Course Information --- CPSC431, IB440, NRES431
Spring Semester, 2022

Tu, Th 11:00 – 12:20, 2020B Natural History Building

Instructors: Dr. Lisa Ainsworth, Room 147, Edward R. Madigan Laboratory, ainswort@illinois.edu. Office Hours: by appointment

Dr. Andrew Leakey, Room 1402, Institute for Genomic Biology, leakey@illinois.edu. Office Hours: by appointment

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Prerequisites: IB100, IB101, IB102, IB103, IB203, or CPSC112 or consent of instructor.

Credit: 3 HOURS credit

Course aims: Plants & Global Change (CPSC 431, IB 440, NRES 431) aims: (1) to provide an overview and synthesis of global atmospheric and climate change and its impacts on plants, including crops and natural ecosystems; (2) to give an appreciation of how atmosphere, climate and ecosystems interact, and models developed both to synthesize current understanding and predict into the future; (3) to provide a basis for considering how agriculture and other land use may be adapted to climate change, how plants and biological systems might be utilized to mitigate atmospheric change, and the environmental implications of these issues. The focus is on the processes and other biological mechanisms that provide the basis for a) understanding responses and b) development of predictions and solutions. **Learning outcomes**: Students will gain biochemical, molecular and physiological understanding of plant responses to global climate change. Students will read and evaluate primary scientific literature, develop effective communication and debate skills, work collaboratively, and critically evaluate science-related news and information from diverse information sources.

Texts: IPCC Fourth Assessment Report: Climate Change 2021
https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/

ADB Leakey (2014) The Anthropocene: Plants in a New Environmental Domain. In: *The Plant Sciences*. Ed: RK Monson. Springer. DOI 10.1007/978-1-4614-7612-2_6_1

Current literature for lectures will be posted on the moodle page.

Evaluation: Midterm examination (25%)
Final examination (25%)
Debate (25%)
Quizzes (12.5%)
Discussion + Readings (12.5%)

Midterm Examination: Multiple choice, short answer and long essay test in class.

Final Examination: Take-home essay questions.
Must be done individually, without consultation from other students.

Debate: Parliamentary-style debate in class. Please see debate rules document for more information.

Reading assignments: You will answer assigned questions from the readings associated with each block of lectures, and then discuss your answers with your classmates.

Course Attendance Policy: Regular class attendance is expected of all students. Students should inform instructors in advance of missing class and generally adhere to the guidelines specified in the UIUC Student Code (https://studentcode.illinois.edu/article1/part5/1-501/).

Disability Accommodation: To ensure that disability-related concerns are properly addressed from the beginning of the semester, students with disabilities who require assistance to participate in this class are asked to see an instructor as soon as possible.

Academic Integrity. As specified in the UIUC Student Code, "*It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions*." It is our responsibility as instructors to uphold the academic integrity policy of the University (https://studentcode.illinois.edu/article1/part4/1-401/).

Course Topics

I. Greenhouse Gases & Radiative Forcing
II. Global Carbon Cycle & Climate Change: Past, Present & Future
III. Plant Response to Rising Carbon Dioxide Concentrations
IV. Plant Response to Rising Temperature
V. Plant Response to Altered Water Availability & Salinity
VI. Plant Response to Rising Tropospheric Ozone
VII. Thresholds for Response
VIII. Solutions

Class #	**Date**	**Topic**
1	Jan 18	Class overview, greenhouse gases & radiative forcing (AL)
2	Jan 20	Global carbon cycle, past & future climate change (LA)
3	Jan 25	Effects of elevated CO_2 on photosynthesis (RB)
4	Jan 27	Elevated CO_2 effects on plant-water relations (RB)
5	Feb 1	Elevated CO_2 effects on nutrient uptake, acclimation and respiration (RB)
6	Feb 3	Elevated CO_2 effects on growth and productivity (RB) *Reading Assignment 1*
7	**Feb 8**	**DEBATE 1**

8	Feb 10	Temperature effects on photosynthesis and respiration (RB)
9	Feb 15	Temperature stress: cellular and molecular responses (RB)
10	Feb 17	Temperature effects on reproductive processes, yield and NPP (RB)
11	Feb 22	**DEBATE 2**
12	**Feb 24**	Drought effects 1 (LA) *Reading Assignment 2*
13	Mar 1	Drought effects 2 (LA)
14	Mar 3	Drought sensing, tolerance and adaptation (LA)
15	Mar 8	Midterm Review *Reading Assignment 3*
16	**Mar 10**	**MIDTERM**
	Mar 12 – Mar 20	SPRING BREAK
17	Mar 22	Chemistry and occurrence of ozone (LA)
18	**Mar 24**	**DEBATE 3**
19	Mar 29	Ozone damage and ozone tolerance in plants (LA)
20	Mar 31	FACE ozone experiments: case studies (LA) *Reading Assignment 4*
21	**Apr 5**	**DEBATE 4**
22	Apr 7	Thresholds in plant and ecosystem responses to global change (AL)
23	Apr 12	Adapting agriculture to climate change (AL)
24	Apr 14	Climate change targets for biotechnology (LA) *Reading Assignment 5*
25	**Apr 19**	**DEBATE 5**
26	Apr 21	Biological approaches to mitigating global environmental change (AL)
27	Apr 26	Building better biofuel crops (AL)
28	Apr 28	The ecology of producing biofuels without causing more problems than you solve. . . (AL) *Reading Assignment 6*
29	**May 3**	**DEBATE 6**
	May 12	**FINAL EXAMS DUE**