Risk and Geohazards

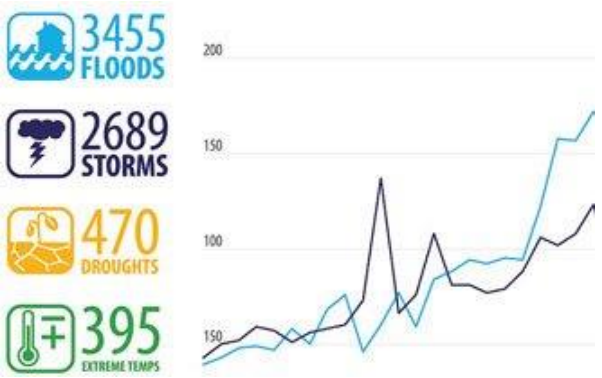
Prof Brian G McAdoo

YID3213- Semester 2, 2017/18

The world is becoming an increasingly risky place. Every year, natural hazards affect more and more people, and these people are incurring increasingly expensive losses. This course explores the nature of risk associated with geophysical and atmospheric phenomena. Are there more hazardous events now than there have been in the past? Are these events somehow more energetic? Or is it that increasing populations with increasingly disparate incomes are being exposed to these hazards? What physical, economic, political and social tools can be employed to reduce this geophysical risk? We will draw on examples from recent disasters, both rapid onset (earthquakes, tsunamis, cyclones), and slow onset (climate change, famine) to examine the complex and interlinked vulnerabilities of the coupled human-environment system.

Learning Goals. By the end of this course, active participants will understand and be able to explain the following:

- How the earth system interacts with **ecosystems, human communities and the built environment** to generate a **disaster**
- The **physics** that govern earth processes interact with vulnerable systems to create disasters
- **Risk** in the context of natural hazards?
- The role of **ecosystems in disaster risk reduction**
- Evidence of disaster risk, including **disaster statistics and geospatial presentation**
- How does **Financing and Insuring** disasters incentivize or disincentivize risk exposure?
- **Communication of disaster risk** to a broad audience



Evaluation

This is a seminar class, therefore much of your grade will be based upon your engagement with the reading, class participation and class projects. The breakdown below is deliberately planned so as to not put too much weight on any one type of assessment. For example, as a seminar-based class, each student is expected to bring a question to class based on the readings. Students will be evaluated (under class participation) on the quality, not the quantity, of the questions, along with the creativity and do-ability of your approach to addressing the question(s) posed. Highest marks will be given to those questions *least* easily answered. And remember, ***there are no stupid questions***!

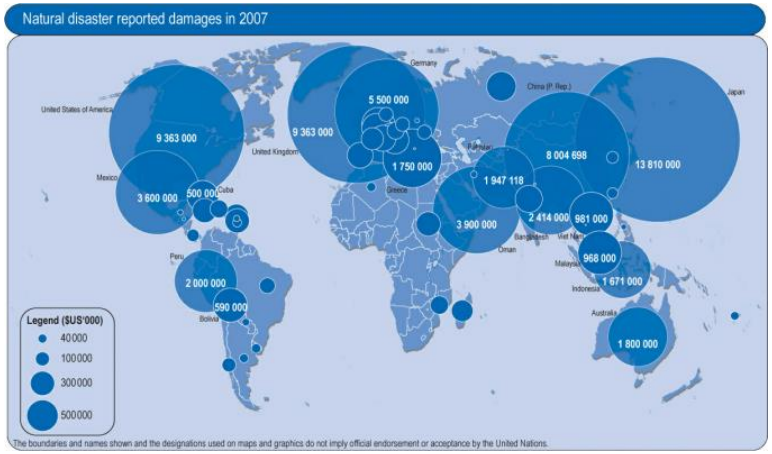
Assignments (40%). We are adopting a Flipped Classroom model for the assignments this semester. Please come to class prepared by having done the reading, and we will work on the assignments either alone or in groups, depending on the specific needs.

Class Participation and Occasional Reports (20%). Disasters befall people daily. You are expected to keep up with Current Events. Be prepared to introduce significant disasters that have occurred/evolved between classes. I will expect each student to prepare **two, 5 minute briefings (STRICT LIMIT)** on a currently unfolding or recent disaster. Please also submit a **1-page summary** of your disaster (can be infographic).

