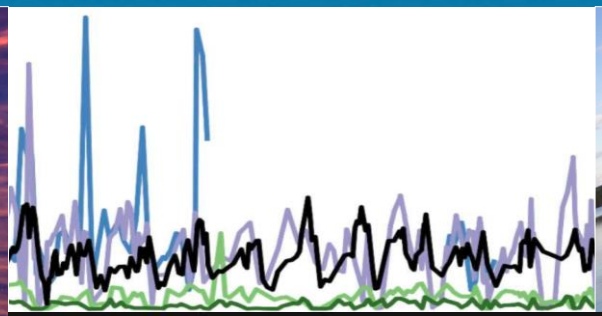
TETRA TECH

Open-Source Scripting
Day 3: Hydrology and Water Quality

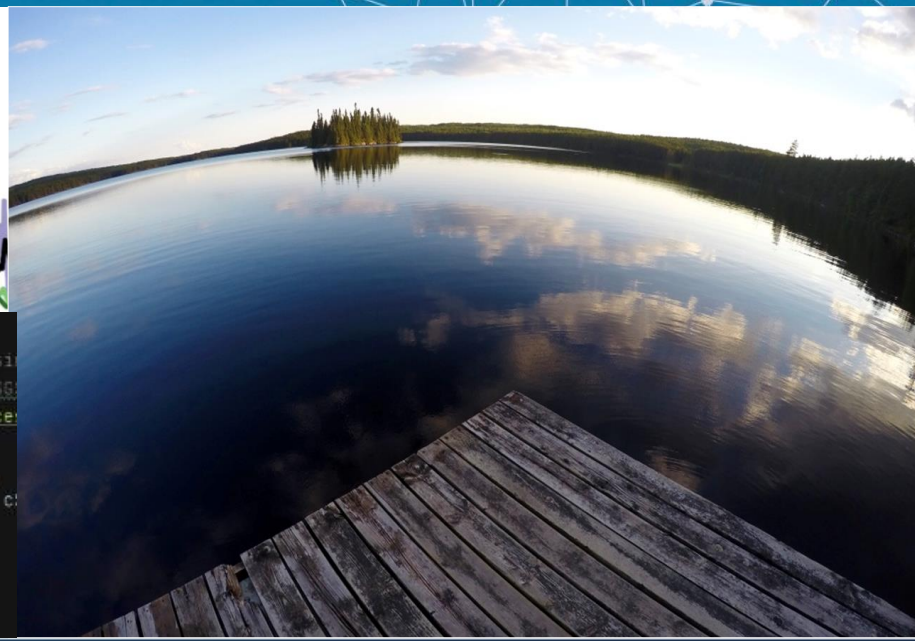
September 22, 2021



```
def getSoilsRaster(bBox, cSize):
    # NASS developed the original extraction example usi
    #  The data are housed and extracted as standard USS
    uri = 'https://agsvip.gis.iastate.edu/arcgis/service

    query_args = {'service': 'wcs', 'version': '1.0.0',
                  'bbox': bBox, 'resx': cSize, 'resy': c
    data = urllib.urlencode(query_args)
    req = urllib2.Request(uri, data)

    outTemp = "%s//outTemp.tif" % env.scratchFolder
```



complex world | CLEAR SOLUTIONS™

Day 3 Agenda

- **Overview presentations (30 min) – Kateri Salk, Tetra Tech**
- **Acquiring and wrangling hydrologic and water quality data (90 min)**
  - Flow data – Eric Hettler, Wisconsin
  - Water quality data – Kateri Salk, Tetra Tech
- **Break (10 min)**
- **Examples of using hydrologic and water quality data in modeling (45 min)**
  - Automated post-model run data analysis & visualization with R and RESTful web services – Joey Kleiner and Rob Burgholzer, Virginia
  - R Shiny apps for long term water quality in WI rivers – Eric Hettler, Wisconsin
  - Utah Division of Water Quality open source data tools and interactive dashboards – Jake Vander Laan, Utah
- **Break (5 min)**
- **Visualizing and understanding model outputs (45 min)**
  - Graphing outputs from common water quality models (e.g., WASP) – Tim Wool, EPA Region 4
  - Chlorophyll TMDL regression – Ansel Bubel, Florida
- **Wrap-up and closing comments (15 min)**

