Risk Analysis & Environmental Management

OIDD-761 / Fall 2021
Monday and Wednesday 10:15am – 11:45am EST
SHDH 215

Instructor: Dr. Carolyn Kousky
Office hours: Tuesday 3:00 – 4:00pm at 217 St. Leonard's Court or Zoom (sign up on Canvas calendar for a 15 min slot)

TA: Ella Schuster

Course Email: oidd761@gmail.com

- All questions about the course, including assignments, should be sent to the course email address. Please do not email the instructor or TA at their personal address for course-related questions or comments.

Course Description

This course will introduce students to concepts in risk governance. We will delve into the three pillars of risk analysis: risk assessment, risk management, and risk communication. The course will spend time on risk financing, including insurance markets. There will be particular emphasis on climate risks, although the course will also discuss several other examples, including pandemics, biodiversity loss, and systemic risks, among others. The course will cover how people perceive risks and the impact this has on risk communication and management. We will explore public policy surrounding risk management and how the public and private sectors can successfully work together to build resilience, particularly to changing risks.

Course Grading

Weekly quizzes	20%
Weekly discussion posts	20%
Mid-term	25%
Final group project	35%

Assignments

Readings: Each day has required readings. You should finish the readings before the scheduled class day on which they are listed. Material from the readings may be necessary for completing online discussion assignments or for the weekly quizzes.

Weekly Quizzes: Each week (with a couple exceptions) there will be a mandatory online quiz. Each weekly quiz needs to be taken sometime between the end of class on Wednesday and Friday at noon. Each quiz will be available on Canvas for this time period. Each quiz will be approximately 3 - 5 questions and will draw on the lectures and readings of the week. To

succeed on the quizzes, you must do the readings and attend the lectures. Quizzes are open-note but they do have a time limit—if you have to look up every answer, you will not have time to finish. You are not to share quiz questions with other students in the course after you take the quiz. Students will not have the option to take quizzes late or to make-up missed quizzes. Your lowest quiz grade will be dropped from your final grade.

Weekly discussion postings: Students will be broken into groups for online discussions. Each week, a discussion prompt will be posted on Monday. Students should respond to the prompt sometime before the end of the day Friday. Students should also respond to at least 2 other posts of classmates. Students will be graded on both their participation in the discussion (responding to the prompt and responding to at least 2 classmate responses) *and* will be graded on the thoughtfulness of their responses. Responses to the prompt and to classmates that demonstrate the student has read the course readings, has attended lectures, and is thinking critically about the discussion will receive higher grades. *The initial response to the prompt should be roughly 250-300 words. The responses to peers can be between 50 and 150 words*. Discussions will close at midnight Friday and no further responses will be allowed. Students will not be allowed to make up discussion if they fail to post during the week. Your lowest discussion post grade will be dropped from your final grade.

Mid-term: There will be an online midterm that will be taken in Canvas. It will be a 60 minute exam that can be taken anytime in the 24 hour period of **October 27**. You can take this exam during the normally scheduled class; you are also free to take it another time in this window. Questions will be short answer and multiple choice. You are to work independently on the midterm and not speak to classmates about the questions or answers. The midterm may cover any reading or lecture material prior to the date of the exam.

Final group project: All students will participate in a final group project for this course. This project is designed to enable you to apply the concepts discussed in the course to a particular risk management problem. In the beginning of the class, students will have the opportunity to choose their group in Canvas by picking the risk management topic they are most interested in examining. Your group is then responsible for producing a 6-7 page report on this topic, due **December 13th by midnight in Canvas**. Note: your report should not exceed 7 pages; you will be marked down for writing over this limit. Please use 1" margins and a standard, 11 or 12 point font. Your report should contain the following:

- Risk assessment (1-2 pages): This should first provide a succinct statement of the risk management challenge being examined and then provide a summary of what is known about the risk. This section should cite peer-reviewed research studies about the topic, demonstrating evidence of independent research. If necessary for your topic, this section may also cite interviews with experts, government reports, or NGO reports.
- Stakeholders and their views (1 page): Who are the key stakeholders in this problem and what are their views of the risk? This section should be informed by citing studies, news articles, reports, or undertaking interviews.
- Risk management proposal: (3-4 pages): Please propose and discuss solutions to your risk management challenge. This should include a detailed proposal of who would

implement the recommendations, how they would do so, and the impact your recommendations would have on the problem. Please discuss any possible challenges to success and how they could be addressed.

