WIS 6934 Ecological Dynamics and Forecasting

|**Instructors** |Dr. Morgan Ernest | Dr. Ethan White |**Office Location** |Building 150, Room 2 | Building 150, Room 1 |**Phone** |352-294-2082 | 352-294-2081 |**Email (preferred)** |skmorgane@ufl.edu | ethanwhite@ufl.edu |**Office Hours** | |

Times and Locations

Tuesday, Period 5 (11:45-12:35), MCCB 2102

Thursday, Period 5 (11:45-12:35), MCCB 2102

Course Objectives

The goal of this class is to provide students a basic understanding of how populations and communities change through time and to provide fundamental concepts of how to forecast those changes. By the end of the semester, students will:

1. Have an appreciation of the dynamics of species and communities.

2. Understand the basic concepts of forecasting that apply across fields and the challenges within ecology

3. Have a basic understanding of working with time series data

4. Be able to fit models to data and use those models to make forecasts

General Course Structure and Expectations

This course is a mixture class discussion of primary literature and hands-on experience involving data and computing. Completing assigned readings, intellectual engagement with topics, discussion participation, and completion of assignments are the main ways students will learn in this class. Tuesdays are typically concept discussion days. Thursdays will be a mix of tools or concept discussion. You are expected to come prepared to discuss the assigned papers.

Paper Discussion Participation

There are two general approaches to participating in paper discussion.

The first is to attend class and participate in the group discussion about the paper. This discussion is generally centered around the discussion questions that are provided in advance but may also expand beyond them. Our goal is to produce a classroom environment where everyone is comfortable participating in class discussions. We will try to manage discussions so that everyone has a chance to contribute and make sure that

folks who are less comfortable interjecting get a chance to participate. We welcome your help in making sure that everyone in the class gets a chance to contribute.

If you can't or don't want to participate in conversations about papers in class you can write up short answers to the provided discussion questions and send them to us each week. You can choose to either have use read them ourselves and count them as participation or let us know that you would like us to share those ideas for you by reading some of them in class as we talk about relevant material.

Course Grading

- 50% of grade will be based on participation including discussing papers and participating in in-class tutorials
- 50% will be based on completion of assignments

Attendance Policy

Two days can be missed without impacts on your grade without the need to submit make-up work, though we recommend that students attempt any missed class activities on their own time because additional class activities or discussions may rely on that knowledge.

Additional missed days can be made-up by submitting make-up work. Class activities can be made-up on the student's time by doing the activity and submitting the code/data. Missed discussions can be made up by providing written responses to the discussion questions on the readings for the day(s) missed. Two to three sentences per question is an approximate guideline for the length of response to each question, but feel free to write more or less as appropriate.

Course Materials

1. All reading materials are made available through the [course website](). If you are off campus you may need to use the VPN to access some of them.
2. Laptops: On class activity days, laptops will be required for class.

UF Policies

University Policy on Accommodating Students with Disabilities

Students requesting accommodation for disabilities must first register with the Dean of Students Office (http://www.dso.ufl.edu/drc/). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive,

therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

University Policy on Academic Misconduct

Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at http://www.dso.ufl.edu/students.php.

Netiquette and Communication Courtesy

All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions and chats.

Getting Help

Other resources are available at http://www.distance.ufl.edu/getting-help for:

- Counseling and Wellness resources

- Disability resources

- Resources for handling student concerns and complaints

- Library Help Desk support

Should you have any complaints with your experience in this course please visit http://www.distance.ufl.edu/student-complaints to submit a complaint.

Most importantly, if you are struggling for any reason please come talk to us and we will do our best to help.

Grading scale

- **A 93-100**

- **A- 90-92**

- **B+ 87-89**

- **B 83-86**

- **B- 80-82**

- **C+ 77-79**

- **C 73-76**

- **C- 70-72**

- **D+ 67-69**

- **D 60-66**

- **E <60**

Course Schedule

The details course schedule is available on the [course website](#).

Disclaimer: This syllabus represents our current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

Activity days when laptops are required are noted in italics. Discussion leaders are listed below each topic.

