



The NEON Soil Archive – A community resource

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NEON

The National Ecological Observatory Network (NEON) is a 30-year National Science Foundation-funded facility for understanding and forecasting the impacts of climate change, land use change, and invasive species on aspects of continental-scale ecology such as biodiversity, biogeochemistry, infectious diseases, and ecophysiology. NEON will measure a wide range of properties at 60 terrestrial and 36 aquatic sites throughout the US using in situ sensors, sample collection/lab analysis, and remote sensing, and all data will be made freely available. The Observatory is currently under construction and will be fully operational by 2017, however, limited data collection and release will begin in 2013.

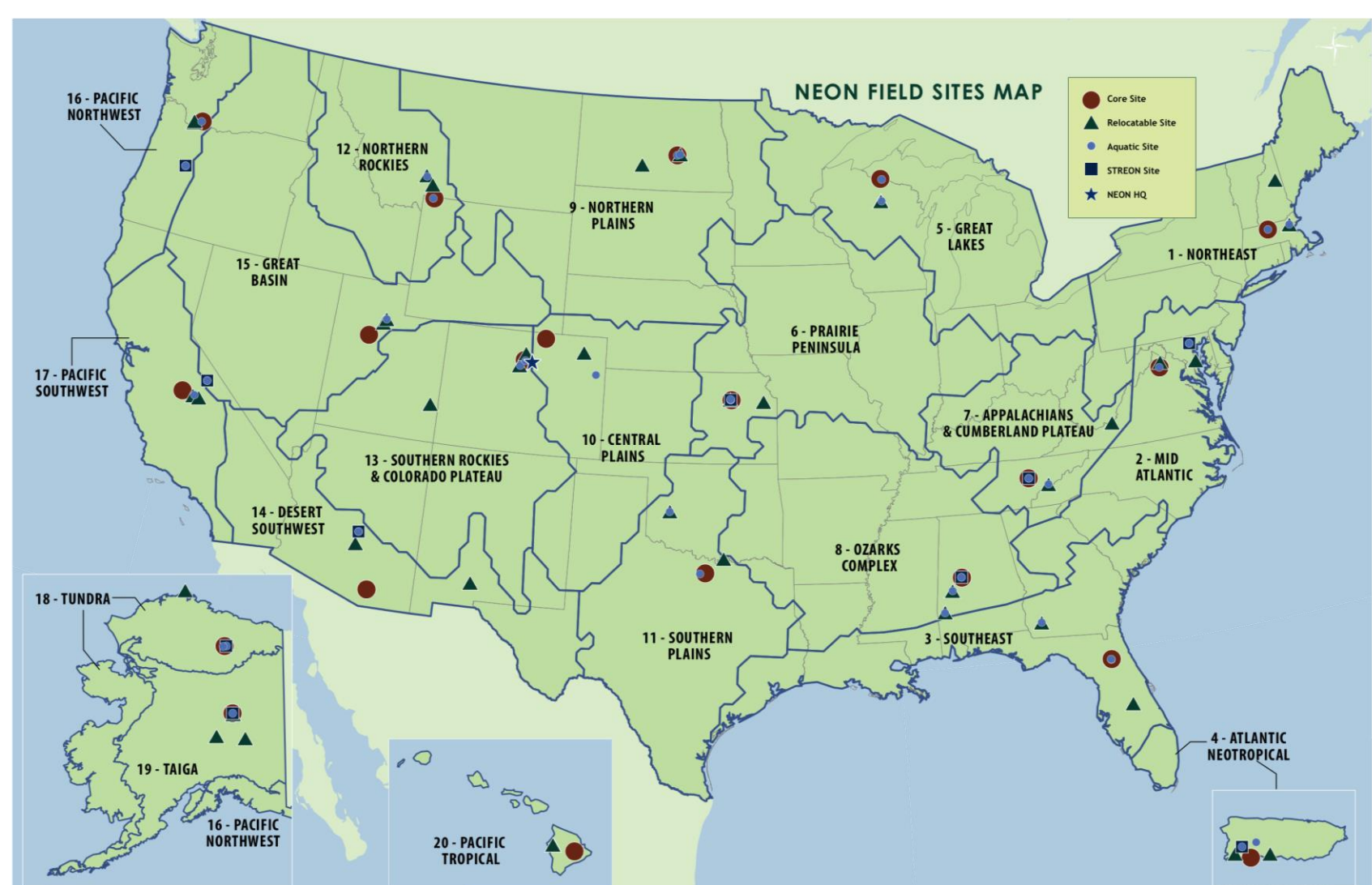


Figure 1. The 60 terrestrial NEON sites are distributed across 20 ecoclimatic domains throughout the US.

