# PUBHEHS 6325 – Climate Change and Human Health

**Instructor:** Qinghua Sun

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**E-mail: *Please log into Carmen to email me***

**Instructor’s Office Hours:** Office hours are available to meet in person.If students have general questions or comments regarding the course, please communicate directly via Carmen or email to the instructor. In addition, digital office hours may also be available based on the feedback or need from the students.

**Prerequisites**: For students matriculated in the graduate and professional degree programs, including admitted non-degree students

**Course Delivery**: This course is a 100% online distance learning (DL) course from the Division of Environmental Health Sciences in the College of Public Health. The course is hosted on OSU’s Carmen learning course management system (https://carmen.osu.edu/). There are 14 weekly and asynchronously delivered course sessions consisting of topic-specific modules for a total of 160 minutes equivalent instruction time per session (~80 minutes per module). The course is structured into four Modules. Within each module, there are a series of weekly topics. You can access all the contents in the modules from the day the module open. Dates are listed in your syllabus as well as in your Carmen course. This structure allows you to read materials, watch the lectures and complete discussion board postings and lecture self-checks at your own pace. These can be completed at your own pace but must be done by the time the module closes. No exceptions. In addition to the equivalent instruction time per module, there are also corresponding supplemental readings and other materials for review and self-study. Much of the content for the course will include applied short case scenarios for students to complete and self-assessment.

**Expectations of Students**: This is a completely asynchronous online course (i.e., there are no times at which we all gather together in person or virtually). The asynchronous design allows for more flexibility, but it also puts more responsibility on you to effectively manage your time and learning. Therefore, please plan well and always try to get course activity and assignment done well ahead of due time to avoid something may occur unexpectedly in the last minute. You should expect to spend around eight hours per week on this course and to log-in multiple times per week to the site on Carmen, although most of the work could be done “off-line”. It is recommended to download the teaching materials, including the self-check tests, Chapter Ohio test and Movie test (once you are done with it), so that you will be able to review them later on (you may not have access to the tests after the due time is passed). These expectations are further discussed in this syllabus.

**Course Description and Contents:** Some people may be skeptical about global warming. However, there seems no doubt that the global climate has been changing. The environmental and climate change challenges the world is facing have never been greater or more complex. Recent US events and disasters indicate that domestic and global actions are needed even we may face stronger political headwinds in the years ahead. Global climate change may have considerable direct and indirect impacts on human health. These impacts could include excessive heat-related illnesses, vector- and waterborne diseases, increased exposure to environmental toxicants, and exacerbation of cardiovascular and respiratory diseases due to declining air quality. This course will be based on scientific facts, focusing on both natural phenomena and anthropogenic activities, with emphasis on associations between disease initiation and progression in humans. It will also serve as a platform for the students to participate in discussion and debate on these issues.

**Course Learning Objectives:**

Upon completion of this course, students will be better prepared to:

1. Recognize the current controversial issues about climate change, including global warming.

2. Summarize the evidence about climate change on human health.

3. Identify major human diseases associated with climate change and possible mechanisms.

4. Discuss and debate major climate changes and human health effects.

5. List possible actions and further research about climate change with human health impact.

**Applicable Foundational Knowledge**

3. Explain the role of quantitative and qualitative methods and sciences in describing and assessing a population’s health

4. List major causes and trends of morbidity and mortality in the US or other community relevant to the school or program

5. Discuss the science of primary, secondary and tertiary prevention in population health, including health promotion, screening, etc.

6. Explain the critical importance of evidence in advancing public health knowledge

7. Explain effects of environmental factors on a population’s health

8. Explain biological and genetic factors that affect a population’s health

9. Explain behavioral and psychological factors that affect a population’s health

10. Explain the social, political and economic determinants of health and how they contribute to population health and health inequities

11. Explain how globalization affects global burdens of disease

12. Explain an ecological perspective on the connections among human health, animal health and ecosystem health (eg, One Health)

