

## Global Change Biology

Fall 2015 Syllabus

Instructor Information: Dr. Rob Guralnick

Assoc. Curator, FLMNH

Office: Rm 359 Dickinson Hall

Lab: Rms 358,288,289 Dickinson

Office Hours: To be announced ASAP

telephone: (352) 273-1980, email: [rguralnick@flmnh.ufl.edu](mailto:rguralnick@flmnh.ufl.edu)

CLASS LOCATION: Little Hall, Room 233

CLASS DATE & TIME: The seminar starts **Feb. 9th** and runs to April 19th, covering 10 sessions (over 11 weeks) of 2+ hours each. We meet Tuesdays from 1:55-3:50pm. There will be “lab homework” and reading each week, and given the enhanced pace of the course (10 weeks versus 15), assume it will be “busy” for those 10 weeks.

### REFERENCE MATERIAL:

Hannah, L. 2011. *Climate Change Biology* (First Edition). Academic Press. CA, USA.

Newman, J.A., Abnand, M., Henry, H.A.L., Hunt, S., Gedalof, Z., 2011. *Climate Change Biology*. CABI, Oxfordshire, UK.

### COURSE OVERVIEW:

The discipline of Global Change Biology focuses on past, present and forecast future responses of the biosphere to large-scale perturbations of the overall earth system. These perturbations can themselves be biotic, and in particular one species, *Homo sapiens*, is enacting a remarkable global-scale “experiment” the likes of which the planet has never before seen. The purpose of this graduate seminar is to gain a deeper understanding of the global-scale patterns of species, functional and genomic biodiversity, how to document biodiversity change, and to understand how to detect drivers of those changes. We will focus on the following themes in particular: how to calibrate the tempo and mode of current changes to the biosphere via understanding past changes; understanding our current knowledge and gaps related to monitoring and assessment of biodiversity and biological systems; understanding the complexities of scale in both drivers of diversity and in the systems under exploration; looking beyond climate to other critical aspects of change such as land conversion, fragmentation, biotic feedbacks and invasions, etc., and new technical and analytical approaches to the study of change and its dynamics. We will also focus on policy issues and the integration of science and policy in relation to data, analytics, metrics etc.

### FORMAT:

The format of this graduate seminar is less a reading group, in that it includes some hands-on learning and skills, especially in GIS. Over the 10 weeks of the seminar (Feb. 8th-April 20th), we will focus our efforts on real-world outputs as much as picking up a critical set of theory and current issues. Weeks 1-2, we will focus primarily on overview topics and consider the deeper time perspective on global change. For those first weeks, we will format classes around “debates”, relating to key topics. For the same topic, two teams will take positions on a debate topic, and argue (in a scientific sense) to the rest of the assembled group about the topic at hand. In Weeks 3-6, we will focus more on

assessing the current state of global biodiversity, what we know and how we know it. This will involve reading key literature and hands-on efforts with data and utilizing R and other software. Weeks 7-8 will take a more directed look at policy issues related to biodiversity. We will tie this portion of the class more to the connectors between essential biodiversity variables and its relation to science and policy. In weeks 9-10, we will focus more on our ability to forecast future biodiversity under climate and landscape change scenarios as well as synthesis activity or activities that involves the class. The outcome of this is a draft review/synthesis paper on a topic of immediate interest to a broader community.

## **SCHEDULE:**

### **Feb 9 Introductions**

**Lecture/Discussion:** Course introduction and organization. (short period -- 1.25 hours)

Guralnick: 30 minute PPT. Discussion of topics. Overview of already assigned topics and reading.

**Lab:** Quick overview of tools you'll need - R packages, QGIS etc. Assembling distributional data products.

**Next week's key reading:** Climate Change Biology Chapter 1. Barnosky paper on 6th great extinction event.

### **Feb 16 The long view**

**Lecture/Discussion:** Global change and the earth record.

Guralnick: 20 minute mini-lecture.

Discussion topic(s): Current approaches to documenting the cadence of change dynamics over different scales. What do we know about past change, and how does it inform current change dynamics?

**Lab:** Fossil data and paleoclimate data. Where is it and what can you do with it. What are the problems with these data resources?

**Next week's key reading:** TBD but focused on knowledge gaps, theory paper on SDM.

### **Feb 23 Understanding the present Part 1.**

Guralnick: 15 minute mini-lecture.

Owens: 15 minute mini-lecture

What do we know about biodiversity and its distribution on the planet? What are the shortfalls/gaps in our knowledge? What methods can we use to assess species distributions? What is the theory of SDM?

**Lab:** How to assemble climatic and other data layers. Simple approaches for generating initial niche models, and tuning models using model parameters. Generating initial outputs.