Ground Rules

- **Mute your mic unless asked to speak**
- **Questions during sessions**
  - During session: add your question/comment to the chat
  - After session: may solicit people to raise hand and turn on mic
- **Tech issues?**
  - Add your issue to the chat, but may not have time to troubleshoot on the fly
  - Follow along on the screen, code is available for use later
  - Can attempt to fix issues following session or after hours

Considerations: Assessment, TMDLs

- **Sampling frequency**
- **Exceedance frequency**
- **Sampling location**
  - **Lakes**: pelagic/littoral, riverine/transitional/lacustrine
  - **Streams**: spatial representativeness (e.g., reach), relation to tributaries, diversions, dams

Data Sources

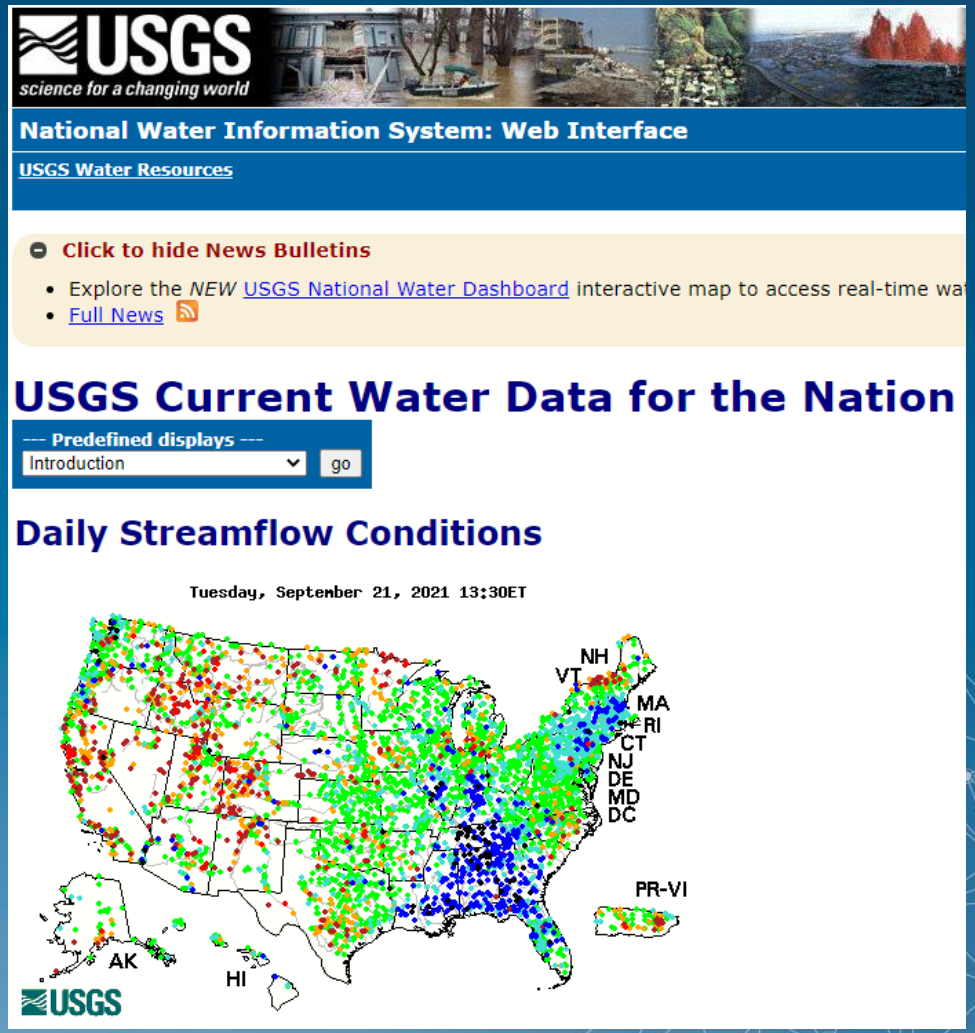
Hydrology/Streamflow

- USGS gages (R package: dataRetrieval)
- Agencies/other entities
- StreamCat
- StreamStats (R package: streamstats)
- NHDPlus (R package: nhdplusTools)