**Applicable MPH Degree Core Competencies**

1. Apply epidemiological methods to the breadth of settings and situations in public health practice

4. Interpret results of data analysis for public health research, policy or practice

7. Assess population needs, assets and capacities that affect communities’ health

8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs

11. Select methods to evaluate public health programs

12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence

13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes

14. Advocate for political, social or economic policies and programs that will improve health in diverse populations

15. Evaluate policies for their impact on public health and health equity

19. Communicate audience-appropriate public health content, both in writing and through oral presentation

20. Describe the importance of cultural competence in communicating public health content

21. Perform effectively on interprofessional teams

**MPH-EHS Specialization Competencies**

1. Explain the significance of the community and workplace environment to public health

2. Outline the health challenges that natural and anthropogenic contaminants in the environment can pose to population health

3. Explain the physiological factors that influence human exposure and the uptake of chemical and biological environmental agents

4. Identify and explain individual (e.g., genetic, physiologic and psychosocial) and community (e.g., social, built, economic, race) susceptibility factors that heighten the risk for populations for adverse health outcomes from environmental hazards

5. Apply various risk assessment, risk management and risk communication approaches for environmental hazards

6. Explain exposure and the underlying mechanisms of toxicity and infectivity resulting from chemical, biological and physical agents

9. Compare the principle components and influencing factors in the exposure continuum from source to disease

**MS-EPH Specialization Competencies**

2. Synthesize literature in student’s area of specialization relative to their thesis topic and its importance for public health

3. Summarize relevant theories and conceptual models that inform their research

6. Communicate in writing and orally a research project’s methods, results, limitations, conclusions and public health relevance

7. Explain individual and community susceptibility and vulnerability factors that heighten the risk for populations for adverse health outcomes from environmental hazards

8. Apply the environmental health paradigm (i.e., EHS Model) to characterizing hazardous physical, chemical and biological agents relative to sources, categories, exposure matrices/pathways, distribution, human exposures, responses, societal/regulatory actions, and technological controls

**PhD-EPH Specialization Competencies**

2. Synthesize and critique existing literature in student’s area of specialization to identify gaps in the evidence base and justify their importance for public health

6. Communicate in writing and orally a research study’s purpose, methods, results, limitations, conclusions and public health relevance to both informed and lay audiences

7. Quantify individual and community susceptibility and vulnerability factors that heighten the risk for populations for adverse health outcomes from environmental hazards

8. Apply the environmental health paradigm (i.e., EHS Model) to characterizing hazardous physical, chemical and biological agents relative to sources, categories, exposure matrices/pathways, distribution, human exposures, responses, societal/regulatory actions, and technological controls

A complete list of College of Public Health Competencies can be found at https://cph.osu.edu/students/competencies

**Reading References:** This course does not require a specific textbook. Assigned supplemental readings, such as journal articles, digital video clips or movies, and applicable website contents/links, are required in most of the modules. The followings are regarded as references (not required to read before the lecture delivery unless specified otherwise) to facilitate the understanding of the lecture notes and will be available in Carmen.

1. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007 and 2013: http://www.ipcc.ch/publications\_and\_data/publications\_and\_data\_reports.htm

2. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. OSU Web E-book. CALL # RA793.S42

3. The Republican War on Science. (2005) Chris Mooney. OSU library CALL # Q175.52.U5 M66 2005

**Course Activities and Assignments**

1. Lecture self-checks

For each topic taught in this course you will be required to view a pre-recorded lecture, slides, or videos/movies. To assess your level of understanding of the lecture topics and contents, you will then be required to complete periodic self-checks. Self-checks may contain true/false, multiple choice, short answer, or other question forms.

2. Question/discussion participation

This class will utilize discussion boards to foster critical thinking skills. You must respond to the prompt questions posted by the instructor in the discussion board. Expectations and posting requirements can be found in the tables. A guide for creating quality discussion posts can be found in Carmen. You are encouraged to post early in the module, but it is understood that this may not always be possible. In addition to posting each week, you are required to respond substantively to one or more of your classmates’ posts. You are required to post your original reply first before seeing the posts of others.Everyone is expected to follow the discussion throughout the module.

3. Tests for Chapter Ohio

After you read the articles related to the State of Ohio that are provided, you will be required to complete a test to assess your understanding of the contents.

