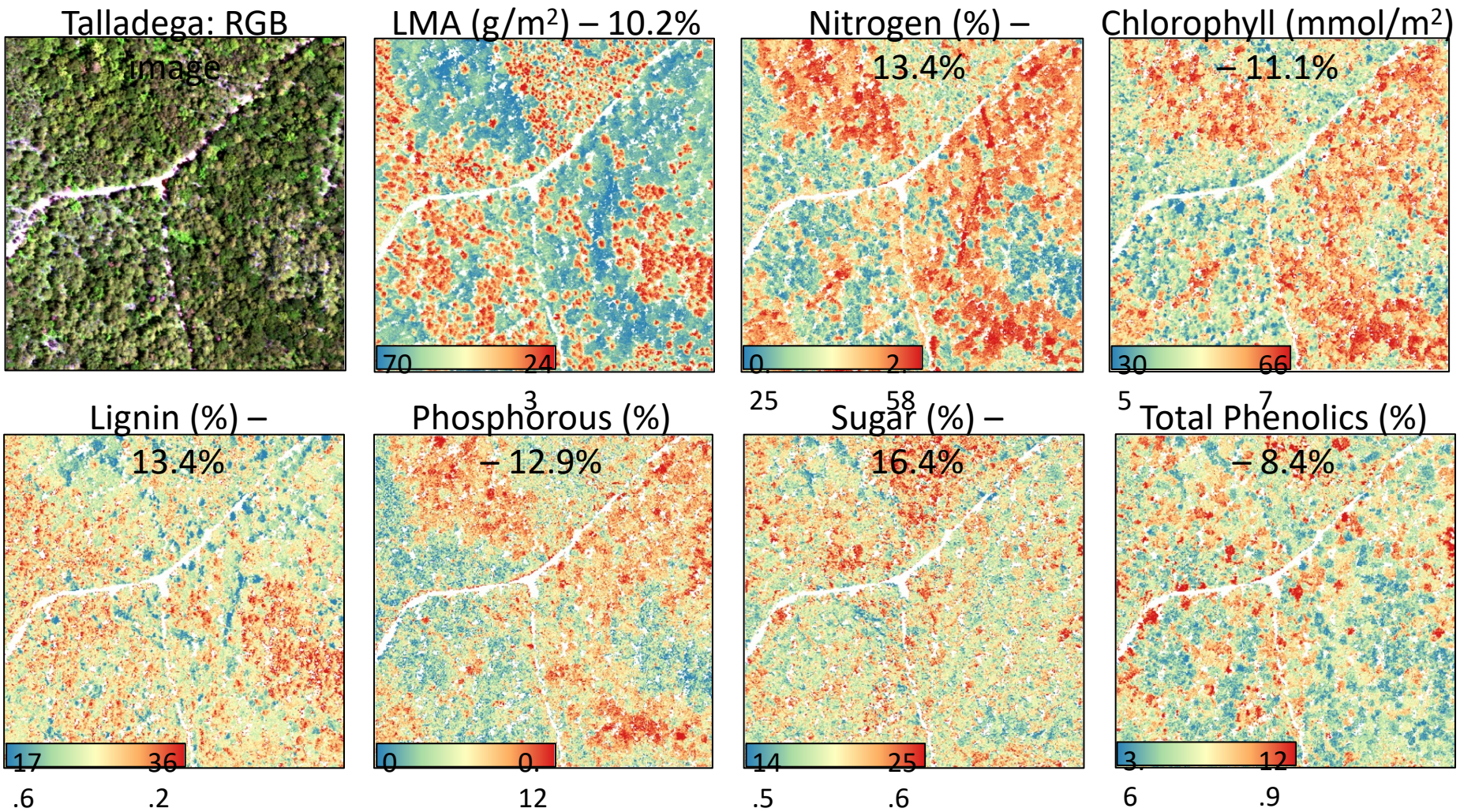
Improved Spectrometer Calibration



BRDF Correction
Phil Townsend lab - PhD Student Adam Chlus

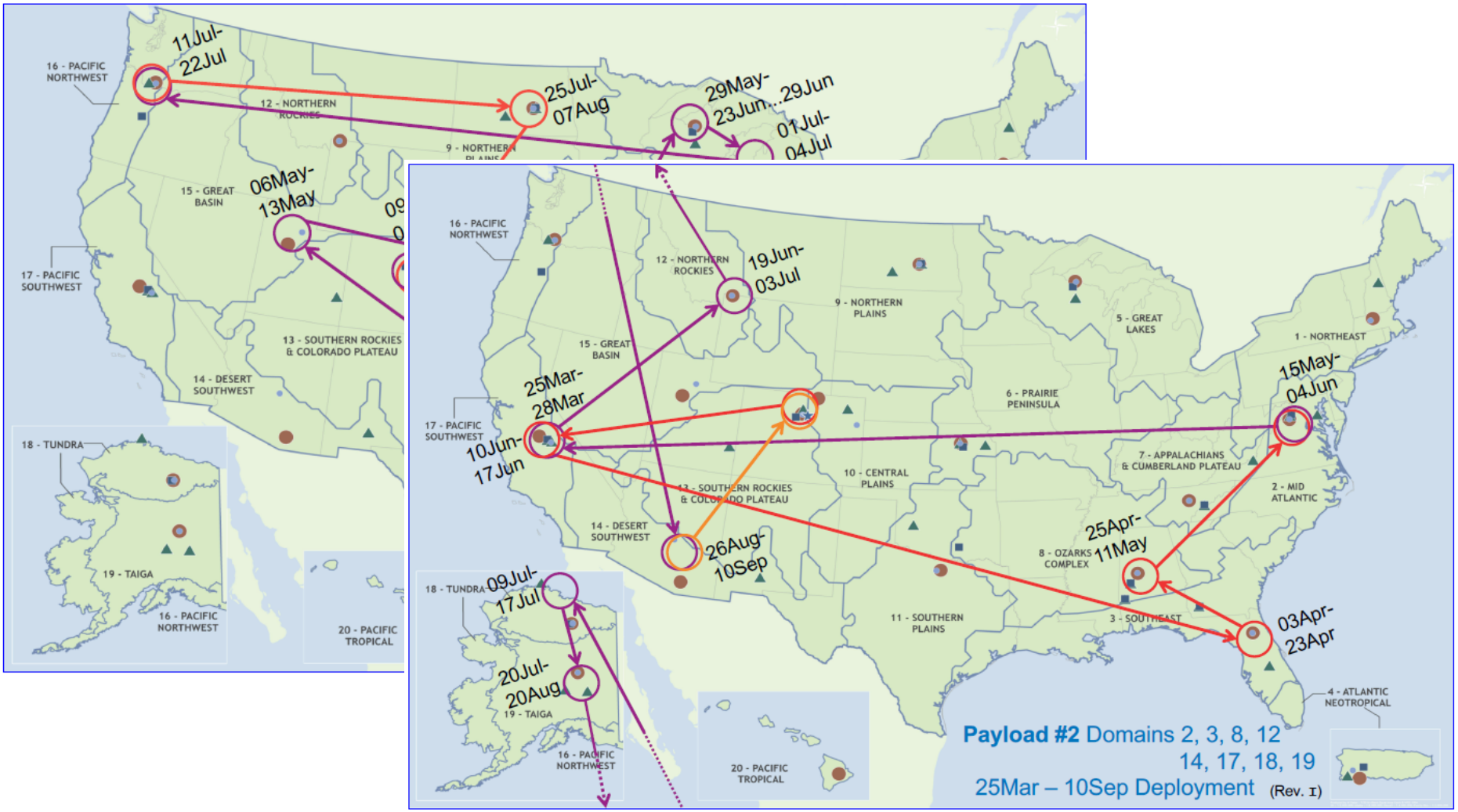


Incorporating algorithms from external research community



