Syllabus
EES 2110/5110: Global Climate Change

Jonathan Gilligan
Vanderbilt University

Fall 2015

1 Nuts and Bolts

1.1 Class Meetings

MWF 9:10–10:00 Furman 217

1.2 Professor

Jonathan Gilligan
Associate Professor of Earth & Environmental Sciences
Office: SC 5735 (Stevenson #5, 7th floor), Phone: 322-2420
jonathan.gilligan@vanderbilt.edu
Office Hours: Mon. 10:15–11:00, Wed. 11:00–12:00, or by appointment.

1.3 Teaching Assistant

Lydia Harmon
Office: 6703 Stevenson
lydia.j.harmon@vanderbilt.edu
Office Hours: Wed. 1:00–2:00 pm

Ms. Harmon will be grading homework, so address questions about your homework grades to her.

1.4 Email

If you want to communicate with Professor Gilligan or Ms. Harmon be sure to begin the subject line of your email with "EES 2210" or "EES 5110". This helps assure that we will see your message quickly and respond to it.

I have set my email reader to flag all messages like this as important, so I will read them first. This also assures that I do not mistake your email for spam. I typically receive over 100 emails per day, so if you do not follow these instructions I may not notice your email.

2 Course Description

This course will study earth's climate and the way it has changed throughout our planet's history. We will study:

- Determinants of climate: What factors affect climate, how do we know this, and how certain are we?
- Scientific evidence about past climates: What do we know, how do we know it, and how certain are we?
- Natural climate change in earth's history.
- Effects of human activity on global climate in the last 200 years.
- What do we know about future climate change and how will it affect the quality of people's lives?
- How do economists and political scientists assess the costs of climate change and the value of policies to limit it?
- What can we do to mitigate future global climate change or adapt to life in a different climate?
- What is happening politically, both in the U.S. and internationally, to respond to climate change?

3 Goals for the Course

My goals for this course are that at the end of the semester:

- You will have a solid scientific understanding of what scientists know, what they don't know, and how they know what they know about how climate works, how and why it has changed in the past, and how it may change in the future.
- You will be able to evaluate the evidence for and against the idea that human activity is warming the planet and assess for yourself whether the evidence is persuasive.
- You will be familiar with the ways economists and policy analysts approach the problem of climate change and public policies that respond to it.
- You will understand the history of scientific and political concern and activity around global warming, the principal policy measures being considered to address climate change, and their major strengths and weaknesses.
- You will have the tools and knowledge to make informed decisions about what climate policies you support or oppose.

When you leave this course, you will not be qualified to work as a climate scientist, but you will be able to follow and critically evaluate news reporting about climate change and climate policy, debate intelligently and knowledgeably, and be an informed voter.

I do not care whether you agree with me politically. I respect people who think for themselves. **What counts is whether you can present your own position clearly and support it with solid evidence and reasoned argument.**

4 Important Dates:

Many of you have athletic and other commitments during the term and may travel for personal reasons. As you plan for your semester, particularly if you are purchasing nonrefundable airplane tickets, consult the syllabus.

If you have away games that require you to miss a scheduled test let me know well in advance.

- The mid-term test is on **Wednesday, October 7**.
- On **Wednesday, Nov. 18**, we will spend the class period doing a role-playing exercise to simulate cap-and-trade and emissions taxes. Participation in this exercise will count toward your final grade so be sure to attend class that day unless you have an absolutely unavoidable conflict.
- The take-home final exam is due at **11:00 am Friday, December 18**

5 Structure of the Course:

I divide the semester into two parts:

1. **Scientific Principles of Climate**: For the first half of the semester, we will focus on the scientific principles of climate and natural climate change in earth's past. This will be very mathematical, using basic algebra. We do not use calculus or other advanced math in this class, but you should be comfortable with simple algebraic equations. We will then look at climate change in the last two centuries and what might happen over the next several centuries. We will emphasize examining the scientific evidence to understand what it can and cannot tell us.
2. **Human Dimensions of Climate Change: Politics, Economics, etc.:** For the second half of the semester, we will focus on the political, economic, and social aspects of climate change and possible public policy and technological responses.

5.1 Reading Material

There are three required textbooks. Supplementary reading on the Internet or in handouts will also be assigned during the term.