4. Movie/Video test

You will be assigned viewing one or more movies and/or videos and then complete a post-viewing test to assess your understanding of the contents.

\*5. Research proposal-final exam-1

It is a research proposal, which will be available during the university assigned final examination time (extended time).

Research proposal: The goal is to promote innovative thinking and encourage high impact research related to climate change and at the same time has significant domestic and global impacts by practicing “real world” research proposal drafting and discussion. It is required to write a research proposal by choosing one topic in climate change (such as extreme weather event, air pollution, or flood) in certain region that may have significant global climate and public health impacts, and propose a study design in human or in animal model with key components (title, background/introduction, hypothesis, design/methods, expected results, alternative approaches, novelty, public health significance, and references) in minimum 6 pages (single space, font 12; in addition to the references) in Word. The rubric for evaluating case studies will also be provided. Detailed instructions about it can be found in Carmen (Canvas).

\* 6. Multiple choice test-final exam-2

At the end of the course, you will be taking a multiple choice test.

\* The research proposal and multiple choice test (#5 and #6) are regarded as final examinations, which may be available before and during the university assigned final examination time (extended time).

Our quizzes and exams are open-book and open-notes. You may use any written materials, such as textbooks, printed handouts, homework assignments, or programs. Make-up exams will not be given except in case of a serious emergency for an extended time period since it has already provided some flexibility to the students. If so, you must contact the instructor before the event (or arrange for someone to do so) or as soon as possible. You must show evidence that you are physically unable to participate it, such as a clear and specific doctor's note mentioning the date, exam, and reason. Generally speaking, no make-ups will be granted for personal reasons such as travel, personal hardship, leisure, or to ease test week schedules, and no student will be permitted to take an exam beyond the scheduled and already-extended time period. The exceptions may be made at the instructor’s discretion.

Other additional assignments may also be announced.

**Grading Policy**

In order to receive credit for the course, participants are encouraged to complete as much as possible of the course activities with satisfactory responses. In order to provide students with flexibility to work through content and complete assignments, the course is organized by monthly modules. By giving students a month to complete the work, students can complete assignments as their schedule allows. Because you have the flexibility to work as your schedule allows no make-ups or extensions will be granted for any missed activity. Quality work is expected from all students. Assignments/activities are to be completed and turned in by the due dates as posted in Carmen. All assignment/activity due dates are also visible in the Syllabus section of your Carmen course. Some activities (such as self-checks) will be auto-graded and some activities (such as discussion participation) may be graded periodically or along with the finals.

Course activities are comprised of the following activities listed below and will be graded as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Activity | Number of questions | Points counted in overall | Note |
| Academic integrity | 1 | 1 | Must do. You will not be granted access to the remaining course content until you complete this task. |
| Lecture self-checks | 88 | 44 | 0.5 points/question |
| Question/discussion participation | 23 | 11 | 0.5 points/question (0.3 points for original post and 0.2 points for reply post; 22 questions counted) |
| Tests for Chapter Ohio | 10 | 10 | 1 point/question |
| Movie test | 10 | 5 | 0.5 points/question |
| Research proposal |  | 15 | Word document |
| Multiple choice exam | 30 | 15 | 0.5 points/question |
| Total |  | 100 |  |

Grading Structure

|  |  |
| --- | --- |
| Activity | Note |
| Question/discussion participation | 1. No less than 400 words  2. Must include at least one citation from a peer-reviewed scientific paper that is preferably indexed in PubMed |
| Research proposal | 1. No less than 6 pages  2. Must be hypothesis-driven, submitted as a Word document. The rubric for evaluation will be provided in Carmen |

**Grade scale**

Grading is done periodically and final grade will be determined via Carmen based on the overall performance and activity participation.

The table (right) shows as reference according to OSU Registrar’s office:[***https://registrar.osu.edu/policies/index.asp***](https://registrar.osu.edu/policies/index.asp)***.***

Grading scheme from A to E



**Attendance:** Your attendance is required and is based, at least in part, on your online activity and participation using Carmen. Student access to posted course modules and contents will be tracked to ensure there is ongoing access, activity, and productivity.

