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Wildfire Research in an Environmental Hazards Course: An Active Learning Approach

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Abstract

Creating opportunities for students to actively apply hazards theory to real-life situations is often a challenge in hazards geography courses. This article presents a project, the Jocko Lakes Fire Project, that implemented learning strategies to encourage students to be active in wildfire hazards research. Wildfire hazards stand out as an increasing threat to communities in forested areas given current and projected rates of urbanization, the growing concentration of wealth in hazard-prone areas, the increasing costs of forest wildfire reduction, and climate change. Components of the project involved students in problem definition and the articulation of a research plan; identifying and collecting relevant data; and analyzing and documenting the wildfire hazard event. The student-based evaluation of the project and its outcomes highlights the ways in which this approach can increase understanding of local hazard scenarios, familiarity with relevant theory, geographical knowledge, and skills in research.

Key Words: *natural hazards, wildfire education, active learning, student research experience*

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Introduction

One purpose of a natural hazards course is to provide a context for understanding the factors and processes that contribute to hazardous situations and their societal impacts (Cross 2009). As a place where future hazards researchers and personnel are trained, the university classroom environment offers an opportunity for bridging the divide between theory and practice, with potential long-term implications for how our society adapts to rapidly changing "hazardscapes" (Cutter 2001; Montz, Cross, and Cutter 2004). Local hazard events provide specific contexts in which students can apply hazards theory and interact with vulnerable environments or social groups; however, the design of effective and locally grounded exercises and projects that facilitate the learning about hazards geography presents a challenge for instructors.

In this article we share our approach to integrating active learning strategies and a real-life hazard situation within the context of an upper-division natural hazards course. The course, Environmental Hazards and Planning,[1] was taught in the Department of Geography at the University of Montana during spring semester 2008. The course was structured around a research project centered on the Jocko Lakes Fire that occurred in July–September 2007 in a mountainous area located approximately fifty miles from our university campus. This wildfire event resulted in tremendous socioeconomic and environmental repercussions for the surrounding communities such as the town of Seeley Lake (Fig. 1). This event also contributed, in part, to statewide wildfire hazard policy developments that ensued in the aftermath of the 2007 wildfire season. Significantly, over forty new pieces of legislation dealing with wildfire mitigation and management went on to be considered by the 2009 Montana State Legislature (Montana State Legislature 2009). For the course, the students studied risk and vulnerability theory (Turner *et al.* 2003; Wisner *et al.* 2003; Birkmann 2006;) and wildfire science, and through biweekly and weekly class discussions they applied theoretical knowledge to analyze the characteristics of this localized wildfire event.

The course research project was designed to satisfy the following three objectives: (1) to build a foundational knowledge of social science aspects of hazards, including hazard perception, human response and adaptation, and vulnerability and risk management with the aim of promoting riskwise decisions and behaviors; (2) to increase scientific knowledge and awareness about a significant hazard—wildfire—that poses a threat to numerous communities in Montana and elsewhere in the American West; and (3) to provide an opportunity for gaining skills in data collection methods, technical tools, data analysis, and reporting that are used in the hazards and disasters field. We considered these knowledge areas and skills to be basic elements for helping students bridge the gap between theoretical models, environmental science, and risk management in on-the-ground settings. In addition to expanding spatial understanding of the hazard situation, the approach to the course aimed to employ active learning strategies to draw students into a collaborative research endeavor resembling what they would likely experience in the twenty-first century workplace.

Active Learning and Teaching about Hazards

Active learning is rooted in pedagogic theory that reflects a belief in the limitations of lecture-based courses (Gardiner 1994). Previous research suggests that lectures have limited effectiveness in helping students retain information,