**Next week's key reading:** TBD but around species richness patterns, tropical-temperate diversity drivers, history matters

### **March 1 - SPRING BREAK GO HAVE FUN!**

### **March 8. Understanding the present Part 2.**

Biodiversity hotspot assessment, understanding global species richness, understanding measures of beta-diversity and drivers of diversity patterns.

**Lab:** How to do modeling right. Choosing accessible areas for modeling, understanding biases and coverage of records, background layers for presence only modeling, choosing the appropriate approach

for model training and testing, and evaluating model outputs.

**Next week's key reading:** TBD. Phylodiversity metrics, trait diversity over space/time, homogenization of biota.

### **March 15. Understanding the present Part 3.**

Guralnick: 15 minute mini-lecture.

Germain-Aubrey: 15 minute PPT mini-lecture.

What do we know about functional and phylogenetic views of biodiversity. What is the theory and practice of phylogenetic diversity metrics and how to build a global observation network that integrates across phylogeny/traits/distributional data.

**Lab:** Access to trait/function data and how to use it. Fitting within and between species variation in key integrator traits.

**Next week's key reading:** TBD but resurvey papers e.g. Grinnell resurvey work and other related manuscripts

### **March 22 Change Dynamics - Short term.**

Guralnick: 15 minute mini-lecture on earth observation from space

Leads mini-lecture&discussion.

What is the evidence for short term change from the in-situ observation record? What do we know about change dynamics from remote sensing record. Can we model biodiversity and its change at global scales or is it all about the "ecology of place"?

**Lab:** Fitting models of persistence from field survey data and evaluating co-variates. Model inference approaches and model averaging.

**Next week's key reading:** TBD but focus on remote sensing and utility in biodiversity analyses, use for trait data at scale

### **March 29 Policy Part I relevant data, analysis and outputs.**

Species range metrics, threat assessments, extinction risk, and the intersection of species data and data on protected areas. The Red List process and how species ranges are used.

**Lab:** Overlaying model outputs to assess species richness, issues with scale and commission error, and measures of species overlaps with protected areas. How to do phylogenetic measures of species diversity, and why it matters.

**Next week's key reading:** TBD but extinction risk papers, essential biodiversity variables.

### **April 5th Policy Part II Essential biodiversity variables and new approaches**

Guralnick: 20 minute mini-lecture.

Class discussion leads.

EBVs, CBD processes, IPBES, and Aichi targets. New tools for decision makers. Next generation approaches for assimilating global-scale data

**Lab:** Using phylogenetic and distributional data both as a source of assessing species conservation metrics. Tools for assessing progress towards Aichi targets.

**Next week's key reading:** Papers focused on CBD, Aichi targets, theory of EDGE metrics.

### **April 12 Forecasting future changes to biodiversity Part 1.**

Guralnick: 20 minute mini-lecture.

Class discussion leads.

What are the IPCC forecast scenarios and how can they be used in biodiversity analyses. What other "forecast scenario" are available? How do SDM forecasts work and why are such forecasts challenging?

**Lab:** Projecting species distributions into the future, or to other novel environmental landscapes and the challenges with this "model transfer". What is clamping and why is it important?

**Next week's key reading:** Focus on forecasting species response to climate change. Pitfalls, challenges and opportunities. Importance of physiology, evolution.

## **April 19 Forecasting future changes to biodiversity Part II.**

Guralnick: 15 minute mini-lecture

How do we bring in more realistic assumptions into forecast models. Biotic interactions, and incorporating species physiology and evolutionary response. Synthesis outputs. Class presentation. Next steps.

**No lab (class presentation in its place)**

**No next-week's reading.**

### **Expected Behavior:**

I expect each class member to behave as is befitting a professional situation like attending a class. The simple rules are: attend class, participate, and know campus policy about expected classroom behavior. I will treat each member with all respect as long as we feel that is reciprocated. Cheating will not be tolerated and we expect all students to follow codes of ethics as outlined by the University of Florida (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>). We love cell phones and mobile devices too, but please be respectful regarding use in the classroom. We'll promise to be respectful in return!

### **Policy regarding Religious Observance:**

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, the instructors will discuss accommodations on a case by case basis. Reasonable requests will almost always be granted.

### **Policy regarding sexual harassment**

The University of Florida policy on Discrimination and Harassment (<http://hr.ufl.edu/manager-resources/policies-2/sexual-harassment/>) will be adhered to strictly. Any student who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status can make a formal complaint report to the Institutional Equity and Diversity officer and/or to the Dean of Students Office/Student Conduct and Conflict Resolution (DSO/SCCR). Resources and reporting options can be found online at <https://www.dso.ufl.edu/sccr/resources/victims>.