Intro to Quantitative Ecology
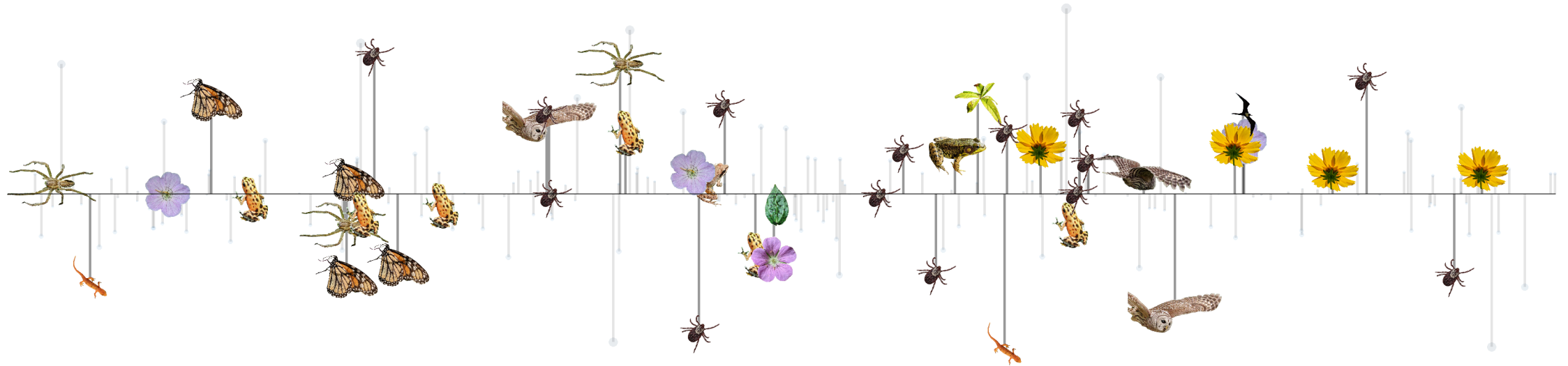# UMass Amherst – Michael France Nelson

Deck 1 - Introductions

Welcome to the Course!

Tuesday	Thursday

• About the course
   • General course info
   • Technicalia: Course websites and software
 	
• Individual assignment info:
   • Software setup
   • Course websites + syllabus
 	
• In-Class: Rarefaction/sampling effort activity
	• Recap from Tuesday's activity
	
	• Software Q+A
	
	• In-Class: R packages and markdown

About the Course

The Basics

Course Structure

This course is focused on team-based and active learning.

That means In-class learning will focus on practicing and reinforcing quantitative concepts.

- To make the most of the class meetings, I expect you to complete assigned readings, videos, and other material **before class**.

- Our class sessions will consist mainly of:
  - Lectures
  - Question/answer time
  - Short in-class activities meant to be completed during the class session
  - Time to work on group projects

Course objectives

In this course, we are going to develop the core quantitative reasoning skills required of a modern ecologist:

- Understanding how science works (or ought to work).

- Data recording, handling, exploration, and visualization.

- Understanding and applying the R programming language.

- Learning statistical concepts in a broad ecological context.

- Development of **statistical intuition.**

- Selecting and interpreting appropriate statistical methods.

Grade Components: Group Work

Consult the syllabus for detailed grading information.

Some key points about collaborative work:

- Group and collaborative work is a large component of your grade: 25%

Grade Components: Assignments

Weekly Assignments: Assignments are due Monday night by 11:55PM

Each week, you'll generally have 2 assignments to turn in:

1. A set of pre-class questions

2. Either an individual or group assignment
   1. Week 2 is an exception; you have a pre-class question set and 2 individual assignments.
   2. You'll typically have more than 1 week to work on these. There will be at least one in-class session devoted to the individual/group assignment.

How to Find Information?

How do I…?

We will cover the key points today, but we can't cover everything. It is **your responsibility** to:

- know the contents of the syllabus: grading and attendance policies, academic honesty, etc.

