In-class Activity Unit 1: Probability and Risk
Case Study Using the State of New Hampshire Multi-Hazard Mitigation Plan 2013
http://www.nh.gov/safety/divisions/hsem/HazardMitigation/documents/hazard-mitigation-plan.pdf

General Purpose—To introduce students to the terminology, concepts, mathematics and mechanisms of natural hazard risk assessment and mitigation in a real-world setting.

Specific Aims—To create a foundational common language and approach that students can use to examine, research, discuss, and compare aspects of risk connected to climate- and weather-related hazards. In this exercise, students will read about natural hazards in New Hampshire (different examples can be substituted if desired) and use data compiled and published by the State of Hampshire to determine the timeline of each hazard's occurrence, frequency, probability, cost, and risk.

Activity:

Part 1 —Review pages 21–26 in Chapter II of the State of New Hampshire Multi-Hazard Mitigation Plan 2013. Discuss the difference between natural and other types of hazards. In small groups, investigate the *natural* hazard you've been assigned using the Mitigation Plan as a primary resource: flooding, coastal flooding, drought, wildfire, earthquake, landslide, radon, tornado/downburst, hurricane, lightning, severe winter weather, or snow avalanche. Use the table on pages 22–24 to create a smaller table that lists data only for your assigned hazard. Using the table you created to answer the following questions:

1. How many years are included in the state's hazard data set (on pages 22–24)?

2. In that interval, how many times did the state require federal assistance to deal with your hazard type?

3. Using the answers to questions 1 and 2, calculate the **frequency** of your hazard type (frequency = number of events per unit time. Example: 5 events in 100 years = 5 events /100 years, or 0.05 per yr.)

4. What is the total dollar amount provided to pay for the hazard damages over the years?

5.   a) What is the average cost per event?

    b) What is the average cost per year?

Part 2—Refer to pages 2–78 in Chapter II of the State of New Hampshire Multi-Hazard, and find the pages relevant to your assigned hazard. These pages detail the entire history of each

hazard within New Hampshire, extending to Colonial times in many cases. Use this information to answer the questions below:

6. Are there any major hazards that occurred more than once in the longer history for New Hampshire that are not rated above a "1" in the current risk assessment (shown in a box at the top right of each hazard description section)? List these hazards and the risk scores given to them.

7. If **you** were assigning a probability, severity and overall risk number to these hazards, based on the information in the HMP, would you give it a higher value? Explain why or why not.

8. The **recurrence interval** of an event is the **average** length of time between events **of similar magnitude**. When you hear about 100-year flood, for instance, it's actually telling you the recurrence interval of a flood that reaches a certain water depth at the designated measuring point, the 100-year flood stage. Recurrence intervals are determined using frequency information: recurrence interval = 1/frequency. Using this formula and the information from the HMP over the last 100 years, what is the recurrence interval (in years) of your hazard?

   Would you expect a flood with 1/1000 yr frequency to be of higher or lower magnitude than a 1/100 yr flood? Explain your reasoning.

9. Many people think probability is easier to understand than frequency or recurrence intervals, but probability can be the least intuitive of all of these concepts. The probability of an event happening *in any one year*, for example, is calculated from recurrence interval: probability = 1/ recurrence interval (in years). Use this formula to determine:

   a. the probability of a 100-year storm within the next year.

   b. the probability of a 50-year flood within the next year.

   c. the probability of your assigned hazard occurring within the next year.

10. You have an opportunity to buy a piece of property on an area designated as a 30-year flood plain. It came up for sale because a 30-year flood happened there two years ago and the owner could not afford to rebuild. You need the property for just a few years, to provide an place to live while you are in school. Assuming you had the money, would you buy the property and live there for the next three years? What number would you give that decision for overall risk? Explain your reasoning.

Part 3—Plot your frequency data with those of the other groups to compare the hazards (hint: you might want to first decide on how to scale the graph). Discuss the results with the other students. What hazards were much lower or higher in frequency than you expected?