

# International Pollution Issues

Spring 2019

Tuesdays/Fridays, 11:10 AM to 12:25 PM – HN 1022

Undergraduate GEOG 33500-01

Graduate GEOG 71500-01

**Instructor:** Enrique Lanz Oca  
**Office:** HN1032  
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## Course Description:

This course explores the international trans-boundary pollution and contamination. The continuous technological advances such as transportation or genetic manipulation, the globalization of industrial processes, the rise of emergent countries known as B.R.I.C.S., and the massive human migrations around the world have made pollutants and contaminants can be transmitted through the borders in an unprecedented scale. From the West Nile Virus reaching the United States to Chinese mercury found in the Olympic-Mountain lakes through stagnant plastics in the Pacific Ocean, any pollutant and contaminant can reach any point in a planetary scale. We examine therefore the main international trans-boundary pollution sources with especial emphasis in the main industrial and urban centers, transport pathways such as oil/gas pipelines, maritime-shipping and aerial routes, and contamination events such as oil spills or nuclear-power plant accidents that impact beyond a country's borders. Finally, this course will discuss the current national and international legal instruments of cooperation such as the London Treaty about ocean dump or possible future international treaties such as a definite international Climate Change Pact to counteract degradation of the environment.

## Course Objectives:

1. This course is designed to introduce students to global implications of anthropogenic activities that lead to production of critical substances resulting in detrimental changes to our environment.
2. Students will study the actions taken by the international community and by international organizations to find appropriate ways for conciliating divergent interests of the major industrialized countries and the developing world.
3. Students will be guided in forming an independent study on environmental concerns at the international level to enhance students' perception of the important role of man's responsibility towards a sustainable future.

## Expected Learning Outcomes:

### **A. Course-Specific Learning Outcomes:**

Students taking this course will be able to...

1. Think critically about the complexities of the planet Earth, especially the intersections between physical and human phenomena.
2. Analyze the planet as a complex structure and be able to comprehend the ways in which students' immediate environments are connected to both the local and distant ecologies.
3. Examine preconceived notions about boundaries of all sorts, including social, political, and geographical ones. Consider the social construction of divisions between humans and non-humans. These processes will be assessed through their participation in class discussion, essays, and Blackboard responses.

## **B. General Education Learning Outcomes:**

1. Communication Skills Students will be able to write, read, listen and speak critically and effectively. Students' ability to speak and listen effectively will be assessed through their participation in class discussions. Their ability to read critically will be assessed by their comments on course readings. Writing skills will be assessed through essays as well as regular responses on Blackboard covering lectures, readings, and class discussions.
2. Scientific Reasoning and Social and Behavioral Sciences- Students will be able to apply the concepts and methods of the natural and social sciences. Students' ability to apply concepts and methods of sciences will be measured via class discussions, essays, and responses on Blackboard.
3. Information & Technology Literacy- Students will be able to collect, evaluate and interpret information and effectively use information technologies.
4. Values- Students will be able to make informed choices based on an understanding of personal values, human diversity, multicultural awareness and social responsibility.

### **Readings:**

There will be no textbook. The course will include assigned materials that are available through articles, texts, chapters, films, and audios. These materials are available in the section "Course Materials" on Blackboard. Where indicated on the syllabus, materials will be found online.

### **Assignments:**

Depending on your status as undergraduate or graduate, you will be expected to complete the following assignments:

#### **Undergraduate Students**

1. Final research paper
  - a. 10 pages
  - b. at least 5 references
2. Research paper proposal (2 pages)
3. Oral presentation of your research paper (5 minutes)
4. Mid-Term exam: Required
5. Final exam: Required

#### **Graduate Students**

1. Final research paper
  - a. between 15 and 20 pages
  - b. at least 10 references
2. Research paper proposal (3 pages)
3. Abstract of the research paper:  
Extra-credit (250 words plus keywords)
4. Oral presentation of your research paper (5-10 minutes)
5. Mid-Term exam: Required
6. Final exam: Required
7. Meetings outside the class (required at least once)

### **Evaluation:**

#### **1. Undergraduate student grades will be based upon the following:**

	<b>Percentage of Final Grade</b>
Research paper proposal	15%
Final Research Paper	35%
Oral Presentation of your research paper	5%
Mid-term exam	20%
Final exam	20%
Participation in discussion of assigned materials	5%

