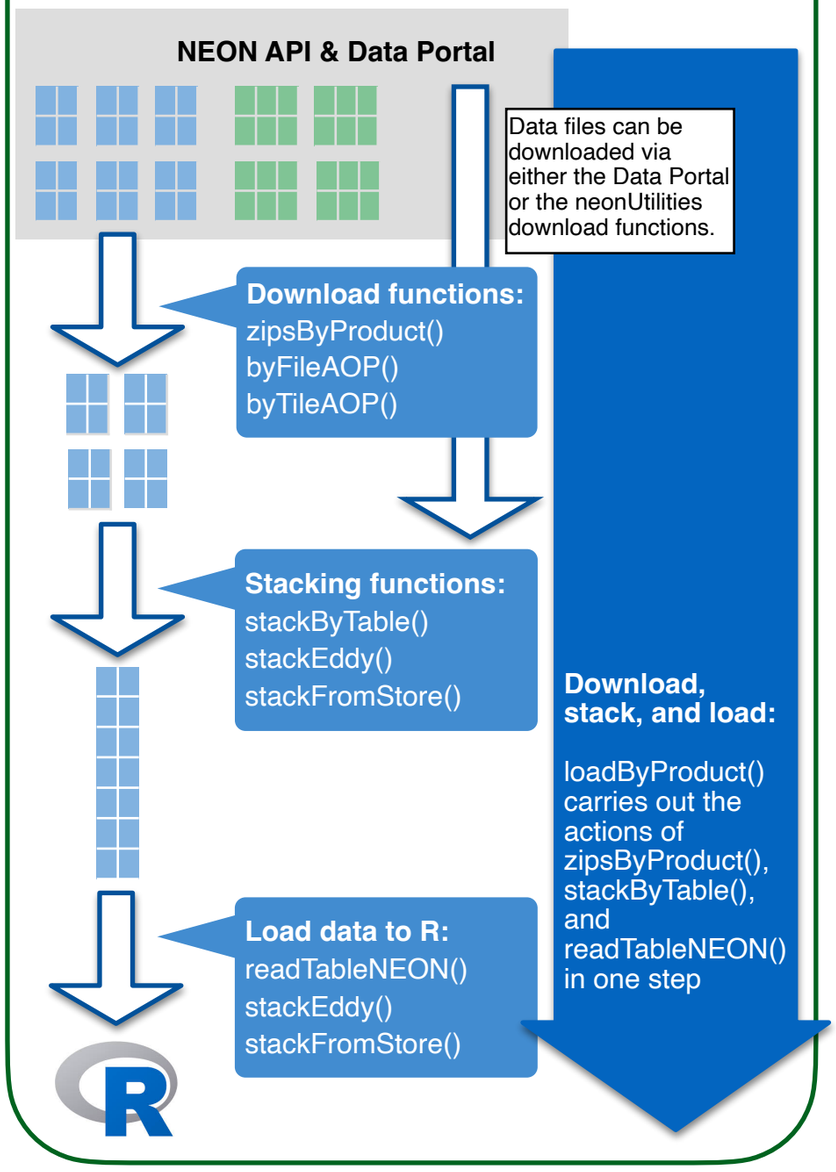
NEON data access and wrangling with neonUtilities

CHEAT SHEET Page 1

Overview

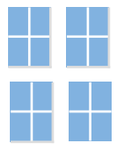
neonUtilities facilitates accessing and working with NEON data.

NEON data are published in discrete packages for each **data product**, **site**, and **month** of data collection. Each package may contain data from several **data tables** and/or **sensor locations**. neonUtilities can help you access those data packages, and also transform them to more tractable data formats.

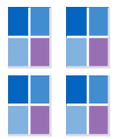


Tabular data

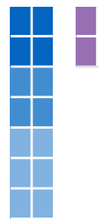
Tabular data published by NEON include both **observational** (human-collected, such as observations and measurements of birds and trees, and collection of physical samples) and **sensor** data. Data collected by sensors in the **surface-atmosphere exchange** system and the **remote sensing** platform are not tabular; see boxes below and to the right for these data.



NEON tabular data are provided in pre-packaged sets for each site and month with available data.

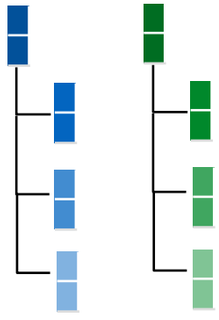


Within the site-month packages, data tables may contain the output of a single sensor, a specific field activity (observational data), or contextual data that are relevant to all time periods (sensor position files, and observational data collected once over the lifetime of the protocol, such as trap establishment or tree mapping data).

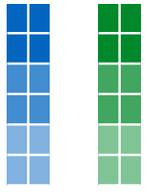


The stacking functions join the matching tables over each site and month, and over multiple sensors within a site, as necessary to create a single table for each data type. For contextual data that are relevant to all time periods, data are duplicated between site-month packages, so only the most recently published data are used in stacking.

Surface-atmosphere exchange



Surface-atmosphere exchange data are published in HDF5 files: Hierarchical Data Format, in which data are arranged in a systematic hierarchy, and descriptive metadata are available at each level in the hierarchy.



At the terminal nodes in this hierarchy, the data are generally tabular. stackEddy() extracts subsets of data from the terminal nodes and joins the matching variables over months and sensors, similar to the process for the sensor data stored in simple tabular format.