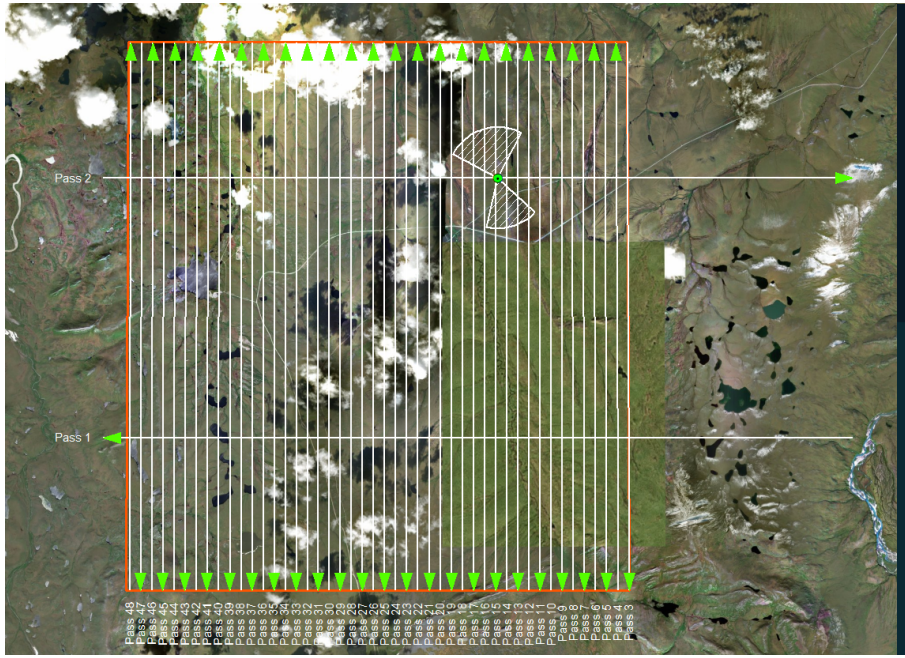
2019 Flight Campaign – 2 Payloads

80% Cloud-free Probability at Foliar Sampling Sites / 62% at non-FS Sites

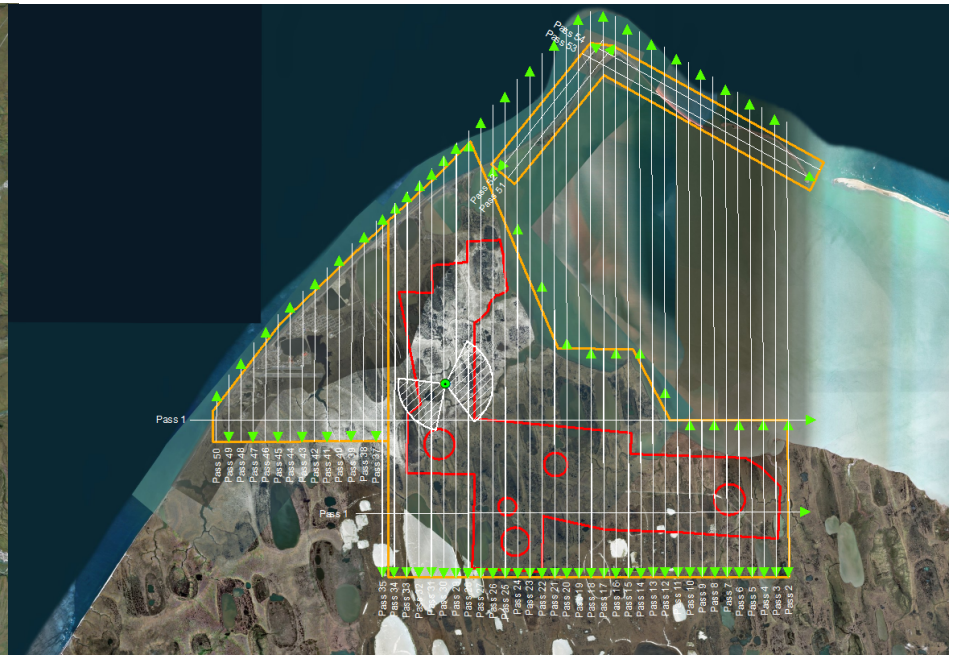


