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Natural Hazards Across the Curriculum: From General Education to Professional Training

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Events such as Hurricane Katrina, and the Sumatra Earthquake and Tsunami demonstrate the complex consequences of natural disasters. Society's response to such events requires an understanding of the physical processes, societal issues, and flexibility. We have developed a suite of courses, each aimed at specific audiences, that are designed to enhance each groups understanding of the role that natural hazards play in their lives and how to communicate that knowledge to others. There are 3 specific courses, one aimed at non-science students, one aimed at a range of Earth Science and engineering students, and a third course (offered on-line) that is part of a professional degree (and certificate) program for practicing health professionals.

Our general Education course, Earth 101 - "Natural Disasters: Hollywood versus Reality" is targeted at non-science majors. In spite of the class size (150-170 students) we have tried to maintain a strong active learning component in a lecture classroom. We have developed a suite of class activities linked to specific natural hazards (and usually to movie excerpts) that employ a combination of collaboration, discovery learning, calculation, role-playing, and synthesis. In all cases in developing these learning modules we use real world examples and essentially un-laundered data. This course is intended to both help the non-science focused community to both better understand the natural hazards and consequences, and also to improve their science and quantitative reasoning skills.

Natural Hazards can be an important component of Earth Science (e.g. Geology, Geophysics, Meteorology, Geography) and several engineering disciplines. We have a de-

veloped an upper-level course based on detailed analyses of case studies that allow students in these fields to link their skills to studies of specific events. This course uses integrated analyses of the physical basis for the event (e.g. understanding the causes of earthquakes in a region) and the resulting consequences - both physical and societal. Each case study is based on actual events (e.g. Hurricane Katrina, Loma Prieta earthquake, Mt Ruapehu lahars, Sumatra earthquake/tsunami) and data. This allows students to appreciate the difficulties of working with real-time data, the complexities of making warnings and forecasts, and the implications of their responses. Finally, communicating their results to diverse communities is a major focus of the course

One critical group, who can have major roles in hazard response that have often been excluded from natural hazard education is the community of health professionals. Penn State University has recently developed and implemented a graduate level degree program (Masters of Homeland Security in Health Preparedness and certificate programs in both Disaster Readiness and Bioterrorism Preparedness) to provide an integrated framework for health professionals in dealing with all forms of disasters, both human and natural. The Penn State program is offered through its World Campus (online learning) and allows health professionals globally to participate. An underlying principle of the program is the recognition that natural, human induced, and terrorism driven disasters have common consequences and will rely on the same teams of professionals for response. Natural disasters play a central role in the program with a core course, built on the existing on-campus course (described above). In the spirit of training professionals to respond to disasters as they develop, the course uses 'real-time' data and requires that students assess and react to events, make choices on how to proceed, and do post-mortem analyses of the both their responses and the outcomes. The goal of the program is to develop a community of health care workers who understand the underlying causes of disasters, appreciate the interconnections and feedbacks operating, and are prepared to respond when and if they are faced with the next event.