Each person will also be asked to submit a **confidential assessment** of the contributions of all team members to the final project. Your team should also designate one individual to provide a 3 minute overview of your risk challenge and solution on the **final day of class**. You will not be allowed to exceed this time limit and should, therefore, plan accordingly.

Collaboration and Plagiarism Guidelines

Students are encouraged to discuss course themes and topics with each other, but all research, idea generation, and writing for the midterm, weekly quizzes, and discussion posts must be done individually.

All literature or other work used in assignments must be documented using a standard citation format accompanied by a reference list at the end of the paper. See guidelines online here. Plagiarism is taken seriously and will be dealt with according to university policy. Students must adhere at all times to the University of Pennsylvania's Code of Academic Integrity.

Students are not allowed to download and repost or share course videos anywhere. Doing so is a violation of the Code of Academic Integrity.

Course Outline and Readings

1. **September 1 (W): Introduction to Risk Management**
   Readings:
   - Global Risks Report 2021, World Economic Forum
   - Morgan, M. G. (1993). "Risk Analysis and Management." *Scientific American* 269(1):32-41.

Topic 1: Risk Identification and Risk Assessment

2. **September 6 (M): Labor Day – No Class**

3. **September 8 (W): Measuring Risk**
   Readings:
   - Hand, D. J. (2008). "Chapter 2: Simple descriptions" and "Chapter 4: Probability." In *Statistics: A Very Short Introduction*, 52-64 New York: Oxford University Press.
   - RMS (2015). Measuring Disaster Risk.
   - AIR (2014). "Modeling Fundamentals: Evaluating Risk Measures." January 23.

4. **September 13 (M): Risk Assessments**
   Readings:

- Apostolakis, G. E. (2004). "How Useful is Quantitative Risk Assessment?" *Risk Analysis* 24(3): 515-520.
- Zscheischler, J. et al (2018). "Future Climate Risk from Compound Events." *Nature Climate Change* 8: 469-477.
- National Research Council (2009). Science and Decisions: Advancing Risk Assessments. Washington, DC: The National Academies Press.
  → *You are only required read Chapter 3, pages 65-73.*

5. September 15 (W): Uncertainty in Risk Assessment

Readings:

- Expert Judgement Provides Better Understanding of the Effect of Melting Ice Sheets
- Lempert, R. et al. (2013). Making Good Decisions Without Predictions. RAND Corporation Research Brief.
- Sunstein, C. (2003). "Terrorism and Probability Neglect." *Journal of Risk and Uncertainty* 26(2/3):121-136.

6. September 20 (M): Flooding in the U.S.

Readings:

- Flavelle, C. et al. (2020). "New Data Reveals Hidden Flood Risk Across America." *New York Times*, June 29.
- Kousky, C. and Golnaraghi, M. (2020). Flood Risk Management in the United States: Building Flood Resilience in a Changing Climate. Geneva Association, June.
- Milley, P. C. D. et al. (2008). "Stationarity is Dead: Whither Water Management?" *Science* 319(5863): 573-574.
- Kousky, C. (2018). "How America Fails at Communicating Flood Risks." *City Lab*, October 11.

Topic 2: Risk Perceptions and Risk Communication

7. September 22 (W): Risk Communication

Readings:

- Spiegelhalter, D. (2017). "Risk and Uncertainty Communication." *Annual Review of Statistics and Its Application* 4:31-60.
- The Psychology of Climate Change Communication, CRED, 2009.
- Play this game online: https://ncase.me/trust/

8. September 27 (M): Behavioral Decision-Making
Guest Lecture from Howard Kunreuther, University of Pennsylvania

Readings:

- Fox, J. (2015). "From "Economic Man" to Behavioral Economics." *Harvard Business Review.*
- Meyer, R. and H. Kunreuther (2017). The Ostrich Paradox: Why We Underprepare for Disasters. Philadelphia, PA: Wharton School Press.
  → *You are only required read Part I.*
- Kluger, J. (2018). "Why We Keep Ignoring Even the Most Dire Climate Change Warnings." *Time,* October 8.

9. September 29 (W): Making Choices with Decision Analysis

Readings:

- National Research Council (2001). "Basic Tools for Applied Decision Theory," Chapter 3 in Theoretical Foundations for Decision Making in Engineering Design. Washington, DC: The National Academies Press.
- Hammond, J. S., R. L. Keeney, and H. Raiffa (1998). "The Hidden Traps in Decision Making." *Harvard Business Review* September-October.
- Maguire, L. A. (1991). "Risk Analysis for Conservation Biologists." *Conservation Biology* 5(1): 123-125.