**Time Management**: University rules stipulate that a student can expect to spend a minimum of 3 hours per week on a course for each credit hour, thus for this 3 credit hour course you should expect to devote roughly 9 hours per week. Workload will vary from week to week, with some weeks having more assignments and others having more active learning time. This is intended as a rough guide to help you plan your time accordingly. In a typical week, you can expect your time to be spent as follows:

* 1 hour – viewing lectures
* 1 hour - completing online knowledge self-checks
* 4 hour - completing assigned reading and homework assignments, viewing movies assigned to this course. This also includes preparing for Case Report and Final Exam
* 3 hours - reviewing materials and interacting on discussion boards

**Carmen**

The lecture notes, additional reading materials, test materials and other notices will be available in Carmen site for the course. You will also use Carmen for other class activities, such as to participate question posting and discussion, quizzes, exams, and submitting case reports. Should you require additional services to use these technologies, please request accommodations with the instructor. HELP DESK call 614-688-HELP at any time if you have a technical problem involving Carmen. Support is available at this number 24/7.

**Office of Student Life: Disability Services**

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office of Student Life: Disability Services at 614-292-3307 in Room 098 Baker Hall 113 W. 12th Ave. to coordinate reasonable accommodations for students with documented disabilities (<http://slds.osu.edu/>).

**Mental Health Services**

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student’s ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life’s Counseling and Consultation Service (CCS) by visiting <https://ccs.osu.edu/> or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1- 800--273-TALK or at suicidepreventionlifeline.org.

**Academic integrity**

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the College of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University’s Code of Student Conduct and the School’s Student Handbook, and that all students will complete all academic and scholarly assignments with fairness and honesty. The Code of Student Conduct and other information on academic integrity and academic misconduct can be found at the COAM web pages (http://oaa.osu.edu/coam/home.html). Students must recognize that failure to follow the rules and guidelines established in the University’s Code of Student Conduct, the Student Handbook, and in the syllabi for their courses may constitute “Academic Misconduct.”

The Ohio State University’s Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: “Any activity that tends to compromise the academic integrity of the University, or subvert the educational process.” Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Please note that the use of material from the Internet without appropriate acknowledgement and complete citation is plagiarism just as it would be if the source were printed material. Further examples are found in the Student Handbook. Ignorance of the Code of Student Conduct and the Student Handbook is never considered an “excuse” for academic misconduct.

If I suspect a student of academic misconduct in a course, I am obligated by University Rules to report these suspicions to the University’s Committee on Academic Misconduct. If COAM determines that the student has violated the University’s Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact the instructor.

**Course Outline**

Note: please pay attention to the multiple changes in the start day and length for each module due to OSU holidays.

**Module 1:**

***Week 1:***

1. Introduction to Climate Change and Global Warming

This lecture will introduce some fundamental concepts, terminations, and related issues, such as global warming, greenhouse effects and Kyoto Protocol.

References: Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 1

Assignments: Carmen discussion participation and lecture self-check

2. Historical Overview of Climate Change Science and its Association with Health Issues

This lecture is to describe the fundamental nature of earth science, and the history of climate change science using a wide-ranging subset of examples and its association with health issues.

References: Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 1

Assignments: Carmen discussion participation and lecture self-check

***Week 2:***

3. Health Risks of Carbon Capture and Storage

This lecture will introduce the potential health risks of carbon capture and storage (CCS), which in theory would prevent carbon dioxide produced from coal-fired power plants from reaching the atmosphere.

References:

1. John Fogarty and Michael McCally. Health and Safety Risks of Carbon Capture and Storage. JAMA. 2010;303:67-68

2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 2-5

Assignments: Carmen discussion participation and lecture self-check

4. Public Health Benefits From Air Pollution Mitigation

This lecture is to introduce the public health benefits from the potential for cap and trade legislation to contribute to reductions in levels of greenhouse gases and other harmful air pollutants

References:

1. Christopher D. Barr; Francesca Dominici. Cap and Trade Legislation for Greenhouse Gas Emissions: Public Health Benefits From Air Pollution Mitigation. JAMA. 2010;303:69-70

2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 5-8

Assignments: Carmen discussion participation and lecture self-check

***Week 3:***

5. Health Impact of Climate Projections-Global

This lecture will introduce the health impact of climate change in a global level and pattern.