#### **2. Graduate student grades will be based upon the following:**

	<b>Percentage of Final Grade</b>
Research paper proposal	15%
Final Research Paper	40%

Oral Presentation of your research paper	10%
Mid-term exam	15%
Final exam	15%
Participation in discussion of assigned readings	5%
Abstract of the research paper	(extra-credit 5%)

**Final letter grades will be assigned based on the CUNY grading policy that can be found in the online undergraduate catalog available at: <http://catalog.hunter.cuny.edu/>.**

These assignments are described in detail in “Assignments Description” located in “Course Materials” on Blackboard.

**Final letter grades will be assigned based on the CUNY grading policy that can be found in the online undergraduate catalog available at: <http://catalog.hunter.cuny.edu/>.**

**Course Policies:**

**Attendance:**

I will take attendance at every class meeting. You should arrive in class on time and stay for the entire session. If you will miss class for any reason, you should discuss this with me ahead of time. You are responsible for any material you may miss. You are allowed five hours of absence, not five days. A low attendance could determine the distinction between an “F” or “WU” grade. Finally, tardiness generates constant interruptions of the class. Continuous tardiness could generate a reduction of points for the final grade. **DO NOT BE LATE TO CLASS.**

**Incompletes:**

I do not give incompletes (IN) except under the most extraordinary and documented medical emergencies. No late assignments will be accepted. Without a valid medical excuse, you will receive a grade of zero (0) on any assignment missed. If, for a valid medical emergency, you do miss an assignment, you must contact me within 48 hours of the missed assignment and present acceptable documentary evidence for your absence. At the time of the request, you must also complete a Contract to Resolve an Incomplete Grade in consultation with me. We will agree on what needs to be completed and when it will be due and, if you meet the mutually agreed upon conditions, your course grade will be recomputed and a new grade, if appropriate, will be submitted. I will allow only one semester in which you can resolve the IN/FIN. After that time no request will be considered. The contract form is available in the Department of Geography office, HN 1006, during normal business hours or in OneStop on the 2<sup>nd</sup> floor of the North Building.

To receive a CR/NC you must have completed all course requirements and have requested the CR/NC option no later than the last scheduled lecture. That means all written assignments, quizzes, exams (including the final exam) must have been completed. If you choose this option, then all grades above 70% will be assigned CR and 69.9% and below will be assigned NC unless you choose the assign D option for grades between 60 and 69.9. Finally, CR/CN is only available to undergraduate students. More information is available at <http://www.hunter.cuny.edu/advising/how-to/file-credit-no-credit-cr-nc>.

**Classroom Electronics Use:**

I permit the use of laptops and tablets **ONLY** for the purpose of taking notes during lecture and discussion. All other personal electronics should be turned off or set to silent before entering the classroom. Absolutely no texting is allowed during class. Any use of electronics beyond their permitted use is a disruption to the class and will be treated accordingly.

**Hunter College Policy on Academic Integrity:**

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures. Plagiarism, dishonesty, or cheating in any portion of the work required for this course will be punished to the full extent allowed according to Hunter College.

Being in college requires discipline, collegiality, and overall honesty. Although knowledge is an accumulation of ideas from different people and epochs that you can use, you have to do so under certain conditions. If you are going to use another's ideas you have to identify their names and works. If you don't, it is called 'plagiarism,' and that is illegal. Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations, require citations of the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism. Students who are unsure how and when to provide documentation are advised to consult with their instructors.

### **ADA Policy:**

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1124, to secure necessary academic accommodations. For further information and assistance, please call: (212- 772-4857)TTY or (212-650-3230).

Students requiring special consideration during the exams must make arrangements with the Office of Accessibility and tell your instructor of the arrangements.

### **Hunter College Policy on Sexual Misconduct:**

"In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

- a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444).
- b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose ([jtrose@hunter.cuny.edu](mailto:jtrose@hunter.cuny.edu) or 212-650-3262) or Colleen Barry ([colleen.barry@hunter.cuny.edu](mailto:colleen.barry@hunter.cuny.edu) or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.

