SEMESTER AT SEA COURSE SYLLABUS
University of Virginia, Academic Sponsor

Voyage: Spring 2016
Discipline: Environmental Science
SEMS 2500-503&504: Introduction to Environmental Science
Division: Lower
Faculty Name: Dr. Catherine Pringle and Dr. Jim Affolter
Credit Hours: 3; Contact Hours: 38

Pre-requisites: No course pre-requisites.

COURSE DESCRIPTION

Humans are dependent on Earth's resources, including air, water, and soil, for our existence. However, we have altered the planet in many ways, large and small. This course focuses on key physical and biological processes that govern how nature works, the interactions between human society and ecosystems, and current and potential solutions to environmental problems. Concepts that provide a foundation for understanding and interpreting environmental change will be introduced first, including the flow of matter and energy through ecosystems, ecosystem ecology, global climates and biomes, evolution and biodiversity, population and community ecology, and patterns of human population growth. We will then explore the past and current impact of human activity on mineral and resource extraction, water resource use and water pollution, air pollution and climate change, development of conventional and sustainable energy supplies, and loss of biodiversity. The countries visited during the voyage provide striking examples of environmental problems arising from rapid population and economic growth, and we will explore these relationships during the voyage.

COURSE OBJECTIVES

By the end of the course students will be able to demonstrate:

- an understanding of the basic scientific principles, concepts, and techniques required to understand the interrelationships of the natural world
- the ability to identify and analyze environmental problems both natural and created by humans, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving or preventing them.
- an understanding of the contributions and the limits of science and technology in addressing environmental issues such as population growth, biodiversity loss, resource limitation, pollution, stratospheric ozone depletion, and global climate change.
- a comparative understanding of how effectively countries visited during the voyage are addressing both local and global environmental challenges.

REQUIRED TEXTBOOKS

AUTHOR:	Norm Christensen
TITLE:	The Environment and You
PUBLISHER:	Pearson Education, Inc.
ISBN #:	978-0-321-73438-9
DATE/EDITION:	2013

TOPICAL OUTLINE OF COURSE

Class meetings listed as "Discussion Days" are composed of "Previews" and "Reflections." Prior to visiting each new port, the instructors will present a 30-45 minute overview of current environmental issues in the target country, with opportunities for questions and answers (the Preview). In the first class meeting after leaving a country, the instructors will lead the students through a discussion of their experiences on land, guided by the primary themes covered during the course and enhanced by images captured by the students during their travels (the Reflections). Three topics not assigned to a single class period — **Environmental Ethics, Economics, and Policy** — will be incorporated in the Discussions Days.

Depart Ensenada- January 5:

B1- January 8: ***Course Introduction; Environmental Science - Studying the State of Our Earth***

Required Readings: Christensen, Chapter 1 (pages 4-8); Schramski, J.R., et al. 2015. Human domination of the biosphere: Rapid discharge of the earth-space battery foretells the future of humankind. PNAS Early Edition (www.pnas.org/cgi/doi/10.1073pnas.1508353112; Renner, M. 2015. "The seeds of modern threats," in *Confronting Hidden Threats to Sustainability*, The Worldwatch Institute, Island Press, p. 3-17.

Writing Assignment: Initial Thoughts on Environmental Science (due A2)

In a paper of not more than 500 words (typed, double-spaced) students respond to three questions describing: (1) their formal and informal background in the field of environmental science; (2) an environmental issue that has personally affected them, their families, or their friends; and (3) a compelling example where science or technology has been used successfully (or unsuccessfully) to address an environmental problem.

B2- January 10: ***The Physical Science of the Environment***

Required Readings: Christensen, Chapter 3 (pages 60-89); Oreskes, N. 2013. Earth science: How plate tectonics clicked. Nature 501: 27-29.

[Honolulu: January 12]

B3- January 13: ***Population Ecology and Evolution***

Required Readings: Christensen, Chapter 4 (pages 90-115)

B4- January 15: ***Human Population Growth***

View video in class: New York Times RetroReport, The Population Bomb? May, 2015 (12:57 minutes) (http://www.nytimes.com/video/us/100000003712862/the-population-bomb.html)

Required Readings: Christensen, Chapter 5 (pages 116-143); Bradshaw, C.J.A., and B.W. Brook. 2014. Human population reduction is not a quick fix for environmental problems. PNAS 111(46): 16610-16615; Dusheck, J. 2014. No way to stop human population growth. Science Magazine (http://news.sciencemag.org/biology/2014/10/no-way-stop-human-population-growth)

Writing Assignment: Response to Chai Jing's video "Under the Dome – Investigating China's Smog" (due B7)