References: Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 9 & 10

Assignments: Carmen discussion participation and lecture self-check

6. Health Impact of Climate Projections- North America

This lecture will focus on the health impact of specific climate change projections in the US.

References:

1. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 11

2. Asbury et al. Hotspot of accelerated sea-level rise on the Atlantic coast of North America. Nature Climate Change. 2012; 2:884–888

Assignments: Carmen discussion participation and lecture self-check

***Week 4:***

7. Health Impact of Climate Projections- Other Regions

This lecture will summarize the health impact of specific climate change projections in other regions, such as Asia, Africa, Polar Regions and small islands.

References:

1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 5

2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: Chapter 9-11

3. What Climate Change Means for Alaska. EPA. August, 2016. https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ak.pdf

Assignments: Carmen discussion participation and lecture self-check

8. Climate Change, Politics, and Policy-making on Health Impact

This lecture will focus on political action about change in laws and regulations that relate to climate change, such as tax incentives, greenhouse gas emissions on human health impact.

References:

1. IPCC Fourth Assessment Report: Climate Change 2007: III, Chapter 13

2. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 11

3. The Politics of Climate. Pew Research Center. October, 2016. http://www.pewinternet.org/2016/10/04/the-politics-of-climate/

Assignments: Carmen discussion participation and lecture self-check

**Module 2:**

***Week 5:***

9. Health Effects: Infectious Diseases

This lecture will focus on major infectious diseases transmitted primarily via parasitic, bacteria or viruses, such as malaria, cholera, and Dengue hemorrhagic fever.

References:

1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 3, 4, & 5.

2. Climate Change And Infectious Diseases. WHO. http://www.who.int/globalchange/environment/en/chapter6.pdf

Assignments: Carmen discussion participation and lecture self-check

10. Health Effects: Non-infectious Disease

This lecture will focus on major non-infectious diseases, such as cardiovascular diseases and cancer.

References:

1. Jonathan A. Patz, et al. Impact of regional climate change on human health. Nature. 2005;438:310-317

2. Friel, et al. Climate Change, Noncommunicable Diseases, and Development: The Relationships and Common Policy Opportunities. Annu. Rev. Public Health 2011. 32:133–47

Assignments: Carmen discussion participation and lecture self-check

***Week 6:***

11. Health Effects: Impacts of Air Pollution

This lecture will focus primarily on the impact of fossil fuel and air quality on human health and diseases.

References:

1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 10.

2. Bernard, et al. The Potential Impacts of Climate Variability and Change on Air Pollution-Related Health Effects in the United States. Environ Health Perspect 109(suppl 2):199–209 (2001).

3. State of the Air. American Lung Association. 2017. http://www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-air-2017.pdf

Assignments: Carmen discussion participation and lecture self-check

12. Health Effects: Impacts of Temperature Changes

This lecture will focus on the role of the extreme change in temperature (heat or cold waves) on human health and disease development.

References:

1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 8 & 9.

2. McGeehin and Mirabelli. The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States. Environ Health Perspect 109(suppl 2):185–189 (2001).

3. van Marken Lichtenbelt, et al. Cold-activated brown adipose tissue in healthy men. N Engl J Med. 2009;360:1500-8

Assignments: Carmen discussion participation and lecture self-check

***Week 7:***

13. Health Effects: Impacts of Extreme Weather Events

This lecture will focus on the role of the extreme weather events (floods, landslides, storms, cyclones, and droughts) on human health and disease development.

References:

1. Greenough, et al. The Potential Impacts of Climate Variability and Change on Health Impacts of Extreme Weather Events in the United States. Environ Health Perspect 109(suppl 2):191–198 (2001).

2. Rose, et al. Climate Variability and Change in the United States: Potential Impacts on Waterand Foodborne Diseases Caused by Microbiologic Agents. Environ Health Perspect 109(suppl 2):211–221 (2001).

Assignments: Carmen discussion participation and lecture self-check

14. Health Effects: Changes in Food and Nutrition

This lecture will introduce the impact of changes in food-crop farming, livestock production, industrial crops, and global food trade and food security on human health.