- Keep track of your gradebook.
  - If something seems wrong, let me know ASAP!

- Know how to navigate the course websites.

It is **my responsibility** to answer your questions about the course to the best of my ability.

To succeed in this course, you need to:

- Setup the software in **week 1**.

- Don't procrastinate on the coding exercises.

- Keep up with the readings. The weekly pre-class exercises are a big part of your grade.

- Take your group work seriously!

- When you get stuck, don't wait to ask for help.
  - If you wait until the weekend to pose your questions to Ana or me, you may not get a very prompt response!

- Be adventurous and have fun. You're learning an exciting new set of skills

Lecture Notes

Weekly slide decks are linked on the course GitHub site.

NOTE: Future lecture notes will be updated as the course progresses:

- Content many be moved forward or backward depending on the pace of the course.

- I may need to adjust based on student feedback.

Consider the posted lecture notes for future lectures to be tentative!

- I'll post final versions (with announcements, etc) at the end of each week.

Course Websites and Software

Course Websites

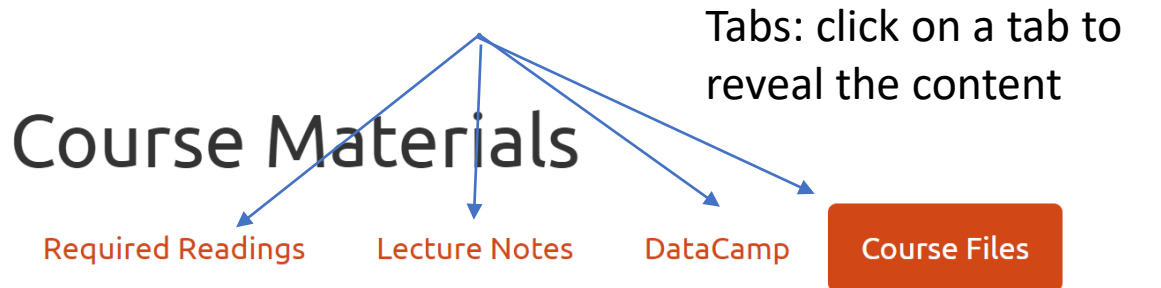| GitHub	Moodle

• Course Materials
• Course information
• Assignment descriptions
• Data files
	• Assignment submission
	• Discussion forums
	• Non-public information:
	   • DataCamp invite link
	   • Course forums

Course GitHub Site: Organization

https://michaelfrancenelson.github.io/intro_quant_ecol/

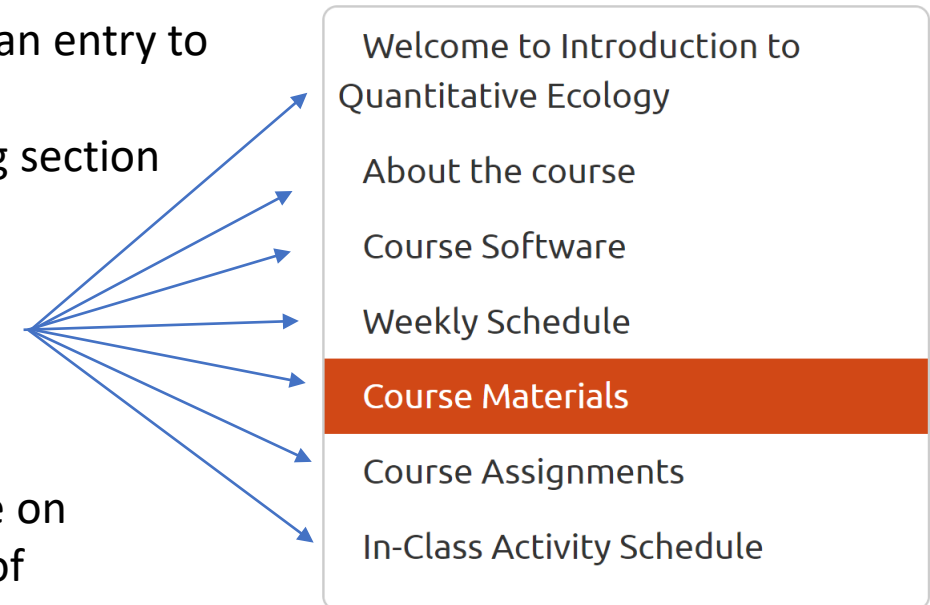**This is our main course site; lots of the content is organized in tabs and tables of contents**

