

Using Multidisciplinary, Conflict-based Experiential Learning to Train Students on How to Address Controversy at the Public-Private Land Interface

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Abstract

Agricultural and natural resource managers face complex problems that involve thinking across multiple disciplines, particularly in North America where professionals often work in multi-use landscapes containing both private and public lands. Here we describe a multidisciplinary, conflict-based experiential learning course we developed to prepare students to address complex issues facing future managers working at the public-private land interface. Using both pre- and post-course surveys and qualitative analysis of reflective essays, we observed that following our course students (1) were more aware of conservation needs and more sensitive to perspectives of various stakeholder groups concerning those needs, (2) embraced complexity and multidisciplinary thinking needed to address management challenges at the public-private land interface, and (3) showed appreciation of and became more comfortable discussing controversial issues with stakeholders and the general public. Students also became more willing to travel, work independently, and take a leading role in peer groups. By embedding students in a charged learning environment with multiple competing perspectives, our course has been able to build a more knowledgeable, empathetic and confident cohort of future employees who are better prepared to address complex issues facing agricultural and natural resource managers working at the public-private land interface.

Keywords: Multidisciplinary, Experiential, Conflict-based, public land, private land

With increasing human populations and associated demands on natural resources, agricultural and natural resource managers face complex problems that involve thinking across multiple disciplines (National Research Council, 1996; Andrade et al., 2014; Mariojouis et al., 2020). This is particularly the case in North America, where natural resource professionals often work across multi-use landscapes containing both private and public lands. Many university programs offer majors in agricultural sciences (i.e., animal, soil, plant, food sciences, etc.) in different departments, or even different colleges, than majors in natural resource conservation. This creates boundaries that limit the extent to which students take courses linking these disciplines (Öberg, 2011). There is a need to move beyond traditional intradisciplinary approaches if the next generation of agricultural and natural resource professionals is to be prepared to address challenging issues at the public-private land interface using a multidisciplinary approach (Arthur and Thompson, 1999; Pauly et al., 2019).

Agricultural and natural resource majors also can benefit from experiential and conflict-based learning environments. Experiential learning in a field setting contributes to increasing student retention and strengthening both problem-solving and decision-making skills of agricultural and natural resource majors (Millenbah and Millspaugh, 2003; Quesada-Pineda et al., 2011; Mazurkewicz et al., 2012; Scott et al. 2012). Conflict-based learning

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can generate emotional involvement and engagement by students in a lesson, potentially leading to a better understanding of complex issues in natural resources (Jungst et al., 2003). Tension created through conflict-based teaching in a multidisciplinary setting can be an engaging learning environment and spark creative problem solving when combined with reflective and generative dialogue (Freeth et al., 2019). Combining conflict-based, multi-disciplinary learning with an experiential environment could be particularly impactful for students being exposed to issues at the public-private land interface, although to our knowledge these pedagogical approaches are seldom combined in a single course or program.

In addition to helping students engage in learning environments that help them conceptualize the complex issues facing agricultural producers and natural resource managers, preparing students to be able to address these challenges in the work force requires students to develop strong interpersonal communication skills (Ryan and Campa, 2000). A recent survey of agricultural and natural resource leaders about priority workforce competencies for new graduates identified communication as one of the highest-rated skills for in both types of majors, particularly as it relates to dealing with crisis, public speaking and writing (Easterly et al., 2017). Further, the survey found that students showing leadership skills were highly desired by employers, especially as they relate to conflict or crisis situations (Easterly et al., 2017).

Here we describe a multidisciplinary, conflict-based experiential learning course we developed to prepare students to address complex issues facing agricultural and natural resource managers working at the public-private land interface. We used pre- and post-course student surveys and qualitative reviews of the students' reflective essays to evaluate the extent to which students became more adept at addressing complex, multidisciplinary issues. We focused particularly on problem-solving and communication skills. Our results support the adoption of this course format to address the need to better prepare students for careers requiring substantial interpersonal skills.