References: Godber OF, Wall R. Livestock and food security: vulnerability to population growth and climate change. Glob Chang Biol. 2014;20:3092-102.

Assignments: Carmen discussion participation and lecture self-check

***Week 8:***

15. Health Effects: Cumulative Effects and Multiple Stresses

This lecture will introduce multiple environmental stresses from natural, managed, and socioeconomic systems on human health and disease development.

References:

1. IPCC. II. Chapter 8.

2. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 7

Assignments: Carmen discussion participation and lecture self-check

3. Patz, et al. When It Rains, It Pours: Future Climate Extremes and Health. Annals of Global Health 2014;80:332-344

16. Health Effects: Impacts on Vulnerable Populations

This lecture will focus on climate change on the health of some vulnerable populations, such as children, elderly, and people with certain disease conditions.

References:

1. Environmental Health Perspectives. 2007;115:A196-A203

2. Perera, Children Are Likely to Suffer Most from Our Fossil Fuel Addiction. Environ Health Perspect. 2008;116:987–990.

Assignments: Carmen discussion participation and lecture self-check

**Module 3:**

***Week 9:***

17.Latest updates about climate change and human health.

References:

a. Zhang, et al. Co-benefits of global, domestic, and sectoral greenhouse gas mitigation for US air quality and human health in 2050. Environ. Res. Lett. 2017.12:114033

b. Example of hypothesis-based research proposal

Assignments: Carmen discussion participation

18. Recent Developments and Next Steps in Climate Change and Human Health

This lecture will introduce possible strategies in partnership development, global collaboration, new assessment methodologies, the characterization of future conditions, and its impact on human diseases.

Reference: Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 6 & 11 and their supplements

Assignments:

1. Reading (required): Confronting Climate Change in the U.S. Midwest: Ohio. Union of Concerned Scientists. July 2009
2. Chapter Ohio Test (based on the required reading materials)

***Week 10:***

19. Significant Cases of Climate Change and Human Adaptation-1

This lecture will introduce historical cases about human adaptation to climate change, such as the abandonment of Viking settlements in Greenland.

Reference: Orlove. Human adaptation to climate change: a review of three historical cases and some general perspectives. Environmental Science & Policy 8 (2005) 589–600

Assignments: Carmen discussion participation and lecture self-check

20. Significant Cases of Climate Change and Human Adaptation-2

This lecture will introduce historical cases about human adaptation to climate change, such as the US dust bowl.

Reference: Orlove. Human adaptation to climate change: a review of three historical cases and some general perspectives. Environmental Science & Policy 8 (2005) 589–600

Assignments: Carmen discussion participation and lecture self-check

***Week 11:***

21. “An Inconvenient Truth”: Science, politics, and more

The movie of 2006 documentary film directed by Davis Guggenheim about former United States Vice President Al Gore's campaign to educate citizens about global warming via a comprehensive slide show will be viewed and debated.

Assignments:

1. Movie to watch (required): “An Inconvenient Truth”
2. Movie Test (based on the movie above)

22. Changing Planet: Past, Present, Future (Lecture 4)

This is the final lecture in a four-part lecture series. In this series, leading scientists Andrew H. Knoll of Harvard University, Naomi Oreskes of the University of California, San Diego, and Daniel P. Schrag of Harvard University guide us on an exciting exploration of the history of life on Earth and discuss present-day concerns about climate change. Lecture 4 can be accessed here http://media.hhmi.org/hl/12Lect4.html

Assignments:

1. Movie to watch (required): Changing Planet: Past, Present, Future (Lecture 4)
2. Multiple choice questions (based on the movie and the lecture above)

***Week 12:***

Journal club and case study- Ambient temperature exposure on human health and disease development

One representative, high impact paper will be introduced and summarized.

Assignments:

1. Readings (required): Cypess, et al. Identification and importance of brown adipose tissue in adult humans. N Engl J Med. 2009;360:1509-17.
2. Carmen discussion participation

**Module 4:**

***Week 13:***

Journal club and case study- Ambient air pollution exposure on human health and disease development

One representative, high impact paper will be introduced and summarized, and a list of questions will be posted so that the students can participate in the discussions.