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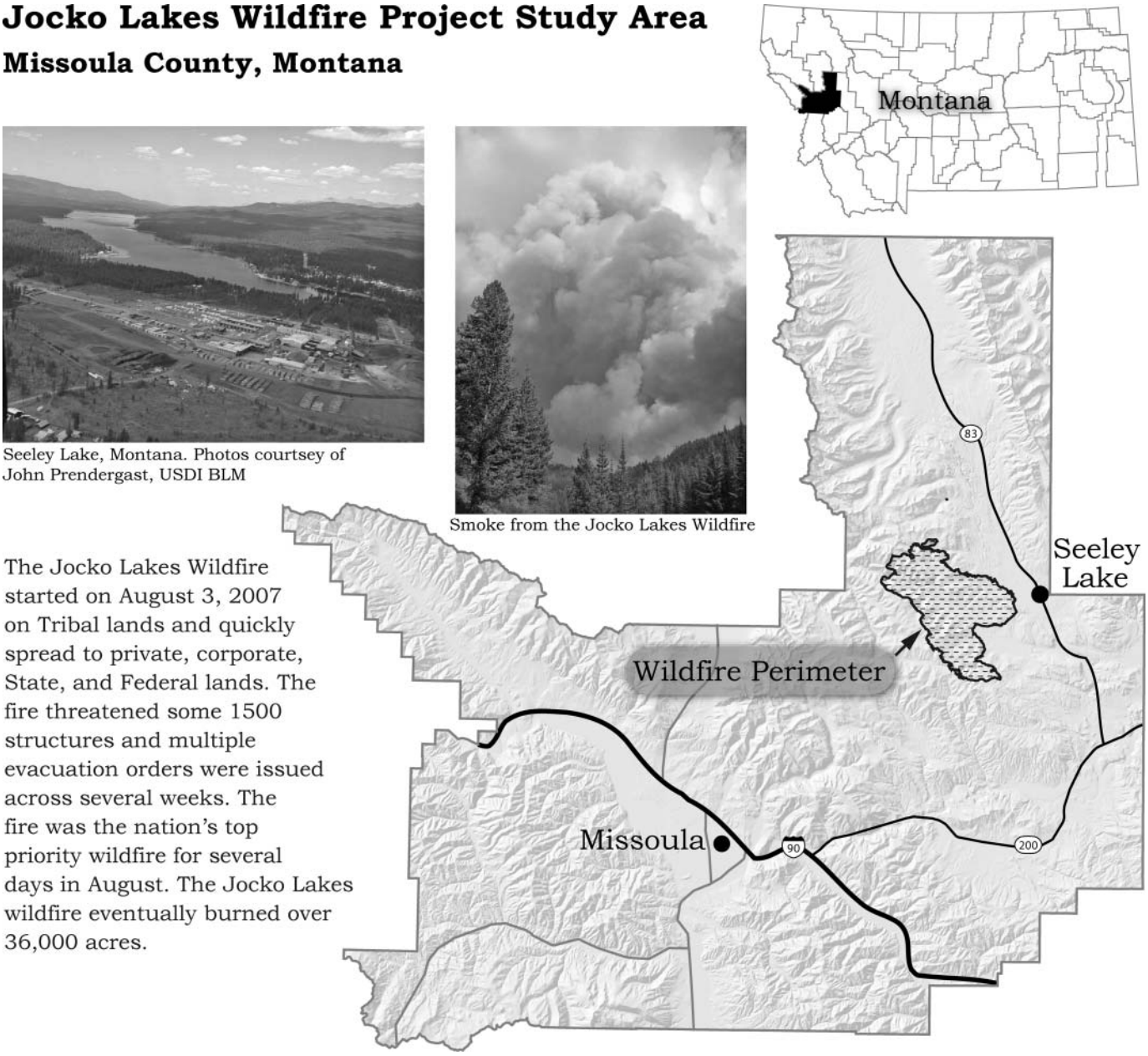

Figure 1. Map of study area in Montana.

become self-learners, and develop skills in transferring knowledge and solving problems (McLeish 1968; Davis and Alexander 1977; Saunders 1980; Bonwell and Eison 1991; Gardiner 1994; Fink 2003). Studies suggest that students at the university level often show little growth during their college years in higher-level complex reading, thinking, and analytical skills (Fink 2007). Additional research demonstrates that when students are active participants in the learning process, rather than passive recipients, retention of knowledge is increased (Grant 1997; Cooper *et al.* 2000). In this regard, Fink's (2003) work on "significant learning experiences" is instructive. Learning through significant experiences has both *process* and *outcome* dimensions, with basic content mastery integrated with opportunities to manage complex projects, apply critical thinking, and develop skills in inquiry that have applications beyond the classroom. Emphasis is placed on the *process* of learning itself and designing experiences that foster the opportunity for significant learning (Fink 2003).