Materials and Methods

Teaching Model

"In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught." This quote by forestry engineer Baba Dioum during his 1968 presentation to the International Union for the Conservation of Nature and Natural Resources General Assembly highlights the primary hypothesis behind our approach: where as a student becomes more knowledgeable about a system, its stakeholders and its endangerment, they should be more likely to want to conserve it. This phenomenon is relatively well documented in human psychology and neuroscience, where conservatism can be triggered in response to negative or threatening stimuli (Pederson et al., 2018; Jost et al., 2003). Put in a natural resource management context, the more a student learns about biodiversity and endangerment of species

within an ecosystem, the more likely they will support the conservation of biodiversity in that system – likely often making them less supportive of extractive or agricultural land uses. Similarly, as students learn more about the threats agricultural producers face in response to shifting social, political, environmental and economic conditions, students should become more concerned with conserving their livelihood. Thus, our approach was to expose students to multiple stakeholder perspectives that often occur at the public-private land interface, and to have students address the conflicting questions of what to conserve, where, and by what means. By doing so, we hoped to increase student knowledge, empathy, communication and comfort in addressing complex management problems at the public-private land interface in their future careers.

To achieve this overall goal, our teaching model had three main objectives: (1) "setting the stage" by providing multidisciplinary instruction and instilling a deep understanding of the cultural and biological diversity in a focal ecosystem, (2) providing immersive, field-based experiences with stakeholders from different perspectives on a contentious issue, and (3) challenging students to reflect and articulate their experiences and thoughts on how to manage conflict at the intersection of agricultural production and natural resource management.

We carefully selected a focal ecosystem that (1) contained a matrix of public and privately managed lands and (2) had a diversity of stakeholders with varying attitudes and opinions on a contentious issue (or set of issues) concerning how that landscape should be managed. This latter point about diverse attitudes and opinions was key, as we wanted to identify an ecosystem where stakeholders would be open to engaging with the students on a topic of persistent conflict that was without an easy solution. We selected the Northern Great Plains (NGP) of central Montana as our focal area. Native temperate grasslands are one of the most endangered terrestrial ecosystems in the world and are identified as a high conservation priority by multiple conservation organizations (Carbutt et al., 2017). As a result, over the past several decades multiple governmental and non-governmental organizations in this region have taken steps to modify or reduce agricultural land use and resource extraction. For example, the Bureau of Land Management has changed policy for a large tract of land it now manages as the Upper Missouri River Breaks National Monument, the U.S. Fish and Wildlife Service has eliminated domestic cattle grazing leases from large portions of the 1.1 million acres Charles M. Russell National Wildlife Refuge, and a newly formed conservation group called the American Prairie Reserve has purchased 32 cattle ranches and eliminated agricultural production on over 420,000 acres of private and public rangeland (Yu et al. 2021). As a result of these actions and a decline in the population of rural agricultural producers in the region, there are increasingly polarized conflicts between the needs of conservationists and agricultural producers, with conservation organizations trying to conserve natural resources, and agricultural producers trying to conserve their way of life (Titus and Jachowski, 2021). This situation is not unique to the NGP; it occurs globally in what have

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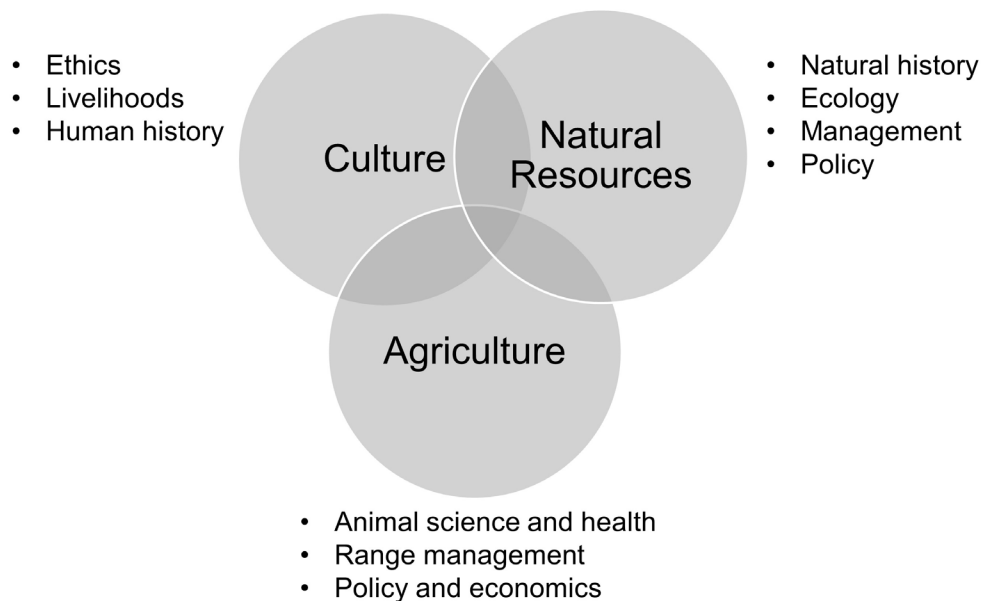
been popularly termed “Working Conservation Landscapes” (Cannavò, 2007).