- August 20: Introduction. Can we forecast in ecology?

    o   Discussion Leader: Ethan and Morgan

- August 22: Introduction to ecological forecasting (reading)

    o   Video: [NEON: Forecasting](#)

    o   Reading: Ecological forecasting and data assimilation in a data-rich era **(through end of the Uses of Models for Ecological Forecasting section)**

- August 27: Paleo dynamics - Pleistocene/Holocene transition

    o   Reading: Just the Introduction of Ecological Change, Range Fluctuations and Population Dynamics during the Pleistocene (i.e. stop when you reach the section titled "The Glacial Refugium Theory")

    o   Reading: Read all of Novel climates, no-analog communities, and ecological surprises

    o   Discussion leader: Morgan

- *August 29: Time series data*

- September 3: Discussion on data sources

- *September 5: Working with time series data in R*

    o   Before class install R Packages: ggplot2, lubridate, dplyr

- September 10: Community Dynamics – Species Composition and Richness

- o Reading: Assemblage time series reveal biodiversity change but not systematic loss

  o Discussion leader: Morgan

- *September 12: Basics of Time Series – Time Series Decomposition* * Bring computers. Install the R package: forecast * Data file: [portal_timeseries.csv]({{ site.baseurl }}/data/portal_timeseries.csv)

- September 17: Changes in phenology

  o Reading Shifting plant phenology in response to global change

  o Discussion leader: Morgan

- *September 19: Basics of Time Series – Time Series Autocorrelation*

- September 24: Regime shifts

  o Reading: Repeated regime shifts in a desert rodent community

  o Discussion leader: Morgan

- *September 26: Introduction to time-series modeling*

- October 1: Introduction to forecasting

  o Reading: Forecasting Principles & Process Chapter 1

  o Discussion leader: Ethan

- *October 3: Introduction to forecasting in R*

- October 8: Importance of uncertainty

  o Reading: Dietze Chapter 2

  o Discussion leader: Ethan

- *October 10: Evaluating forecasts*

- October 15: Forecasting using State-space model [quantitative]

  o Reading: Forecasting climate change impacts on plant populations over large spatial extents

  o Discussion leader: Ethan

- *October 17: State-space model*

- October 22: Near-term Iterative Forecasting

  - Reading: Iterative near-term ecological forecasting: Needs, opportunities, and challenges

  - Discussion Leader: Morgan

- *October 24: State-space model pt 2*

- October 29: Forecasting using Species Distribution Models

  - Reading: Species Distribution Models:Ecological Explanation and Prediction Across Space and Time

  - Discussion Leader: Ethan

- *October 31: Species Distribution Models*

- November 5: How do other fields forecast - Hurricane Forecasting A good general overview of hurricane forecasting has proven elusive, so instead we have a series of web pages and blog posts that will provide the framework for our discussion. The first reading is to set the stage and the subsequent readings will fill in the details of the types of models hurricane forecasting relies on and the challenges involved.

  - What goes into hurricane forecasting?

  - Types of Hurricane Forecast Models

  - Statistical, Statistical-Dynamic, Trajectory Models

  - Dynamical Models

  - Numerical Weather Predictions/Ensemble Forecasting Explained

  - How Hurricane Forecast Models Work

  - Ensemble or Consensus Models

  - The State of Hurricane Forecasting is...

  - Discussion leader: Morgan

- November 7: How do other fields forecast - Elections

  - Reading:A User's Guide to FiveThirtyEight's 2016 Election Forecast

  - Reading:Another model to forecast the house elections? Meet Mr. P

  - Discussion leader: Morgan

- November 12: Data-driven models for forecasting [quantitative]

  - Reading: Equation-free mechanistic ecosystem forecasting using empirical dynamic modeling

  - YouTube video: https://www.youtube.com/watch?v=fevurdpiRYg

  - Discussion leader: Ethan

- *November 14: Empirical Dynamic Modeling Tutorial*

- November 19: Scenario based foreasting

  - Reading: Why global scenarios need ecology

  - Discussion leader: Ethan

- November 21: Ethics of Forecasting

  - Reading: Ethical considerations and unanticipated consequences associated with ecological forecasting for marine resources

  - Discussion Leader: Morgan

- November 26: Thanksgiving

- December 3: Can we forecast in ecology (and what can we forecast)?

  - Reading: Prediction, precaution, and policy under global change

  - Discussion Leader: Ethan and Morgan