
ENVIRON 736K

Planetary Health & Environmental Epidemiology



Fall 2018

Dates / course meeting time:

Academic credit: 3 Credits

Course format: Presentation + Lecture + Discussion + Lab

Instructor's information

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What is this course about?

As the pace and scale of human impacts on Earth's natural systems continue to increase, there is growing importance in understanding and quantifying the implications of these accelerating changes for human health. This field has recently been termed "planetary health." Throughout this course, we will study the human health impacts of accelerating environmental change through interdisciplinary approaches including environmental science, political science, and public health.

What background knowledge do I need before taking this course?

This is a graduate level iMEP elective course. Students are encouraged to have taken one quantitative methodology class (statistics, biostatistics, epidemiology, or econometrics) prior to enrollment. Students from other graduate programs may enroll if space is available. Undergraduate students need permission from the instructor and their own academic advisor to join this class.

About the course

Over the past several decades, the collective impact of humanity on the structure and function of Earth's natural systems has ballooned exponentially, and as a result we have entered a new era in which biophysical conditions are changing more rapidly than ever before in human history. Very rapid human population growth combined with even more rapid growth in per capita consumption are driving an extraordinary transformation of most of Earth's natural systems including its climate system, its oceans, land cover, biogeochemical cycles, biodiversity, and coastal and water systems. These are the biophysical systems that underpin global food production, our exposure to infectious disease and natural hazards, even the habitability of the places where we live. There is growing concern that global environmental change is likely to be a major driver of the burden of disease over the coming century. Throughout the course of the semester, students will engage in diverse materials from many types of examples of planetary health

research, from nutrition and mental health, to infectious and non-communicable diseases. A special emphasis will be placed on environmental epidemiology.

Overarching Themes:

Each class will follow a similar narrative, where an aspect of environmental change is associated with a human health outcome. Through successive case studies over the course of the semester, we expect that each student will become familiar with the subject content central to planetary health and will also become familiar with recurring, overarching themes. We have listed the following six themes that we will reinforce in every class throughout the semester.

- 1. Planetary Health Lens:** We expect students to be able to use a planetary health lens to understand the connectedness between environmental change and human health outcomes. Students will be able to examine ecological determinants of human health and to predict the likely health consequences of certain types of environmental change. By the end of the course, we want students to understand that how humanity manages Earth's natural systems will be a primary determinant of future global health.
- 2. Urgency and Scale:** The field of planetary health is driven by the sheer scale of environmental activities and their impact on human health, and the urgency which this presents to humankind. Examining the ways in which geographical scale, temporal scale, socio-cultural and economic context, and the selection of human health outcomes determine whether the presence of natural systems improves or degrades human health is an essential skill. We will also focus on framing these impacts in a cohesive framework called the Global Burden of Disease. In using this framework, we expect students to be able to assess whether some types of environmentally driven human health impacts will have a greater or lesser burden of disease.
- 3. Inequality:** We expect students to be thoughtful in understanding how these issues of scale (both geographic and temporal) and socio-cultural and economic context will lead some types of people to benefit from environmental change while others are burdened by it. Understanding who wins and who loses under what scenarios is a core objective of the course. One must always ask: *whose* health is at stake?
- 4. Bias:** We expect students to understand potential biases in planetary health research and the landscape of vested interests both in support of and against strong connections between environmental change and human health. Environmental change is not an apolitical process and it is important to think critically about whether this political dynamic may be driving the presentation of the topic. We want students to understand how the selection of case studies may in some ways predict the outcome that we find. There will be cases that demonstrate how the destruction of natural systems benefit human health, and other cases that demonstrate how the conservation or rehabilitation of natural systems benefits human health.
- 5. Policy:** Planetary Health is intrinsically policy-oriented. By quantifying the human health impacts of how we manage natural systems, we can identify policies and management strategies that optimize human health while maintaining sustainable natural systems. By the end of the course, we want students to be familiar with the policy implications of planetary health research and be able to provide examples of ways that planetary health science informs changes in natural resource management.
- 6. Unintended Consequences:** Although the first theme expects students to be able to predict potential health impacts of environmental change, we recognize that a common theme in the case studies of this course are often surprising unexpected consequences that cascade out from environmental change. We want students to recognize that we will continue to be surprised by how the changing biophysical conditions on Earth will affect human health.

Readings

The bulk of the reading material will be derived from these commission reports, accessible through Sakai.

- The Rockefeller Foundation—Lancet Commission on planetary health. *The Lancet*
- The Lancet Commission on pollution and health. *The Lancet*
- The Tsinghua–Lancet Commission on Healthy Cities in China *The Lancet*

Grading

Each week, one or more students will be asked to share a news event from the prior week which has a planetary health dimension and lead the class in a brief (10-15 minutes) discussion consistent with our recurring themes: an environmental change shown to have a human health implication; whose health? Who stands to gain/lose by quantifying/publicizing these connections? Why do you think it was reported and who pushed the story? What policies and other types of interventions could address it? This assignment will constitute 10% of the final grade.