With the aforementioned pedagogic concerns in mind, the question for us became: How can a significant learning experience be integrated into what has been a traditional lecture-oriented hazards geography course? In addressing this question, consideration was given to maintaining a holistic approach to thinking and learning about hazards. As Cross (2009) points out, the content of hazards courses

has tended to be more attentive to physical science aspects rather than the societal conditions that contribute to risk and vulnerability. We sought to expand the conventional approach to hazards instruction by building foundational knowledge on both physical and social processes and their interactions in a contextualized place-based manner. This framework motivated the strategic choice of a hazards research project to encourage students' understanding of the risk environment surrounding them and their awareness of the range of mitigation responses by the public to a recurring and costly local hazard: wildfire. As Mitchell (2009, 134) suggests, "Before people can make protective decisions fitting their own situations, appropriate education about the character of threats and their interplay with human populations is necessary." We envisaged the research project as a starting point for building both locally relevant hazards education and risk-aware behavior and adjustment.

Within a broader context, recent wildland fires in Greece, Australia, southern California, and across the Rocky Mountains have underscored the devastating nature of wildfire and renewed public interest in learning more about wildfire hazard threats and disaster risk reduction. In western Montana wildfire risks and hazards have significant social, economic, and health impacts at local and regional levels. How local, state, tribal, and federal agencies and legislative bodies are choosing to manage these impacts will effect both ecological and human populations for decades to come (Pyne 2004; Gude, Rasker, and van den Noort 2008; Headwaters Economics 2008, 2009). The following paragraphs present an overview of wildfire hazards. The discussion then turns to the design and implementation of the project.

Wildfire Hazards in Montana

Wildfire is the most pressing and costly natural hazard in western Montana (Halvorson 2002; Wall 2007; Montana State Legislature 2009). The increasing severity and impact of wildfires can be attributed to a number of factors, all of which are present elsewhere in the American West. These include extended drought, climate change, increased residential development in forested landscapes, increased fuel loads for fires from forest biomass, and increasing competition for national firefighting resources (Teie 1999; Collins 2008, 2009; Gude *et al*. 2009). The State of Montana's fiscal responsibility for wildfire suppression costs in 2007 was $40 million, more than twice the average amount calculated over a seven-year period (Montana State Legislature 2008). Escalating wildfire suppression costs in Montana are reflective of national trends. National annual wildfire suppression appropriations from 2001 to 2007 have doubled from the previous period, and currently exceed $3 billion per year (United States Government Accountability Office [GAO] 2009). Current projections suggest that there could be a 55 percent increase in the number of homes built in the wildland urban interface in Montana by 2025 (Headwaters Economics 2009). With future home construction and a warmer climate, the average cost of protecting homes in Montana could be as much as $84 million per year. In a year similar to 2007 the cost could be as high as $124 million by 2025 (Gude, Rasker, and van den Noort 2008; Headwaters Economics 2008). Outside of costs to the state and taxpayers, wildfire can be incredibly destabilizing to communities owing to evacuations and the damage to private homes and infrastructure. Public health can also be threatened through impaired air quality, often at levels that make it unsafe for children, the elderly, and those with compromised pulmonary systems to be outside.

While forests in Montana have evolved with wildfire, current conditions (i.e., decades of wildfire suppression, insect infestation, and above normal spring and autumn temperatures) have contributed to high-intensity fires that are difficult to manage and have a greater level of ecological impacts. Effects from high-intensity wildfires include reduced soil productivity, increased flooding, damage to waterways and aquatic systems, and longer forest regeneration time frames (Whitlock 2004).

The Jocko Lakes Fire event involved this type of high intensity wildfire. On July 18, 2007, a lightning storm delivered a number of wildfire starts to the dry forested Mission Mountain range. On August 4 the area experienced unusually intense 50 mph wind gusts. The fire rapidly became active and burned 1,000 acres within two hours, expanding across state, tribal, federal, and private lands. The fire also began to burn directly towards Seeley Lake in Missoula County. Within hours, portions of the community were forced to evacuate, and by nightfall the fire was one mile from Seeley Lake. For several days the fire was the nation's top priority fire (Frank and Medley 2007; Lowery 2007) and eventually burned over 36,000 acres by mid-September.

