

This guide walks viewers through how to access data through the NEON data portal and a few related resources for working with NEON data. The NEON data portal remains in dynamic development. This photographic guide will be regularly updated. If the data portal you are viewing does not match this guide, please check for an updated version.

The guide is laid out to be followed sequentially from starting on the NEONScience.org website to downloading data to your computer. After this sequence additional slides are provided that provide details on other pages or topics of interest to data users.

Slideshow Sections



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Understand Downloaded Data Structure

Additional Important Pages & Information



Discover NEON Data

• NEONScience.org

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• NEONScience.org/data

This section highlights key resources provided on neonscience.org and data.neonscience.org. You will want to familiarize yourself with both sites to better understand how NEON collects and provides data.



We start the journey to downloading NEON data from the NEONScience.org homepage. The main NEON website, NEONScience.org, provides many resources for researchers and educators interested in NEON including direct access to the data portal.

- Data Collection introductory information to how NEON collects data. A good place to start to understand what types of data NEON collects or determine if the data NEON collects is what you want for your research or teaching.
- Field Sites The field site maps and list will help you gain familiarity with the sites. If you are interested in data from particular locations, identify the four letter codes for each site of interest, you will need these when selecting the data for these sites.
- Data Information on NEON data, samples & specimens, data policy, and more. Includes of the the other links to get to the data portal.

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The NEON data portal, at data.neonscience.org, is the place to explore and download NEON data products as well as find the detailed information about all NEON data products. We will go through many of these pages in more detail.



Explore & Download Data From Portal

• Explore Data Page

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- Download Tabular Data Including:
 - Instrumented Sampling
 - Observational Sampling

In this section, we will go through steps to explore and download NEON data from the Data Portal.



Start your NEON data exploration on the Explore Data Products page. The direct URL is <u>https://data.neonscience.org/data-products/explore</u>.

(This slide contains animations to fully view each step)

Step 1: The fastest way to access NEON data from this page is by clicking on the Explore Data Products link here.

Step 2: Or, you can choose Download Data -> Explore Data Products.

Step 3: You are now in the data explorer. Proceed to next slide.

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To begin, choose keyword(s) or select from the available categories to filter to NEON data products of interest to you. Alternatively, you can scroll down through data products when there are no filters selected to view all of NEON's data products.

When using the keyword search, if you don't get the result you are interested in try a related word or shorter phrase. For example, if you are interested in small mammal data from live trapping, you'll find that "trapping data" returns zero data products, while "small mammals" returns two data products ("Small mammal box trapping" and "Small mammal sequences DNA barcode") and simply "mammals" returns three data products (the two previous plus "Rodent-borne pathogen status").



Each data product window provides a variety of useful information and links to other useful information.

- Key among these are the data product name and data product number. Both are important for referring to your data and looking up the data in the future.
- Product Details is a link that takes the user to the Product Detail Page (see page specific slide for details). Clicking the data product name will take you to the same page.
- The Available Time Range and Availability bar icons are both related to what is available for download from the data portal at the current time. All data are distributed in per month packages therefore, each bar represents one calendar month. Blue month boxes mean that data are currently available for use. The grey boxes could mean that data were never collected and will never be available, data were collected but have not been processed but will be availability in the future, or that the specific months occur in the future (a full year shows up at a time).



You can view the availability of NEON data as an overall summary or by site, state, or domain. A given site, state, or domain will only appear if it is available for at least one month for that data product. If you are only interested in data from select locations, you can click on those locations here to select them for download or you can do that in the next step.

If you are interested in only specific locations, you will need to know the four-letter code for these sites. These can easily be looked up on the field site map (https://www.neonscience.org/field-sites/field-sites-map) or list (https://www.neonscience.org/field-sites/field-sites-map/list).



Select Download Data when ready to configure your data set to download. You can only configure and download one data product at a time in the data portal.

There are a few data products, primarily phenocam data, that cannot currently be downloaded from the Explore Data page. When you select "Download Data" for these data products, you will be reverted to the previous explore data page. For details on how to configure this data for download, see the slide "Configure AOP data for Download" or "Configure Data Hosted by Partner".



When you select "Download Data" on the Explore Data page, a pop up window will appear where you will configure your data set.



- Include documents? This will provide PDFs of related documents (User Guides, Protocols, Algorithm Theoretical Basis Documents, etc) in the folder that you are downloading. We recommend you do this on the initial download of a data product so that you readily have this important information for use while using NEON data. All related documents can also be found on the Documents tab of each Data Product Details page (see slide for more details).
- Basic vs Expanded Data Type? Basic data include an overall data flag for the overall quality of the data. The expanded data types have additional data tables and data flags regarding specific processing steps or data control analyses. For research purposes, you will likely want the expanded package. For educational or initial data exploratory, the basic package is likely sufficient.