Topic 3: Structuring a Decision Problem

10. October 4 (M): Benefit Cost Analysis and Risk Regulation

Readings:

- Arrow, K, J., et al. (1996). "Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation? *Science* 272(5259): 221-222.
- Kelman, S. "Cost-Benefit Analysis: An Ethical Critique." *Regulation* 5(1): 33-40.
- Flavelle, C. (2020). "A Climate Plan in Texas Focuses on Minorities. Not Everyone Likes It." *New York Times*, July 24.

11. October 6 (W): Valuation and Discounting—Putting a Number of Benefits

Readings:

- Tengs, T. et al. (1995). "Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness." *Risk Analysis* 15(3): 369-390.
- Ashenfelter, O. (2006). "Measuring the Value of a Statistical Life: Problems and Prospects." NBER Working Paper 11916. Cambridge, MA: National Bureau of Economic Research.
- Boyd, J. (2012). Economic Valuation, Ecosystem Services, and Conservation Strategy. Palo Alto, CA: Gordon and Betty Moore Foundation.

Topic 4: Risk Management

12. October 11 (M): (Enterprise) Risk Management

Readings:

- Kaplan, R. S. and A. Mikes (2012). "Managing Risks: A New Framework." *Harvard Business Review*, June.
- Disparte, D. (2016). "Simple Ethics Rules for Better Risk Management." *Harvard Business Review*, November 8.
- Zeckhauser, R. and K. Viscusi (1990). "Risk Within Reason." *Science* 248(4955):559-564.

13. October 13 (W): The Precautionary Principle

Readings:

- Foster, Kenneth R., Paolo Vecchia, and Michael H. Repacholi. (2000). "Science and the precautionary principle." Science 288.5468: 979-981.
- Taleb, N. N. et al. (2014). "The Precautionary Principle (with Application to the Genetic Modification of Organisms)." Extreme Risk Initiative – NYU School of Engineering Working Paper Series.
- Sunstein, C. (2002-3) "The Paralyzing Principle," *Regulation* (Winter): 32-37

14. October 18 (M): Disaster Risk Management in the United States
Guest Lecture from Paul Huang, Acting Associate Administrator of Resilience, FEMA
(*Note: MBA Opportunity Week)*

Readings:

- Labrador, R. C. (2018). "U.S. Disaster Relief at Home and Abroad." Council on Foreign Relations, August.
- Kousky, C. (2018). "Financing Flood Losses: A Discussion of the National Flood Insurance Program." *Risk Management and Insurance Review.* 21(1): 11-32.

15. October 20 (W): Risk Management in Practice
Guest Lecture from Dave Heller, Vice President, Enterprise Risk Management & Insurance, Edison
(*Note: MBA Opportunity Week – no quiz this week)*

Readings:

- D'Auria, G. and De Smet, A. (2020). Leadership in a Crisis: Responding to the Coronavirus Outbreak and Future Challenges. McKinsey & Company, March 16.

16. October 25 (M): Horizon Scanning and Scenario Planning

Readings:

- Shoemaker, P. J. H. (1995). "Scenario Planning: A Tool for Strategic Thinking." MIT *Sloan Management Review* 36(2): 25-40.
- International Risk Governance Council (2013). Preparing for Future Catastrophes: Governance Principles for Slow-Developing Risks that May Have Potentially Catastrophic Consequences. Concept Note.

- Sutherland et al. (2019). "A Horizon Scan of Emerging Issues for Global Conservation in 2019." Trends in Ecology & Evolution 34(1): 83-94.
- Clarke, Lee. "Thinking about Worst-Case Thinking." Sociological Inquiry 78.2 (2008): 154-161.4.

17. October 27 (W): NO CLASS: MIDTERM

18. November 1 (M): The Politics of Risk and the Risks of Politics

Readings:

- Kamarck, E. (2019). "The Challenging Politics of Climate Change." *Brookings*, September 23.
- Nguyet, N. (2019). "The Perfect Storm: Politics of Disaster Management." *Berkeley Political Review*, January 4.
- Bremmer, I. (2005). "Managing Risk in an Unstable World." *Harvard Business Review,* June.
- Rice, C. and A. Zegart (2018). "Managing 21st-Century Political Risk." *Harvard Business Review*, May-June.

Topic 5: Risk Transfer

19. November 3 (W): Overview of Insurance and Risk Transfer

Readings:

- Insurance Information Institute. Insurance 101
- .
- Kousky, C. (2019). "The Role of Natural Disaster Insurance in Recovery and Risk Reduction" *Annual Review of Resource Economics* 11(3).