When our hazards course began to focus on the Jocko Lakes Fire, less than six months had passed since the evacuees from Seeley Lake had returned to their homes. This proximity to the hazardous event, in combination with the timeliness of the event, made it an ideal project for the class to consider. The opportunity to research and document a local, recent hazard event offered a real-world purpose to the project that it otherwise would have lacked. Although it will not always be possible to have both a local and recent hazard event, we believe this model can be extended to historic events in the geographic area or current events that are not geographically proximate. Investigating historic events could develop archival research skills and qualitative methods by interviewing survivors. Current hazard events, such as the Gulf of Mexico oil spill, have the potential to engage students and provide a wealth of research mediums (e.g., Internet videos, first-person narratives via blogs, etc.).

Jocko Lakes Fire Project: Design and Implementation

The design of the project was based on the fact that the majority of the students had limited experience with

Table 1. Student groups, objectives, and outcomes.

Learning Teams	Research Objectives	Data Sources & Methods	Team Approach and Progression
Socioenvironmental Context/Study Area	Develop environmental history for wildfire behavior and policy, history of Seeley Lake area, and settlement patterns.	Primary sources: Phone interviews with Seeley Lake homeowner associations, business owners, and community members. Secondary sources: Wildfire behavior and policy literature, surveyed local newspaper and Web reports, analyzed archived data.	This group worked together throughout the semester but split into two sub-groups, one of which focused on history and settlement of the Seeley Lake area and the other focused on wildfire behavior and policy.
Wildfire Event and Timeline	Develop a timeline of the wildfire, review of suppression costs.	Primary: Phone interviews with local, state, federal, and tribal agency personnel involved directly and indirectly with the Jocko Lakes Wildfire. Secondary: Wildfire report logs, agency news releases, agency Web-based documentation, cost documents.	As the structure of the student report began to take shape towards the end of the semester, this team and the Agency/Community team essentially merged into three teams that each developed and wrote a chapter.
Agency and Community Response/Recovery	Review of local, state, federal, and tribal agencies involved in the jurisdiction of the Jocko Lakes Wildfire. Document the community response and recovery.	Primary: Phone interviews with local, state, federal, and tribal agency personnel involved directly and indirectly with the Jocko Lakes Wildfire. In-depth individual (N = 3) and one group interview with Seeley Lake community members. Secondary: Analyzed data from agency records, reports, and manuals.	Two members of this team chose to focus on in-depth interviews. Two other members chose to focus on additional research that reviewed current funding issues and risk mitigation strategies for wildfire in Montana with suggestions for future directions.

wildfire hazards or familiarity with the Seeley Lake area. The class consisted of geography undergraduate students, a forestry major, and a geography graduate student. It was the first time this group of students had been exposed to hazards theory or the study of natural hazard events.

In addition to background on wildfire hazards, the students gained familiarity with local wildfire history and the Jocko Lakes Fire from local media, public documents, and Web sources. We also had two guest speakers early in the semester, the Chief Forester for the Montana State Department of Natural Resources and the U.S. Forest Service Seeley Lake District Ranger. Both speakers had integral roles in managing the Jocko Lakes Fire and provided the class with a personal, detailed account of the fire.

Following these background discussions, we began the process of developing a research plan and schedule. Through brainstorming sessions, students came up with ideas about what to study in regard to the Jocko Lakes Fire. After possible topics had been identified, the sixteen-member class was divided into three teams of 4–6 students with similar interests (Table 1). Within the teams, each member was assigned a specific research topic. A two-week deadline was set for reporting team progress to the class. During class meetings dedicated to the project we further refined the outline of the case study, research goals, and team/individual research assignments with clearly defined team and class-level deadlines. The iterative process was repeated throughout the remainder of the semester, with more class time dedicated to the case study as the semester progressed.