CUNY Policy on Sexual Misconduct Link: <http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links-pdf>

### **Schedule of Topics and Assignments\***

\*Except for changes that substantially affect implementation of the evaluation statement, this syllabus is a guide for the course and is subject to revision by the instructor. Any changes will be announced in advance.

## **Course Contents and Calendar:**

### **Week 1:**

#### **January 25<sup>th</sup> (Friday): Introduction**

1. Introduction to the course and description of the syllabus
2. Science and the Scientific Method
3. What is Pollution?
4. Understanding Transboundary Pollution

#### **Required Materials:**

- Bradford, Alina (2015). "Science & the Scientific Method: A Definition." *Livescience* (March 30). Available at <http://www.livescience.com/20896-science-scientific-method.html>
- Environmental Encyclopedia (2003). "Transboundary Pollution." Available at <https://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/transboundary-pollution>
- European Environmental Agency (2018). "Pollution." Available at <https://www.eea.europa.eu/archived/archived-content-water-topic/wise-help-centre/glossary-definitions/pollution>
- Urbina, Ian (2008). "Growing Pains for a Deep-Sea Home Built of Subway Cars." *The New York Times* (April 8). Available at [http://www.nytimes.com/2008/04/08/us/08reef.html?\\_r=0](http://www.nytimes.com/2008/04/08/us/08reef.html?_r=0)

## **PART I: Atmosphere and Pollution**

### **Week 2: Earth's Atmosphere:**

#### **January 29<sup>th</sup> (Tuesday):**

1. Structure and Composition
2. Solar Energy and the Earth
3. Atmospheric Pressure Systems
4. Air Masses and the Atmospheric Circulation

#### **Required Materials:**

- Bergman, Edward F. and Rennick, William H. Chapter 2: "Weather and Climate" (pages 45-66) in *Introduction to Geography: Peoples, Places, and Environment*
- McKnight, Tom L. Chapter 3: "Introduction to the Atmosphere" (pages 59-65) in *Physical Geography*

#### **February 1<sup>st</sup> (Friday): Atmospheric Pollution 1**

1. Smog: Smoke + Fog  
Cases studied: Donora, London, New York, and Beijing
2. Acid Deposition (rain and snow)
3. The Ozone Layer and Its Depletion

#### **Required Materials:**

- Dahlman, Carl T. and Renwick, William H. (2014). Chapter 5, "Earth's Resources and Environmental Protection" (read pages 187-191) in *Introduction to Geography*
- Met Office (2018). "The Great Smog of 1952." Available at <https://www.metoffice.gov.uk/learning/learn-about-the-weather/weather-phenomena/case-studies/great-smog>
- The New York Times* (2018). "In a High-Stakes Environmental Whodunit, Many Clues Point to China." Available at <https://www.nytimes.com/2018/06/24/world/asia/china-ozone-cfc.html>
- Union of Concerned Scientists (n. d.). "Is There a Connection Between the Ozone Hole and Global Warming?" Available at [https://www.ucsusa.org/global-warming/science-and-impacts/science/ozone-hole-and-gw-faq.html#.W0PK\\_K2ZOGQ](https://www.ucsusa.org/global-warming/science-and-impacts/science/ozone-hole-and-gw-faq.html#.W0PK_K2ZOGQ)

### **Week 3: Atmosphere and Pollution 2:**

#### **February 5<sup>th</sup> (Tuesday):**

1. Wildfires

2. Volcanic Eruptions

3. Aerosols

Required Materials:

-British Geological Service (2016). "Eyjafjallajökull eruption, Iceland | April/May 2010."

Available at [http://www.bgs.ac.uk/research/volcanoes/icelandic\\_ash.html](http://www.bgs.ac.uk/research/volcanoes/icelandic_ash.html)

-Casazza, Marco; Lega, Massimo; Liu, Gengyuan; Ulgiati, Sergio; and Endreny, Theodore (2018). "Aerosol pollution, including eroded soils, intensifies cloud growth, precipitation, and soil erosion: A review." *Journal of Cleaner Production*, Volume 189, 10 July 2018, Pages 135-144. <https://doi.org/10.1016/j.jclepro.2018.04.004>.

-Chapter 16, "Wild Fires."