In a paper of not more than 500 words (typed, double-spaced) students respond to a series of questions based on the documentary video (published March, 2015) by the former state television reported Chai Jing, investigating how pollution regulations have been steamrolled by industrial growth in China.
(https://www.youtube.com/watch?v=T6X2uwlQGQM)

B5- January 18: ***Community and Ecosystem Ecology***

Required Readings: Christensen, Chapters 6 & 7 (pages 144-195)

[Study Day: January 19]

B6- January 21: ***Climate Change***

Required Readings: Christensen, Chapter 8 (pages 196-233); Climate change impacts — Southeast Asia, UN International Fund for Agricultural Development (https://www.google.com/?gws_rd=ssl#q=how+climate+change+will+affect+southeast+asia)

B7- January 23: ***Air and Water Pollution; Solid Waste Management; Japan Preview***

Required Readings: Christensen, Chapter 9 & 18 (pages 234-261, 554-579); Chapter 11 (pages 182-211), The Golden Ingot, in Minter, A. 2013. Junkyard Planet. Bloomsbury Press; view video "Return to Fukushima" PBS News Hour with Miles O'Brien, Aug, 2014 (33:15 min) (http://www.pbs.org/newshour/updates/miles-obrien-returns-site-japans-nuclear-disaster-three-years-later/);

[Yokohama: January 24-25
In-Transit: January 26
Kobe: January 27-28]

B8- January 30: ***Discussion Day: Reflections on Japan; China Preview***

[Shanghai: January 31-February 1
In-Transit: February 2-3
Hong Kong: 4-5]

B9- February 7: ***Discussion Day: Reflections on China; Viet Nam Preview***

Required Readings: New York Times RetroReport. Agent Orange's long legacy, for Vietnam and veterans. May 11, 2014 (10:10 minutes).

Ho Chi Minh: February 8-12

B10- February 14: ***Discussion Day: Reflections on Viet Nam; Myanmar Preview***

Required Readings: Schmidt, C. 2012. As isolation ends, Myanmar faces new ecological risks. Science 137: 796-797.

B11- February 17: ***Geography of Terrestrial Life***

Required Readings: Christensen, Chapter 10 (pages 262-289)

Yangon: February 18-22

B12- February 24: ***Tropical Ecology and the Exploitation of Tropical Resources***

Required Readings: Christensen, Chapter 14 (pages 420-449); Sodhi, N., et al. 2010. Conserving Southeast Asian forest biodiversity in human-modified landscapes. Biological Conservation 143: 2375-2384; Vignieri, S. 2014. Vanishing fauna. Science 345: 392-395; Stokstad, E. 2014. The empty forest. Science

345:396-399.

B13- February 26: **Midterm Exam**

Cochin: February 27-March 3

B14- March 5: ***Discussion Day: Reflections on India***

Study Day: March 6

B15- March 8: ***Earth's Resources: Geologic Processes, Soil, and Minerals; Mauritius Preview***

Required Readings: Christensen, pages 391-393

Port Louis: March 9

B16- March 11: ***Water Resources***

View video in class: Blue Gold: World Water Wars. 2010. Sam Bozzo. Purple Turtle Films. DVD. 2010.

Required Readings: Christensen, Chapter 12 (pages 332-375); Rulli, M.C., et al. 2013. Global land and water grabbing. PNAS Early Edition **(http://www.pnas.org/content/110/3/892.full).**

Study Day: March 12

B17- March 14: **Agriculture and the Ecology of Food; South Africa Preview**

Required Readings: Christensen, Chapter 13 (pages 376-419); Munang, R. 2014. Despite climate change, Africa can feed Africa. Africa Renewal, Special Edition on Agriculture, United Nations Department of Public Information (http://www.un.org/africarenewal/magazine/special-edition-agriculture-2014/despite-climate-change-africa-can-feed-africa)

Cape Town: March 15-20

B18- March 22: ***Discussion Day: Reflections on South Africa***

Required Readings: Christensen, Chapter 2 (pages 30-59)

B19- March 24: **Nonrenewable and Renewable Energy**

View video in class: Three Mile Island documentary: Nuclear power's promise and peril, New York Times RetroReport, April, 2014 (12:59 min) (http://www.nytimes.com/2014/04/29/us/three-mile-island-and-nuclear-hopes-and-fears.html)

Required Readings: Christensen, Chapters 15 (pages 450-477) and 16 (pages 479-515); Princen, T., et al. 2013. Keep them in the ground: Ending the fossil fuel era, page 161-183, in State of the World 2013, Is Sustainability Still Possible, The Worldwatch Institute.