Remote sensing

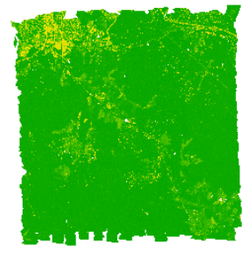
byFileAOP() downloads all available data for a specified **data product**, **site**, and **year**. It can be used to download any remote sensing data product.

```
byFileAOP(dpID="DP3.30026.001",
  site="SCBI", year=2017)
```

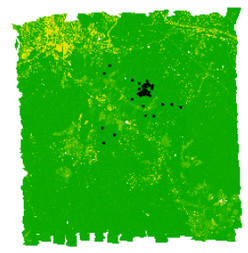
SCBI: Smithsonian Conservation Biology Institute

DP3.30026.001: Data product ID for Vegetation indices

byFileAOP() downloads all available data. For example, here are the 143 tiles for the download specified above, which total 5 GB of data when uncompressed:

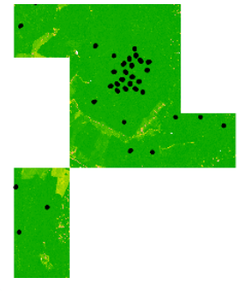


But downloading all 5 GB is excessive if you don't need it all. What if you're only interested in the tiles containing locations where trees have been measured on the ground, shown here in black dots? In that case, use byTileAOP() as described below.



```
byTileAOP(dpID="DP3.30026.001",
  site="SCBI", year=2017,
  easting=veg$easting,
  northing=veg$northing)
```

Easting and northing vectors obtained from DP1.10098.001



byTileAOP() downloads only the tiles corresponding to a specific set of coordinates, in this case only 10 out of 143 tiles!
This option is only available for mosaicked (tiled) data products.

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Function inputs: Download

```
zipsByProduct()
loadByProduct()
byFileAOP()
byTileAOP()
```

dpID="DP1.100098.001"
site=c("WREF","TOOL")
include.provisional=FALSE
savepath="/Users/name/data"
token="alphanumeric string"
check.size=TRUE

Data product ID of the product to download. IDs are listed in catalog: https://data.neonscience.org/data-products/explore

Four-letter code(s) of site(s) to be downloaded, or "all" for all sites. For AOP functions, only a single site can be downloaded at once.

True/Flase: Include Provisional data in downloaded data. Provisional data are subject to change without notice; see https://www.neonscience.org/data-samples/data-management/data-revisions-releases

File path to save downloaded files. Defaults to working directory if unspecified; omitted in loadByProduct() since data are loaded directly to R environment.

True/False: Require confirmation before downloading, after calculating file size?

NEON API token, associated with a user account. Optional, but enables faster download.

Legend:

An example entry is given for each input parameter. Description of parameter in bubble. Underlined **input** parameters with bubbles outlined in purple are required and do not have default values.

Only in:

```
byFileAOP()
byTileAOP()
```

year=2019

Year of data to download

Only in:

```
zipsByProduct()
loadByProduct()
```

package="basic"
release="RELEASE-2021"
startdate="2019-01"
enddate="2019-12"
timeIndex=30
tabl="vst_mappingandtagging"

Basic or expanded data package

Data Release to download. Defaults to most recent Release; see https://www.neonscience.org/data-samples/data-management/data-revisions-releases

Start and end dates of data to download, at one month resolution. Omit to download all dates. Download size may be very large if all dates are included.

Index of time interval to download; usually equals number of minutes in averaging interval. Sensor data only.

Table name, to download a single data table. Observational data only. Use with caution; omitting tables may leave out critical data.

Only in:

```
byTileAOP()
```

easting=c(583000,584000)
northing=c(5075000,5070000)
buffer=20

Vectors of UTM easting and northing coordinates used to determine which tiles to download

Size, in meters, of buffer around coordinates to include when determining tiles to be downloaded

Function inputs: Data stacking

```
stackByTable()
stackEddy()
stackFromStore()
```

filepath="/Users/name/data"

Path to location of files to stack. Files should be in a single directory, except in stackEddy(), where the file path can optionally be a vector of .h5 files.

Only in:

```
stackByTable()
```

savepath="/Users/name/data"
saveUnzippedFiles=FALSE
nCores=1

Path to location to save stacked files. If omitted, files are saved to the filepath directory. To load to R instead of saving to file, enter "envt".

True/False: Save the original, unzipped, unstacked files?

Number of cores to use for optional parallel processing

Only in:

```
stackEddy()
```

level="dp01"
var=c("rtioMoleDryCo2","dlta13CCo2")
avg=30
metadata=FALSE
useFasttime=FALSE

Data product level of data to extract and stack. Defaults to "dp04", the half-hourly net fluxes.

Variable set to extract and stack. Omit to stack all variables for the level and averaging interval.

Time interval to extract and stack, in minutes. Required if level is dp01.

True/False: Should the attribute data be extracted from the h5 files?

True/False: Should time stamp ingest use the fasttime package? Enables faster stacking, but may introduce uncertainty at the millisecond level.

Only in:

```
stackFromStore()
```

pubdate="2020-11-05"

Maximum publication date of data to include when stacking

Most inputs to loadByProduct(), stackByTable(), and stackEddy() can be used as inputs to stackFromStore(): **dpID, site, package, startdate, enddate, timeIndex, level, var, nCores**