Resilience to Climate Challenges: Learning Site Selection with Field Investigations

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Introduction

- Good Afternoon!
- This presentation shows experiential learning in a course on design with climate in an undergraduate environmental design program. This course teaches site analysis through field investigations at high-impact zones of postfire debris flows during the 2013 Colorado historic floods, combining geomorphic knowledge with vernacular experiences. Moreover, this course guides students to discuss the factors causing postfire debris flows and the human responsibilities in such natural hazards.

- The high temperatures and dry climate in the western United States have made for frequent wildfire threats. Erosions in fire-scar areas accelerate and amplify the debris flow process, called the postfire debris flow. A debris flow is born from a higher elevation and generates speed and power when proceeding downhill. Moving fast and climbing banks, a debris flow can knock down houses, take lives, and even bury an entire village. Debris flow is one of the most dangerous natural hazards. It is often called by the media a “mudslide,” ”rockslide,” “mudflow,” or “flash flood.”

http://www.sciencemag.org/news/2015/03/tiny-beetles-don-t-cause-big-fires-study-finds-raising-policy-questi

From September 9th - 16th, 2013, the Colorado Front Range experienced a week of heavy rain, which caused historic floods. The most highly impacted areas experienced debris flows that caused additional flooding. The fatality and homes destroyed within debris flow impact zones exemplify the site selection failure. A lack of knowledge of postfire debris flow exposes the site selection education weakness, in which scientific knowledge on natural hazards has only been introduced superficially.

Experiential Learning:
Field Investigations in Impacted Areas

The most effective way to learn site selection is to conduct field investigations. As a *Feng-shui* master stated, to learn *feng-shui*, people must hike for thousands of miles along with studying thousands of books. Field investigations are the highlight of this course. The students have presented eagerness and curiosity during field observations.

The class has investigated the high-impacted site at Chapel on the Rock, Allenspark, CO. This debris flow originated from Mt. Meeker, five miles away. With a huge basin, Mt. Meeker can be classified as a "sick dragon" by *feng-shui*. This first-hand knowledge enhances students' understanding of larger-scale considerations crucial in site selection to avoid natural hazards.

The class visited several high-impact areas affected by the 2013 post-fire debris flows. Eight years after the hazard events, Boulder has recovered and is as beautiful as ever. The recovered environment presents the desire to rebuild homes, an effort supported by state and federal government funds. Surprisingly, several cases show that new buildings were built upon the same spots where debris flows destroyed the original buildings. This common situation inspires students to think critically. What is the best way to enhance the mountain community's resilience to climate challenges?

For example, in the 2013 floods, a post-fire debris flow destroyed one home on a steep hillside, Big Elk Meadow Drive, Lyons, CO. (Photo 2017 by Ping Xu)

Now, a new house has been constructed on the same site and within ten feet of the 2013 debris flow attack area.
(Photo 2017 by Ping Xu)

Current insurance policy requests to rebuild the house ‘like for like” the original one at the same impact spot, which will repeat the failure because the landforms of these areas are prone to postfire debris flows.

Class Discussions on Human's Responsibilities

Students participated with great interest in the class discussions guided by the professor. Some people attempt to believe that the hazard experienced has never happened before and will not occur again in their lifetime. In fact, these mountain hazards are likely to occur more often with recent extreme weather patterns. Should humans take responsibility for their role in these disasters?

Fire strikes are often called "wildfires." However, over sixty percent of Colorado "wildfires" are caused by human ignition, particularly by campfires. Some people ventured their freedom and independence, regardless of the risks associated with hazard-prone zones. Some reside by lakes or at a confluence of two rivers, where there are often debris flow-prone zones. In addition, more people are moving into these susceptible hazard zones, which aggravates hazard impacts further.

Through the discussions, students realized that humans have significant responsibilities in causing and avoiding the high impacts of natural hazards.

Conclusions

Homes destroyed in high-impact zones illustrate the failure of site selection, which demonstrates the educational weakness. To improve site selection education, we should require scientific knowledge in current curriculums. An interdisciplinary approach would contribute to seeking better solutions for the future.

- Experiential learning demonstrates great value in undergraduate education. Many undergraduate students love field trips as most are energetic hikers, nature lovers, and quick learners through keen observation. Increasing field investigations would benefit teaching because students can use first-hand experience to examine a theory. Training students' critical thinking by going to the real world, finding problems, and making solutions, is a crucial educational approach along with teaching skills applied in a digital-virtual world.

- Educating undergraduate students to recognize human responsibilities to natural hazards will enhance their social responsibility. Identifying human mistakes in causing hazard impacts would inspire students to seek solutions to reduce hazard damages in the future. Facing climate challenges, we must find new paths towards a future that enhances the resilience of mountain communities.

Thank you!