USGS Gage Data

https://cran.r-project.org/web/packages/dataRetrieval/vignettes/dataRetrieval.html

https://github.com/USGS-R/dataRetrieval



dataRetrieval

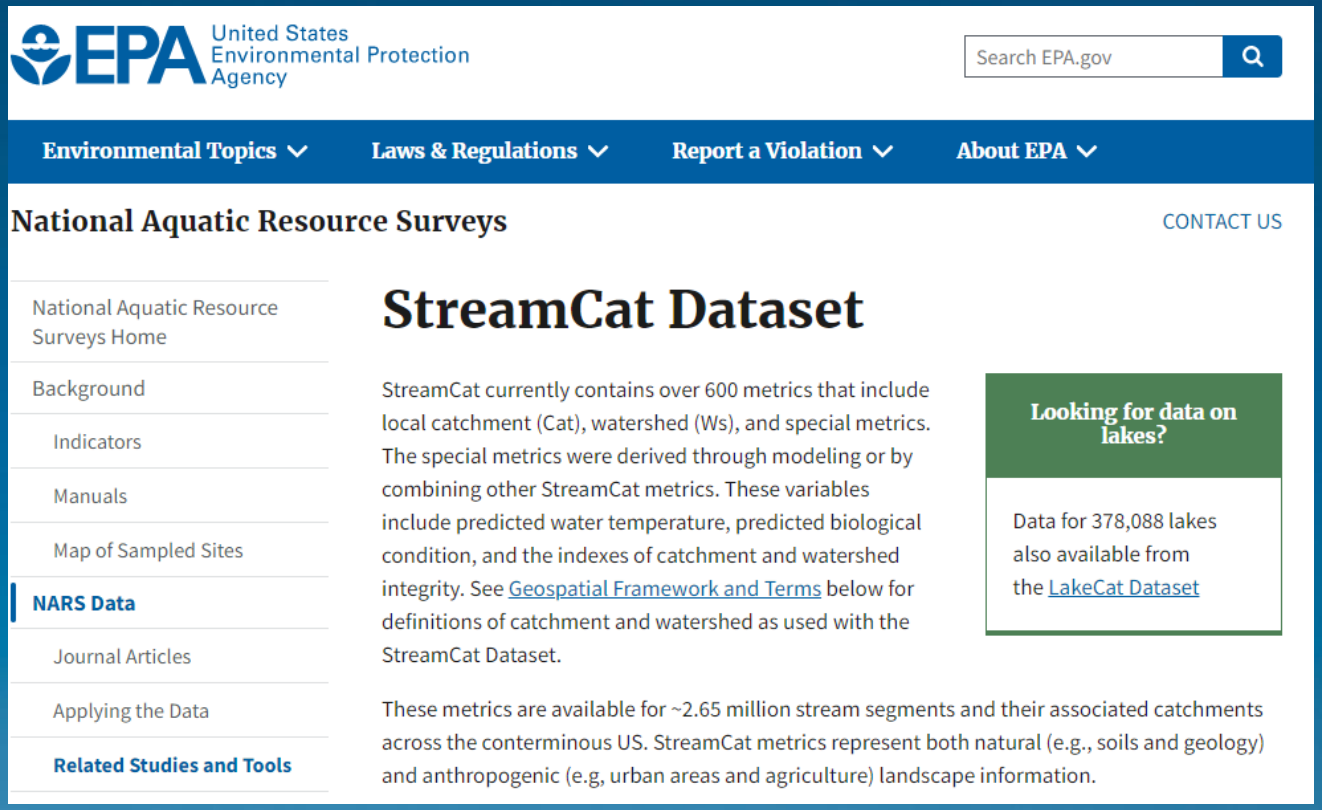
Retrieval functions for USGS and EPA hydrologic and water quality data.