To ensure that our students did not get lost in the “richness” of traveling without achieving our learning objectives, as happens in many field-based courses (Weidenhoff et al. 2003), we required them to take part in a 4-month (1 credit hour) course prior to the trip that provided an introduction to the diversity of disciplines, stakeholders and demands on natural resources in this ecosystem. We solicited for students to apply to the program from across the entire university, with targeted recruitment presentations given to students in two departments: (1) Animal and Veterinary Sciences and (2) Forestry and Environmental Conservation. In selecting students, we attempted to retain as much diversity in majors as possible (all students were from one of the two departments above), and did not discriminate based on past course work or year (i.e., freshmen, sophomores, juniors and seniors took part in the course). Our pre-trip instruction addressed three primary topics: agricultural production, natural resource management, and culture (Figure 1). In weekly meetings the students attended lectures by faculty with expertise in the natural history, livestock production, animal health and range management practices of the region. To develop a deep knowledge of the cultural history of this ecosystem, each student read and led a class discussion on the historical occurrence of people in this region, spanning

early Native American communities through the successive waves of European colonization and associated agricultural (e.g., homesteading, sheep, cattle) and natural resource extraction (silver, gold, oil and natural gas) practices up to the present.

The students then traveled to the NGP to take part in an immersive, 3-week field program led by 4 different faculty instructors. Activities generally fitted into the same three primary topics as the on-campus pre-trip lecture program: agriculture, natural resource management, and culture (Figure 1). The agricultural production portion was largely accomplished while living on a working cattle ranch, where students were exposed to everything from forage biomass and quality estimations and range management, to livestock health and management, and finally animal finishing and marketing (Figure 2). A ranch house served as a base camp for the 3-week field program, where students lived with faculty, prepared and ate meals together, and had ample opportunity for unstructured feedback and post-experience reflection. The natural resources section focused on field-based data collection and expert-led field trips involving natural history, site visits and active monitoring and implementation of wildlife conservation actions (Figure 2). The cultural component was incorporated in each section with unstructured interactions and scheduled meetings with people who were stakeholders in this ecosystem. The wide range of stakeholders included state politicians,

Figure 1.



Note. Diagram of the three primary content themes of natural resources, culture and agriculture that guided our educational approach to having students conceptualize the Northern Great Plains of Montana. This working conservation landscape model was intended to expose students to multidisciplinary thinking needed to understand the often-conflicting perspectives among stakeholders on what needed to be conserved in this region and how.

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private landowners, members of A'aninin and Nakoda Tribes in the Ft. Belknap Indian Reservation, conservation biologists and feed lot owners, among others. Interactions often took place over multiple days while working side-by-side, over a meal or in a car, but occasionally during round-table discussions following field sessions (more details on course activities can be found on the program webpage www.prairieecology.blogspot.com). In addition to these interactions with individual stakeholders, students attended an annual rangeland science symposium held in the core of the focal area with attendees from multiple stakeholder groups. This exposed the students to the first-hand exchange of conflicting attitudes and opinions, as well as areas of consensus or agreement among different stakeholders. Following each section of the field program, we provided a rest day to allow time for each student to reflect and, by the end of that day, to submit a reflective essay summarizing their observations and opinions on what they had experienced in that section.