-*The New York Times*. "Where the Fires Are Spreading in Southern California." Available at

<https://www.nytimes.com/interactive/2017/12/06/us/southern-california-wildfires.html>

**PART II: Hydrosphere and Pollution**

**February 8<sup>th</sup> (Friday): The Hydrosphere**

1. The Water or Hydrological Cycle

2. Planetary Water Distribution

3. Surface Waters: Oceans, Rivers, Lakes, and Ice

4. Underground Water (aquifers)

Required Materials:

-McKnight, Tom L. (1996). Chapter 9, "The Hydrosphere" in *Physical Geography* (5<sup>th</sup> edition)

**Week 4:**

**February 12<sup>th</sup> (Tuesday): NO CLASS**

**February 15<sup>th</sup> (Friday): Oceans and Pollution 1:**

1. Plastics, Microplastics, and the Ocean

2. Sargassum and Algae Invasion

3. The Law of the Sea (UNCLOS) and International Dumping

Required Materials:

-Browne, Mark Anthony, Crump, Phillip, Niven, Stewart, Teuten, Emma, Tonkin, Andrew, Galloway, Tamara, and Thompson, Richard (2006). "Accumulation of Microplastic on Shorelines Worldwide: Sources and Sinks." *Environmental Assessment & Management* 13 (3): 466-69. Doi:10.1002/ieam.1916

-Hoagland, P. and Schumacher, M.E. (2001). "Law of the Sea." *Encyclopedia of Ocean Sciences* (Second Edition). Available at <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/law-of-the-sea>

-Hu, Chuanmin, Brock Murch, Brian B. Barnes, Mengqiu Wang, Jean-Philippe Maréchal, James Franks, Donald Johnson, Brian Lapointe, Deborah S. Goodwin, Jeffrey M. Schell, and Amy N. S. Siuda (2016). "Sargassum watch warns of incoming seaweed." *Earth and Space Science news (Eos)* (Sept. 6)

-Napper, Imogen E. and Richard C. Thompson (2016). "Release of Synthetic Microplastic Fibres from Domestic Washing Machines: Effects of Fabric Type and Washing Conditions." *Marine Pollution Bulletin* 112, no. 1-2 (September 14)

**Week 5:**

**February 19<sup>th</sup> (Tuesday): Oceans and Pollution 2:**

1. Oil Spills

2. The New Arctic Exploitation and Pollution

Required Materials:

-Chang, Stephanie E. et al. (2014). "Consequences of oil spills: a review and framework for

informing planning.” *Ecology and Society* 19 (2): 26. <http://dx.doi.org/10.5751/ES-06406-190226>.

Available at <https://www.ecologyandsociety.org/vol19/iss2/art26/>

- Hamilos, Paul (2013). “Spanish government cleared of blame for Prestige oil tanker disaster” *The Guardian* (Nov. 13). Available at <https://www.theguardian.com/world/2013/nov/13/spanish-prestige-oil-tanker-disaster>
- Kaushik, Mohit (2018). “Major Oil Spills of the Maritime World.” *Marine Environment* (March 26). Available at <https://www.marineinsight.com/author/mohitk/>
- National Geographic (2016). “In the Arctic’s Cold Rush, There Are No Easy Profits.” Available at <https://www.nationalgeographic.com/magazine/2016/03/new-arctic-thawing-rapidly-circle-work-oil/>

### **February 22<sup>nd</sup> (Friday): Oceans and Pollution 3:**

1. Submarine Mining
2. Acidification
3. Coral Bleaching

#### Required Materials:

- Fabry, Victoria J., Seibel, Brad A., Feely, Richard A., and Orr, James C. (2008). “Impacts of Ocean Acidification on Marine Fauna and Ecosystem Processes.” *ICES Journal of marine Science*, Volume 65, Issue 3, 1 April 2008, Pages 414 – 432 <https://doi.org/10.1093/icesjms/fsn048>
- Hughes, Terry P. et al. (2018). “Global warming transforms coral reef assemblages.” *Nature*, Volume 556, pages: 492-496
- The International Union for Conservation of Nature (IUCN)* (2018). “Deep-Sea Mining.” Available at <https://www.iucn.org/resources/issues-briefs/deep-sea-mining>

### **Week 6:**

#### **February 26<sup>th</sup> (Tuesday): Rivers and Lakes Pollution**

1. Transboundary Watersheds
2. Convention on the Law of the Non-Navigational Uses of International Watercourses (1997)
3. Water Transfers

