IYPE STUDENT CONTEST
United States Representative

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HAZARDS: Minimizing Risk, Maximizing Awareness

"Floods drive thousand from homes in Mexico"

http://news.bbc.co.uk/2/hi/americas/7074271.

"Strong cyclone kills 1,784 in Bangladesh"

http://www.katu.com/news/national/11545046.html

"'Slow avalanche' gobbles road, homes in San Diego"

http://www.nytimes.com

HAZARDS: Minimizing Risk, Maximizing Awareness

Every month at least one natural hazard makes the newspaper headlines. Many more affect countless people every day, and are a continual threat to populations worldwide. Natural hazards pose risks around the world to infrastructure, personal property, resources, and lives. It is one of the few hazards that affect people universally, without regard to country boundaries, political ties, social class, or culture. Between flooding, volcanoes, earthquakes, fires, hurricanes, and landsliding there is no place to live that is entirely safe from natural hazards. However, I believe that these natural hazards do not have to become the disasters shown in the news. If they are better understood, people are better educated about the processes, and thorough planning and smart response programs are put in place the risks can be minimized. Slope failures in particular are global phenomena that cause millions of dollars of damage each year in the United States alone. With more research on the landslide hazards, we can better understand where the highest risks exist and how to prevent the most damage to people and structures.

Introduction

The current hillslope research lacks enough firm conclusions surrounding slope stability and processes for application to all hillslopes. While soil properties and erosion due to a variety of factors including climate and vegetation have been studied extensively, they have mostly been case studies modeling a unique set of conditions. These results are also mainly theoretical, and still being tested. Applying the findings from these studies more universally would require completing more case studies to check the hypotheses. The data would then have to be compiled to find the trends for given sets of conditions. At this point there is not a clear understanding of how most slopes behave, especially when heavily influenced by humans. Without any firm conclusions, it is hard to help educate people about the subject.

In general, the public likes to hear results and they listen better to people they trust. The general populus relies on scientists to produce accurate information, but usually do not want to be bothered too much with how scientists arrived at that answer. They just want to know how the results will affect their lives personally. In the case of landslides, people need a trusted source to turn to in order to know what is happening and what to do. Ambiguity does not work in this situation, and the current results do not lend themselves well to giving people a clear breakdown of the risks. More research is needed to gain a better understanding so as to better pass the information along constructively. Scientists should also take the social aspects of natural phenomena and disasters into account during their research. Peoples' religious beliefs, cultural practices, and even economic status are contributing factors to how receptive people are as well as how they respond to hazards.

Maximizing Awareness and Minimizing Risk

I am interested in studying natural hazards in order to better prepare people and limit the damage to lives and property that they cause. I have been fortunate enough to be able to travel to Bhutan and Sikkim, where I witnessed firsthand the effects of the monsoon rains and road development on the destabilizing the landscape. I am currently studying geology in school in order to gain a better understanding of science behind natural hazards. However, it is not just the science that needs to be understood. I feel these are natural processes that are being exacerbated by humans, but do not necessarily have to become disasters with good policies and education.

Now instead of continuing to point out problems, it is time to find a solution. To better address the risk of landslides I propose more localized monitoring of slope movement. Local

monitoring can be more applicable than trying to do regional, national, or global assessments of slope stability. Localizing the research will also incorporate more people, spreading knowledge of both the processes involved and the risks. The local research can then build off of or contribute to quantitative standards for analyzing slope failures. Quantitative standards can then lead to policies to better protect homes and lives.

Current Research

Currently there are several classification schemes, methods for mapping and evaluating landslides, and theories surround slope processes. There is no set way to evaluate slopes. What would be helpful is developing a universal system for classifying, mapping, and identifying landslides and risk areas. I think even establishing a widely accepted method of identifying risk areas could improve risk management. For one it could lead to better education of homeowners as well as landslide insurance. In the United States, insurance companies generally do not offer landslide insurance because they do not feel they can sufficiently quantify the risk. Even trivial improvements, like agreeing on one method of analysis, could help inform people purchasing homes near hillslopes and people building in high-risk areas. This is a very complex undertaking, but local monitoring and education could eliminate some of the difficulties.

Future Research

The advantages of local monitoring are evaluating slopes regionally in real time and including people locally. In order to achieve local monitoring, I propose following the idea of the company Weather Underground, Inc. Weather Underground (or Wunderground) is a commercial, web-based weather service that reports from stations across the US. To improve their coverage they started the "Personal Weather Station Project". The project allows people to purchase low-cost weather stations and report back to Wunderground. This improves the data Wunderground can distribute to the public as well as incorporates people using a bottom up approach. Applying this idea to slope stability stations and/or people monitoring soil creep, biogenic activity, precipitation, etc. could be set up to report back to a larger agency. Granted some rural areas may not be able to afford stations individually, but using human observation or subsidized a few stations could expand the monitoring area worldwide.

I think this could improve modeling and help create individual solutions, instead of trying to apply a "one size fits all" model to hillslopes. If ground movement can be monitored locally and then coupled with precipitation data and basic information about the hillslope processes, it could create an advanced warning system.

In conjunction with this proposal, more research could be done to evaluate the human impact on slopes. It is known that roads, agriculture, deforestation, and grazing all have a profound effect on slope stability. However, the effects of development have not been quantified. The timescale and magnitude to which these human changes play a role, though, should be explored as development progresses. Improving monitoring, reporting, education, and response will help minimize the risk to the growing number of people.

Education

Education is key for both policymakers and citizens. Policymakers need to know how humans and development interact with slope stability in order to make informed decisions to help the public. Building permits and codes need to take into account the surrounding slopes to minimize risk to inhabitants and property. As well as being made aware if they are living in a

hazard zone, citizens could learn about the processes behind slope failure. Then they know the signs of impending failure. Knowing the signs adds to the local and real-time monitoring and can contribute qualitative data to future research. More observation of slopes could lead to improved theories and clearer answers for the public. Locals could then also be influential in formulating better policies and becoming a trusted source for information along with scientists.

Social Aspect

Tied to education and response is the social aspect of disasters. It is the side often forgotten by scientists that needs be counted as well. To be the most effective in raising awareness and in responding to disasters, policymakers, scientists, and educators should be aware of the behavior, beliefs, and cultures of the people at risk. Different approaches are needed for those who believe natural hazards are acts of God that cannot be stopped versus those who look at it from a purely scientific approach. The information presented to the public needs to be tailored so people can relate, and therefore best understand and retain it, without being unnecessarily worried.

Studying the social aspect also addresses why a natural hazard becomes a disaster. Disasters happen because of human vulnerability due to lack of preparedness and inability to cope. Disasters do not occur on their own, they are linked to the political, economic, and social structures. For example, the fact that economic disparity can force people to build in higher risk areas needs to be acknowledged in order to minimize risk.

More developed nations should also not discount the practices of non-Western communities. Applying a purely high-tech solution ignores the fact that many rural communities have been successfully coping with the threat of landsliding. One simple example is the practice of rural people in the Himalayan foothills, like the Bhutanese, who terrace their rice patties in order to reduce the risk of slope failure.

Possible Solutions

I believe what is needed first is a more universal system of landslide evaluation. Next, people need to be clearly and consciously educated of the risks, what causes the risks, and potential mitigation techniques. Education can then lead to policies to protect people as well as preparing local peoples to help with slope monitoring. This proposal can be applied in rural areas, urban areas, developing nations, and countries like the United States to ultimately maximize awareness and hopefully minimize risk worldwide as a consequence of education and research.

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