We did not assign team roles to individuals.[2] In-class time allowed us to monitor teams, address questions, and reduce the problem of meeting outside of class. Teams also were required to e-mail a weekly progress report that allowed us to address questions and provide feedback. With a few exceptions, the students found working in teams a positive experience, which we believe directly relates to the combination of structure and the opportunity to connect collaborative work with the larger project goals:

> I think we did well. Everybody broke up into smaller sections, and accomplished their goals on a smaller team scale. Then when it was time, everything came together well.
>
> The project felt more important than a simple team project.

Spending significant in-class time working in teams was key to team cohesion, productivity, acquiring foundational knowledge, and learning how to work effectively in a group dynamic. Having class time dedicated to the project allowed the whole-class forum to encourage the completion of assigned tasks. We believe this learning approach would

also work well with a large class size. Our personal experiences using small learning teams in 100-level classes with over 100 students suggests that this approach can be successful in engaging students in the course material, increasing writing and analytical skills, and fostering peer-mentoring between team members.

The final eight weeks of class were dedicated to writing and revising the final case study report. At least three major revisions of the final report were completed during class meetings. To this end, we acted as facilitators/recorders by outlining the production process involved in creating the final report from the team reports. Students were assigned new roles in the production process and in setting deadlines for each stage. An advantage of this collaborative method of researching, writing, and producing a final document in the space of one semester was the opportunity for students to see a project from start to finish, including the final case study report (Environmental Hazards & Planning 2008). The report included a history of the Seeley Lake area; wildfire ecology, history, and behavior; a review of the hazard event, timeline, and involved local, state, and federal agencies; interviews with wildfire personnel and Seeley Lake residents; wildfire costs; and synthesis of development and mitigation issues. The major learning points underscored the role that land use and land management play in shaping wildfire risks and hazards and also the significance of jurisdictional boundaries in response and mitigation.

Evaluation of the Research Project

Student evaluation and feedback are key elements to an active learning approach. Students' evaluations of the Jocko Lakes Fire Project allowed us to gather information and feedback to improve the design of the project organization and the implementation of similar projects in future courses.

During the final week of the regular semester, students were asked to complete an evaluation of the project along with the regular course evaluations. The survey included nine questions that were broken into three parts: research experiences, team experiences, and project critiques. A written evaluation of the project was completed by 74 percent of the students. In addition to the written comments, the other source of evaluation feedback was provided through an in-class project discussion at the end of the semester.

The responses on the survey were overwhelmingly positive in favor of the team-based approach and the development of a course-length research project that reflected individual and collaborative research efforts into a single document. The student surveys indicated the following outcomes: acquisition of foundational knowledge and the relevance of using a local event as the course research project, increased knowledge of wildfire hazards, improvements in research skills, and positive experiences of collaborative work. Students also provided several key insights as to how a course-length case study approach could be improved in the future to meet the three aforementioned course objectives. The students' comments in the final survey demonstrated a high level of reflection and interest in the project, underscoring their continued engagement in the project.

Foundational Knowledge and Local Hazards

A common resistance to active learning techniques and strategies is often a concern that foundational knowledge and content will be neglected (Scheyvens *et al.* 2008). In this project, students were encouraged to bridge between hazard theory and active risk management on-the-ground and apply this knowledge and skills in evaluating a local hazard event. Students demonstrated foundational knowledge acquisition as well as a strong level of engagement in the topic:

> I was most surprised by how well the body of literature on hazards was embodied by the people of Seeley Lake.
>
> The social aspects related to hazards is so interesting, I wish I spent a bit more time on those topics.

Often, the theory and teaching of hazards can be an abstract process for both teachers and students. We sought to overcome abstraction by helping the students to identify the social, economic, and political factors that influenced the vulnerability of Seeley Lake residents to wildfire and to examine specific reasons why some residents were differentially impacted by the wildfire. Employing the concept of vulnerability seems to have helped students to theoretically understand and identify the ways in which "hazardscapes" are socially constructed. Further, an advantage of using a local hazardous event was that it allowed students to interact with people directly involved and affected by the event. Students in the class commented on how the hazards theory we studied in the beginning of class and readings were reflected in their interviews with Seeley Lake residents and wildfire personnel. Risk and risk management became empirically grounded as students made connections between the consequences of individual and collective public actions to manage risk and the particular circumstances surrounding the Jocko Lakes Fire. The results of this project suggest that using active learning techniques and a local hazard event can create a situation that engages students and fosters an environment for students' to acquire and apply foundational knowledge.