#### Required Materials:

- United Nations (1997). “Convention on the Law of the Non-Navigational Uses of International Watercourses. UN International Law Commission. Available at [http://legal.un.org/ilc/texts/instruments/english/conventions/8\\_3\\_1997.pdf](http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf)
- U.S. EPA (2015). “What is a Watershed?” Available at <http://water.epa.gov/type/watersheds/whatis.cfm>
- Water-technology.wet (2015). “GMR (Great Man-Made River) Water Supply Project, Libya.” Available at <http://www.water-technology.net/projects/gmr/>
- WWF (2015). “Water Transfers between River Basins.” Available at [http://wwf.panda.org/about\\_our\\_earth/about\\_freshwater/freshwater\\_problems/infrastructure/water\\_transfers/](http://wwf.panda.org/about_our_earth/about_freshwater/freshwater_problems/infrastructure/water_transfers/)

### **March 1<sup>st</sup> (Friday):**

1. Transboundary Conflicts
2. Transboundary River Pollution
  - Cases: a. The Rhine River
  - b. The Tijuana River
3. The Aral Sea Disaster

#### Required Materials:

- Columbia University (2008). “Aral Sea Crisis.” Available at <http://www.columbia.edu/~tmt2120/introduction.htm>

- Tory, Sarah (2018). "Two countries, one border and their shared pollution." *High Country News* (Dec. 8). Available at <https://www.hcn.org/articles/pollution-two-countries-one-border-and-their-shared-pollution>
- Verweij, Marco (2017). "The remarkable restoration of the Rhine: plural rationalities in regional water politics." *Journal Water International*, Volume 42, Issue 2: Transboundary River Cooperation: Actors, Strategies and Impact. <https://doi.org/10.1080/02508060.2017.1278576>

### **Part III: Climate Change**

#### **Week 7:**

#### **March 5<sup>th</sup> (Tuesday):**

1. What is *that* so-called Climate Change, Global Warming, and Greenhouse Effect?
2. Causes of Climate Change
3. *Trumpism* and the "Chinese Hoax"

#### **-RESEARCH PAPER PROPOSAL**

#### **Required Materials:**

a. For Climate and Global Warming its main causes, see:

-Chapter 2, "Weather, Climate, and Climate Change"

b. For Greenhouse effect, see:

-Chapter 2, page 55

c. For Trumpism and the "Chinese Hoax", see:

-Won, Edward (2016). "Trump Has Called Climate Change a Chinese Hoax. Beijing Says It Is Anything But." *The New York Times* (Nov. 18). Available at <https://www.nytimes.com/2016/11/19/world/asia/china-trump-climate-change.html>

#### **Further materials:**

-Suzanne (2015). "Exxon knew of climate change in 1981, email says – but it funded deniers for 27 more years" *The Guardian* (July 8). Available at <https://www.theguardian.com/environment/2015/jul/08/exxon-climate-change-1981-climate-denier-funding>

#### **March 8<sup>th</sup> (Friday): Some Known Consequences of Climate Change**

1. Sea Level Rise
2. Heat, Drought, Floods, and Hunger
3. Climate Change/Environmental Refugees

#### **Required materials:**

a. For Sea level rise in general, see:

-NOAA (2017). "Climate Change: Global Sea Level." Available at

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>

b. For Heat, Drought, and Climate Change Refugees:

-Vidal, John (2017). "From heatwaves to hurricanes, floods to famine: seven climate change hotspots." *The Guardian*. Available at

<https://www.theguardian.com/environment/2017/jun/23/from-heatwaves-to-hurricanes-floods-to-famine-seven-climate-change-hotspots>

#### **Further materials:**

-Goodell, Jeff (2017). "Rotterdam has learned to cope with rising seas. Here's how." Available at <https://www.vox.com/energy-and-environment/2017/11/15/16651460/rotterdam-climate-change-sea-level-rise>

