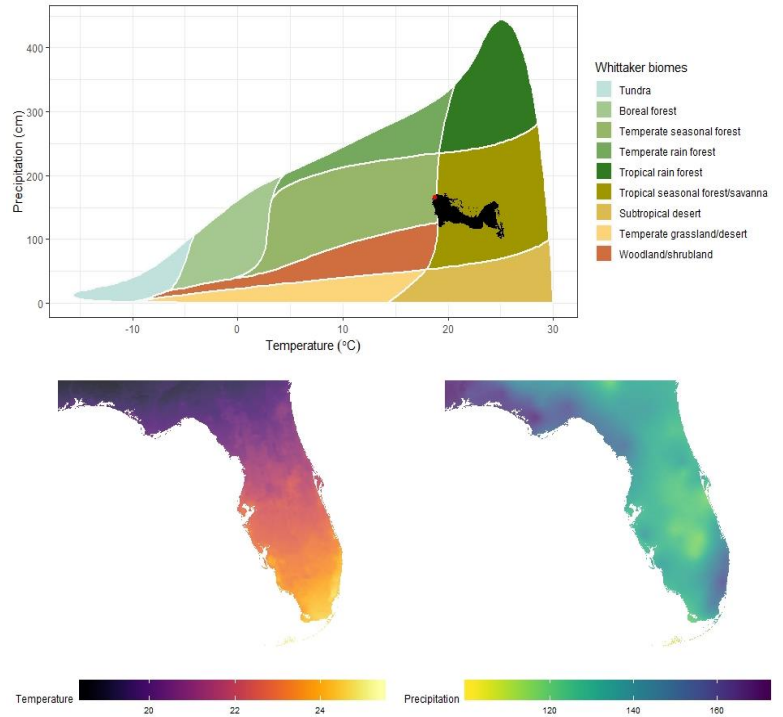


# Visualization of ecological data

(3 credits)

## FOR 6943



*Visualization gives you answers to questions you didn't know you had.*

*-Ben Schneiderman*

### Course description

This course will equip students with knowledge and skills to work effectively with ecological data, with a specific focus on data visualization as exploratory data analysis in the programming language R predominately using the ggplot2 package. At the end of this course, students will know the basics of effective visualization and communication of their data and/or findings through visualization. We initially focus on existing data from forestry and fisheries. Moving on towards building storyboards for individual research projects. We emphasize active engagement and students will need access to a computer. Ideally students will bring their own data and/or analyses to work with later in the course. The final product of the course are publication quality graphics of this data and/or analyses.

### Class hours and location

**Tuesday 10:40 – 11:30 (period 4)**  
**Thursday 10:40 – 12:35 (period 4&5)**  
Online

**Dr. Daniel J. Johnson**  
363 Newins-Ziegler Hall  
johnson.daniel@ufl.edu  
352-273-0295  
Office hours: Thursday 9:30-10:30 am, other times by appointment

**Dr. Geraldine Klarenberg**  
430 McCarty Hall C  
gklarenberg@ufl.edu  
352-273-0792  
Office hours: Wednesday 2-4 pm, other times by appointment

### Learning objectives

- By the end of this course, the student will be able to:
- Import, manipulate, organize, manage and visualize data sets with R
  - Choose and implement appropriate visualization methods for exploratory data analysis or the presentation of results, depending on the type of data and visualization objective
  - Create publication-quality graphics

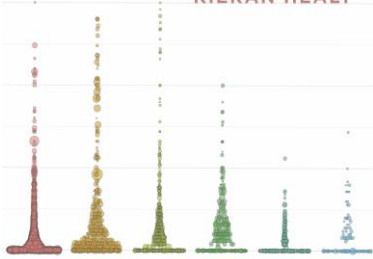
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# Course resources

## DATA VISUALIZATION

A PRACTICAL INTRODUCTION

KIERAN HEALY



You will need to a computer for this class with R (<https://www.r-project.org/>) and Rstudio (<https://rstudio.com/>) installed.

There are several free online resources that we will use (selectively):

*R for Data Science* by Garrett Grolemund and Hadley Wickham

(<https://r4ds.had.co.nz/index.html>)

*Data Visualization* by Kieran Healy

(<https://socviz.co/>)

*The tidyverse style guide* by Hadley Wickham

(<https://style.tidyverse.org/>)

*Ggplot2: elegant graphics for data analysis* by Hadley Wickham (<https://ggplot2-book.org/>)

*The greatest value of a picture is when it forces us to notice what we never expected to see.*

-John Tukey

We will use CANVAS for all assignments, grades, resources and announcements. Make sure that under Account > Notifications, "Announcements" are set to "Notify me right away"

## Course requirements

We expect students to have a working knowledge of R. Please contact the instructors if in doubt. This course will be delivered as a hands-on experience. If you miss classes, and especially labs, you are required to do the work on your own – which can be challenging though recordings will be made available.