Awareness of Wildfire Hazards

As a major recurring natural hazard in Montana, the awareness of wildfire risk and management that these students gained is a valuable addition to their understanding of these issues as they move forward in their professional careers and as residents of this region. The students' level of knowledge acquisition, both theoretical and applied, suggests that the direct student involvement in problem definition, articulation of the research plan, data collection,

and documenting the course research project were key elements of this success.

> I actually learned quite a bit about fire and the circumstances around Seeley. I didn't know that much about either.
>
> I enjoyed the project more as it went along, as we each got more involved with the case study. Looking at wildfires would not be my first choice of study, but I have learnt so much that I feel comfortable relating to this topic, which I did not expect.

Overall, students felt that they had a greater understanding of the risks associated with wildfire and the current development geography playing out in the wildland urban interface. A recent U.S. Forest Service (2009) study estimates that by 2030 an additional 21.7 million acres of rural land within ten miles of national forests and grasslands will have increased housing development. As populations continue to increase in these areas, more lives and property will be placed at risk, requiring future risk managers to understand the social, economic, and ecological dimensions of wildfire hazards.

Research Skills

We have observed that many students, even at the senior level, are often completely unaware of the university library resources and databases. The students participating in our course initially relied on basic Internet searches for their research assignments. This project was a direct effort to address those research skill deficiencies, and also set up situations where the answers to a research problem were not immediately obvious. In addition to secondary research through the relevant literature, several students also engaged in primary research and interviewed public officials directly and indirectly involved with the Jocko Lakes Fire and members of the Seeley Lake community. The students developed their interview questionnaire (Appendix), participated in the Institutional Review Board application process, and received training in ethics in research involving human subjects (OSRP 2010). For several students, their favorite part of the project was the opportunity to do primary research:

> Research; going out and conducting interviews and using my own work in a paper is something I had never done before so I learned a lot there.
>
> Definitely the interviews. I haven't done qualitative research before, and it was a very valuable experience (both in terms of this project, and for future knowledge of research methodologies).

Several students also commented on the experience of working collaboratively on a large document and the impact this had on their perception of working on a project from initial topic development through final production. This emphasis on the process of the document, as well as the outcome, was reflected in student comments, for example:

> I appreciated the opportunity to learn how to write large, multi-authored papers. This will be very common for me during my professional career, but none of my classes thus far have given any instruction on the subject.

The student responses suggest that the course design, utilizing active learning techniques and a local hazard event, facilitated meeting the course objectives. Although there is no quantitative assessment of students' knowledge acquisition with this course design compared to a traditional lecture-based course covering similar material, the students' responses were a provocative suggestion that embracing project-based learning can meet learning objectives. The achievements of the students in developing a comprehensive case study report and their level of engagement in the semester-length project and material suggests that there may be significant advantages to using this type of course methodology in teaching hazards courses. However, there were also several problem areas that became apparent over the course of the semester.

Critiques of the Project Design

Most of the student critiques of the project design were oriented around a need for more structure and oversight of the project design and work. Several students also commented on the difficulty of meeting outside of class, which suggests the importance of dedicating in-class time to team work and redesigning a course around teams in order to facilitate students learning:

> [We needed] more clarity in students actual work requirements. It seems like some people strayed off topic or had a hard time knowing what to say about their topic.
>
> Communicating more in class, instead of relying on emails and trying to arrange personal schedules on weekends—was complicated and stressful (too many people with outside obligations).

The problems students encountered were familiar:

> I think our biggest obstacles were getting emails and info back from people in a timely manner, which isn't really their fault because they work—but I'm not sure what we could have done differently.

Our experiences with this project suggest that there was often a delicate balance between acting as facilitator for the project design and providing the more traditional oversight found in a university course. Because one of the purposes

of this course design was to allow students to develop self-learning and problem-solving skills we encouraged students to work through research and group issues and stepped in only as requested or when we felt intervention was necessary.