For complete tutorial information, see:

https://usgs-r.github.io/dataRetrieval

https://owi.usgs.gov/R/dataRetrieval.html

StreamCat



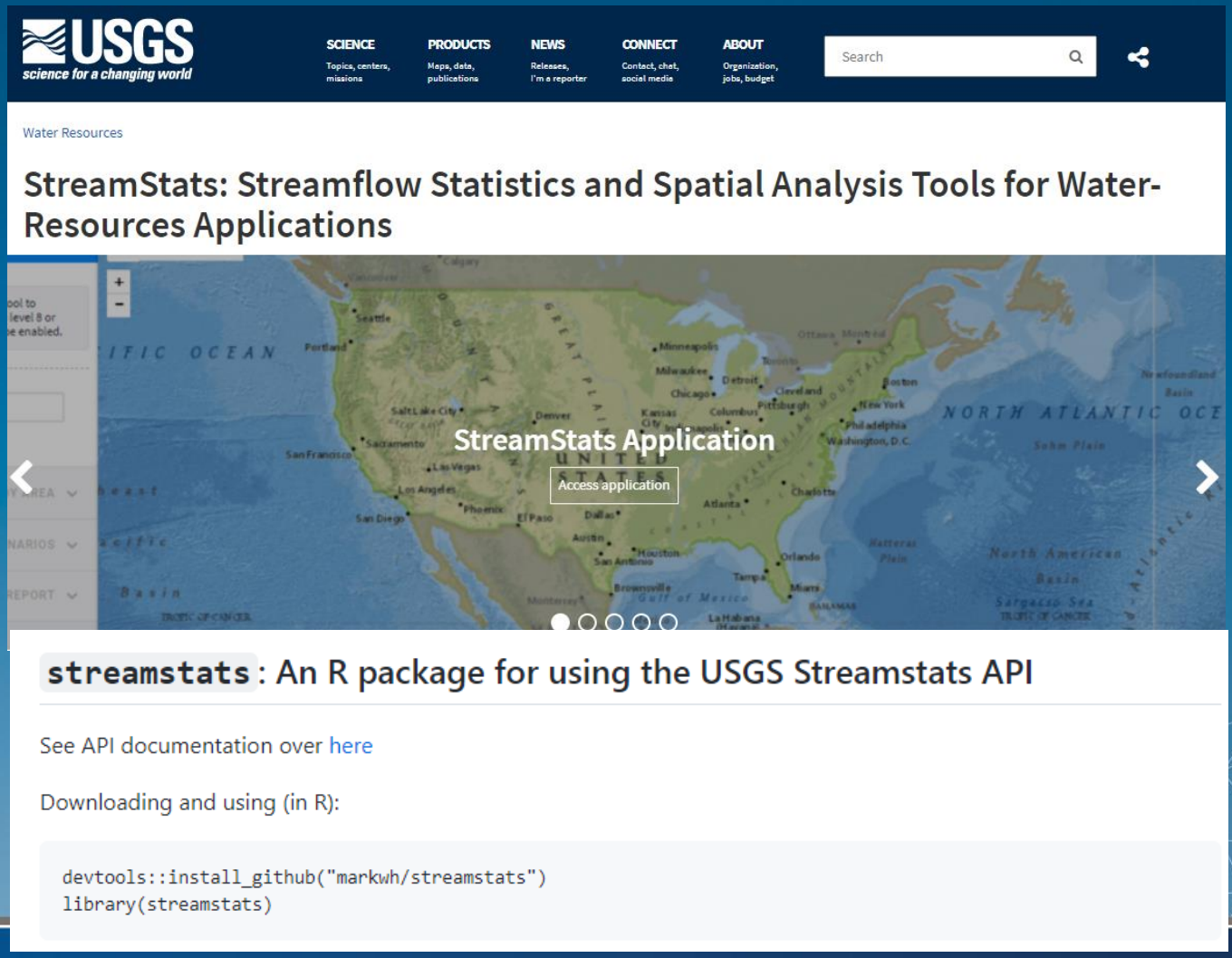
StreamCatTools

lifecycle experimental | R-CMD-check failing

`StreamCatTools` is a draft R package for accessing StreamCat data via the in-development StreamCat API and for working with site data in conjunction with StreamCat and NHDPlus. The StreamCat API is currently behind the agency firewall so the functions in the package will not currently work for those outside the EPA. `StreamCatTools` is in pre-alpha development - this is a work in progress, look for a working package release in the next year.