Assignments:

1. Readings (required): Pope, et al. Fine-particulate air pollution and life expectancy in the United States. N Engl J Med. 2009;360:376-86.
2. Carmen discussion participation

***Week 14:***

Journal club and case study- Increased greenhouse gas on human health and disease development

One representative, high impact paper will be introduced and summarized, and a list of questions will be posted so that the students can participate in the discussions.

Assignments:

1. Readings (required): Maizlish, et al. Health cobenefits and transportation-related reductions in greenhouse gas emissions in the San Francisco Bay area. Am J Public Health. 2013;103:703-9.
2. Carmen discussion participation

***Week 15:*** Final examination preparation and exams

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Topics** | **Aligned Course**  **Learning**  **Objective** | **Aligned Foundational**  **Knowledge** | **Aligned**  **Public Health**  **Core Competencies** | **Aligned EHS Specialization**  **Competencies** | **Readings/**  **Other Assignments** | **Student Evaluation**  **Activity for Assessment** |
| 1 | 1. Introduction to Climate Change and Global Warming  2. Historical Overview of Climate Change Science and its Association with Health Issues | 1,2,3,4,5 | 4,5,6,7,8,9,10,11,12 | 1,6,7,12,14,15,20 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 1  2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 1 | 1. Carmen discussion participation  2. Lecture self-check |
| 2 | 3. Health Risks of Carbon Capture and Storage  4. Public Health Benefits From Air Pollution Mitigation | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. John Fogarty and Michael McCally. Health and Safety Risks of Carbon Capture and Storage. JAMA. 2010;303:67-68  2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 2-5  3. Christopher D. Barr; Francesca Dominici. Cap and Trade Legislation for Greenhouse Gas Emissions: Public Health Benefits From Air Pollution Mitigation. JAMA. 2010;303:69-70  4. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 5-8 | 1. Carmen discussion participation  2. Lecture self-check |
| 3 | 5. Health Impact of Climate Projections-Global  6. Health Impact of Climate Projections- North America | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 9 & 10  2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: 11  3. Asbury et al. Hotspot of accelerated sea-level rise on the Atlantic coast of North America. Nature Climate Change. 2012; 2:884–888 | 1. Carmen discussion participation  2. Lecture self-check |
| 4 | 7. Health Impact of Climate Projections- Other Regions  8. Climate Change, Politics, and Policy-making on Health Impact | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 5  2. Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007: Chapter 9-11  3. What Climate Change Means for Alaska. EPA. August, 2016. https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ak.pdf  4. IPCC Fourth Assessment Report: Climate Change 2007: III, Chapter 13  5. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 11  6. The Politics of Climate. Pew Research Center. October, 2016. http://www.pewinternet.org/2016/10/04/the-politics-of-climate/ | 1. Carmen discussion participation  2. Lecture self-check |
| 5 | 9. Health Effects: Infectious Diseases  10. Health Effects: Non-infectious Disease | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 3, 4, & 5.  2. Climate Change And Infectious Diseases. WHO. http://www.who.int/globalchange/environment/en/chapter6.pdf  3. Jonathan A. Patz, et al. Impact of regional climate change on human health. Nature. 2005;438:310-317  4. Friel, et al. Climate Change, Noncommunicable Diseases, and Development: The Relationships and Common Policy Opportunities. Annu. Rev. Public Health 2011. 32:133–47 | 1. Carmen discussion participation  2. Lecture self-check |
| 6 | 11. Health Effects: Impacts of Air Pollution  12. Health Effects: Impacts of Temperature Changes | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 10.  2. Bernard, et al. The Potential Impacts of Climate Variability and Change on Air Pollution-Related Health Effects in the United States. Environ Health Perspect 109(suppl 2):199–209 (2001).  3. State of the Air. American Lung Association. 2017. http://www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-air-2017.pdf  4. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 8 & 9.  5. McGeehin and Mirabelli. The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States. Environ Health Perspect 109(suppl 2):185–189 (2001).  6. van Marken Lichtenbelt, et al. Cold-activated brown adipose tissue in healthy men. N Engl J Med. 2009;360:1500-8 | 1. Carmen discussion participation  2. Lecture self-check |
