

Carleton University
IPIS 5505
GEO HAZARDS, NATURAL DISASTERS AND SECURITY PROVISION
Fall 2011

Dr. Michael Parkes, PCIP
Contract Instructor

1. Scope of the Course

Every region of the populated earth is susceptible to natural disasters and geo hazards of varying proportion. Security of the populations affected therefore constitutes a major public responsibility. Mitigating the effects of these phenomena is dependent on a combination of scientific research, technical engineering and political will. Understanding the causes and nature is the responsibility of both private and public sectors, and we have made important progress in so doing.

Yet, as the world's population increases, the number of people and amount of critical infrastructure at risk has escalated almost geometrically. This course examines the science behind natural disasters and geo hazards and our ability to predict their occurrence and control their outcomes. The students will gain an appreciation of the nature of natural disasters and geo hazards and their relationship to the provision of public security and safety. In addition the use of structural engineering design/construction options to mitigate the effects of natural disasters and geohazards as well as non-structural responses will be reviewed.

The need for greater understanding in this area, by necessity, involves cross disciplinary research and multiple jurisdictional input. Scientifically informed, and more perceptive technical/engineering decisions must be made by both public and private sector decision makers in order to avoid escalating threats of economic losses and the expense of replacing critical

infrastructure, and above all, protecting human life. Education in this area will be critical to all sectors of society to allow this to happen.

2. Lectures

The course will consist of 12 lectures, 3hrs, once a week (evenings) starting 13 September 2011.

3. Evaluation Framework: 30% - term paper; 30% in –class presentation; 10% in-class quizzes; 30% in class final examination

4. Reading List: One required reading; additional sources listed below

5. **Course Calendar Description:** NATURAL DISASTERS ,GEO-HAZARDS, NATURAL HAZARDS AND SECURITY PROVISION The occurrence, assessment and mitigation of natural disasters and geo-hazards- Earthquakes, Tsunamis, Landslides, Ice storms, Hurricanes, Tornadoes, Flooding ; legal aspects, human response analysis, risk assessment, and mitigation (both engineering solutions and non-structural options are considered).

6. Topics

- (i) Introduction: Perspectives on natural disasters and geohazards; historical data; natural hazards, risk calculation and the determination of vulnerability and mitigation; predictive models, return periods, inundation mapping, seismic hazard mapping,
- (ii) Flooding : Rivers (Souris River 2011); Tsunamis/storm surges (Japan 2011); Hurricanes (Katrina 2005). Engineering solutions -Flood management engineering structures - dykes, levees, control dams. Design/analysis, failure mode analysis, and consequence. Non-structural options – zoning, development control,insurance
- (iii) Volcanoes: eruptions, impacts on climate and populations. Associated earth tremors (quakes) and impact. Mitigation options

- (iv) Tsunamis: sources, impacts, local and long distance impacts, critical infrastructure impacts. Tsunami loading, mitigation options
- (v) Tornadoes: characteristics, occurrence, predictive models; effects. Wind loading (conversion of wind speeds to wind pressure, wind gusts, design level wind speeds (or pressure), 3-second vs. 1-s wind gust design. Mitigation design options.
- (vi) Ice storms: effects on critical infrastructure, populations; precipitation and temperature forecasting. Mitigation design options.
- (vii) Landslides: slope stability, geo-hazards in the Ottawa/St Lawrence area. Engineering solutions for slope stability design, embankment dams, retaining walls (structures). Loading and failure mode analysis. Non structural solutions - determining high hazard zones through slope stability mapping and related development and zoning controls
- (viii) Earthquakes – prediction models, both local and international. Magnitude and attenuation models. Seismic hazard maps of Canada. Consequence of earthquake on infrastructures. Case studies.
- (ix) Legal aspects of natural hazards and security provision: non-technical solutions: zoning, planning and alternative development; emergency response capabilities; business continuity plans; organizational resiliency
- (x) Risk Assessment and Mitigation Measures
- (xi) Presentation of case studies by groups
- (xii) Final examination (in-class)

Required Reading:

Etkin, D., Haque, C.E and Brooks, G. An Assessment of Natural Hazards and Disasters in Canada Reprinted from Natural Hazards, Volume 28, Nos. 2-3, 2003 Kluwer Academic Publishers Dordrecht, The Netherlands, 2003.

Additional Reading:

Bryant, E.A., 1991 Natural Hazards: Cambridge , Cambridge University Press

Courtillot, V. 1999. Evolutionary Catastrophes. Cambridge, Cambridge University Press

Conrad, Cathy T. Severe and Hazardous Weather in Canada. Oxford University Press 2009

Forsey, Sen. Eugene, 1980 and subsequent editions. How Canadians Govern Themselves available at [www. parl.gc.ca](http://www.parl.gc.ca) also Published by PWGSC Canada 2011

Gore, Al, 2006. An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It .London: Bloomsbury Press

Klusky, T.M. Geological Hazards, Greenwood Press, 2003

McCall, G. J. H., D.J.C. Laming and S.C. Scott, eds. 1992. Geohazards: Natural and Man-made. London, Chapman and Hall

McGuire, B., I.Mason, and Kilburn, C., 2002, Natural Hazards and Environmental Change. London, Arnold.

Parkes, J.G. Michael, Awareness of, and Adjustment to a Natural Hazard: Sensitive Clays in the Ottawa-Hull Area., Geographical Review

Zebrowski, Jr. E. 1997. Perils of a Restless Planet: Scientific Perspectives on Natural Disasters Cambridge , Cambridge University Press