Tabs	Table of Contents

Tabs

Tabs: click on a tab to reveal the content

Course Materials

Required Readings   Lecture Notes   DataCamp   Course Files

Here are links to the various data, template, and script files we'll use in the course:

- butterfly_table.csv
- eastern_white_pine.csv
- flour_beetles.csv
- grazing_data.csv
- mander_anova.csv
- rarefaction_data_sheet.csv
- week_03_practice_data.csv

Table of Contents

TOC: Click on an entry to warp to the corresponding section

Welcome to Introduction to Quantitative Ecology

About the course

Course Software

Weekly Schedule

Course Materials

Course Assignments

In-Class Activity Schedule

The TOC is always visible on the left side of the course page

Required Software

This course is very software-heavy. We'll primarily be using the following:

- R

- RStudio

- Excel

However, you will also need to be proficient with word-processing/document editing software (like Google Docs or Word) as well as cloud-based file sharing services like OneDrive or Google Drive.

R: What is it and why do I need to know it?

Did you ever think you'd need to learn computer programming to be an ecologist???

- R is a computer programming language used for performing statistical analyses.

- R is (relatively) easy to learn.

- R is a powerful tool for analyzing and visualizing data.

- You are going to learn to use R!

WHAT THE HECK Is R?

Finding Info: R

Learning R can be challenging. Fortunately there are **tons of resources** available (but beware, not all tutorials and help entries are created equal).

Some good resources include:

- Google

- Your peers

- The R help documentation

- Your instructor.
  - I'm here to help, but I expect you to put in a good-faith effort to thoroughly read and follow instructions and walkthroughs.

RStudio and DataCamp

RStudio	DataCamp
• R is a programming language – by itself, the program not very user-friendly. • RStudio is an Integrated Development Environment (IDE). • We will use RStudio to communicate with R. • We write our code and markdown using RStudio. • Don't worry, we'll talk all about what this means	• DataCamp is an online learning platform for lots of data science related topics. • It has courses in R, Python, and other programming languages. • We'll use its basic R course to get acquainted with the language.

Getting Help

If you are stuck or confused, don't wait to ask for help!

Individual Assignments

Let's Dive In!

Grade Components: Individual Assignments

Individual assignments and pre-class exercises are a big part of your grade (40%)

- I encourage you to work together with your peers on the individual assignments.

- However, all individual assignments must be your own work, **in your own words!**

- Students who submit duplicated materials in individual assignments will not receive credit.

Individual Assignments: The First Batch (Due Feb 13)

Software Setup	Course Websites and Syllabus
- Start this one ASAP. - For about 70% of students, the process will be smooth, for the rest you may need a little extra time and guidance. - Don't take your chances – get started right away! - Lots of info and resources in the assignment walkthrough and supporting info.	- The course GitHub page has a lot of information and materials - This assignment is your chance to learn how to use it! - Rather than spend class time on the syllabus, you can read it on your own and test your knowledge with the assignment questions.

Our First In-Class Activity!

Rarefaction and Sampling Effort

In-Class Group Activity: Rarefaction

Instructions

1. Form groups of 5-6 students
2. Locate the activity group self-selection in Moodle and add your group members
3. Find the link to the activity on the course GitHub site (link in Moodle)
4. Find the data file on the course GitHub site
5. Designate a record-keeper. This person will record the data and submit the completed data sheet for your group.
6. Count seeds and submit your data sheet.