Other students also suggested earlier deadlines and an opportunity to see what previous classes had produced as a model of what to aim for in the project:

> I think in the future it would be useful for classes to be able to see what we did to see what worked and what didn't b/c a lot of the time I was like I have no idea what this is supposed to look like.

One student who had interviewed community members about their experiences with the Jocko Lakes Fire felt there needed to be greater engagement with the involved agencies and the Seeley Lake community at the conclusion of the project:

> For example, finish the project two week earlier and present 4–6 times; in Seeley, to DNRC/USFS etc. . . . Larger culminating presentations would be a great way to wrap up the semester of hard work.

Although time constraints would make it difficult to finish a project earlier in the semester, the student makes a valid point. Presenting the analysis and findings to community members and agency personnel would further engage students in communicating hazard theory, geographic knowledge, and research products to a wider audience.

In summary, we believe the most difficult aspect of attempting a course design based on a semester-length team project is the balance between allowing the students the freedom to choose their topics of research to promote their engagement and involvement while guiding the project into a cohesive, integrated product at the end of the semester. A piece we felt was lacking, in hindsight, was efforts at immediate feedback on students' work. While we did a great deal of feedback during class discussions, we feel that it is vital to maintain that high level of feedback through other communication methods, either meeting with teams during class time or through e-mails. Notably, this active learning and project-centered approach used approximately 70 percent of the available class time. While much theoretical and foundational material typically covered in a traditional hazards course format was included, we spent a relatively limited amount of time addressing a full range of specific natural (e.g., earthquakes, tornadoes, hurricanes, etc.) or environmental (e.g., oil spills, chemical explosions, toxic mine waste, etc.) hazards. Based on our experience, we feel that the students' attainment of foundational knowledge and the ability to apply hazards theory to a specific hazard event makes this investment of class time worthwhile. In developing critical thinking and research skills in students, the *process* of applying foundational knowledge and theoretical frameworks is emphasized, thereby creating a significant learning experience that can be difficult to do in a lecture-based approach (Fink 2007).

Pedagogic Implications for Hazards Courses

Hazards geography is oriented towards field research. As such, it is vital that students in a hazards course gain the skills and methods utilized by hazards researchers and managers. In addition, it is critical for them to have exposure to field settings. This course design garnered a high positive response from the students involved and demonstrated the ability of an active learning/team-based approach to engage students in learning hazards theory and research methods in a field setting. A key aspect of the success of this course was the emphasis on studying a local hazard event that had direct effects on both the local, state, and regional communities through the impacts of the hazard event itself and as a catalyst for ongoing discussions on how to respond to wildfire risk and hazard in the region. This aspect of the project created a level of engagement in the students that we do not believe could be matched by studying a remote hazard event.

An important outcome of this project is that active learning strategies integrated into a project-based course creates an opportunity to enhance learning of theory and application. The components of the project allowed students to grasp hazards theory and key concepts such as vulnerability, risk, the geographic patterns of wildfire in western Montana, and the roles, policies, and mitigation work aimed at reducing risk. The students would not have experienced a similar level of learning about the wildfire hazards facing Montana and the American West through conventional lectures and teaching methods.

A second outcome of this course design is an acknowledgment that there is often resistance to moving away from conventional lecture and teaching methods from the students themselves. Although a minority, some students are intimidated by the complexity of this type of project when it is introduced at the beginning of the semester and are accustomed to a greater level of specific instruction and direction in course assignments. Efforts need to be made to reassure and monitor these students throughout the semester. With these students, working on a team can become vital to their success in the class. A team can create a sense of direction and offer support that is much more immediate and continuous than an instructor can provide.

This aspect of the course design also touches on the balance that is needed between student-directed research and guidance from the instructor. Active learning techniques such as this course design are not a de facto hands-off approach by the instructor. This type of course design requires a shifting balance between fostering independence and engagement in the students and providing adequate direction for research and the project development that provides the students with the knowledge and skills they need to succeed. Learning this balance and how it changes throughout the course requires time and experience with

these teaching methods. Encouraging active learning and team-based course design with graduate assistants and faculty will require the opportunity to work with faculty members who are experienced in these methodologies and willing to mentor others.