### **Part IV: Energy Sources and Pollution**

#### **Week 8: Nuclear Energy**

#### **March 12<sup>th</sup> (Tuesday): Nuclear Energy**

1. What is Nuclear Energy?

2. Fission and Fusion
3. Nuclear landscape: uranium mining/enriching, reactor, and deposit

#### Required Materials

- Reisser, Wesley and Reisser, Colin (2019). Chapter 6, “Nuclear Power” in *Energy Resources: From Science to Society*
- “Nuclear Reactor - Understanding how it works” (video). Available at <https://www.youtube.com/watch?v=1U6Nzcv9Vws>

#### **March 15<sup>th</sup> (Friday): Nuclear Pollution**

1. Radioactivity
2. Nuclear Residual Materials
3. Ocean Dumping Events and Transportation
3. Nuclear reactor Accidents  
Case: Three Mile Island, Chernobyl, and Fukushima

#### Required Materials:

- Calmet, Dominique P. (1989). “Ocena Disposal of radioactive Waste: Status Report.” Available at <https://www.iaea.org/sites/default/files/31404684750.pdf>
- Lallanilla, March (2013). “Chernobyl: Facts About the Nuclear Disaster.” *Livescience* (Sept. 25). Available at <http://www.livescience.com/39961-chernobyl.html>
- Reisser, Wesley and Reisser, Colin (2019). Chapter 6, “Nuclear Power” in *Energy Resources: From Science to Society*

#### **Week 9: Coal and Pollution 1:**

##### **March 19<sup>th</sup> (Tuesday):**

1. Geological Formation
2. Types of Coal
3. Mining, Transportation, Production, and Consumption

#### Required materials:

- Reisser, Wesley and Reisser, Colin (2019). Chapter 3, “Coal” in *Energy Resources: From Science to Society*

##### **March 22<sup>nd</sup> (Friday): Coal and Pollution 2**

1. Coal and Pollution
2. Coal and the Trans-border Pollution

#### Required Materials:

- Berkes, Howard (2018). “An Epidemic Is Killing Thousands Of Coal Miners. Regulators Could Have Stopped It.” *NPR* (December 18) (also audio). Available at <https://www.npr.org/2018/12/18/675253856/an-epidemic-is-killing-thousands-of-coal-miners-regulators-could-have-stopped-it>
- Scientific American* (2017, Jun. 7). “The Other Reason to Shift away from Coal: Air Pollution That Kills Thousands Every Year.” Available at <https://www.scientificamerican.com/article/the-other-reason-to-shift-away-from-coal-air-pollution-that-kills-thousands-every-year/>
- Wong, Edward (2014). “China Exports Pollution to U.S., Study Finds.” *The New York Times* (Jan. 20). Available at <https://www.nytimes.com/2014/01/21/world/asia/china-also-exports-pollution-to-western-us-study-finds.html>

#### **Week 10:**

##### **March 26<sup>th</sup> (Tuesday): Review of the Research Paper Progress and the Mid-Term Exam**

##### **March 29<sup>th</sup> (Friday): MID-TERM EXAM**

## **Week 11: Oil-Tar Sand, Hydraulic Fracturing, and Mining**

### **April 2<sup>nd</sup> (Tuesday): Petroleum and Natural Gas**

1. Geological Formation
2. Extraction, Transportation, Refining, and Consumption

#### Required Materials:

-Reisser, Wesley and Reisser, Colin (2019). Chapters 4 and 5, “Oil” and “Natural Gas.” in *Energy Resources: From Science to Society*

### **April 5<sup>th</sup> (Friday): Petroleum, Natural Gas, and Pollution**

1. The Canadian Oil-Tar Sand
2. Hydraulic Fracturing (Fracking)
3. Trans-Border Oil Transportation: pipelines and trains

#### Required Materials:

- Al-Jazeera (n.d.). “To the Last Drop: Canada’s Dirty Oil Sands.” Available online at <http://www.capp.ca/canadian-oil-and-natural-gas/oil-sands/what-are-oil-sands>
- Brown, Matthew (2018). “US miscalculated benefits of oil train brakes” AP (December 20).
- Canadian Association of Petroleum Producers (2015). “What are the oil sands?” Available at <http://www.capp.ca/canadian-oil-and-natural-gas/oil-sands/what-are-oil-sands>
- Smith, Mitch and Bosman, Julie (2017). “Keystone Pipeline leaks 210,000 gallons of oil in South Dakota.” *The New York Times* (Nov. 16). Available at <https://www.nytimes.com/2017/11/16/us/keystone-pipeline-leaks-south-dakota.html>
- U.S. Environmental Protection Agency (EPA) (2015). “Assessments of the Potential Impacts of the Hydraulic Fracturing for Oil and Gas on Drinking Water Resources. Executive Summary (June). Available on EPA: “Fracking has no broad impact on drinking water” (US Today June 2015) at <http://www.usatoday.com/story/news/2015/06/04/fracking-epa-drinking-water/28510779/>

