Master of Science in Sustainability Management

SSM 1030 Environmental Science

Lecture and seminar course

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Course Description:

The main objectives of this course are to provide a scientific foundation of environmental science to better understand the driving mechanisms of key environmental problems and therefore the scientific aspects of addressing these problems. The course covers the fundamentals of environmental science, including systems theory and major earth system processes (ecosystem energetics, biogeochemical cycles), and environmental change and environmental impact caused by various sectors (agriculture, forestry, industrial systems, mining, fisheries). Some of the specific environmental issues discussed include as air pollution, ozone depletion, climate change, water/marine pollution, contaminants (metals and organic contaminants), renewable and nuclear energy systems, waste management and science/policy interactions. The scientific aspects of these environmental issues will be analyzed using a systems approach and case studies will be used to investigate such issues in real-life context.

Learning Outcomes:

- Understand the science behind major challenges such as climate change, air pollution, sustainable/renewable energy and humans contributes to these challenges both negatively and positively
- Understand fundamental scientific laws, principles and mechanisms that control ecosystems and environmental processes because this knowledge will allow you to problem-solve creatively, to adapt and stay current as the field of environmental science and sustainability continues to evolve
- Be able to translate scientific knowledge and communicate it effectively to your peers and to non-experts through oral and written communication

Course Materials:

No Textbook is required. Readings and additional resources will be posted on blackboard throughout the semester.

Instructional Approach:

The course will consist of lectures (including guest presentations), student group presentations, and in-class discussions and activities. Throughout the semester, groups of students will be assigned to research a topic relating to sustainability and lead an in-class presentation. A reading list will be made available and students will be expected to familiarize themselves with this material as papers relevant to the week's topic will be discussed in class. The in-class discussion may be based on these readings or any others that are pertinent.

Grading:

Grading scheme

Mid-term test 25%

Group Presentation 15%

Simulation of international negotiations on a global environmental issue (mercury pollution) 10%

Briefing note 10%

Participation and Professionalism 10%

Final Exam 30%

Academic Misconduct:

Students should note that copying, plagiarizing, or other forms of academic misconduct will not be tolerated. Any student caught engaging in such activities will be subject to academic discipline ranging from a mark of zero on the assignment, test or examination to dismissal from the university as outlined in the academic handbook. Any student abetting or otherwise assisting in such misconduct will also be subject to academic penalties. **Students are generally expected to behave in a professional and respectful manner in all aspects of the course, including in their interactions with their peers and instructor.**

Master of Management in Sustainability Management Program
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Late submission of assignments will be subject to a late penalty, as per the MScSM policy.

Any modifications to the course will be announced and explained in class.

Course Schedule and important dates:

Spring Semester 2019: Room KN132, Kaneff Innovation Complex
Tuesdays, from 2:00 to 5:00 pm. First class is Tuesday, January 8, 2019. Last class is Tuesday, April 2, 2019, and there is no class Feb. 19 due to Reading Week.

Please note that the SGS final date to drop winter session course without academic penalty is Monday, February 25, 2018. Please note that MScSM Program students must have the written permission of the Program Director to drop a course. Please consult with the Program Registrar if you are considering dropping a course.

Overview of Topics Covered:

Lecture and class discussion topics

Fundamentals of Environmental/Physical Sciences: systems theory, equilibrium

Climate change – heat budgets, radiative forcing, greenhouse gases, physical basis of climate change (causes, impacts, change on multiple temporal scales, natural vs. human induced climate change, solutions and mitigation tools)

Environmental change – at different times in human history and pre-history, the *Anthropocene*, archives and proxies for examining environmental change in different environments

Major biogeochemical cycles (water, C, N, P) and human disturbances thereof

Atmospheric science and pollution – atmospheric structure and circulation, gases and aerosols, criteria air contaminants, ozone depletion (Montreal Protocol), smog (classic vs. photochemical) and acid rain (Sudbury as a case study)

Energy systems – renewable vs. non-renewable, pros and cons of different energy sources including wind, solar, natural gas (hydraulic fracturing), nuclear, case study using Ontario and the Ontario Long-Term Energy Plan

Land degradation and desertification – causes (agriculture, overgrazing), feedbacks, links with climate and climate change, management/reclamation strategies

Environmental issues in aquatic ecosystems – ocean acidification, coral bleaching, microplastics and garbage islands, eutrophication, drinking water and wastewater treatment

Contaminants and pollutants – bioaccumulation/biomagnification, transport and fate as a function of structure, bonding, solubility, etc.; mercury (using the Canadian Arctic as a case study), persistent organic pollutants and the Stockholm Convention, emerging contaminants and endocrine disruptors

Waste Management – Incineration, energy from waste, landfilling, life-cycle assessment

Tentative Course Schedule (subject to change)

Date	***Lecture Topic***	***Class activities/readings/deadlines/notes***
Jan. 8	Course Intro, systems theory, the Anthropocene	
Jan. 15	Biogeochemical cycles, Climate change part I	• ***Presentation outlines due*** • Read: Harvey 2014; Steffen et al., 2015
Jan. 22	Climate change part II	
Jan. 29	Atmospheric science and air pollution	Group Presentation 1
Feb. 5	Guest lecture, TBD	Group Presentation 2
Feb. 12	N/A	**MIDTERM**
Feb. 19	**NO CLASS: Reading Week**	
Feb. 26	Oceans	Group Presentation 3
Mar. 5	Environmental contaminants	Group Presentation 4
Mar. 12	Guest Lecture, TBD	Group Presentation 5 Mercury Negotiation simulation prep
Mar. 19	N/A	Mercury Negotiation Simulation (time/location to be confirmed)
Mar. 26	Energy systems part I	Group Presentation 6
Apr. 2	Energy systems part II	Group Presentation 7 ***Briefing note due***

Tentative topics for group presentations (7 from the following list):

The role of science in developing environmental policy

Environmental issues and solutions in fisheries

Environmental issues and solutions in forestry

Environmental issues and solutions in agriculture

Environmental issues and solutions in mining

Environmental issues and solutions in industrial systems

Developing and managing sustainable cities

Mitigation and adaptation strategies for addressing climate change impacts

Selected examples of assigned readings (not complete):

Hoekstra, Arjen Y. and Thomas O. Wiedmann. 2014. Humanity's unsustainable environmental footprint. *Science* 344: 1114-1117.

Lui, J. et al. 2015. Systems integration for global sustainability. *Science* 347: 1258832-1

D'Odorico, Paolo, et al. 2013. Global desertification: Drivers and feedbacks. *Advances in Water Resources* 51: 326-344.

Gallant, P and Fox, G. 2011. Omitted Costs, Inflated Benefits: Renewable Energy Policy in Ontario. *Bulletin of Science, Technology & Society* 31(5): 369-376.

Assamoi, B. and Lawryshyn, Y. 2012. The environmental comparison of landfilling vs. incineration of MSW accounting for waste diversion. *Waste Management,* 32(5): 1019-1030.

Limburg, M. 2010. Energy Is The Key: Renewable Energy Problems In Germany: "Renewable" energies are not a solution rather they increase foreign dependency. *Energy & Environment*, 21(1): 1289-1303.

Harvey, D. 2014. Sustainability – Definitions and Criteria. The Journal of the Ontario Association of Architects, 22(3): 23.