Syllabus – BOMI 355 – Plant Responses to Global Change
Spring 2019, Dr. Laurie Anderson

Class and lab location and meeting times: Science Center 247, Class: MWF 9AM – 9:50AM, Lab: M 1:10-4PM
Office hours: W 10-12PM, Th 2:30-3:30PM and by appointment
Office phone and e-mail: 368-3501, ljanders@owu.edu **Pronouns:** She, Her

Overview: This course is organized around four major global environmental changes: increases in atmospheric CO_2, increases in temperature, increases in nitrogen deposition, and changes in precipitation patterns. We will explore how plants and ecosystems interact with these changes in terms of physiology and ecosystem dynamics, and the implications of these interactions for ecosystem function, global biogeochemical cycles, climate change, and the future of the biosphere. Tropical rainforests, which have a significant role in global and regional climate, the boreal/tundra habitat, which has experienced the most dramatic warming of all ecosystems, the temperate forest, where we live, and agricultural ecosystems, which support human civilization, will all serve as case studies to explore these topics more deeply. Our goal is to explore the ways in which people and plants are shaping the future of our planet. For more specifics, see the **Learning Goals** for the class on the last page of this syllabus!

Required Papers: A range of papers from the primary literature will serve as the required reading for this class. We will be reading 2 to 5 papers per reading assignment. These will be posted on Blackboard (abbreviated PL for "primary literature" on the schedule below).

Week of:	**Lecture Topics**	**Reading List**
Wed Jan 16 and Fri Jan 18	Global environmental changes: carbon, temperature, nitrogen, water – why do we care? Physiological ecology: scaling from leaf to atmosphere Introduction to the Amazon, the boreal region, the temperate forest, and agriculture: our case studies *No lab this week*	*PL Readings 1*
Week of Jan 21	What are climate models and how do they work? The global carbon cycle and rising atmospheric CO_2 Photosynthesis – C_3, C_4 and CAM *Lab: Planting of C_3, C_4 species for drought and temperature study, global climate models exercise from Teaching Issues and Experiments in Ecology* **PL Discussion 1 on Friday, 1/25**	*PL Readings 1*
Week of Jan 28	Plant responses to atmospheric CO_2: photosynthesis and growth, FACE studies, carbon isotopes *Lab: Linked class with Remote Sensing: Orientation and GIS*	*PL Readings 2*
Week of Feb 4	Plant and ecosystem carbon budgets Palm oil plantations and tropical carbon budgets **PL Discussion 2 on Friday, 2/8** *Lab: Temperature change and effects on phenology in Ohio – Exercise from Teaching Issues and Experiments in Ecology*	*PL Readings 2*

Week of Feb 11	The greenhouse effect and global temperature changes – causes, predictions and implications The respiration connection **Exam 1 on Friday, 2/15** *Lab: Linked class with Remote Sensing – Calculating NDVI*	*PL Readings 3*
Week of Feb 18	Global temperature changes, continued **PL Discussion 3 on Friday, 2/22** *Lab: Field lab – set up for microsite temperature monitoring for spring ephemerals*	*PL Readings 3*
Week of Feb 25	Global temperature changes, continued Temperature changes in the boreal/tundra region **Topic ideas for Global Change papers due Friday, 3/1** *Lab: Harvest greenhouse study*	*PL Readings 4*
Week of Mar 4	Global temperature changes – continued Climate change and phenology *Lab: Weigh plants, analysis and graphing of data* **PL Discussion 4 on Friday, 3/8**	*PL Readings 4*
Week of Mar 11	**Spring Break**	**Spring Break**
Week of Mar 18	Increased N deposition and ecosystem responses Nutrient dynamics in the temperate forest **Lab Report on Greenhouse Study due Friday, 3/22** *Lab: Linked class with Remote Sensing – Joint projects*	*PL Readings 5*
Week of Mar 25	Links between invasive species and nitrogen deposition Crop nutrition in a changing world **Exam 2 on Friday, 3/29** *Lab: Linked class with Remote Sensing – Joint projects*	*PL Readings 5*
Week of Apr 1	Microbes, plants, soil and global change **PL Discussion 5 on Monday, 4/1** **Global change paper draft due Friday, 4/5** *Lab: Linked class with Remote Sensing – Joint projects*	*PL Readings 6*
Week of Apr 8	Global changes in precipitation Drought in the Amazon rainforest and the boreal region **PL Discussion 6 on Friday, 4/12** *Lab: Tree coring, observe flowering patterns in spring ephemerals and leaf out in shrubs*	*PL Readings 6*
Week of Apr 15	Water transport and drought stress in plants Hydropower and methane **Final paper due Friday, 4/19** *Lab: Poster Session*	*Students finish final paper and prepare presentations*
Week of Apr 22	**Student presentations on Global Change papers all week** *Lab: Tree core analysis*	
Week of April 29	Final class, course evaluations, no lab this week **Exam 3 during finals week – Thursday, May 2, 8:30AM**	