Students will write a mini-case study on the subject of planetary health (500-800 words). This will constitute 10% of the final grade. Writing guidelines will be given in class.

- Describe a particular type of environmental change in a specific geographical region. Discuss its scope and rate of change, and any relevant historical, social, and economic drivers.
- Describe a specific human health outcome (or suite of health outcomes) expected to arise from this type of environmental change. Focus here on the evidence base linking the environmental change to its human health impact.
- Generate a novel hypothesis on environmental and human health relationship.

There will be a heavy emphasis on participation, which will constitute 20% of the final grade, including in-class activities, discussions and presentations. We understand that participation means different things to different people. Listening carefully and helping your peers is as, if not more, important than taking an opportunity to speak.

News Presentation	10%
Problem Set (4 total, 10% each)	40%
Case Study	10%
Participation (attendance & discussion)	20%
Final Examination	20%

Without prior permission from one of the instructors, late assignments will be docked one full letter grade for each day they are late.

What are the course policies?

Academic Integrity:

As a student, you should abide by the academic honesty standard of the Duke Kunshan University. Its Community Standard states: “Duke Kunshan University is a community comprised of individuals from diverse cultures and backgrounds. We are dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Members of this community commit to

reflecting upon and upholding these principles in all academic and non-academic endeavors, and to protecting and promoting a culture of integrity and trust.”

Academic Policy & Procedures:

You are responsible for knowing and adhering to academic policy and procedures as published in University Bulletin and Student Handbook. Please note, an incident of behavioral infraction or academic dishonesty (cheating on a test, plagiarizing, etc.) will result in immediate action from me, in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising). Please visit the Undergraduate Studies website for additional guidance related to academic policy and procedures.

Academic Disruptive Behavior and Community Standard:

Please avoid all forms of disruptive behavior, including but not limited to: verbal or physical threats, repeated obscenities, unreasonable interference with class discussion, making/receiving personal phone calls, text messages or pages during class, excessive tardiness, leaving and entering class frequently without notice of illness or other extenuating circumstances, and persisting in disruptive personal conversations with other class members. I do not have a paternalistic policy on laptop usage in class, as it can better facilitate student learning. However, laptops may be distracting to others around you. For this reason, by week 2, students can choose to sit in the laptop section or no laptop section of the classroom, and must remain in that section for the rest of the semester. If you choose not to adhere to these standards, I will take action in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising).

Academic Accommodations:

If you need to request accommodation for a disability, you need a signed accommodation plan from Campus Health Services, and you need to provide a copy of that plan to me. Visit the Office of Student Affairs website for additional information and instruction related to accommodations.

What campus resources can help me during this course?

Academic Advising and Student Support

Please consult with me about appropriate course preparation and readiness strategies, as needed. Consult your academic advisors on course performance (i.e., poor grades) and academic decisions (e.g., course changes, incompletes, withdrawals) to ensure you stay on track with degree and graduation requirements. In addition to advisors, staff in the Academic Resource Center can provide recommendations on academic success strategies (e.g., tutoring, coaching, student learning preferences). Please visit the Office of Undergraduate Advising website for additional information related to academic advising and student support services.

Language Learning Studio

If you want additional help with academic writing – and more generally with language learning – you are welcome to go to the Language Learning Studio (LLS), located in the Conference Center. You can find more information on the LLS website.

Course Schedule

Week 1	Introduction to Planetary Health
Planned in-class activities	Introductions, course logistics, and an overview of global environmental change and human health. What is planetary health, where has it come from, and what characterizes it?
Assignments	<u>Reading</u> Executive Summary of Rockefeller Foundation—Lancet Commission Report on Planetary Health. 2015. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation—Lancet Commission on planetary health. <i>The Lancet</i>

Week 2	Research Methods I: Introduction to Environmental Epidemiology
Planned in-class activities	Explore basic concepts of environmental epidemiology, emphasis is placed on the principles and methods of epidemiologic investigation, appropriate summaries and displays of data, and the use of classical statistical approaches to describe the health of populations. Topics include ratios and proportions; methods of direct and indirect adjustment, and clinical life table which measures and describes the extent of disease problems. Various epidemiologic study designs for investigating associations between risk factors and disease outcomes are also introduced, culminating with criteria for causal inferences.
Assignments	Problem Set 1 Assigned (Due Week 4)

Week 3	Population Growth and Urbanization
Pre-class work for students	<u>Reading - required</u> The Rockefeller Foundation—Lancet Commission on planetary health. <i>The Lancet</i> - Population growth, consumption, and technology—drivers of environmental change (p.1983) - Urbanization (p.1985) The Tsinghua—Lancet Commission on Healthy Cities in China:unlocking the power of cities for a healthy China. <i>The Lancet</i> - Executive summary <u>Reading – optional</u> Gong P, Liang S, Carlton EJ, et al. Urbanisation and health in China. <i>Lancet</i> 2012
Planned in-class activities	Most of the world's population now live in towns and cities and, for the foreseeable future, most population growth will be in urban areas. What does this changing landscape mean for the planet and health?