We strongly encourage peer to peer learning; this means that we expect those less experienced to ask questions to those more experienced, and vice versa, that more experienced students are willing to help others. To facilitate more interaction team-based activities will be implemented.

There will be **5 assignments**, spaced 2 weeks apart. The **final project** will be a "storyboard", +/- 4 figures based on (ideally your own) data sets. You will be required to present your story board to the class.

## Course evaluations

Student assessments are an important part of efforts to improve teaching and learning.

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available

at <https://gatorevals.aa.ufl.edu/students/>.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

## About the instructors

Dr. Dan Johnson is an Assistant Professor in the School of Forest Resources and Conservation. He has a PhD in Biology (Indiana University), MS in Environmental Science (IU) and a BS in Forestry (Purdue University).



Teaching Philosophy: I strongly believe that a college education is not meant to simply relate facts and skills, but to provide the basic framework for the life-long adventure of learning. I approach class time as an explorer and guide while leading classes on an expedition of the knowledge landscape. I love making graphs.

Dr. Geraldine Klarenberg is a lecturer in quantitative data science in the School of Forest Resources. She has a PhD in Agricultural and Biological Engineering (UF) and an MSc in Tropical Land Use / Irrigation (Wageningen University).



Teaching philosophy: I like to see my classroom as a community, and I specifically promote interaction and peer learning. I believe that interactive work and learning-by-doing are the best ways to gain skills and retain knowledge. Most of all, I want everyone have fun and feel valued!

# Grading policy

Assignments .....	40% of total
Quizzes.....	10% of total
Final project .....	50% of total

Assignments compose 50% of the final grade, the final project the other 50%.

## Grading Policy

A	90.0-100
B+	86.7-89.9
B	83.7-86.6
B-	80.0-83.6
C+	76.7-79.9
C	73.7-76.6
C-	70.0-73.6
D+	66.7-69.9
D	63.7-66.6
D-	60.0-63.6
E	< 60.0

*All grades will be announced on CANVAS. You have 1 week after grades are returned to discuss the grade. After this, grades are final.*

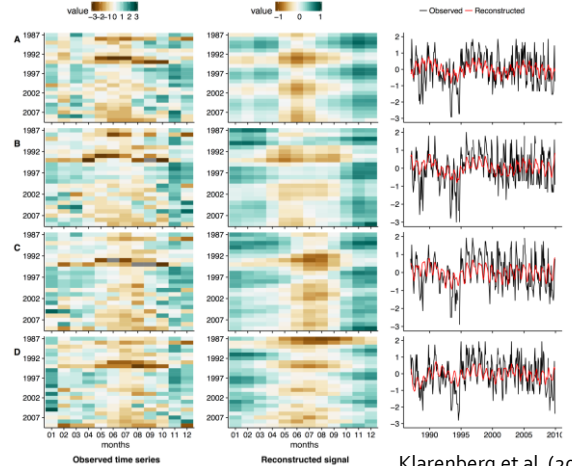
More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

# Code of Conduct

We provide a welcoming and supportive environment for all people, regardless of background or identity. By participating in this community, participants accept to abide by these ground rules. Any form or behavior to exclude, intimidate, or cause discomfort is a violation of these ground rules. In order to foster a positive and professional learning environment we expect and encourage the following kinds of behaviors in all platforms and events:

- Use welcoming and inclusive language
- Be respectful of different viewpoints and experiences
- Gracefully accept constructive criticism
- Focus on what is best for the community
- Show courtesy and respect towards other community members



Klarenberg et al. (2018)

# Class expectations

## Attendance

Attendance is strongly encouraged, especially labs.

If you will be absent, inform the instructors at least a week in advance.

In the case of emergency absences, inform the instructors as soon as possible.

Excused absences must be consistent with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/ugrad/current/regulation/info/attendance.aspx>

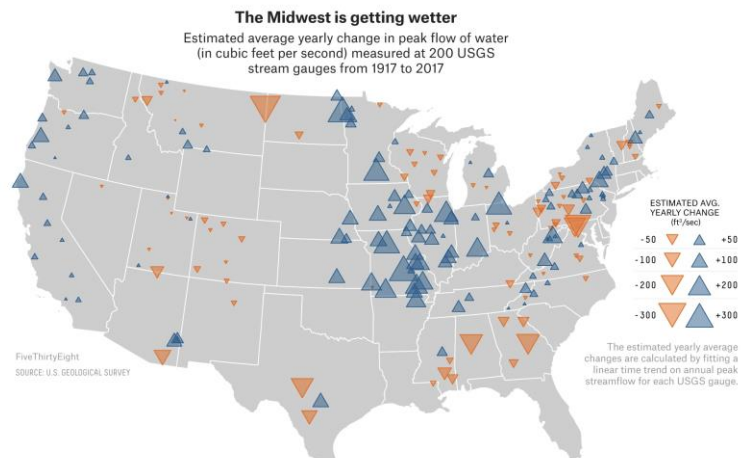
```
heatmap_recon1<-ggplot(subset(mydata_melt,variable="recon"),aes(x=months,y=years,fill=value))+
  geom_tile()+
  scale_fill_gradientn(colours = cols_recon,limits=c(-1.5,1.5),breaks = c(-1.5,0,1.5))+
  xlab("")+ylab("")+
  scale_y_discrete(limits = rev(levels(mydata_melt$years)), breaks=seq(1987,2009,by=5))+
  theme(plot.margin = unit(c(0, 0, 0, 0), "cm"))+ #top,right,bottom,left
  theme(axis.text.x=element_blank())+
  theme(legend.position="top")
```