StreamStats

https://github.com/markwh/streamstats



nhdplusTools

https://github.com/USGS-R/nhdplusTools

nhdplusTools

nhdplusTools: Tools for Accessing and Working with the NHDPlus

Terminology:

The following definitions have been used as much as possible throughout the package.
Terms for rivers:
Flowline: The NHD name for a hydrographic representation of a flowing body of water. Flowline is generally used when referring to geometry.
Flowpath: The HY_Features name for a hydrologic feature that is the primary path water follows through a catchment; either from headwater to outlet or inlet to outlet. Flowpath is used when describing aspects of the abstract flowpath featuretype, generally in relation to a flowpath's relationship to a catchment.

Terms used for hydrologic units:
Catchment: The most abstract unit of hydrology in HY_Features is the catchment. It is a physiographic unit with zero or one inlets and one outlet. It does not inherently have any conceptual realizations. Rather, a given catchment can be realized in a number of ways; flowpath, divide, and networks of flowpaths and divides are the primary realizations.
Catchment divide: NHD "catchment" polygons are more accurately described as "catchment divide" features. Because of the overlap with the HY_Features abstract "catchment" feature type, "catchment divide" is used for polygon representations of catchments.

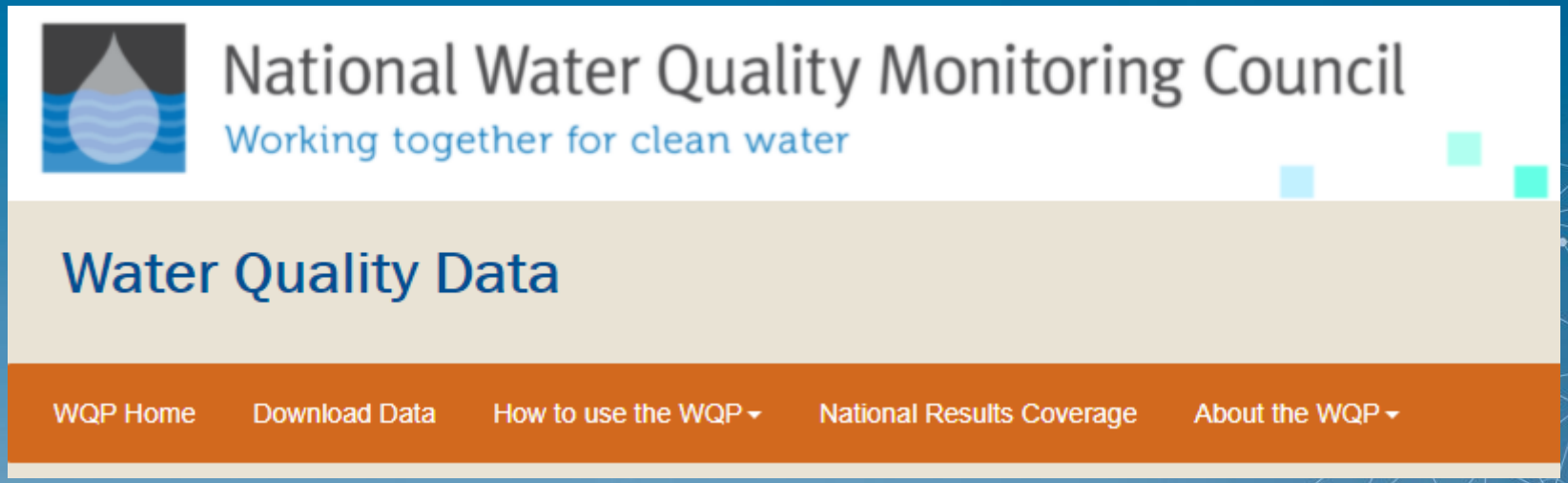
Data Sources

Water Quality

- USGS NWIS (R package: dataRetrieval)
- EPA STORET (R package: dataRetrieval)
- Agencies/other entities
- National Lakes Assessment, National Rivers & Streams Assessment
- LAGOS-NE (soon, LAGOS-US) (R package: LAGOSNE)