B20- March 25: ***Conservation of Biodiversity; Ghana Preview***

Required Readings: Christensen, Chapter 11 (pages 290-331)

Takoradi: March 27-28
Tema: March 29-31

B21- April 2: ***The Environment and Human Health***

Required Readings: Christensen, Chapter 19 (pages 580-615)

B22- April 4: ***Cross-country Comparisons, Day 1 (student presentations)***

Required Readings: Christensen, Chapter 20 (pages 616-635)

B23- April 6: ***Cross-country Comparisons, Day 2 (student presentations)***

Casablanca: April 7-11

Study Day: April 12

B24- B Day Finals, April 14: ***Final Exam***

April 16: Disembarkation Day

FIELD WORK

Experiential course work on Semester at Sea is comprised of the required field lab led by your instructor and additional field assignments that span multiple ports.

FIELD LAB

Field Lab Section 1: Mangrove Restoration and Coral Reef Conservation

Country: Port Louis, Mauritius

Idea: Mangrove forests and coral reefs harbor much of the biodiversity of tropical marine ecosystems. Mangrove trees and coral provide structural complexity to near shore marine habitat, allowing the co-existence of diverse species assemblages. When that structure is damaged or removed, these ecosystems can collapse. Mangrove forests have been cleared throughout much of the tropics for coastal development, while coral reefs are threatened by ocean acidification and other human sources of habitat degradation. In this lab, we will visit a mangrove restoration program associated with the UN Development Program and a local organization restoring island coral reefs, exploring both habitat types to learn about their ecology, conservation issues, and restoration efforts.

Objectives:

1. Explore the impact of development and other human activity on the ecological health of two threatened marine ecosystems.

2. Observe the effect of changing ocean acidity on coral reefs.

3. Investigate strategies for mangrove and coral reef restoration.

Field Lab Section 2: Kirstenbosch National Botanical Garden and Cape of Good Hope Nature Reserve

Country: Cape Town, South Africa

Idea: Botanical gardens play a critical role worldwide in displaying and interpreting the diversity of the plant kingdom and in conserving rare and endangered species. Kirstenbosch National Botanical Garden in Cape Town is one of the world's premier botanical gardens, located in a dramatic setting at the foot of Table Mountain. Its plant collections and associated natural habitats illustrate the incredible biodiversity of the Cape flora. Its scientific programs demonstrate how research can be used to protect biodiversity and its societal benefits, with programs in ecosystem services, invasive species, threatened species, climate change, and sustainable wildlife trade. Students will tour the collections, learn about the remarkable evolutionary and biogeographic history of the Cape flora, see examples of rare plant conservation, and study the Garden's efforts to introduce more ornamental and useful native South African species (such as Rooibos tea) into sustainable commercial markets. We will then travel to the Cape of Good Hope Nature Reserve to discuss the ecology of the famous "fynbos" vegetation, and to hike through a landscape at the very southern tip of the African continent that

is home to wildlife such as baboons, Cape zebras, elands, red hartebeests, ostriches, and hundreds of other bird species.

Objectives:

1. Study examples of the extraordinary evolutionary and ecological adaptations displayed by the South African flora in the setting of a world class botanical garden.

2. Observe how horticulture, botany, and other scientific disciplines contribute to conserving and restoring threatened ecosystems.

3. Understand the role that public education programs can play in shaping attitudes towards the environment.

4. Analyze the role that nature reserves play in ecosystem conservation, environmental education, and ecotourism.

FIELD ASSIGNMENTS

- Students will write a two page summary following the Field Lab responding to specific questions posed by the instructors prior to the experience. Questions will require students to interpret and evaluate what they see, not just summarize.

- In five ports-of-call, students will be required to submit a "Post-card from the Field" independent field assignment, consisting of 1-3 photos accompanied by a one paragraph caption. The photo and caption must illustrate an environmental science theme discussed in the course. These "post-cards" will be shared with the rest of the class on discussion days.

- The final day of classes will consist of presentations by pre-assigned teams of students that address cross-country comparisons of one of the major environmental themes presented in the course (e.g., water resources, renewable energy, biodiversity conservation). The presentations must be based on original observations made by the students during the trip, supplemented by subsequent readings and research.