REQUIRED READING MATERIALS

- David Archer, *Global Warming: Understanding the Forecast,* 2nd ed. (Wiley, 2011; ISBN 978-0-470-94341-0). Be sure you get the second edition because it is significantly different from the first.
- William Nordhaus, *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World* (Yale, 2013; ISBN 978-0-300-18977-3)
- Roger A. Pielke, Jr., *The Climate Fix* (Basic Books, 2010; ISBN 978-0-465-02519-0)

There is a companion web site to *Global Warming: Understanding the Forecast* at `forecast.uchicago.edu`, which includes videos of the author's own lectures on the material and interactive on-line computer models that we will use for some exercises in the book.

OVERVIEW OF READING MATERIALS

I will give out detailed reading that give specific pages to read for each class and notes on important things you should understand. **I expect you to complete the reading before you come to class on the day for which the reading is assigned**, so you can participate in discussions of the assigned material and ask questions if there are things you don't understand.

While science aims to give correct answers to scientific questions, there are not right or wrong answers to questions of what is the best economic model with which to assess the costs of climate change or the best policy with which to respond to climate change, so I have chosen books and other reading material that present different points of view on the political and economic aspects.

5.2 Graded Work

BASIS FOR GRADING

Class participation & in-class exercises	5%
Homework	20%
Mid-term exam	25%
Projects	15%
Final exam	35%

HOMEWORK

Homework is due at the beginning of class on the day it is assigned. Late homework will be accepted for half-credit if I receive it before I post the answer key on OAK (usually a week after the assignment is due).

PROJECTS

You will do a few extended projects, which constitute policy analyses of possible measures to reduce greenhouse gas emissions.

TESTS AND EXAMINATIONS

There will be one in-class midterm exam, on Wednesday, October 7. This test will be closed book. I will hold an evening review session before the test. **You will need to bring a calculator, number two pencils, and erasers to the in-class test.**

FINAL EXAMINATION:

There will be an open-book take-home final exam, for which you may use your books and notes. You will submit your take-home final electronically. It will be due at the end of the scheduled final examination, 11:00 am Friday December 18.

The final exam will be cumulative over all the material covered during the term.

6 Honor Code:

This course, like all courses at Vanderbilt, is conducted under the Honor Code.

I encourage you to to seek help from me, from Ms. Harmon, or from other classmates or friends in your studying. I also encourage working together on homework assignments: you may talk with your friends and classmates about homework assignments, compare notes on how you are working a problem, and you may look at your classmates' work on homework assignments. But you must work through the problems yourself in the work you turn in: **Even if you have discussed the solution with others you must work through the steps yourself and express the answers in your own words. You may not simply copy someone else's answer.**

Tests are different from homework: **all work you turn in and all work on tests and exams must be entirely your own**. **You may not work together with anyone or receive any help from anyone but me or Ms. Harmon on exams and tests (this includes take-home exams and tests)**.

Writing assignments will contain instructions how the honor code applies. If you ever have questions about how the Honor Code applies to your work in this course, please ask me. **Uncertainty about the Honor Code does not excuse a violation.**

7 Final Note:

I have made every effort to plan a busy, exciting, and instructive semester. I may find during the term that I need to revise the syllabus to give more time to some subjects or to pass more quickly over others rather than covering them in depth. Many topics we will cover are frequently in the news. Breaking news may warrant a detour from the schedule presented on the following pages. Thus, while I will attempt to follow this syllabus as closely as I can, you should realize that it is subject to change during the semester.

8 Meet Your Professor

Jonathan Gilligan has worked in many areas of science and public policy. His past research includes work on laser physics, quantum optics, laser surgery, electrical properties of the heart, using modified spy planes to study the ozone layer in the stratosphere, and connections between religion and care for the environment.

Professor Gilligan is the Associate Director for Research at the Vanderbilt Climate Change Research Network, where he conducts interdisciplinary research on global warming policy and is also active in the Vanderbilt Institute for Energy and Environment.

His current research investigates the role of individual and household behavior in greenhouse gas emissions in the United States; water conservation policies in American cities; vulnerability and resilience to environmental stress in Bangladesh; adaptation to water scarcity in Sri Lanka; and developing new directions for climate policy in the US.

Apart from his academic work, Professor Gilligan dabbles in writing for the theater. His play *The Scarlet Letter*, co-written with Carol Gilligan, has been staged at The Culture Project in New York City, starring Marisa Tomei and Bobby Cannavale, and was later performed by The National Players and Prime Stage, Pittsburgh. Prof. Gilligan, wrote the libretto for an opera, *Pearl*, in collaboration with Carol Gilligan, composer Amy Scurria, and producer/conductor Sara Jobin, which was most recently performed at Shakespeare & Company in Lenox MA on Aug. 5, 2013, starring Maureen O'Flynn, John Bellemer, Marnie Breckenridge, John Cheek, and Michael Corvino.