2019 Flight Campaign Schedule

80% Cloud-free Probability at Foliar Sampling Sites / 62% at non-FS Sites



Toolik



Barrow

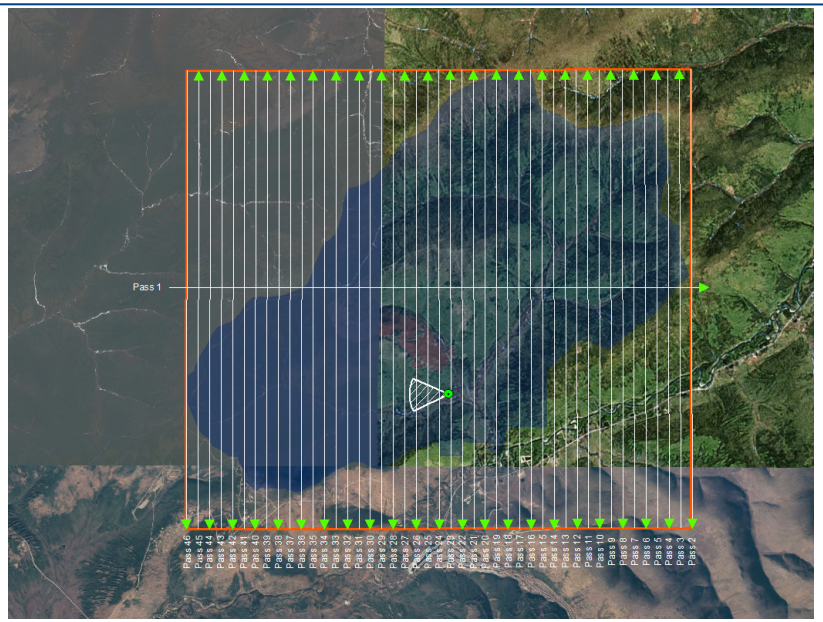
Approximate survey dates – Domain 18

2 Payloads: July 9-17