Book Chapter (40%). In conjunction with our colleagues with the **EnviroLab Asia** project at the Claremont Colleges in California, we will be working together on a volume that describes climate risks to Thailand. Your professor will write the Foreword, and each student will be responsible for a chapter on a topic that describes a given hazard, risk and possible adaptations and mitigations for your chosen location. We have flexibility as to the structure of the volume- we can be as creative as we want, doing anything between a series of fictional narratives to a technical document meant for government officials and/or international aid organizations.

Here is the way I view grades:

- To get an "A" you must go above and beyond what is asked. Go the extra mile (kilometer…).
- A "B" means you have done what is expected, and done it very well.
- A "C" means you did what was asked, but slacked off somewhere along the way.
- If you get a "D", you did not do all the reading, assignments and/or did not demonstrate sufficiently that you engaged the material, and that showed clearly in mistakes in the assignments and/or statements made during class discussions.
- An "F" means that you did not engage the material sufficiently and repeatedly, and missed a significant portion of the outlined learning goals.



Late Policy. Class attendance is mandatory. If you miss more than 2 classes during the semester without a Vice Rector's note, your class participation grade will be impacted. Your assignment will be considered late if it misses the deadline without a Vice Rector's note or Medical Certificate from a Doctor. No points will be deducted if the assignment is turned in after the end of the class period that it was due, but it will be graded more critically. Assignments turned in after the end of the second class after it was due will be docked one letter grade, and one letter grade for each class period thereafter. Late work will be accepted until the end of the semester- it is always better to turn in something rather than nothing.

Academic Integrity. We expect you to abide by the highest standards of academic integrity as a matter of personal honesty and communal responsibility. Acting with academic integrity requires that (a) you do your own work, (b) you not interfere with the work of others, (c) you accurately and honestly represent the content of your work, and (d) you properly attribute others' work. Violations of the College's academic integrity standards undermine both the community and your individual growth. Accordingly, they will be addressed with the utmost seriousness and sanctions ranging from grade penalties to expulsion. Examples of violations of academic integrity include plagiarism, copying or sharing homework answers, submitting work completed for one course as 'new' work for another course, or fabricating or falsifying research data. For more information please visit the Student Services website, Policies and Procedures section: https://studentlife.yale-nus.edu.sg/policies/academic-integrity/. The Yale-NUS Library provides resources on citations and plagiarism here: http://library.yale-nus.edu.sg/plagiarism/

A note on etiquette.

- Come to each session **on time, awake and ready to participate**. I assume you will have done the readings, and have a **thoughtful, well-written question** that does not have an easy answer prepared to start that day's discussion. As these questions will be based on the readings, it will require a sufficient understanding of the readings to start considering answers/solutions that we can discuss- just make sure that it is cored in the readings!
- **Drinks are OK** in the classroom (coffee, water… *not* tequila.), but please **do not bring food**.
- Please bring your **laptops** to class.
- If you send an **email** after hours or on weekends, please don't expect an immediate response. And be extremely cognizant of sending emails written while under **duress**- trust me on this one;
- **Do your own work**, unless specifically instructed to work in groups. Collaboration is a skill that I highly encourage you work to develop, and I also expect you to be able to handle this material if and when collaborators are not available. Help each other, but accept only enough help to get you over the hump and moving toward self-sufficiency.