NWIS and STORET: Water Quality Portal

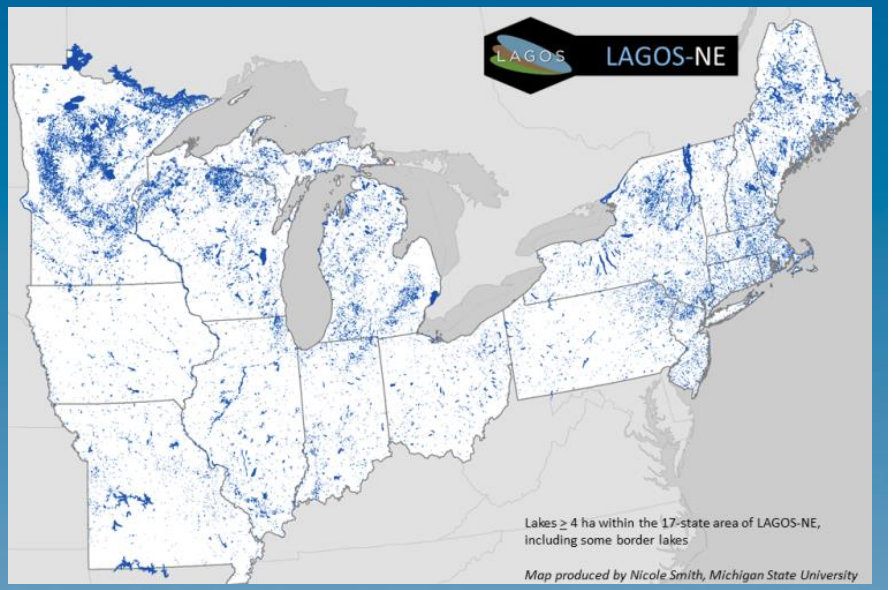
- USGS
- EPA
- NWQMC
- >400 state, federal, tribal, local agencies