For Thursday

Complete these tasks to be ready for Thursday's class

- Begin the Week 2 readings.
  - Your reading questions are due next Monday. Next class period will be the last chance for questions on them before they are due!

- Begin software setup and set up your DataCamp account.

- Be prepared to run RStudio!
  - We will walk through some R tasks on Thursday.

- Come to class with a question about the readings, slides, course website, assignments, software setup, or any other course related topic.
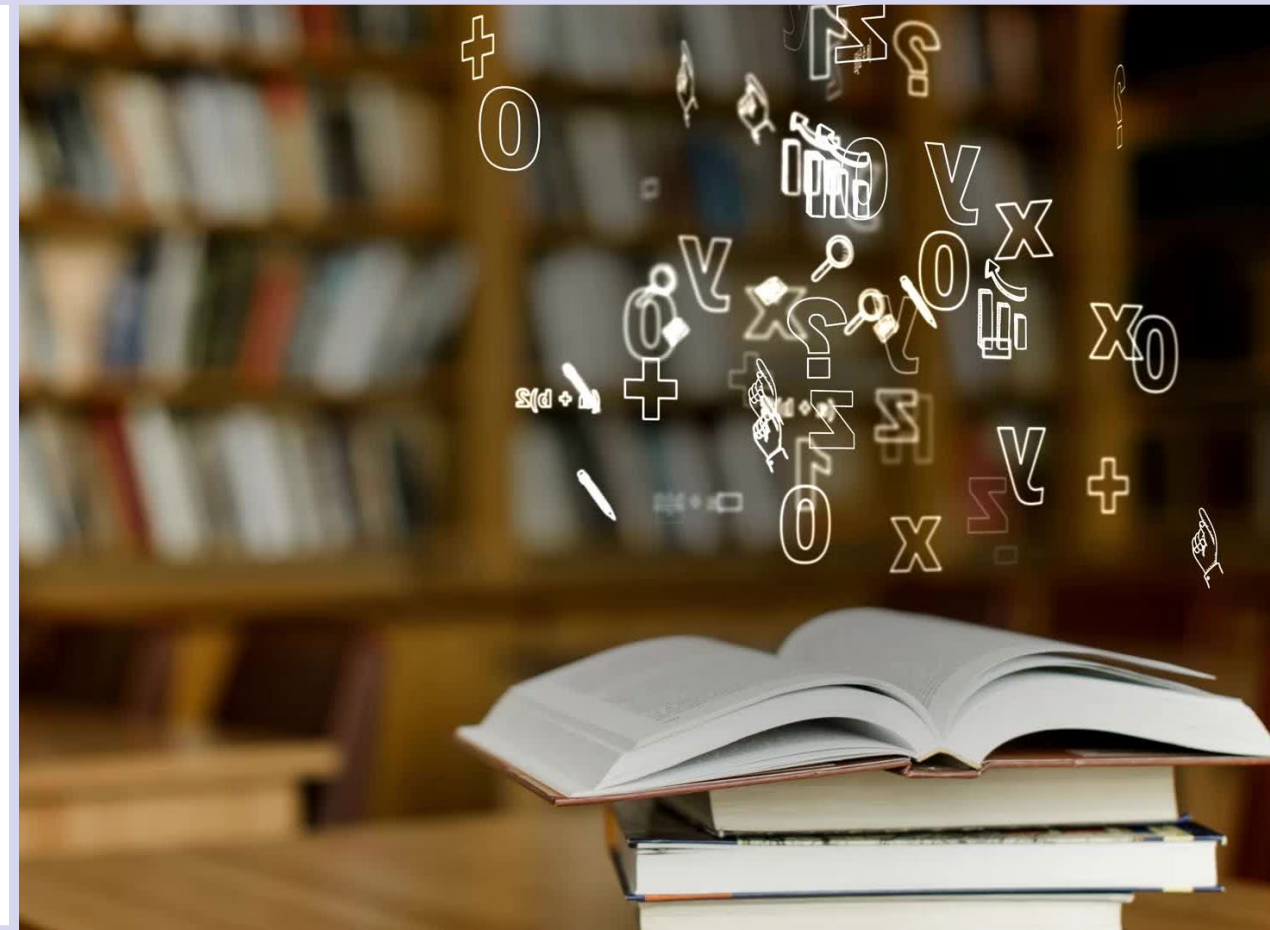
Thursday

Meet Ana Ivanova!