## Late / make-up work

Late assignments will be graded as follows:

- < 24 hrs: -10%
- < 48 hrs: -25%
- > 48 hrs: -50%

Make up work: contact the instructor to agree on new deadlines (only for excused absences)



# UF policies

## Honesty policy

UF students are bound by The Honor Pledge which states, "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.*" On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment.*"

The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions.

Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## Student privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

## Students requiring accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. **Students with disabilities should follow this procedure as early as possible in the semester.**

## Software use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. *We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.*

## Campus resources

### Health and wellness

#### U Matter, We Care:

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

#### Counseling and Wellness Center:

<http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### Academic resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu), <https://elearning.ufl.edu>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

#### Student Complaints Campus:

<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>

#### On-Line Students Complaints:

<http://www.distance.ufl.edu/student-complaint-process>.

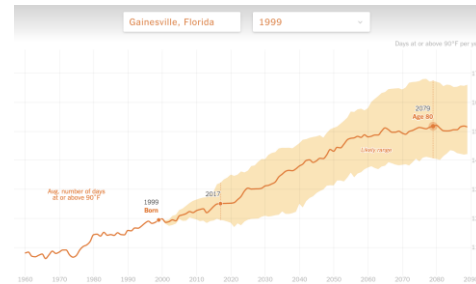


# Course schedule

Date	Topic
Thurs 5 Jan	Introductions, data, base plot, & R projects (lab)
Tues 11 Jan	Introduction to good visualization
Thurs 13 Jan	Good, bad and ugly visualization (lab)
Tues 18 Jan	ggplot2
Thurs 20 Jan	Digging deep into ggplot2 (lab)
Tues 25 Jan	Introduction to the Tidyverse
Thurs 27 Jan	Using the Tidyverse (lab)
Tues 1 Feb	Getting a plot ready for publication
Thurs 3 Feb	Making publication quality figures (lab)
Tues 8 Feb	Working with geospatial data
Thurs 10 Feb	Mapping in R (lab)
Tues 15 Feb	Working with geospatial data
Thurs 17 Feb	Mapping in R (lab)
Tues 22 Feb	Bring your own data - discussion
Thurs 24 Feb	Data exploration (lab)
Tues 1 Mar	Conceptual diagrams
Thurs 3 Mar	Creating conceptual diagrams (lab)
Tues 8 Mar	SPRING BREAK
Thurs 10 Mar	SPRING BREAK
Tues 15 Mar	Big Data
Thurs 17 Mar	Dealing with big data (lab)
Tues 22 Mar	Work on your own data
Thrs 24 Mar	Peer review and continue with own data (lab)
Tues 29 Mar	Animations
Thurs 31 Mar	Creating animations in R (lab)
Tues 5 Apr	Story board
Thurs 7 Apr	Story board
Tues 12 Apr	Story board
Thurs 14 Apr	Oral presentations
Tues 19 April	Oral presentations

*Most of us need to listen to the music to understand how beautiful it is. But often that's how we present statistics: we just show the notes, we don't play the music.*

*-Hans Rosling*



<https://www.nytimes.com/interactive/2018/08/30/climate/how-much-hotter-is-your-hometown.html>

## Important dates

### Assignments

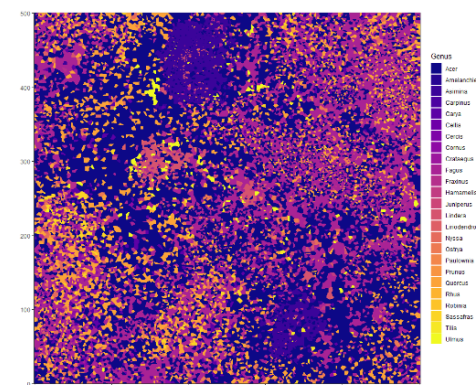
- 1 February
- 10 February
- 24 February
- 3 March
- 24 March

### Presentations

- 14 or 19 April

### Final project

- 26 April



5

**Course schedule, topics and assignment/project due dates are subject to change. If changes are necessary, these will be announced at least one week in advance, on Canvas.**