Soil Archive Sampling and Processing

The soil profile is described by local NRCS soil scientists and soil is collected by horizon to 2 m from each pit. Each sample is broken-up and mixed by hand, and ~4-8 liters soil is sent for processing. If bedrock (R horizon) is encountered within the pit chunks of rock are collected and archived without additional processing. Additional material is sent to the NRCS Kellogg Soil Survey Lab for analysis.

Soil samples are air-dried and 2 mm sieved (mineral soil) or air-dried (organic soil). 1.2 kg soil is split between 4 amber glass jars, certified to meet EPA Performance Based Specifications for semi-volatile organics, pesticides, PCBs and metals analyses. The jars are stored in locked, water-resistant and fire-resistant cabinets at room temperature. The soil archiving protocol is available upon request.

Archived Samples

To date 18 soil pits have been sampled, representing 7 soil orders. Soils from 135 horizons have been archived or are being processed.

Once soils from all 60 sites have been archived all common US soil orders are expected to be represented within the archive (Fig. 3).

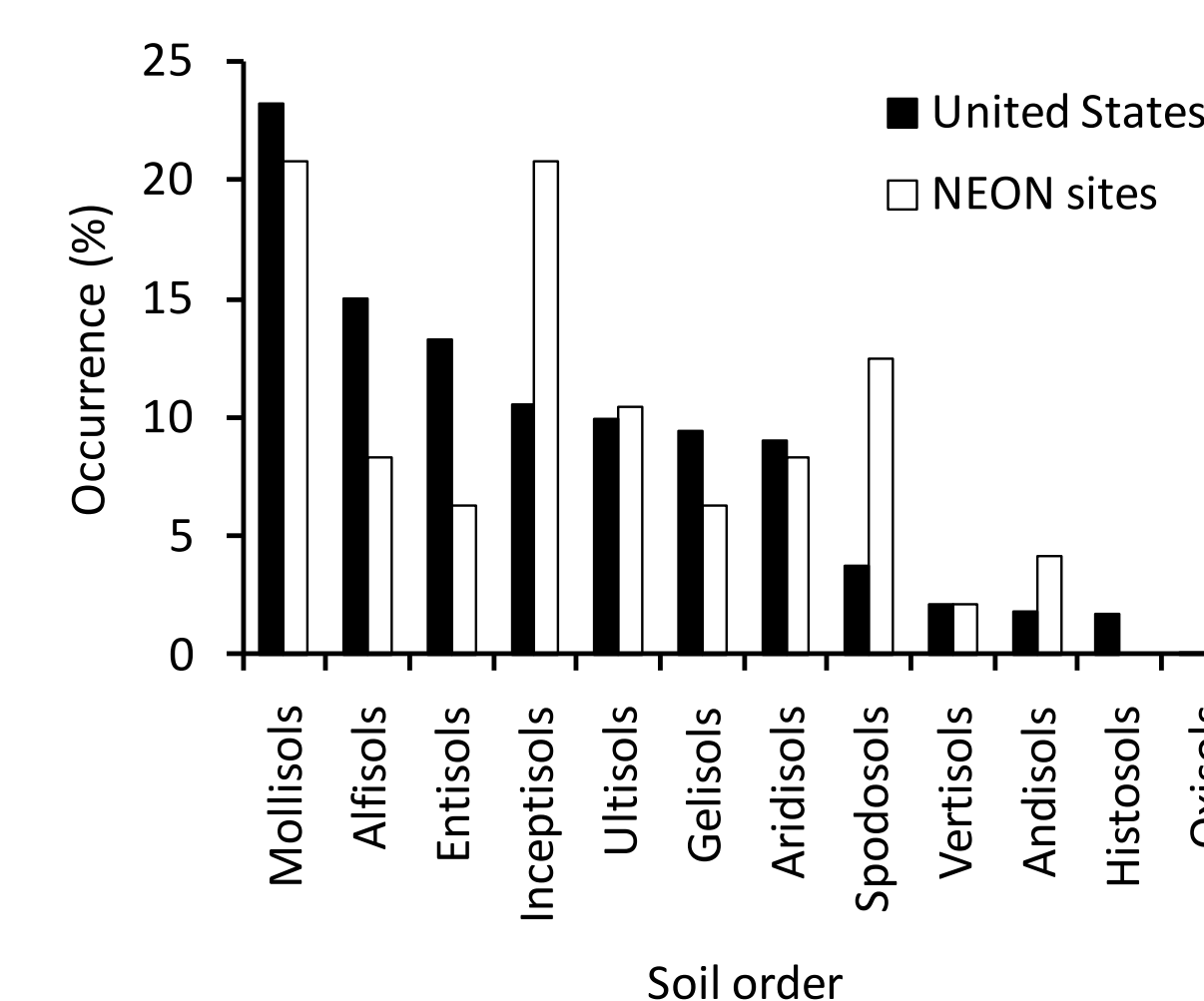


Figure 3. Occurrence of soil orders in the US and expected occurrence at the 60 terrestrial NEON sites.

Metadata

Metadata associated with each soil archive sample includes:

- Latitude, longitude, elevation, & sampling date
- Soil taxonomy, profile description, & photos
- Texture, bulk density, & pH
- Total C, N, S, Al, Ca, Fe, K, Mg, Mn, Na, P, Si, Sr, Ti, & Zr

Additional soil measurements will be made at each site throughout NEON's lifespan.

Table 1. Example metadata from surface horizons at Harvard Forest. Data has not yet been QA/QC'd.