The final component of our course allowed time for reflection and required students to articulate their thoughts regarding the NGP as a working conservation landscape. Within one week following the 3-week summer field program, each student was required to submit a reflective, synthetic essay focused on “defining” the Great Plains as a Working Conservation Landscape. Students were instructed to ask themselves and reflect on “...what each of these words

mean. What are we trying to conserve? What shaped this landscape in the past, shapes it now and will do so in the future? What did, and now does, this place mean to you? Who are the stakeholders and how are they unique? What are the conflicts? What role does science play?”

Assessment

We used both pre- and post-course surveys and student reflective essays to assess the extent to which our course accomplished our overall goal of making students more adept at addressing multidisciplinary problems facing managers at the public-private land interface. In traditional intradisciplinary learning environments there is a tendency for students to become polarized in their focus, or less likely to think across disciplines, as they learn of a topic or system - leading to the rise of interdisciplinary education programs over the past 60 years (Casey, 2010). We predicted that our multidisciplinary, field-based approach would simultaneously increase awareness across disciplines and sensitivity to the conservation needs of various agricultural and natural resource stakeholders living in close proximity to these lands. Accordingly, our first objective was to assess the extent to which our course simultaneously increased knowledge of conservation needs and sensitivity to multiple stakeholder perspectives as it relates to both agricultural production and natural resources. Second, we wanted to

Figure 2.



Note. Student field experiences focused in part on range management and animal production, where students engaged with multiple stakeholders, particularly agricultural producers, often assisting with ranch operations including fence repair (A) and cattle vaccination (B). The other portion of the field course focused on wildlife conservation, with students working with biologists to participate in a variety of tasks including the application of insecticide flea powder for disease mitigation in prairie dogs (C) and using trail cameras to monitor wildlife (D).

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assess the extent to which students became more aware and accepting of the need to think in a multidisciplinary fashion that takes into account various stakeholder perspectives when addressing complex issues at the public-private land interface. Third, we wanted to assess the extent to which our course influenced how comfortable students were in communicating with stakeholders. Finally, we wanted to assess how comfortable students became in taking leadership roles in addressing complex issues facing managers at the public-private land interface following our course.

We developed a 32-question survey questionnaire to assess student perspectives on conservation and public land management issues in a pre-post format. The survey questions were asked in a 7-point Likert scale format and focused on opinions regarding conservation, agriculture, and public lands management; as well as questions focused on confidence in interpersonal skills and professional development. Students were given the same survey questions on the first day of the classroom program and on the final day of the field program. We evaluated data from four years of the course (2016-2019), with 6-8 students taking part in the course each year, resulting in survey data for a total of 23 individual students. We used Wilcoxon signed-ranked tests to determine differences in responses to survey questions before and after the course and considered responses to be significantly different at $p \leq 0.05$.

We adopted a sequential explanatory approach (Wisdom and Cresswell, 2013) by using student reflective essays as qualitative data to better understand the findings from our quantitative surveys. Because the reflective essay was initiated a year before the survey questionnaire, we were able to include an additional seven student essays, allowing us to evaluate a total of 377 coded excerpts from 30 student reflective essays in our qualitative analysis. Using thematic analysis, we deductively coded students' essays into six different categories related to the course learning objectives: embracing conflict or complexity, empathy to multiple stakeholder perspectives, multi-disciplinary thinking and skills, self-growth and reflection, communication skills and other notable observations (Table 1). All survey materials and analyses were approved by the Clemson University Institutional Review Board (IRB-2020-059). All quantitative analyses were conducted using program R (R Core Team, 2017) and all qualitative analyses were conducted in MAXQDA (VERBI Software, 2019).

Results and Discussion

Simultaneously Increasing Awareness and Multidisciplinary Sensitivity

We found that students became more aware of the biodiversity ($F = 2.26$, $p = 0.03$) and endangerment of species of the Great Plains ($F = 2.93$, $p = 0.01$) after taking part in this course (Figure 3). Despite an overall increase in student awareness of the need to conserve species in this region, students did not become less supportive of multiple

uses of the land ($F = 2.37$, $p = 0.02$). Rather, students were more likely to support management actions on public lands that directly benefited neighboring private landowners and local communities (Figure 3).