TA Office Hours

Ana's office hours will be Fridays 4-5 on Zoom. Check Moodle for the Zoom link!

Ana is also available for questions over email, and you can arrange virtual meetings outside of her regular office hours.

Today's Class

- Recap of Tuesday's in-class activity

- Software setup Q+A

- In-class R packages and RMarkdown

Announcements

- Remember to bring your computer to class.

- If you don't have access to a laptop that you can bring to class, please get in touch with me ASAP (you may email if you don't want to talk about it in class).

Announcements

Three assignments due on Monday night:

- Software Setup

- Class websites/syllabus

- Week 2 pre-class questions

And now, your questions/comments from Tuesday!

Why are you taking this course?

Why are you taking this course

- It's required/I need a stats course!
- Want to learn the analytical side of conservation science!
- It's required…
- Interested in analyses of large-scale data sets
- Passionate about the environment, want to understand how data/analyses fit into that realm
- Prep for grad school/professional work

What do you hope to learn in this course?

What do you hope to learn

- Statistical analyses

- R programming, become fluent in R

- ANOVA

- Relationship between ecology and R/quantitative components, how it might relate to interests

- Want to learn statistical analyses.

- Applications to the real world

- Connections between ecological data and real world

What is a burning question you have about the course?

Burning questions

- Why the heck do we need WVD?
- What types of jobs need R, what level of proficiency is needed?
- How much coding will we be doing??
- How will our coding work relate to ecology?
- How much space does R take up on my CPU???
- How much time will I need to spend outside of class?
- Why did we count the seeds, how many were in bag A8.
- What's the best way to gather data?
- How can we make data more accessible to the average person?

Is there anything fun, funny, or interesting you'd like to share?

Fun, Funny, Interesting?

- Same hats!

- Seed ecophysiology!

- Park ranger in most visited national park! (which park is that???)

- Big Dragon😜

- Why did the tree get stumped? It couldn't get to the root of the problem.

- What's a tree's favorite subject in school? GeomeTREE

- We're excited to do research!

Announcements

Start up your computers now, and open RStudio!

- You'll need it for the in-class activity.

Software Setup Questions?

For Next Week

Next Week: DataCamp and Desert Shrubs

Start on the DataCamp ASAP, we'll be doing an in-class activity based on vectors and data frames on Tuesday.

- Find the DataCamp invite link in Moodle.

Desert Shrubs Assignment

- Read the assignment description, we'll select groups and work on this in-class next Thursday.

Assignments Due on Week 2

Remember that we have 3 assignments due on Monday night:

- Software Setup

- Syllabus/Websites assignment

- Week 2 reading exercises

  - Gardener Chapter 1: Planning

  - Barraquand et al paper

R Packages and R Markdown

Fire up your RStudio and follow along!

What are these things you're talking about???

What is an R package?	What is R Markdown?
• An R package is like an extension to R.	• R Markdown is a markdown language.
• Packages may contain data sets.	• Kind of like html, but much easier to learn.
• Packages can contain tools for a specific analytical purpose, for example working with time-series data.	• R Markdown makes it easy to create professional reports, documents, and webpages.
	• All of the course webpages were created in R Markdown.
• Packages can contain general purpose utilities, for example utilities to efficiently work with large datasets.	• R Markdown lets you include graphics and R code in your output documents

Let's create an R Markdown document!

- Make sure you have RStudio running and follow along with me for the demo.

In-Class Packages and Markdown

Instructions:

- Form a group of 3 – 5 students
  - Use Moodle self-select
- Follow the activity instructions to create a new markdown document with content.
- Submit your knitted document in Moodle