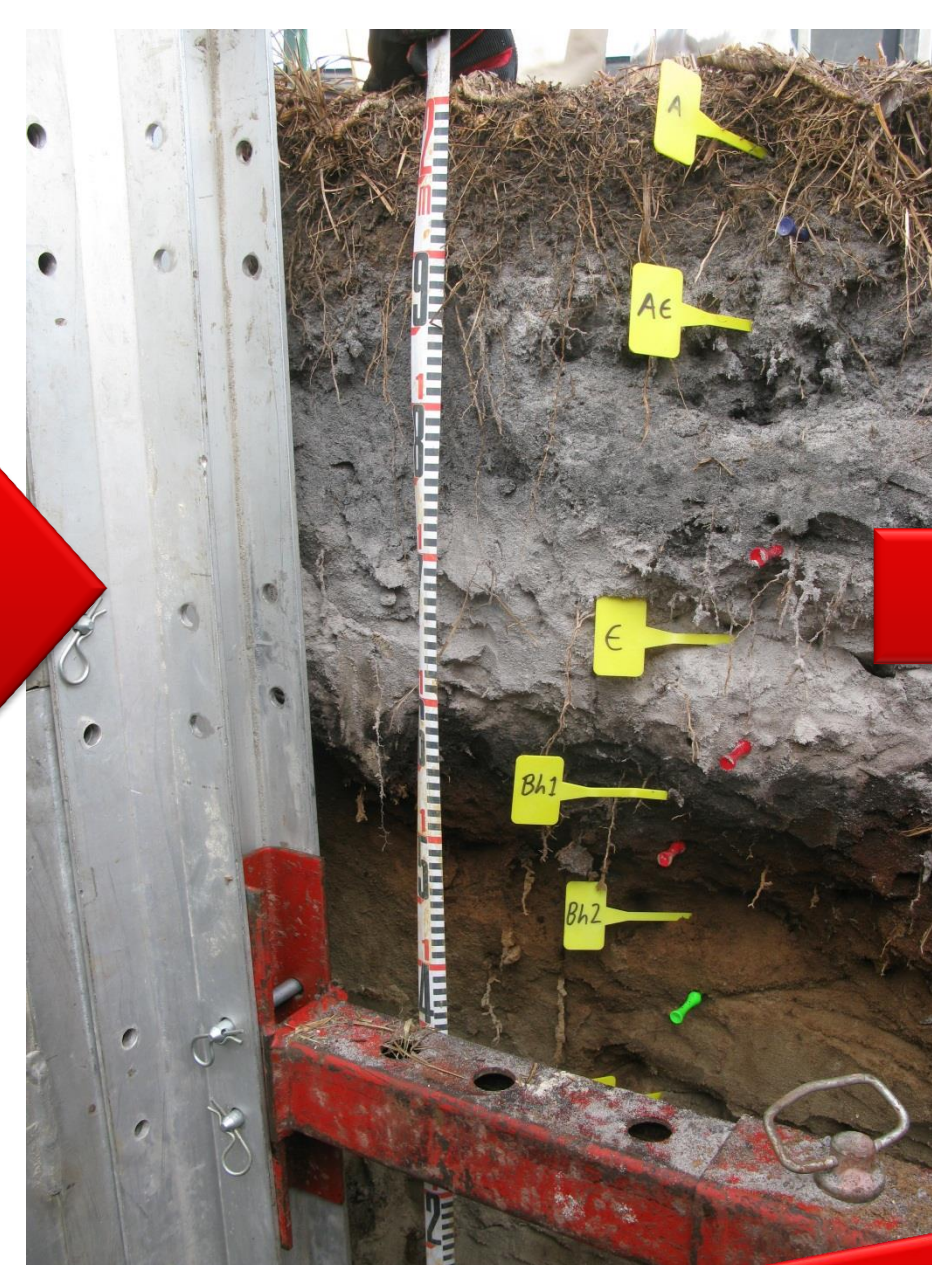
	Horizon	
	O1	A
Top depth (cm)	0	4
Bottom depth (cm)	4	9
Bulk density (g cm ⁻³)	0.34	0.48
Total C (%)	25.67	9.64
Total N (%)	1.35	0.6
Total S (%)	0.01	0.02
Total Al (mg kg ⁻¹)	32588	58854
Total Ca (mg kg ⁻¹)	5529	9490
Total Fe (mg kg ⁻¹)	13558	22543
Total K (mg kg ⁻¹)	7556	13203
Total Mg (mg kg ⁻¹)	1909	3752
Total Mn (mg kg ⁻¹)	295	555
Total Na (mg kg ⁻¹)	7177	12161
Total P (mg kg ⁻¹)	1438	1470
Total Si (mg kg ⁻¹)	183014	271003
Total Sr (mg kg ⁻¹)	121	197
Total Ti (mg kg ⁻¹)	2564	4298
Total Zr (mg kg ⁻¹)	54	68
pH in CaCl ₂	3.5	3.8
pH in H ₂ O	4.6	4.6
Total sand 0.05-2 mm (%)	53.3	58.8
Total silt 0.002-0.05 mm (%)	31	29.5
Total clay <0.002 mm (%)	15.7	11.7
Fine silt 0.002-0.02 mm (%)	21.8	17.8
Coarse silt 0.02-0.05 mm (%)	9.2	11.7
Very fine sand 0.05-0.1 mm (%)	11.8	12
Fine sand 0.1-0.25 mm (%)	19.1	20.5
Medium sand 0.25-0.5 mm (%)	18.2	16.3
Coarse sand 0.5-1 mm (%)	3.6	8.6
Very coarse sand 1-2 mm (%)	0.6	1.4

The NEON Soil Archive

Soil pit



Horizons identified



Samples collected by horizon



Building a community resource

The NEON Soil Archive is a resource for the community and researchers are encouraged to request samples for study. Samples from the archive, as well as all associated metadata, are freely available.

The archive is growing steadily, with soil from 1-2 soil pits added monthly. Soil from all 60 NEON sites should be archived by 2016. Table 2 shows the sites where soil has been collected to date.

Table 2. Sites where soil has been collected to date.