Date	Topic (*in class exercise)*	Reading	Assignment (due date)
Week 1 15 Jan 19 Jan	**Risk and Geophysical Hazards Theoretical Background** This week we will discuss the big picture. What is a disaster? Why do more people die during an event in one place than in a similar event in a different place? Is there anything we can do to limit future disasters? We will have a brief lecture on the physics of environmental hazards. ***Disaster Statistics exercise***	Coppola Ch 1; GAR 2015, Ch 1; Sendai Framework	Disaster Statistics (due 28 Jan)
Week 2 22 Jan 26 Jan	**Floods I** **Floods** have devastating consequences throughout Asia, and are only getting more intense with climate change, severe land-use changes, and increasing urbanization. ***Flood GIS exercise***	***Talk by F. Williamson, ARI*** Coppola, Ch 2	Rivers and Floods in Singapore GIS (due 12 Feb)
Week 3 29 Jan 2 Feb	**Floods II** This week we are going to do some real research. Digitizing rain gauge data and old maps from Singapore will help us better understand Singapore's flood control measures. ***Flood GIS (continued)***	***PUB Field Trip (TBC)*** Skinner, Ch 8; Julien Ch. 1, 2 and 9.	
Week 4 5 Feb 9 Feb	**Brainstorm Book Chapters** While McAdoo is presenting at Asia Oceania Geosciences Society Meeting, discuss a plan to write a chapter for a class document on hazard and risks in SE Asia. These topics should focus on flooding, drought, sea level rise, extreme temperatures or tropical cyclones, or earthquakes/volcanoes if you prefer. It should describe both the hazard and the risk based on the vulnerability and resilience of the exposed human-ecological system, and proposed adaptations and mitigation. We will tie in with the EnviroLab Asia project.	***Writer's Centre to run class on first day, brainstorm and work second day***	Table of Contents with individual chapter proposals, including prelim bibliography (due 11 Feb)
Week 5 12 Feb 16 Feb	**Probability and Geohazard Assessment** How do geoscientists determine the frequency-magnitude relationship of **earthquakes** (Yates and Sieh), **tsunami** (Monecke, Rubin) and **cyclones** (Emanuel)? We will look at the recurrence of disaster impact and how to plan accordingly. Does this change over time? Why or why not? And perhaps most importantly, how is this information transferred to policy makers and the general public (Pielke)? ***Chinese New Year (no class)***	Yates et al., 1997;, Monecke et al., 2008; Rubin et al., 2017; Pielke Ch 1-3; Emanuel	Tsunami Recurrence Include wave timing exercise, ^{14}C, Rubin paper. And model of grain size and wave height (Andy's paper). (due 23 Feb)
Week 6 19 Feb 23 Feb	**Probability** (cont'd) ***Probabilistic Assessment exercise*** Wrap up Probabilistic exercise and share notes and structure of detailed Chapter Outlines. (McAdoo out of town)	Geist and Parsons, 2006;	Detailed Chapter outlines with shared Annotated Bibliography (due 23 Feb)
Recess Week!			

Date	Topic *(in class exercise)*	Reading	Assignment (due date)
Week 7 6 Mar 9 Mar	**Disaster Preparedness and Mitigation** So, how can we reduce risk? This is the quintessential *transdisciplinary* question, as solutions are multiple and interconnected (Coppola, Mileti). Build better buildings? Rely on local, traditional knowledge (McAdoo)? Better governance? Land tenure? Early warnings?	Coppola, Ch 4,5; Mileti, Ch 5,6; McAdoo et al. (2006, 2009);	
Week 8 10/11 or 17/18 Mar	**Day trip to Johor Bahru (To be confirmed…)**		Chapter DRAFT No. 1 (due 19 Mar)
Week 9 20 Mar 23 Mar	**Eco-DRR** Ecosystems provide a range of services that can help communities both less vulnerable before and more resilient after disasters, especially in the developing world. This week, we will explore the strengths and limitations of mangroves, coral reef, forests, wetlands and riparian vegetation as cost-effective means of DRR. ***Workshop Eco-DRR options for your Thai chapter.***	Renaud et al., Ch. 1; SAGE protocols	Eco-DRR plans for Thailand (due 26 Mar)
Week 10 27 Mar 30 Mar	**Disaster Finance and Justice** Introduction/Overview of Disaster Finance. Microfinance/insurance, Cat Bonds, Insurance, Re-Insurance. Grameen Bank to Goldman Sachs. Talk by Marie Delalay, NUS Geography. ***In-class debate- Easterly vs. Sachs.*** Poverty reduction undoubtedly lessens the risk from disasters. How to reduce poverty effectively is a very complex, fiercely debated question. Do we throw tons of money at the problems (Sachs)? Or, do we encourage "pick yourself up by your own bootstraps" approaches (Easterly, Moyo)? What are the benefits and detractors from each? How might the different approaches effect the environment, the base of sustainable DRR?	***Talk by Marie Delalay, SwissRe/NUS Geography PhD*** Sachs, Easterly, Moyo	Prepare for in-class debate (on 30 Mar)
Week 11 3 Apr 6 Apr	**360 Risk Assessment** ***What could possibly go wrong?*** This week, we will be trialing a plan that a few of us came up with to bring rapid risk assessment to the investment side of development. As a team, we will be given a case-study investment and complete an analysis of what natural hazards pose a risk to the business. It could be anything from a major manufacturing center that could provide hundreds of local jobs, to a field terracing project that will provide food and income for a family in the countryside. The end product will be a very short (2 pages) prospectus, and presentation (5 slides or less).	Risk 360; Rovins, McAdoo and Weiss	Group report and presentation (9 Apr)
Week 12/13 **10 Apr** 13 Apr 17 Apr 20 Apr	***Wrap up*** **360 Risk Presentations** The last 2-weeks of class, students will present background setting, analysis of the event and future risk reduction plans for the hazard/risk they analysed for Thailand. Additional time can be used for in-class writing and tying up of loose ends.		