Lastly, this article discusses a course design that integrates physical and human dimensions in hazards events and responses, which has been identified as a key shortcoming of current hazards courses in the United States (Cross 2009). The shortcomings associated with limited classroom instruction on the human/societal dimensions of hazards and the social constructions of risk cannot be overstated as a vital issue in hazards courses today. In the dry, western portions of the United States and in other countries, such as Australia, the tensions between the physical hazards from wildfires and the societal practices that channel wildfire risk create a compelling motivation to reexamine our approach to teaching hazards theory and risk management. Simply addressing the physical hazards of wildfire will only promote a reactive response by fire management agencies and communities that contributes to the increasing costs and risks from wildfire.

Our future researchers and risk managers need to have the understanding and conceptual ability to link hazard theory and practice and understand how social, economic, and political structures influence individual and societal responses to risk and hazard events. As the Geography Education Standards Project (1994, 18) notes "Geography has much more to do with asking questions and solving problems than it does with rote memorization of isolated facts." To this end, relying on lecture formats, particularly for upper-division courses, and focusing only on the physical aspects of hazard events will not provide these opportunities for integrating and applying foundational knowledge to on-the-ground hazard planning and events.

In sum, this article has suggested that the Jocko Lakes Fire Project is an effort to increase active learning in an undergraduate hazards course. Through the various project tasks of problem identification, research design, data collection, and synthesis, the students developed an empirically rich analysis of a important hazard event. As the number of populations and communities across the world affected by global climate change continues to grow, there will be an increasing need for risk managers and hazard researchers to become involved in addressing societal responses to adapting and mitigating these risks.

Acknowledgments

We wish to thank the students for their participation in the course and for their contributions to the case study project. We also greatly appreciate the insights and involvement of Tim Love, Seeley Lake District Ranger; Bob Harrington, Chief Forester, Montana Department of Natural Resources; and the community of Seeley Lake.

Notes

1. This course surveys the characteristics and impacts of selected natural and technological hazards. Course material emphasizes risk and vulnerability assessment procedures, mitigating measures to reduce damage, and strategies for planning community response.
2. We used the concept of small learning teams as an instructional strategy that focuses on teaching students how to work together to solve problems and produce work that is beyond their individual efforts and skills (Michaelson, Knight, and Fink 2004).

Appendix: Survey Instrument

1. How did the fire last year affect you?
   a. Prompt: Did you leave your home? Did you pack anything or think about what to take?
   b. Are you happy with the firefighting response from the state, tribe, and federal agencies involved?
   c. Do you think that one particular agency took more action in fighting the fire?
   d. Did you receive conflicting messages about fire threat level from any of the agencies?

2. Did the fire change how you feel about living here?
   a. Prompt: do you feel less safe?
   b. Prompt: How do you deal with (____)?
   c. Are there things that you do differently now than you did before the fire?

3. Do you think about moving from Seeley Lake because of wildfire?
   a. Prompt: would you stay in the area, but rather live away from forested areas?

4. Do you think you face a greater risk of wildfire after the Jocko Lakes fire than you did before the fire?
   a. Prompt: Do you feel your home is at risk from future wildfires?

APPENDIX: SURVEY INSTRUMENT

5. How do you feel about the State and the USFS and the work they have done to reduce wildfire risk in the Seeley Lake area?
   a. Prompt: What do you think they have done the best? What would you change or think they should do?

6. Do you feel that you can make yourself safer from wildfires?

7. Is it the job of the state and USFS to keep people safe from wildfires?
   a. Prompt: Who do you think has what responsibilities?

8. If there were to be a fire in this area, do you feel that your property would be safe?
   a. Prompt: due to topography, forest conditions, etc.?

9. Are there things you can do to make yourself feel more prepared or safe from a wildfire?
   a. Prompt: do you plan to do (_____)?
   b. Prompt: do you have your own personal evacuation plan? Would you tell me about it?

10. If you lost your house due to wildfire would you rebuild in this spot?

11. Did the Jocko Lakes event change how you feel about staying in this spot?

12. Do you worry more about wildfires now?
   a. Prompt: are you worried about this summer?
   b. Is there anything you do to keep from worrying about wildfires?

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