Given the timeframe and types of data collected, NEON data product packages can quickly become very, very large. We recommend always checking the estimated download size BEFORE starting any download.

Please cite NEON data in your work – it helps NEON to sustain our funding to continue to provide you with high-quality data!



Special Cases for Downloading Data

- Aerial Observation Platform (AOP) Data:
 - Lidar

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- Hyperspectral
- Aerial Imagery
- Phenocam & Genomics Data from Partner Organizations

In this section, we will go through some special cases for downloading NEON data

Airborne Observation Platform (AOP) Data

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Note that our AOP datasets may be VERY LARGE! Start by downloading one at a time. We recommend downloading these files programmatically, however, you may want to explore a small subset of the data by downloading through the portal.

Select Download Data when ready to configure your data set to download. You can only configure and download one data product at a time in the data portal.



There are many ways to specify the particular data that you are looking for – here we show an example using the 'Site' interface for View Availability.

Note that our AOP datasets may be VERY LARGE! Start by downloading one at a time.



- Here we see that there are 92 individual files available for ABBY in 2019., including the readme .txt file, for a total of 348 MB.
- The file name also specifies location, using the UTM zone's easting and northing for the lower left corner of the tile. See more information about file naming conventions here: <u>data.neonscience.org/file-naming-conventions</u>



- Include documents? This will provide PDFs of related documents (User Guides, Protocols, Algorithm Theoretical Basis Documents, etc.) in the folder that you are downloading. We recommend you do this on the initial download of a data product so that you readily have this important information for use while using NEON data. All related documents can also be found on the Documents tab of each Data Product Details page (see slide for more details).
- Basic vs Expanded Data Type? AOP does not have separate 'Basic' or 'Expanded' package types, so you will not be prompted as per the instructions above.

Explore through visual browser

- Explore mosaicked camera and hyperspectral imagery
- Available on the Data Product Detail Page
- Current download options: only can download .png or binary files
- Partnership with University of Utah's ViSUS team availability of data product that this is for will be expanding
- Two products available to browse:
- High-resolution Imagery:
 - https://data.neonscience.org/data-products/DP3.30010.001
- · Vegetation indices:

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	Land-water interface images	5		
. Select your dataset of interest	Data for this product is not cur particular site from the Phone	rently available for download through the N Cam Project.	EON Data Portal. Please use the links below	to access data for this product for a
. Follow the links provided	Alabama • DUNA: Mack Wanter River • EUC- Arona Lake • LUNO - Lonnie Landing • MM - Huydid Orek • DUL: Tailadeg-Internal Forest • TOME - Transignee River	Alaska BAR - Burea Environmental Obsenstery BOM-Credits Cardoo Paker Cardia Cardoo Credit A Cardoo Paker Cardia Research Waterhold DCUJ - Deta Junction HIGLInaly DCSR - Docubayil Credit 100C - Foolik Lake 100C - Foolik Lake	Arizona • SRR-Sana Ris Openmental Range • SICA-Sysamore Creek	California BIOC - Upper IIg Creek SURF - Son Anapula SOMP - Songerout Solid T TUX Lower Tailwette T TUX Tookette 2 Creek
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	New Hampshire BART - Bartlett Experimental Forest	New Mexico JORN- Jornada LTER	North Dakota • DCFS - Dakota Coteau Field School • NOCP - Northern Great Plains Research Laboratory	Oklahoma BLUE - Blue River OAES - Klemme Range Research Station

Phenocam Data are provided through the PhenoCam Project: <u>https://phenocam.sr.unh.edu/webcam/about/</u>.

Links on the Download Data process will link you directly to their portal.



Understand Downloaded Data Structure



The data will download to your default download location (likely your Downloads folder).

Most NEON data products are delivered as compressed (zipped) .csv files. Other formats include .hdf5, .tif, and .kmz. These next few slides only pertain to the data products delivered compressed with data in .csv files. For all compressed files, view them by uncompressing.



- Included documentation (if selected)
 - The User Guide, Protocol, etc. Exact files vary by data product. All files can also be found on the Data Product Details page.
 - Information in the User Guide is specifically designed to help users work with NEON data.
- Validation file
 - Contains the machine readable data processing rules –
- EML (.xml) file
 - Machine readable metadata file. More about EML at NEON (http://data.neonscience.org/faq) and KNB (http://ecogrid.ecoinformatics.org/external//emlparser/docs/index.html).
- Readme file
 - Important information on the data product and

- includes information on the specific download.
- Data table(s)
 - One or more related .csv files
- Variables file
 - Lists which variables are found in which data table. This can be very useful for figuring out how to link the related data tables.