| 7 | 13. Health Effects: Impacts of Extreme Weather Events  14. Health Effects: Changes in Food and Nutrition | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Greenough, et al. The Potential Impacts of Climate Variability and Change on Health Impacts of Extreme Weather Events in the United States. Environ Health Perspect 109(suppl 2):191–198 (2001).  2. Rose, et al. Climate Variability and Change in the United States: Potential Impacts on Waterand Foodborne Diseases Caused by Microbiologic Agents. Environ Health Perspect 109(suppl 2):211–221 (2001).  3. Godber OF, Wall R. Livestock and food security: vulnerability to population growth and climate change. Glob Chang Biol. 2014;20:3092-102. | 1. Carmen discussion participation  2. Lecture self-check |
| 8 | 15. Health Effects: Cumulative Effects and Multiple Stresses  16. Health Effects: Impacts on Vulnerable Populations | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. IPCC. II. Chapter 8.  2. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 7  Assignments: Carmen discussion participation and lecture self-check  3. Patz, et al. When It Rains, It Pours: Future Climate Extremes and Health. Annals of Global Health 2014;80:332-344  4. Environmental Health Perspectives. 2007;115:A196-A203  5. Perera, Children Are Likely to Suffer Most from Our Fossil Fuel Addiction. Environ Health Perspect. 2008;116:987–990. | 1. Carmen discussion participation  2. Lecture self-check |
| 9 | 17. Latest updates about climate change and human health.  18. Recent Developments and Next Steps in Climate Change and Human Health | 1,2,3,4,5 | 4,5,6,7,8,9,10,11,12 | 1,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Zhang, et al. Co-benefits of global, domestic, and sectoral greenhouse gas mitigation for US air quality and human health in 2050. Environ. Res. Lett. 2017.12:114033  2. Seasonal Forecasts, Climatic Change and Human Health. (2008) Edited by Madeleine C. Thomson, Ricardo Garcia-Herrera and Martin Beniston. Chapter 6 & 11 and their supplements | 1. Carmen discussion participation  2. Lecture self-check |
| 10 | 19. Significant Cases of Climate Change and Human Adaptation-1  20. Significant Cases of Climate Change and Human Adaptation-2 | 4,5 | 4,5,6,7,8,9,10,11,12 | 1,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | Orlove. Human adaptation to climate change: a review of three historical cases and some general perspectives. Environmental Science & Policy 8 (2005) 589–600 | 1. Carmen discussion participation  2. Lecture self-check |
| 11 | 21. “An Inconvenient Truth”: Science, politics, and more  22. Changing Planet: Past, Present, Future (Lecture 4) | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | 1. Movie: “An Inconvenient Truth”  2. Movie: Changing Planet: Past, Present, Future (Lecture 4) | Multiple choice test |
| 12 | Journal club and case study- Ambient temperature exposure on human health and disease development | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15,19,20,21 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | Cypess, et al. Identification and importance of brown adipose tissue in adult humans. N Engl J Med. 2009;360:1509-17. | Carmen discussion participation |
| 13 | Journal club and case study- Ambient air pollution exposure on human health and disease development | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15,19,20,21 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | Pope, et al. Fine-particulate air pollution and life expectancy in the United States. N Engl J Med. 2009;360:376-86. | Carmen discussion participation |
| 14 | Journal club and case study- Increased greenhouse gas on human health and disease development | 1,2,3,4,5 | 3,4,5,6,7,8,9,10,11,12 | 1,4,6,7,11,12,13,14,15,19,20,21 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | Maizlish, et al. Health cobenefits and transportation-related reductions in greenhouse gas emissions in the San Francisco Bay area. Am J Public Health. 2013;103:703-9. | Carmen discussion participation |
| 15 | Final exam | 1,2,4,5 | 3,4,5,6,7,8,9,10,11,12 | 4,6,7,12,13,14,,15,19,20 | MPH: 1,2,3,4,5,6,9  MS: 2,3,6,7,8  PhD: 2,6,7,8 | No | 1. Research proposal  2. Multiple choice test |