20. November 8 (M): ILS and Cat Bonds

Readings:

- Braun, A. and C. Kousky (2021). Catastrophe Bonds. Wharton Risk Center Primer, University of Pennsylvania, July.
- Scism, L. and Hinshaw, D. (2020). "Pandemic Insurance for Poor Countries Pays Out $195.8 Million." *Wall Street Journal*, May 1.
- Wharton Risk Center (2020). Uniting Disaster Risk Transfer with Sustainable Development: A Q and A with the World Bank Treasury. *Lab Notes*, August 4.

21. November 10 (W): Innovations in Risk Transfer for Escalating Extremes

Readings:

- The World Bank Group. Sovereign Catastrophe Risk Pools.
- Colman, Z. (2020). "Insurance for When FEMA Fails." *Politico*, July 14.
- The Nature Conservancy (2019). Insuring Nature to Ensure a Resilient Future.

- Casazza, V. (2017). "7 Things to Know about Peer-to-Peer Insurance Platforms." *Christian Science Monitor*, February 9.

Topic 6: Current Risk Challenges

22. November 15 (M): Climate Impacts

Readings:

- Managing Climate Risk in the U.S. Financial System, Report of the Climate-Related Market Risk Subcommittee, Market Advisory Committee of the U.S. Commodity Futures Trading Commission (Executive Summary only)
- Lustgarten, A. (2020). "The Great Climate Migration." *New York Times Magazine*, July 23.
- O'Neill, B. C. et al. (2017). "IPCC Reasons for Concern Regarding Climate Change Risks." *Nature Climate Change.* 7(January):28-37.
- https://drawdown.org/solutions/ (choose half a dozen to read in detail)

23. November 17 (W): Pandemics

Readings:

- Menon, G. (2020). "How Do Scientists Model the Spread of an Infectious Disease?" *Th e Wire Science.* March 27.
- Mulligan, C. B. et al. (2020). "Some Basic economics of COVID-19 Policy." *Chicago Booth Review*, April 27.
- Levite, A. and L. Jinghua (2020). Travails of an Interconnected World: From Pandemics to the Digital Economy. Carnegie Endowment for International Peace. April 30.

24. November 22 (M): Equity and Risk

Readings:

- Henisz, W. (2020). "Why We Need a Social Solidarity (i.e., Wealth) Tax to Recover from COVID-19." LinkedIn, April 16.
- Villarosa, L. (2020). "Pollution is Killing Black Americans. This Community Fought Back." *New York Times.* July 28.
- Morrison, J. (2019). "Can We Turn Down the Temperature on Urban Heat Islands?" *Yale Environment 360*, September 12.
- Wharton Risk Center (2019). Improving Disaster Recovery for Low Income Households. Wharton Risk Center Digital Dialogue, October.

25. November 24: Thanksgiving Break – No Class

26. November 29 (M): Disinformation

Readings:

- Menczer, F. and T. Hills (2020). "Information Overload Helps Fake News Spread, and Social Media knows It." *Scientific American*, December 1.
- Stoycheff, E. (2020). 4 Ways to Protect Yourself from Disinformation. The Conversation, September 17.
- Starbird, K. (2019). "Disinformation's Spread: Bots, Trolls and All of Us." *Nature* 24 July.

27. December 1 (W): Systemic Threats

Readings:

- T. M. Lenton, et al. (2019). "Climate tipping points — too risky to bet against." *Nature* 27 November.
- Howitt, A. M. and H. B. Leonard (2010) "Understanding and Coping with the Increasing Risk of System-Level Accidents." In: *Integrative Risk Management: Advanced Disaster Recovery* edited by S. Woodward. Zurich, Switzerland: Swiss Re, Centre for Global Dialogue, pp. 13-26.
- Futures Platform. Key Success Factors of a Foresight Program.
- Taleb, N. N. (2007). "The Black Swan: The Impact of The Highly Improbable." *New York Times*, April 22.

28. December 6 (M): Our Planet's Life Support Systems

Readings:

- Kolbert, E. (2009). "The Sixth Extinction?" *The New Yorker*, May 18.
- World Economic Forum (2020). Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy. The New Nature Economy Project, World Economic Forum.
- "I've Seen a Future Without Cars, And It's Amazing," *New York Times*, July 9, 2020.
- Bradshaw, C. J. A. et al. (2021). "Underestimating the Challenges of Avoiding a Ghastly Future." *Frontiers in Conservation Science* 13 January.

29. December 8 (W): Wrap up

- 3 minute summaries of group projects