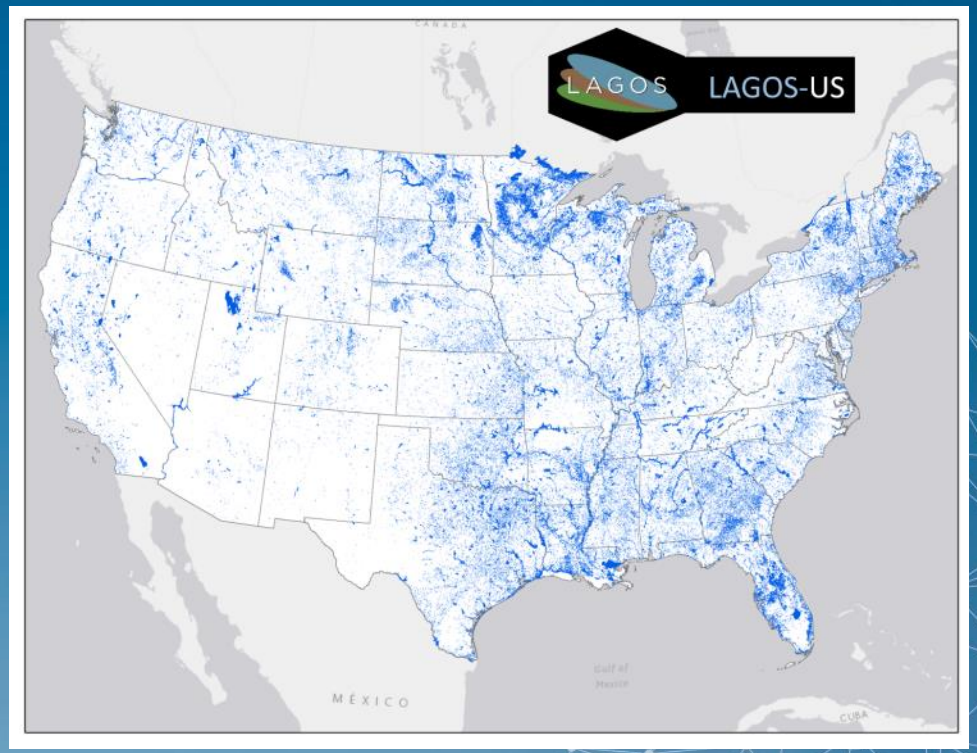


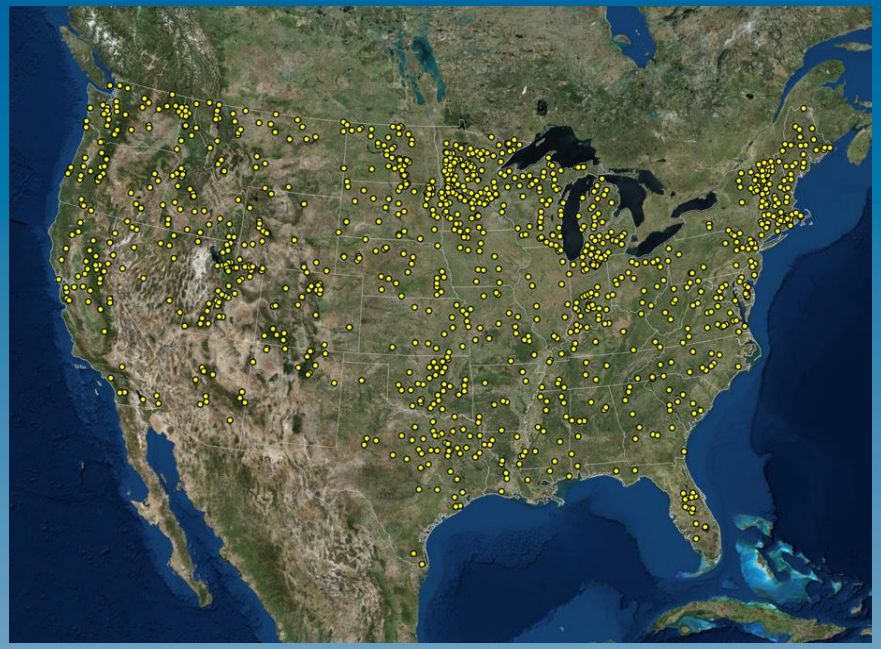
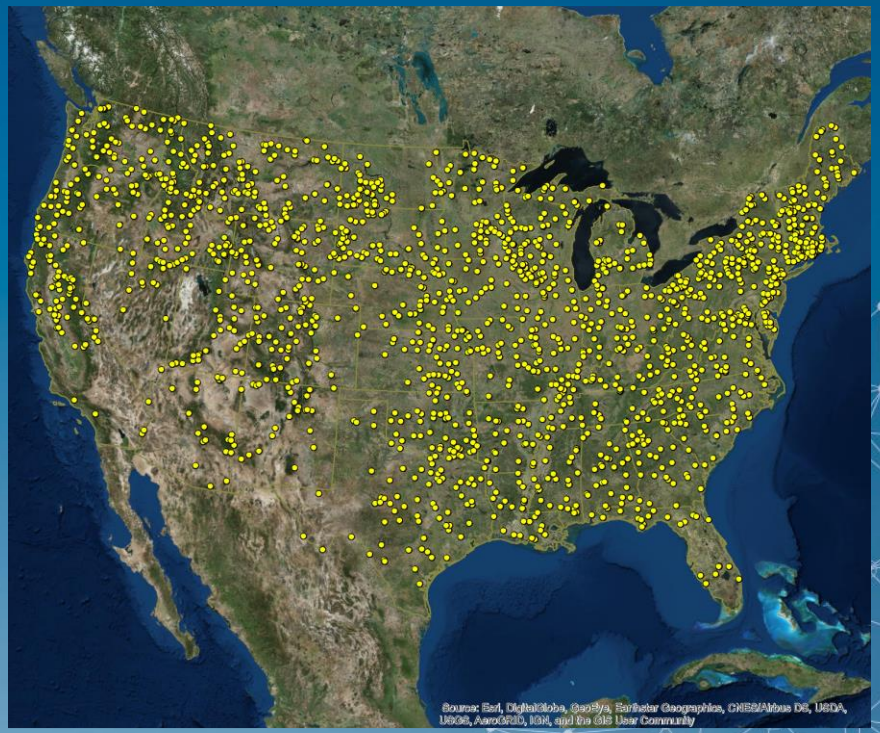
LAGOS-NE (soon, US)

https://lagoslakes.org/

https://github.com/cont-limno/LAGOSNE





NLA and NRSA

- National & Regional focus (includes AK & HI)
- Statistically representative
- Not linked to R packages