Schedule of Classes (Subject to Change)

IMPORTANT NOTE: This schedule gives a rough indication of the reading for each day. See the detailed assignment sheets posted on OAK for the daily reading and homework assignments.

Date	Topic	Reading
Wed, Aug. 26	Introduction	
Fri, Aug. 28	What is Climate Change?	*Forecast*, Ch. 1; *Casino*, Ch. 1–2
Mon, Aug. 31	Energy Balance and Climate	*Forecast*, Ch. 2–3
Wed, Sept. 2	Greenhouse Effect	*Forecast*, Ch. 3
Fri, Sept. 4	Greenhouse Gases	*Forecast*, Ch. 4
Mon, Sept. 7	Vertical Structure of the Atmosphere	*Forecast*, Ch. 5
Wed, Sept. 9	Review of Greenhouse Effect	
Fri, Sept. 11	Feedbacks	*Forecast*, Ch. 7.
Mon, Sept. 14	Feedbacks	*Forecast*, Ch. 7.
Wed, Sept. 16	The Carbon Cycle	*Forecast*, Ch. 8.
Fri, Sept. 18	The Carbon Cycle	*Forecast*, Ch. 8.
Mon, Sept. 21	The Perturbed Carbon Cycle	*Forecast*, Ch. 10
Wed, Sept. 23	Climates of the Past	*Forecast*, Ch. 11
Fri, Sept. 25	Climates of the Past	*Forecast*, Ch. 11
Mon, Sept. 28	Computer Models	*Casino*, Ch. 3–4
Wed, Sept. 30	Future Climate Change	*Forecast*, Ch. 12, *Casino*, Ch. 5
Fri, Oct. 2	Future Climate Change	*Forecast*, Ch. 12, *Casino*, Ch. 24 *Climate Fix*, Ch. 1
Mon, Oct. 5	Catching up and Review	
Wed, Oct. 7	**MIDTERM EXAM**	
Fri, Oct. 9	Impacts of Climate Change	*Casino*, Ch. 6–9
Mon, Oct. 12	Impacts of Climate Change	*Casino*, Ch. 10–12
Wed, Oct. 14	Uncertainty	*Climate Fix*, Ch. 1 *Forecast*, Ch. 10
Fri, Oct. 16	**FALL BREAK**	

Date	Topic	Reading
Mon, Oct. 19	Policy Myths	*Climate Fix*, Ch. 2; *Casino*, Ch. 25
Wed, Oct. 21	Energy Use and Conservation	*Climate Fix*, Ch. 3, *Casino*, Ch. 14
Fri, Oct. 23	Potential for renewable energy	Handouts
Mon, Oct. 26	Global Decarbonization Policies	*Climate Fix*, Ch. 4
Wed, Oct. 28	Global Decarbonization Policies	*Climate Fix*, Ch. 4
Fri, Oct. 30	Geoengineering	*Climate Fix*, Ch. 5, *Casino*, Ch. 13
Mon, Nov. 2	Geoengineering	*Climate Fix*, Ch. 5, *Casino*, Ch. 14
Wed, Nov. 4	The cost of slowing Climate Change	*Casino*, Ch. 14–15
Fri, Nov. 6	Discounting and the Value of Time	*Casino*, Ch. 16
Mon, Nov. 9	Goals of Climate Policy	*Casino*, Ch. 17; *Climate Fix*, Ch. 6
Wed, Nov. 11	Costs and Benefits	*Casino*, Ch. 18
Fri, Nov. 13	Pricing Carbon	*Casino*, Ch. 19
Mon, Nov. 16	Carbon Pricing Instruments	Handouts
Wed, Nov. 18	Class Exercise: Carbon Trading Game	Handouts
Fri, Nov. 20	Reprise of economics and carbon trading	*Casino*, Ch. 20–21
Mon, Nov. 23	**THANKSGIVING BREAK**	
Wed, Nov. 25		
Fri, Nov. 27		
Mon, Nov. 30	A global viewpoint	Handout
Wed, Dec. 2	Second-best policies	*Casino*, Ch. 22; Gilligan & Vandenbergh (Handout)
Fri, Dec. 4	New technologies & new policies	*Climate Fix*, Ch. 9; *Casino*, Ch. 23
Mon, Dec. 7	Obstacles and Perspectives	*Casino*, Ch. 26
Wed, Dec. 9	Review	
Fri. Dec. 18	**TAKE-HOME FINAL EXAM DUE 11:00 AM**	