Week 4	Research Methods II: Exposure and Outcome Assessment
Planned in-class activities	This week we will learn the basics of environmental epidemiology, including cause (exposure variable) and outcome (disease or outcome variable). We will also introduce how to use a directed acyclic graph (DAG) to choose which variables on which to condition to control confounding between exposure (cause) and disease (outcome or effect) in your model.
Assignments	Problem Set 1 Due in class Problem Set 2 Assigned (Due Week 6)

Week 5	Air Pollution, Indoor and Ambient Air Quality and Health
Pre-class work for students	<u>Reading - Required</u> The Lancet Commission on pollution and health. <i>The Lancet</i> - Air Pollution (p.13) - Air pollution, poverty, and environmental injustice (p.30) <u>Reading - Optional</u> Dockery DW, Pope CA, Xu X, et al. An association between air pollution and mortality in six US cities. <i>New England Journal of Medicine</i> , 1993
Planned in-class activities	Air pollution is the biggest topic in environment and health. The learning objectives of this lesson are: define air pollution and the common air pollutants, understand study designs, identify common sources of indoor and outdoor air pollution, discuss methods to reduce air pollution.

Week 6	Research Methods III: Confounding, Measurements of Association
Planned in-class activities	This week we will delve deeper into environmental epidemiology. We will cover: rates and risk ratios, binary outcomes and odds ratio, confounding and conditioning on a variable, stratification and effect modification.
Assignments	Problem Set 2 Due in Class Problem Set 3 Assigned (Due Week 8)

Week 7	Soil Erosion and Chemicals
Pre-class work for students	<u>Reading - Required</u> The Lancet Commission on pollution and health. <i>The Lancet</i> - Soil, heavy metal, and chemical pollution (p.16) - Global spread of extractive industries: oil and gas production, mining, and smelting (p.28) <u>Reading – Optional</u> - John Snow and Broad Street Pump, http://www.ph.ucla.edu/epi/snow/snowcricketarticle.html

Planned in-class activities	Water pollution is any contamination of water with chemicals or other foreign substances that are detrimental to human, plant, or animal health. These pollutants include fertilizers and pesticides from agricultural runoff; sewage and food processing waste; lead, mercury, and other heavy metals; chemical wastes from industrial discharges.
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Week 8	Research Methods IV: Epidemiology Study Designs
Planned in-class activities	What is a perfect study design? What is a feasible study design. Armed with knowledge on how to measure exposure, outcome, and confounders, we will delve into how to use these data points. This section of the class will introduce cross-sectional study, case-control study, cohort study, and randomized controlled trials.
Assignments	Problem Set 3 Due in Class Problem Set 4 Assigned (Due Week 10)

Week 9	Water Pollution and Waterborne Diseases
Pre-class work for students	<u>Reading - Required</u> The Lancet Commission on pollution and health. <i>The Lancet</i> - Water Pollution (p.14) - Water pollution, poverty, and environmental injustice (p.30) <u>Reading – Optional</u> - John Snow and Broad Street Pump, http://www.ph.ucla.edu/epi/snow/snowcricketarticle.html - Flint Michigan Leaded Tap Water (TBD)
Planned in-class activities	Water pollution is any contamination of water with chemicals or other foreign substances that are detrimental to human, plant, or animal health. These pollutants include fertilizers and pesticides from agricultural runoff; sewage and food processing waste; lead, mercury, and other heavy metals; chemical wastes from industrial discharges.

Week 10	Research Methods V: Statistical Modeling and Inference
Planned in-class activities	We will cover the theoretical basis of linear regression, ANOVA, logistic regression, cox proportional hazard model. This lecture to equip students to read and understand common statistical techniques.
Assignments	Problem Set 4 Due in Class Case Study Assigned (Due Week 12)

Week 11	Climate Change, Environmental Conservation and Public Health Interventions
Pre-class work for students	<u>Reading - Required</u> The Rockefeller Foundation—Lancet Commission on planetary health. <i>The Lancet</i> - Trends in global environmental change (p.1980)
Planned in-class activities	The global environment is in a state of rapid flux. We will explore technological, policy, and behavioral changes that would reduce vulnerability to a rapidly changing environment while providing benefits in today's world, including agriculture, fisheries management, urban design, climate change mitigation.

Week 12	Research Methods VI: Multiple Measurements
Planned in-class activities	This is our last lesson on research methodology. We will cover how to longitudinal and panel data are analyzed. Longitudinal data, sometimes referred to as panel data, track the same sample at different points in time. The sample can consist of individuals, households, establishments, and so on. We will also explore potential data sources for planetary health studies
Assignments	Case Study Due in Class

Week 13	Sustainable Development Goals
Pre-class work for students	<u>Reading - Required</u> The Rockefeller Foundation—Lancet Commission on planetary health. <i>The Lancet</i> - The potential to capitalise on the post-2015 Development Agenda (p.2014) The Lancet Commission on pollution and health. <i>The Lancet</i> - Pollution-related disease, poverty and the SDGs (p. 26)
Planned in-class activities	How will the 17 SDG goals and its 169 targets help achieve planetary health?

Week 14	Final Examination
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