In support of these quantitative findings, the post-course reflective essays demonstrated a high level of empathy towards private landowners (specifically ranchers). Empathy towards stakeholders (which included ranchers) was the second most frequently represented code (Table 1), and there were many excerpts describing amazement at the work ethic and dedication of the ranchers, which likely elicited emotive reflection among many of the students throughout the course.

The goals of ranchers ultimately relate back to sustainability of the land and even more, many ranchers are tied to their prairie land and feel connected to it along with any wildlife that may inhabit it.

Our pre- and post-course survey also suggested that students exhibited less support for conservation organizations as being good stewards of the land ($F = -3.00$, $p < 0.01$; Figure 3). Similarly, in their reflective essays, students often commented about the value of private landowner stewardship, which is not surprising given that many of them wrote that interacting with the ranchers was their favorite part of the course. Collectively, given that a majority (74%) of students in the course came from natural resource conservation majors with little or no animal production background, we view this as a strong indication of the impact of our course on students with regard to greater awareness and empathy toward agricultural producers as stakeholders in this landscape.

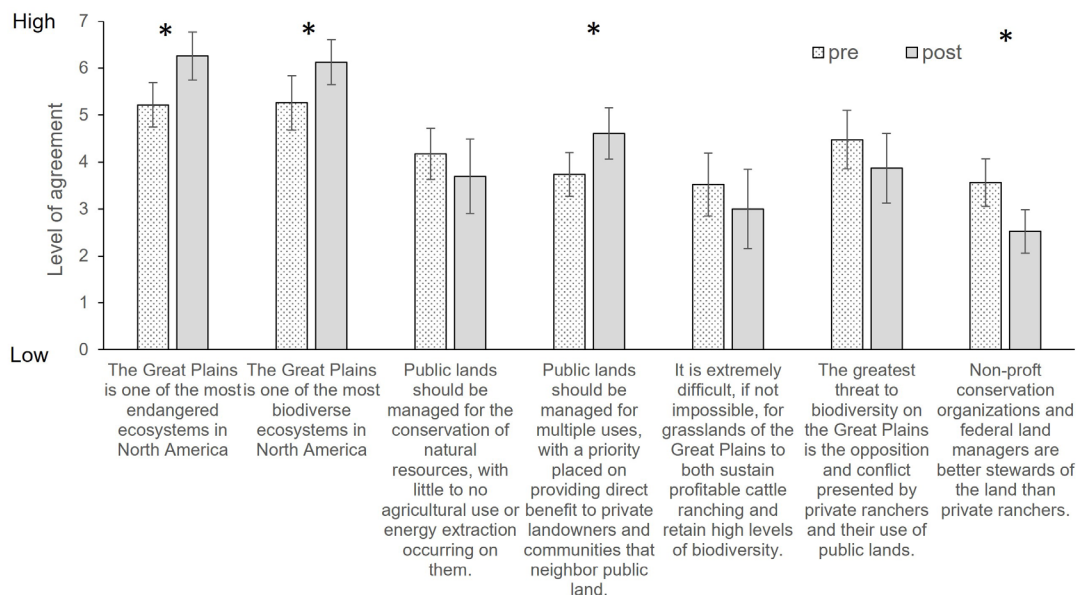
In addition to agricultural producers and natural resource conservation organizations, students also exhibited a greater understanding of and empathy toward other stakeholder groups in the region. This was especially the case when students reflected on the inclusion of Native American constituents throughout the conservation decision-making process. "Conservationists must possess the ability to understand other cultures within Montana that have been previously established for hundreds of years."

Statements of these types highlight an intended theme of the course, in which students were challenged to define what needed conservation in multiple forms, including the need for cultural conservation in the region (Figure 1).