METHODS OF EVALUATION / GRADING RUBRIC

The final grade in the course will be computed according to the following formula:

20% Midterm exam
20% Final exam
10% Writing assignments (due A2 and A7)
15% Independent field assignments
20% Field lab
15% Final class presentation

RESERVE BOOKS AND FILMS FOR THE LIBRARY

AUTHOR: Adam Minter
TITLE: Junkyard Planet
PUBLISHER: Bloomsbury Press
ISBN #: 978-1-60819-791-0
DATE/EDITION: 2013

AUTHOR: Charles Moore
TITLE: Plastic Ocean
PUBLISHER: Avery
ISBN #: 978-1-58333-424-9
DATE/EDITION: 2012

AUTHOR: Helen Caldicott
TITLE: Crisis Without End: The Medical and Ecological Consequences of the Fukushima Nuclear Catastrophe
PUBLISHER: The New Press
ISBN #: 978-1-59558-970-5
DATE/EDITION: 2014

AUTHOR: Lochbaum, et al.
TITLE: 2014. Fukushima: The Story of a Nuclear Disaster
PUBLISHER: The New Press
ISBN #: 978-1-59558-908-8
DATE/EDITION: 2014

These videos and DVDs (or selected segments) will be shown during class, or placed on the intranet for access:

The Pfiesteria Files. Maryland Sea Grant and Maryland Public Television. DVD. 2001.

Blue Gold: World Water Wars. Sam Bozzo. Purple Turtle Films. DVD. 2010.

Global Dumping Ground. Bill Moyers. Center for Investigative Reporting and KQED. Video. 1990.

Large Dams, False Promises. David Phinney with the International Rivers Network. Distributed by The Video Project. Video.

ELECTRONIC COURSE MATERIALS

Bradshaw, C.J.A., and B.W. Brook. 2014. Human population reduction is not a quick fix for environmental problems. PNAS 111(46): 16610-16615.

Climate change impacts — Southeast Asia, UN International Fund for Agricultural Development (https://www.google.com/?gws_rd=ssl#q=how+climate+change+will+affect+southeast+asia).

Dusheck, J. 2014. No way to stop human population growth. Science Magazine (http://news.sciencemag.org/biology/2014/10/no-way-stop-human-population-growth).

Minter, A. 2013. Chapter 11 (pages 182-211), The Golden Ingot, in Junkyard Planet. Bloomsbury Press.

Munang, R. 2014. Despite climate change, Africa can feed Africa. Africa Renewal, Special Edition on Agriculture, United Nations Department of Public Information (http://www.un.org/africarenewal/magazine/special-edition-agriculture-2014/despite-climate-change-africa-can-feed-africa)

Oreskes, N. 2013. Earth science: How plate tectonics clicked. Nature 501: 27-29.

Princen, T., et al. 2013. Keep them in the ground: Ending the fossil fuel era, page 161-183, in State of the World 2013, Is Sustainability Still Possible, The Worldwatch Institute.

Renner, M. 2015. "The seeds of modern threats," in *Confronting Hidden Threats to Sustainability*, The Worldwatch Institute, Island Press, p. 3-17.

Rulli, M.C., et al. 2013. Global land and water grabbing. PNAS Early Edition **(http://www.pnas.org/content/110/3/892.full).**

Schmidt, C. 2012. As isolation ends, Myanmar faces new ecological risks. Science 137: 796-797.

Schramski, J.R., et al. 2015. Human domination of the biosphere: Rapid discharge of the earth space battery foretells the future of humankind. PNAS Early Edition (www.pnas.org/cgi/doi/10.1073pnas.1508353112.

Sodhi, N., et al. 2010. Conserving Southeast Asian forest biodiversity in human-modified landscapes. Biological Conservation 143: 2375-2384.

Stokstad, E. 2014. The empty forest. Science 345:396-399.

Vignieri, S. 2014. Vanishing fauna. Science 345: 392-395.

Video: New York Times RetroReport, The Population Bomb? May, 2015 (12:57 minutes) (http://www.nytimes.com/video/us/100000003712862/the-population-bomb.html)

Video: Chai Jing, "Under the Dome – Investigating China's Smog" (https://www.youtube.com/watch?v=T6X2uwlQGQM)

Video "Return to Fukushima" PBS News Hour with Miles O'Brien, Aug, 2014, (http://www.pbs.org/newshour/updates/miles-obrien-returns-site-japans-nuclear-disaster-three-years-later/);

Video: New York Times RetroReport. Agent Orange's long legacy, for Vietnam and veterans. May 11, 2014 (10:10 minutes).

Video: Blue Gold: World Water Wars. 2010. Sam Bozzo. Purple Turtle Films. DVD. 2010.

Video: Three Mile Island documentary: Nuclear power's promise and peril, New York Times RetroReport, April, 2014 (http://www.nytimes.com/2014/04/29/us/three-mile-island-and-nuclear-hopes-and-fears.html)

HONOR CODE

Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University's honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed "[signed]."