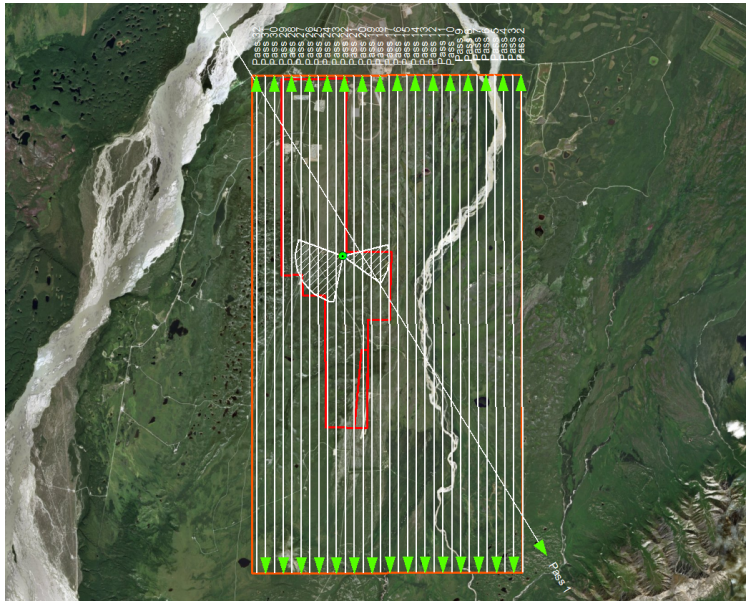
3 Payloads: July 2-26

2019 Flight Campaign Schedule

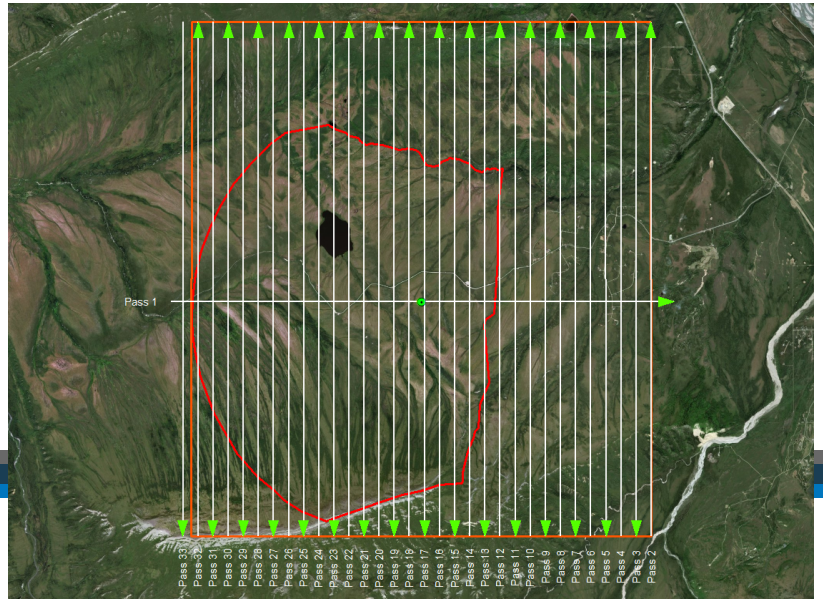
80% Cloud-free Probability at Foliar Sampling Sites / 62% at non-FS Sites



