## Lakes, Landscape, and R:

A framework for open science on freshwater cyanobacteria

Jeff Hollister and Bryan Milstead (USEPA)

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Chicago, IL

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#### Twitter?



hashtag: #usiale2018 #rstats #cyanobacteria

me: @jhollist

# **Open Science?**

# Why open science?

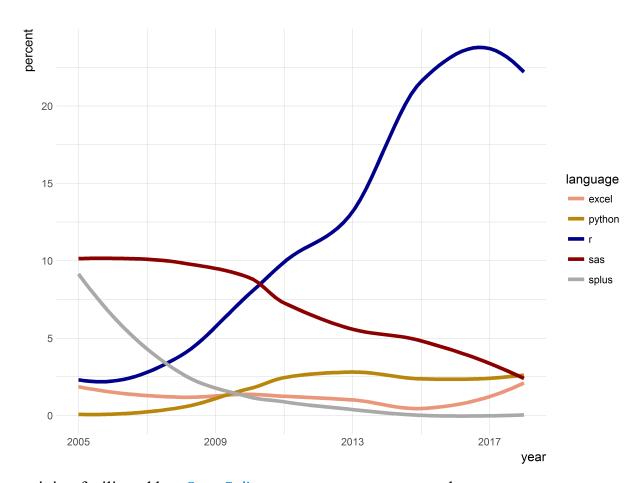
- Often required
  - Government/Funders/Journals
- Benefits researchers
  - o Mciernan et al. (2016) How open science helps researchers succeed
- Improves quality
  - The classic example: Reinhart and Rogoff
- Benefits to society
  - "Sharing of Data Leads to Progress on Alzheimer's"



# **Open Science Solutions**

- Publishing
- Data
- Code

# R in Landscape Ecology



Text mining facilitated by <u>rOpenSci's</u> awesome <u>fulltext</u> package

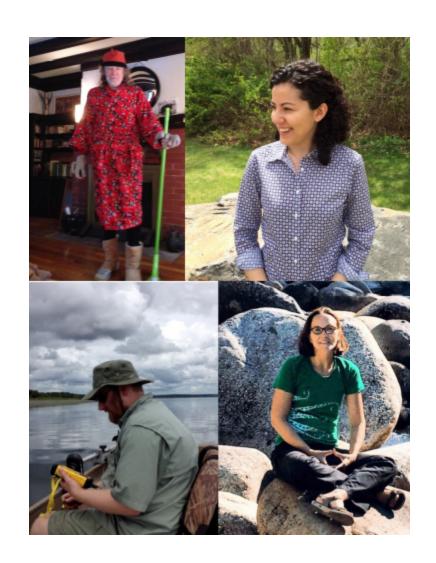
# R in Landscape Ecology

- Foundations
  - sp, rgdal, raster, rgeos
  - o sf, stars
- Speciality
  - <u>landsat</u>
  - <u>SDMtools</u>
  - o <u>nlmr</u>
  - <u>landscapetools</u>

# R, lakes, and cyanobacteria at USEPA

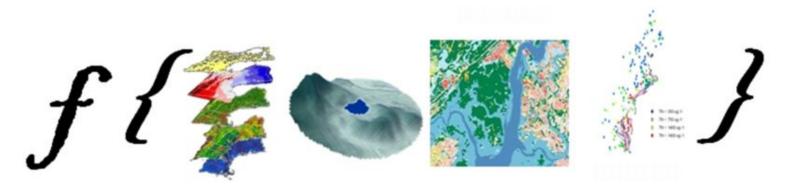
#### Who are we?

- Ecologists
- Computational focus
  - Enough to be dangerous
- 3 FTE
  - Myself
  - Betty Kreakie
  - Bryan Milstead
- 1 Post-doc
  - Stephen Shivers
- Alum
  - Farnaz Nojavan



#### What do we do?

- Apply computational approaches to understand water quality impacts in lakes
- Open Science
- Use R
  - Analysis
  - Sharing code
  - Solve common problems



# Packages to solve common problems

- lakemorpho
- elevatr
- goatscape (in development)



### lakemorpho

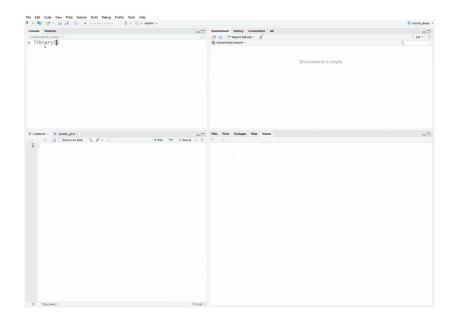
<img src="figure/lakemorpho\_demo.gif" style:
margin-top: 50px">

- Lake morphometry metrics in R
- Built off of sp, rgdal, rgeos, and raster suite
- Version 1.0
  - o August 2014
- Version 1.1.0
  - o December 2016
- sf support to be added
- National Lake Morphometry
- Some metrics included in NHD+
- Hollister and Milstead (2010)
- Hollister *et. al.* (2011)
- Hollister and Stachelek (2017)

Package URL: <a href="https://cran.r-project.org/package=lakemorpho">https://cran.r-project.org/package=lakemorpho</a>

#### elevatr

- Access elevation data in R
  - Mapzen
  - o AWS
  - USGS
- Built off of sp, rgdal, rgeos, and raster suite
- Version 0.1.1
  - o January 2017
- Version 0.1.3
  - o March 2017
- Will be paired with lakemorpho
- sf support to be added



### goatscape

- New effort with Bryan Milstead
- What's in a name?
- Summarizes ancillary data for a user-defined landscape polygon
  - Census (via censusapi)
  - Landcover
  - Impervious
- Accepts arbitrary spatial data for the landscape
- Based on sf and tidy by design
- <a href="https://github.com/usepa/goatscape">https://github.com/usepa/goatscape</a>



# Take Home Message

## Take Home Message

- R is awesome
- Can be used for a wide array of uses (including this talk)
- Increasing use in LE
- Our packages and Others

#### Thanks!

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Slides created via the R package <u>xaringan</u>.