Domain	Site, State	Soil Order	Soil series	Horizons
1	Harvard, MA	Inceptisol	Henniker-taxadjunct	10
1	Bartlett, NH	Spodosol	Sunapee	9
2	Blandy, VA	Alfisol	Poplimento-taxadjunct	7
2	SCBI, VA	Alfisol	Lew	10
3	Jones, GA	Ultisol	Lucy	5
3	Ordway, FL	Entisol	Astatula	4
3	Disney, FL	Spodosol	Smyrna	9
5	UNDERC, MI	Spodosol	Tula	10
7	Oak Ridge, TN	Ultisol	Fullerton	7
8	Dead Lake, AL	Ultisol	Angie	7
9	Woodworth, ND	Mollisol	Manning	7
9	Dakota Coteau, ND	Mollisol	Max	10
9	NGPRL, ND	TBD*	TBD*	10
10	CPER, CO	Mollisol	Ascalon	7
10	Sterling, CO	Mollisol	Goshen	6
10	RMNP Castnet, CO	Mollisol	TBD*	6
11	Klemme, OK	Inceptisol	Cordell-taxadjunct	5
14	Jornada, NM	Aridisol	Nations	6

*Additional analyses are being performed to inform soil taxonomy.

An interim process has been established for researchers to request soil from the archive. Instructions can be found at the archive website: www.neoninc.org/science/soil-archive