Caribou Creek



Delta Junction



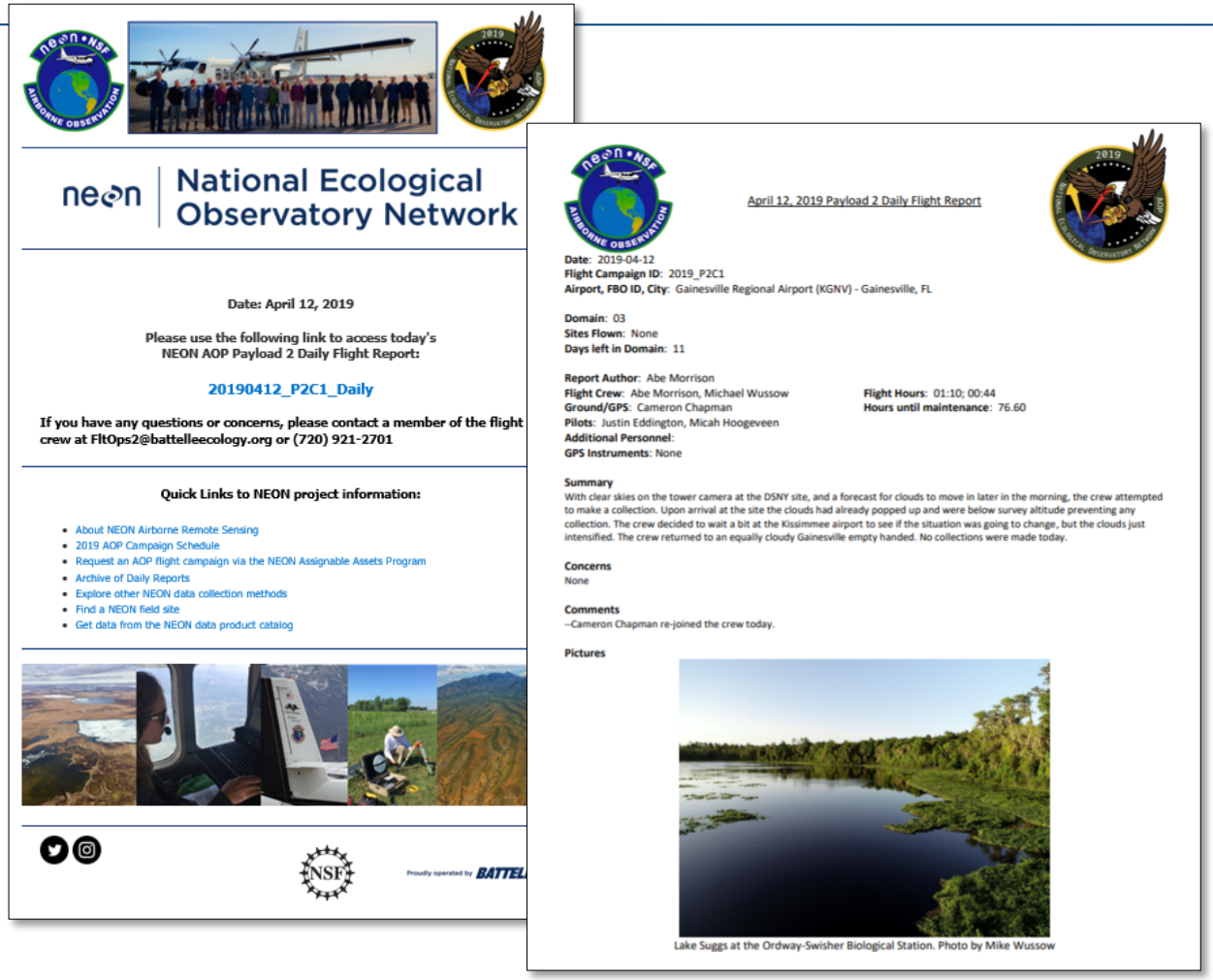
Healy

Approximate survey dates – Domain 19

2 Payloads: July 20-Aug 20

3 Payloads: July 28-Aug 20

Daily Reports from the 2019 Flight Campaign



neon | National Ecological Observatory Network

Date: April 12, 2019

Please use the following link to access today's NEON AOP Payload 2 Daily Flight Report:

20190412_P2C1_Daily

If you have any questions or concerns, please contact a member of the flight crew at FltOps2@battelleecology.org or (720) 921-2701

Quick Links to NEON project information:

- About NEON Airborne Remote Sensing
- 2019 AOP Campaign Schedule
- Request an AOP flight campaign via the NEON Assignable Assets Program
- Archive of Daily Reports
- Explore other NEON data collection methods
- Find a NEON field site
- Get data from the NEON data product catalog

Proudly operated by BATTEL

April 12, 2019 Payload 2 Daily Flight Report

Date: 2019-04-12
Flight Campaign ID: 2019_P2C1
Airport, FBO ID, City: Gainesville Regional Airport (KGNV) - Gainesville, FL

Domain: 03
Sites Flown: None
Days left in Domain: 11

Report Author: Abe Morrison
Flight Crew: Abe Morrison, Michael Wussow
Ground/GPS: Cameron Chapman
Pilots: Justin Eddington, Micah Hoogeveen
Additional Personnel:
GPS Instruments: None

Flight Hours: 01:10; 00:44
Hours until maintenance: 76.60

Summary
With clear skies on the tower camera at the DSNY site, and a forecast for clouds to move in later in the morning, the crew attempted to make a collection. Upon arrival at the site the clouds had already popped up and were below survey altitude preventing any collection. The crew decided to wait a bit at the Kissimmee airport to see if the situation was going to change, but the clouds just intensified. The crew returned to an equally cloudy Gainesville empty handed. No collections were made today.

Concerns
None

Comments
--Cameron Chapman re-joined the crew today.

Pictures

Lake Suggs at the Ordway-Swisher Biological Station. Photo by Mike Wussow

Sign up at https://www.neonscience.org/daily-flight-reports

National Ecological Observatory Network

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It can be done

National Ecological Observatory Network is a project sponsored by the National Science Foundation and operated under cooperative agreement by Battelle.

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