Embracing Complexity and Multidisciplinary Thinking

Among the six codes we used in assessing reflective essays, two of those most commonly represented were embracing conflict or complexity (30.6%) and embracing multi-disciplinary thinking and skills (14.4%; Table 1). Realization of the complexity of conservation issues in the NGP was nearly unanimous among students, with many referring to these issues as 'not black and white' as they once thought. Through engaging with diverse stakeholders, students became more aware of the different challenges that these individuals face and how one group's actions can influence other groups.

Figure 3.



Note. Pre vs. post-course survey results from student taking part in our course, where students responded to questions pertaining to natural resource conservation and land management on a Likert scale of agreement between 0 and 7. Asterisk above paired bars indicates a significant difference existed between pre- and post-course survey responses.

The complexity of the Great Plains goes far deeper than I initially thought. So when planning out conservation efforts it is important to look at every component in the system. You cannot expect a system to work efficiently by leaving out an integral piece, and every representative person and community is integral in the working system of the Great Plains.

Students also displayed the ability to synthesize multiple stakeholder perspectives in guiding their formation of opinions and solutions to issues facing land managers. “We were able to see it from several different points of view and piece together the different parts of the trip to form our own views and opinions.” This multidisciplinary thinking in turn often led to new appreciation and understanding of what was needed in order to become a future professional.

Through this I was able to ask new questions and view conservation from a perspective I had never thought of before; this knowledge has not only rounded me as a person but also as a future wildlife biologist.

Communication

We found that in comparing pre- and post-course survey results, student became more comfortable discussing controversial issues with private agricultural producers, government agency employees and the general public (Figure 4). Further, in reflective essays students showed in increased appreciation for the value of inter-personal communication skills, particularly as a means to mitigate future conflict. “Modern conservationists must be diplomatic and focus of communication between stakeholders.”

The only stakeholder group about which students failed

to illustrate a significant increase in comfort following the course was communicating with scientists. This finding was initially surprising given the amount of time students spent with faculty instructors as part of this course, but was likely in part due to the students showing a high level of pre-course comfort in speaking with scientists. Absence of a strong increase in comfort post-course also could be due to the exposure of students to other disciplines of scientific thinking and the Dunning-Kruger effect (Kruger and Dunning, 1999), where the complexity of how to apply and discuss science across disciplines made them feel less comfortable overall despite the increased exposure to scientists and likely increased knowledge of how to apply science during our course. Finally, this result could in part be due to students taking the post-course survey at the end of the field section and ahead of analyzing and reporting on the field data they collected – so it is possible that if we did a later post-course survey those scores would differ following the presentation of their findings to a scientific audience.

Students became more willing to travel, work independently, and take a leading role in peer groups as a result of the course (Figure 4). While future job placement tracking is needed to assess the impact of students in the work force, we view this course as a success in terms of producing students who are more knowledgeable, prepared and willing to take a leading role in applying multidisciplinary thinking needed in addressing complex issues facing managers working at the private-public land interface of conservation landscapes.

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Table 1.

Codes used in qualitative analysis with example quotes and percent represented in student reflective essays.

Code	Description	Example Excerpt	Percent Represented
Embracing conflict and complexity	Pertaining to realization of complexity of conservation issues or apparent conflict surrounding such issues	"The debate regarding the future management of this ecosystem is not just a black and white issue but rather a complex multilayered affair as the main components of ranching, conservation and management techniques all connect together in the grand design of the prairie."	30.6
Empathy towards multiple stakeholder perspectives	Recognizing and empathizing with multiple and often opposing stakeholder perspectives simultaneously	"How can you sympathize with a group if you do not have a thorough understanding of their beliefs and background? Similarly, how can you expect someone to reciprocate if you have not invested time in learning the reasons behind their beliefs?"	29.3
Multidisciplinary thinking and skills	Understanding the importance of interdisciplinary tools/ thinking to achieve sustainable conservation outcomes	"In order for conservation in a working landscape to be successful, we must first recognize that it is an innately multi-dimensional field that involves nearly all other disciplines."	14.4
Self-growth and reflection	Intrapersonal reflections on impactful experiences/ interactions from the course	"I met some of the hardest working people while being in Montana, and it just further motivated me to pursue my career goals and work as hard as I possibly can to get there."	14.4
Communication skills	Understanding the importance of public communication skill development for achieving conservation goals	"It seems to me that we need effective communication between agricultural industries and the academic world now more than ever."	5.8
Other	Other interesting excerpts regarding course experiences	"One of our most harmful limitations as humans is our frequent inability to see the world through another's eyes."	5.6