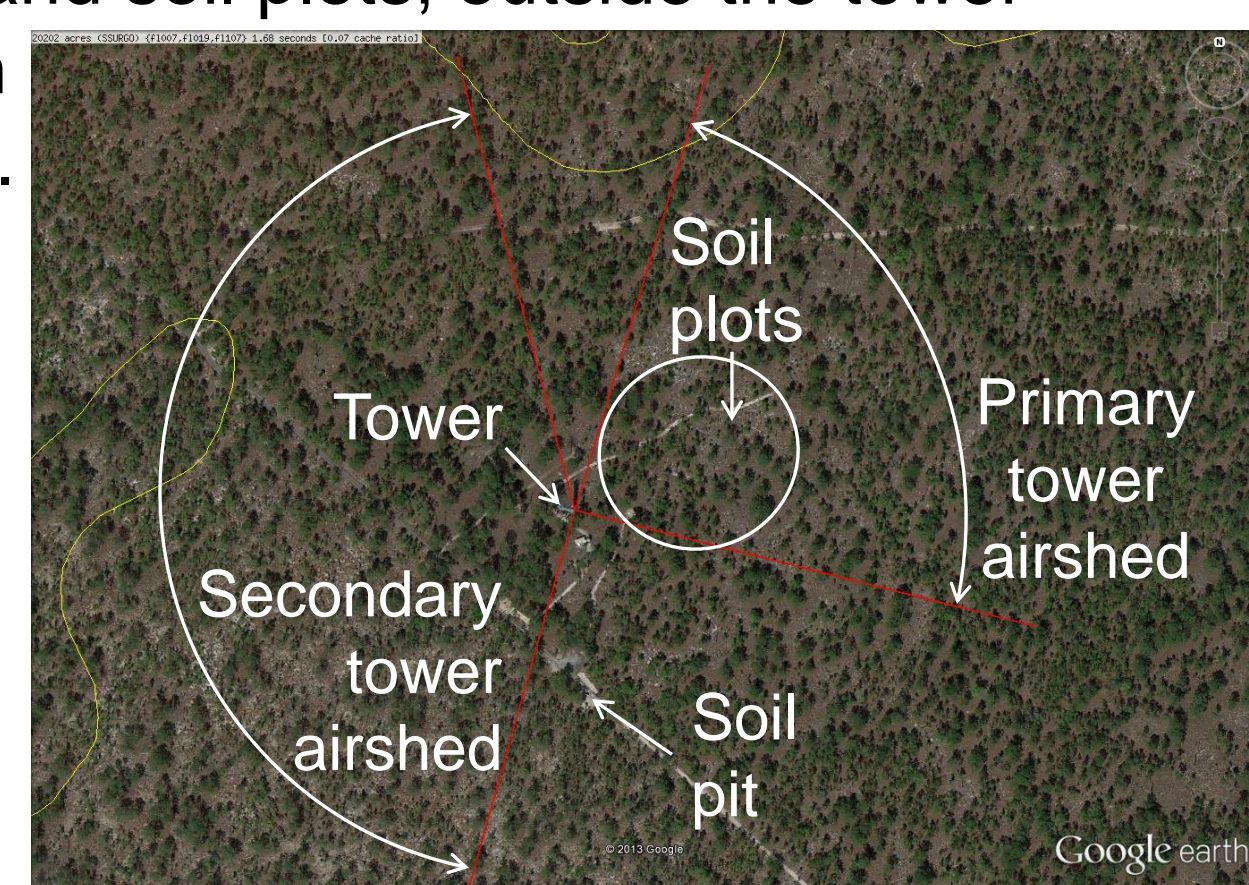
NEON Archives

NEON is archiving large numbers of samples of a variety of types including plants, beetles, mosquitos, and soil. Soil archiving consists of two types of samples:

- Surface soils (top ~30 cm) collected every 3-5 years from multiple locations across each site, and
- Soils collected by horizon to 2 m deep from a single, temporary soil pit at each site.

Here we present information about the latter, focusing on sampling and processing, metadata, and currently