## **Week 12: Genetics, Pollution/Contamination and Borders**

### **April 9<sup>th</sup> (Tuesday):**

1. What is the Biosphere?
2. Planetary Biochemical Cycles:
  - a. Flow of Energy and Matter
  - b. Water, Carbon, Oxygen, and Nitrogen
3. Ecosystems and Biomes

#### Required Materials:

- Chapter 10, “Cycles and Patterns in the Biosphere”
- Chapter 11, “Terrestrial Flora and Fauna” in *Physical Geography* by Tom L. McKnight

### **April 12<sup>th</sup> (Friday): Ecosystems, Genetics, and Invasive Species**

1. Genetic Modified Organisms (GMOs)
2. Invasive Species

#### Required Materials:

- Democracy Now* (2010, Sept. 17). “Percy Schmeiser vs Monsanto: The Story of a Canadian Farmer's Fight to Defend the Rights of Farmers and the Future of Seeds.” Available at [https://www.democracynow.org/2010/9/17/percy\\_schmeiser\\_vs\\_monsanto\\_the\\_story](https://www.democracynow.org/2010/9/17/percy_schmeiser_vs_monsanto_the_story)
- DiBacco, Claudio et al. (2012). “Ballast water transport of non-indigenous zooplankton to Canadian ports.” *ICES Journal of Marine Science*, 69(3), 483 – 491. doi:10.1093/icesjms/fsr133. Available online
- Gallegos, Jenna (2017). “GMO salmon caught in U.S. regulatory net, but Canadians have eaten 5 tons.” *The Washington Post* (August 4). Available at [https://www.washingtonpost.com/news/speaking-of-science/wp/2017/08/04/gmo-salmon-caught-in-u-s-regulatory-net-but-canadians-have-eaten-5-tons/?utm\\_term=.1695ac7c0ebc](https://www.washingtonpost.com/news/speaking-of-science/wp/2017/08/04/gmo-salmon-caught-in-u-s-regulatory-net-but-canadians-have-eaten-5-tons/?utm_term=.1695ac7c0ebc)

-U.S. Environmental Protection Agency (EPA) (2018). "Predicting Invasive Species in the Great Lakes." Available online at [http://www.epa.gov/research/gems/scinews\\_great\\_lakes.htm](http://www.epa.gov/research/gems/scinews_great_lakes.htm)

### **Week 13:**

#### **April 16<sup>th</sup> (Tuesday): International Pollution and Transportation**

1. Airplane Traffic
2. Shipping Transportation

#### **FINAL RESEARCH PAPER DUE**

#### **Required Materials:**

- Clear Seas (2018). "Air Pollution and Marine Shipping." Available at <https://clearseas.org/en/air-pollution/>
- IATA (2013). "Airlines Expect 31% Rise in Passenger Demand by 2017." Available online at <http://www.iata.org/pressroom/pr/pages/2013-12-10-01.aspx>
- Inman, Mason (2010). "Plane Exhaust Kills More People Than Plane Crashes." *National Geographic* (October 10). Available at <http://news.nationalgeographic.com/news/2010/10/101005-planes-pollution-deaths-science-environment/>
- Mann, Adam (2010). "Space tourism to accelerate climate change." *Nature* (October 22) Available at <http://www.nature.com/news/2010/101022/full/news.2010.558.html>
- Vidal, John (2009). "Health risks of shipping pollution have been 'underestimated'." *The Guardian* (Thursday 9 April). Available at <http://www.theguardian.com/environment/2009/apr/09/shipping-pollution>