Grades – Students will be evaluated based on the following:
3 exams – 45% (15% each)
Paper on global change issue – 18%
Presentation on global change issue – 6%
Paper on greenhouse study – 10%
Poster on joint project with Remote Sensing class – 6%
Participation in class discussions and activities – 15% (class and lab attendance, lab worksheets, preparation for literature discussions)

Grading Scale – Grades on assignments and in the course will be assigned using the following scale: 93 and above = A, 90-92 = A-, 87-89 = B+, 83-86 = B, 80-82 = B-, 77-79 = C+, 73-76 = C, 70-72 = C-, 67-69 = D+, 63-66 = D, 60-62 = D-, Below 60 = F

Readings – There is no textbook for this course. All readings will come from the primary literature, or from Dr. Anderson's advanced textbooks and will be available on Electronic Reserve, or handed out in class. It is very important that readings be completed by the due date so that students can discuss the material in class (see class participation grade above).

Exams – Written exams will be given on the material covered in lectures, labs and readings. Exams will be essay format. Two exams will be given during the semester, and one during the final exam period. The final exam will be the same format as the semester exams, and will cover material presented since the second exam.

Greenhouse Research Project – The class will conduct a greenhouse experiment on responses to drought and soil warming in C_3 and C_4 plants. Students will collaborate on carrying out the experiment and analyzing the data. However, each student will write their own scientific paper reporting the results of the experiment. Each paper should include a brief review of scientific literature on the research topic, a statistical analysis of the data, and high quality graphics. Each paper should be five pages of text, and include at least five citations from the primary literature. Students will receive written guidelines for this short paper.

Project with Remote Sensing Class – Remote sensing with satellites and drones is an important set of tools for detecting changes in vegetation across large spatial scales. We will partner with Dr. Nathan Rowley's Remote Sensing class (GEOG 369) during some of our lab sessions to learn more about how remote sensing technology works and apply it to global change ecology problems. See the schedule above for the dates of our "linked classes". You will be completing a poster presentation with students from GEOG 369. More guidance on this assignment will be provided during the linked classes.

Global Change Papers and Presentations – Each student will write a scientific review paper on a topic related to global environmental change. Students will be given a list of suggested topics, but are able to select their own. All topics must be approved in advance by Dr. Anderson. Students will also give a 10 minute power point presentation their chosen topic. The final paper will be 12-15 pages of text, and should include 20 citations from the primary literature. See the schedule above for due dates for the presentations and the paper. If you wish to receive a writing option, your paper must be 15 pages; see Dr. Anderson for additional rules for writing options.

Lateness Policy - Papers and other assignments are due at class time. If assignments are submitted late, the following policy will apply:
After class by midnight on the same day = 2% deduction
By midnight on the following day = 5% deduction
5% will be deducted for each additional day late.

Learning Goals

- Students will be able to describe global changes in atmospheric carbon dioxide, temperature, nitrogen deposition, and precipitation, and how human activities interact with these changes at the ecosystem to global scale.

- Students will be able to explain how carbon, nitrogen, water, and temperature affect the physiology and growth of individual plants and how processes at the physiological level connect to processes at the ecosystem and biosphere scales.

- Students will be able to discuss the relevance of global changes in carbon, nitrogen, water, and temperature for boreal/tundra ecosystems, tropical rainforests, temperate forests and agricultural ecosystems and how the responses of these ecosystems to these changes interact as feedbacks to the biosphere and the climate.

- Students will be able to describe a range of field sampling approaches, instruments, and data analysis techniques used in global environmental change research, such as eddy covariance and automated environmental sensor technology.

- Students will be able to manipulate sample datasets to explore global change questions.

- Students will be able to describe the major features of tropical forests, boreal forests, tundra, temperate forests and agricultural systems in terms of soil, vegetation, dominant animal life, climate, and biogeochemical cycles.

- Students will be able to explain climate modeling scenarios that are relevant to the boreal/tundra, tropical forest, temperate forest regions and the regional to global implications of these ecosystem changes (such as permafrost melting, glacier melting and vegetation changes from boreal to temperate forest).

- Students will be able to describe human pressures on natural ecosystems and how these may exacerbate or mitigate climate change effects.

- Students will explore creative options for sustainable use and preservation of natural ecosystems in the context of dramatic global changes.

- Students will learn best practices for scientific field ecology research.