available samples. At each NEON site the soil pit is located in the locally dominant soil type, near the instrumented tower and soil plots, outside the tower airshed, and near an access point (Fig. 2).

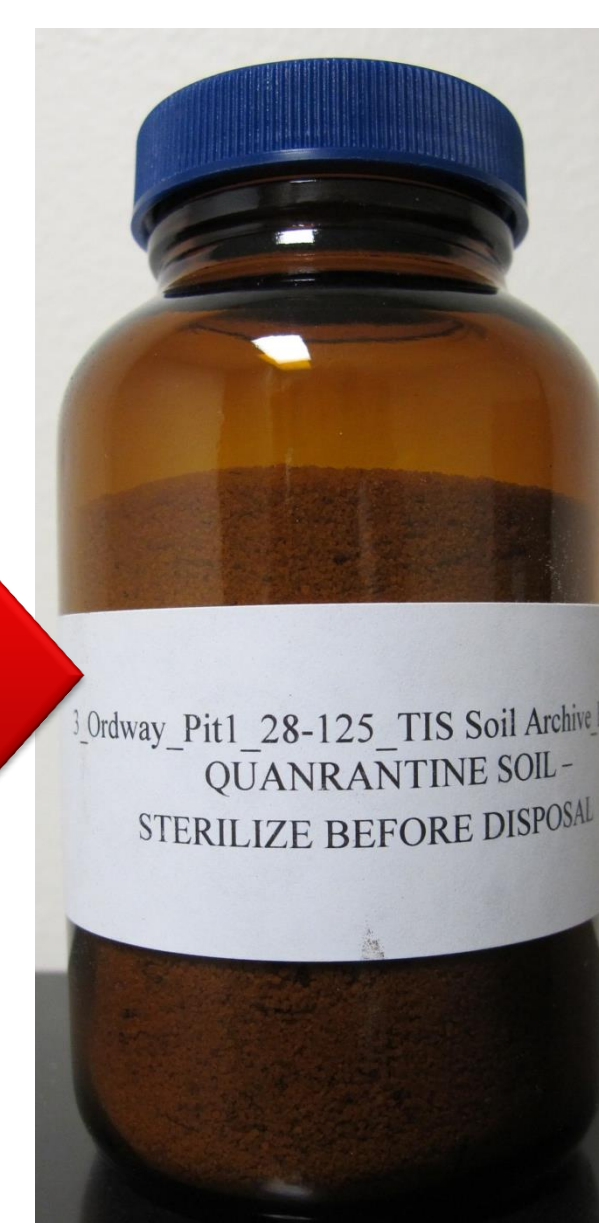
Figure 2. Example NEON site layout at Ordway-Swisher Biological Station, FL. Yellow lines designate NRCS soil type boundaries. Red lines are 300 m long.



Air dried & sieved



Sample splitter



Storage jars



Soil archive

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