

Master Syllabus

1. *Full course title:

Current topics in climate change

2. *Course Number and Level

ESS/ATS 543

3. *Credit hours for the course:

2 Credit Hours

4. *Recommended prerequisites or other special information:

Student should have completed upper division coursework in biology, ecology, or chemistry that has prepared them to understand basic chemical transformations, elemental and energy budgeting, and atmospheric processes. Solid communication and mathematical skills and the ability to think broadly and solve problems will also contribute to student success in this course.

5. *Short course description for the catalog:

Climate fundamentals and current topics in climate change.

6. *Long course description:

This course examines the science of climate change through reading and discussion of current literature. Students will explore the physical characteristics of greenhouse gases, emission trajectories and drivers, climate change impacts (observed and forecast), and climate change adaptation.

7. *Description of the major goals and objectives of the course, and specific student learning outcomes. (Goals should be broad, general statements about outcomes, and objectives should be specific, measurable outcomes representing specific competencies)

The goal of this course is to provide students with theoretical underpinnings and conceptual frameworks needed to understand the role of a variety of organizations in greenhouse gas emissions and emission reduction strategies, design, and opportunities.

Learning objectives. After completing this course, a successful student will be able to:

- understand how changes in radiation balance affect Earth's climate;
- explain the concepts of climate forcing, sensitivity, feedback, and response;
- understand physical mechanisms for anthropogenic climate change;
- understand the principles, strengths, and weaknesses of global climate models;
- read and comprehend current scientific literature about climate change;
- anticipate and explain likely impacts of climate change on ecosystems and society;
- be aware of proposed technical and policy approaches to mitigation and adaptation;
- comprehend debates about climate change science; and
- understand the risks of climate change, and policy action and inaction.

8. List of general course topics, recommended contact hours per topic and recommended sequencing.

List of General Course Topics:

- Earth's energy balance
- Vertical transfer of energy in and among the Earth's atmosphere, oceans, and surface
- Greenhouse gases and thermal radiation
- Climate sensitivity: forcing, response, and feedbacks
- Climate change in the past
- Climate models
- Projections of future climate change
- Ecological and societal impacts of climate change-- observations
- Ecological and societal impacts of climate change-- forecasts/risks
- Climate change policy
- Climate change mitigation
- Climate change adaptation

9. Expanded Course Topics and recommended sequencing:

1-Simple

- albedo impacts
- water vapor as a GHG
- climate feedbacks (one or several) – magnitude, likelihood, certainty
- benefits of CO₂/negative feedbacks
- Observation sets (pause, periodicity-El Nino/PDO)/ Reconciling estimates of climate sensitivity
- solar-driven climate change
- aerosol emissions, reflective properties, lifetime, reactions, etc.

2-Serious

- ice sheet/glacial losses
- benefits of warming
- sea level rise – extent and rate
- climate change impacts on food production (water)
- costs of adaptation
- the long tail (referred to in Gardiner)
- prospects for rapid sea level rise
- extreme events (hurricanes, floods, fires, drought)
- impacts on ecosystems

3-Solvable

- energy intensity
- carbon intensity of energy
- role of forests
- geoengineering
- Paris Agreement
- estimating likelihood of achieving 2°C threshold; how much more difficult for 1.5°C
- economics of climate solutions (discounting)

9. Library requirements or other special resources recommended for inclusion in the course, such as web links, supplementary readings, or multimedia content:

Nature and Science magazines

- <http://www.nature.com/nature/index.html>
- <http://www.sciencemag.org/magazine.dtl>

11. Specific pedagogical techniques, or recommended course activities:

Students will participate in and lead blocks on selected topics. For the four meetings over each block, students will

- develop presentations on an emerging climate change topic
- read and discuss popular and scientific literature
- create in-class exercises to facilitate student interaction/discussion
- interact with guest speakers with experience in climate change science

12. Grading

- Class participation 5%
- Presentation of discussion topic 95%
 - Written lesson plan 40%
 - Presentations/discussion 20%
 - Quizzes/formative evaluation 15%
 - Engagement activity/homework 20%