#### **April 19<sup>th</sup> (Friday): NO CLASS SPRING RECESS**

### **Week 14:**

#### **April 23<sup>rd</sup> (Tuesday): NO CLASS SPRING RECESS**

#### **April 26<sup>th</sup> (Friday): NO CLASS SPRING RECESS**

### **Week 15: Garbage**

#### **April 30<sup>th</sup> (Tuesday):**

1. What is Garbage?
2. Treatment methods: Landfills, incineration, and recycling
3. The Freshkills Landfill Project/Park

#### **Required Materials:**

- Burford, Melanie and Moyer, Greg (2014). "Living City | Where Does Our Trash Go?" *The New York Times* (Sep. 25<sup>th</sup>, 2014) (Video). Available at <http://www.nytimes.com/video/nyregion/100000003131953/where-does-our-trash-go.html>
- The Freshkills Alliance (n.d.). "Freshkills Park." Available at <http://freshkillspark.org/>

#### **May 3<sup>rd</sup> (Friday): Trans-Border Garbage**

1. Trans-Border Garbage
2. Importing Trash and Electricity: Sweden
2. Ship Breakers: Bangladesh
3. E-Waste
4. *Cloud* garbage: Virus, spams, and Trojans

#### **Required Materials:**

- Chen, Thomas and Robert, Jean-Marc (2004). "The Evolution of Viruses and Worms." Chapter from *Statistical Methods in Computer Security*. Available online at <http://vxheaven.org/lib/atc01.html>
- Greenpeace (2009). "Where does e-waste end up?" Available at

<http://www.greenpeace.org/international/en/campaigns/detox/electronics/the-e-waste-problem/where-does-e-waste-end-up/>

- McVeigh, Karen (2018). "Huge rise in US plastic waste shipments to poor countries following China ban." *The Guardian* (Oct. 5). Available at <https://www.theguardian.com/global-development/2018/oct/05/huge-rise-us-plastic-waste-shipments-to-poor-countries-china-ban-thailand-malaysia-vietnam>
- NPR Radio* (Dec. 21, 2010) "After Dump, What Happens to Electronic Waste?" Available at <http://www.npr.org/2010/12/21/132204954/after-dump-what-happens-to-electronic-waste>
- Ross, Alice (2018). "UK Household Plastics Found in Illegal Dumps in Malaysia." *Unearthed* (Oct. 21). Available at <https://unearthed.greenpeace.org/2018/10/21/uk-household-plastics-found-in-illegal-dumps-in-malaysia/>

## **Week 16: Virtual Pollution**

### **May 7<sup>th</sup> (Tuesday):**

1. Noise
2. Magnetic fields
3. Light
4. Thermal
5. Space; satellite junk and the Nemo Point's garbage

#### **Required Materials:**

- Moser, Dave (2017). "A Spacecraft Graveyard Exists in the Middle of the Ocean-here's what's down there." *Business Insider* (Oct. 22). Available at <https://www.businessinsider.com/spacecraft-cemetery-point-nemo-google-maps-2017-10>
- International Dark-Sky Association (2018). "Light Pollution." Available at <https://www.darksky.org/light-pollution/>
- NASA (2013). "Space Debris and Human Spacecraft." Available online at [http://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](http://www.nasa.gov/mission_pages/station/news/orbital_debris.html)
- "Noise Pollution" US Environmental Protection Agency (2015). Available at <http://www.epa.gov/air/noise.html>
- The Encyclopedia of Earth (2010). "Thermal Pollution." Available at <http://www.eoearth.org/view/article/156599/>
- World Health Organization* (2015). "Electromagnetic Fields." Available at <http://www.who.int/peh-emf/about/WhatisEMF/en/index1.html>

#### **Further Materials:**

- "Light Pollution Map." Available at <http://www.lightpollutionmap.info/#zoom=4&lat=5759860&lon=1619364&layers=B0TFFFFT>
- "The Last Quiet Places: Silence and the Presence of Everything" in *On Being* by Gordon Hempton (audio-interview). Available at <https://onbeing.org/programs/gordon-hempton-the-last-quiet-places-silence-and-the-presence-of-everything/>

### **May 10<sup>th</sup> (Friday):**

#### **-PRESENTATIONS 1**

## **Week 17:**

### **May 14<sup>th</sup> (Tuesday):**

#### **-PRESENTATIONS 2**

- Review of the Final Exam

### **May 17<sup>th</sup> (Friday): FINAL EXAM**