When downloaded from the portal, data come in site by month files. We know that it is difficult to work with all these separate files, so NEON provides the neonUtilities R package which contains the stackByTable function to combine the files so that you only have one of each type for all dates and sites.

Tools to help you use this tool:

- Not an R user? No worries, we have a super simple script for beginners: https://www.neonscience.org/resources/code-resources (scroll down to Super Easy R Script to download)
- Prefer to use Python and not R? Not a problem, follow these directions to use the R package functionality within Python: https://www.neonscience.org/neon-utilities-python.
- Want to learn about the many tools that neonUtililities has to offer for working with NEON data? This data tutorial is for you:https://www.neonscience.org/neonDataStackR.

This concludes the sequential series of slides to explore, download and access NEON data.



Additional Important Pages

- Accessing NEON Data Programmatically
- Making the Most of your NEON Account
- NEON Data Policies How to Cite
- Data Product Detail Pages
- File Name Conventions Page
- Data Quality Pages

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In this section, we will go through steps to access additional information about the NEON data.



This guide primarily discusses how to access NEON data from the data portal. However, data can also be accessed programmatically using several tools. For more question, please use our Contact Us form:

- General NEON questions: https://www.neonscience.org/observatory/contact-us
- Data portal/API specific questions: http://data.neonscience.org/feedback

NEON Data Account			
 Review your download history, get data updates, and forward your queries to collaborators 	About Us Data & Sample	is Field Sites Impact Resources Get Involved Q	
 Help NEON track data usage for anonymized reporting to the NSF (our funding agency) 	My Account Zee Midde Name	Contras	
 Retrieve your data or delete your account any time 	Country	Twitter Handle	
Read more about how we secure and respect your information: <u>https://www.neonscience.org/abou</u> <u>t/user-accounts</u>	Data Products of Interest Select data products of Interest view data solutions with the are of interest and receive updates about the particular data view data testions view data testions All Data Products All Data Products	Sites of Interest (a) Seter states that are of interest and receive applies about the particular site. - view dislatories Compositions An Sites: A Sites: A Sites:	
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You can make your NEON account by signing in to the data portal using the button on the top-right corner of your screen. Take advantage of optional account features while helping NEON achieve our mission.



By using NEON data, you agree to appropriately cite these products according to the rules found here: <u>https://www.neonscience.org/data/about-data/data-policies</u>



Data product detail pages can be accessed from the Browse Data page by clicking on the View Product Details text or through the main navigation menu (Resources -> Data Product Catalog; then search for the data product of interest).

File name conventions 🚳 neen About Us Data & Samples Field Sites Impact Resources Get Im Q Provides details on standardized Data Management Data Formats and Conventions Data Availability names of the data files: From data collected by thousands of automated sensors, to hundreds of field staff working through collection Data Formats and Conventions protocols, to airborne instruments collecting data during the flight season, NEON produces millions of data points Data Processing every day. In order to make sure that the data can be ingested into NEON's systems, processed, published, and eventually used, careful attention to how data are organized, named, and documented is critical. In this section, we introduce the basics about the data formats and conventions that NEON uses. https://www.neonscience.org/data Data Quality Data Product Revisions and Releases -samples/data-management/data-Externally Hosted Data General Data Formats and Conventions JUMP TO: This section describes data formats and co formats-conventions ntions that NEON uses ac oss all products. For more inf systems (observational, instrumented, and airborne), jump down to each Data Collection System section Data Packages When a query for one data product, one or more sites, and a date range is submitted to the data portal or API, a downloadable data package is generated from a store of pre-published files and then ripped. Furny package includes that files and documentation files. Each KROI data calcicular system structures data packages offendered to maximize at the data, but generally there are segared pre-published file sets for each take and month, which are kundled into the downlad package. While data, and pervised in this granular way, our recent/timeticular data packages offenders a training theme the take and month which are also that the granular data and the set of the data and month, which are kundled into the downlad package. While data are provided in this granular way, our recent/timeticular data package structures are applicable as an implemented to be file file even multiple takes and months. File Names Data files are named using a series of component abbreviations separated by periods (,) or underscores (_). Naming conventions f data files after between NEON data collection systems to meet the needs of their dominant user groups. A file will have the same ne whether it is accounted with the data portal or the API. For more information, read the <u>NEON Data Product Numbering Convention</u> and explore the tables below. Table 1. General abbreviation ABBREVIATION DEFINITION An identifier that specifies that the data come from NEON Se ne 31

All NEON data file names contain specific information. This page provides the information needed to decipher the file names.



In addition to the information on this page regarding data quality, we have three videos that explain the data processing steps:

- Observational Sampling: https://youtu.be/82-scTZsyeY
- Instrumented Systems: https://youtu.be/0crRkvQWu3E
- Airborne Observation Platform: https://youtu.be/f5e-X9dMnXs