Summary

There is a need for professionals who can effectively sustain agricultural production and manage natural resources in working conservation lands where inherent differences of opinion in what to conserve creates conflicts. By embedding students in a charged learning environment with multiple competing perspectives, our course has been able to build a more knowledgeable, empathetic and confident cohort of future leaders working at the intersection of agriculture and natural resource management.

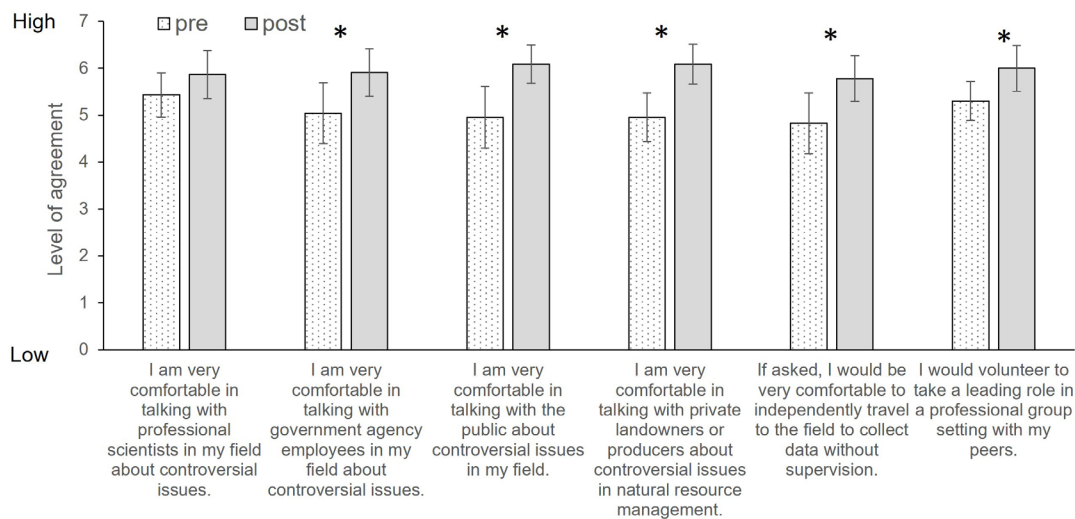
Our multidisciplinary approach helped avoid the trend in intradisciplinary education where students often become less likely to empathize with diverse stakeholder groups. In particular, as students became more knowledgeable about the biodiversity and endangerment of species within the NGP ecosystem, they did not become less likely to support multiple uses of public lands and stewardship from agricultural producers. By contrast, we observed a trend toward supporting private agricultural producers as stewards, which fits the multi-use management policy direction taken by multiple state and public land management agencies in the US, and globally (Bates, 1993; Cannavò, 2007; Hoogstra-Klein et al., 2017). Moreover, our multidisciplinary approach allowed students to realize the many varied definitions of conservation by different stakeholders (i.e.,

agricultural, natural resource, and cultural conservation) that are important to consider in decision making by future managers operating in working conservation landscapes. Such interpretive plurism of the term "conservation" is critical for creating the ethical space for a more inclusive discussion of what to conserve (Crowshoe and Lertzman, 2020), particularly as it relates conservation on or near indigenous peoples' lands, which are a critical part of the western North American landscape.

Direct interaction with stakeholders and experts *in situ* likely provided students with greater confidence in communicating about controversial issues with their peers and the public. In addition, students expressed increased confidence in not only traveling to sites and interacting with diverse sets of stakeholders, but in leading professional teams in using science to address questions of interest. Collectively, while longer-term evaluations of alumni are needed, our multidisciplinary, conflict-based experiential learning course appears to have helped prepare students to enter the workforce and address complex issues facing agricultural and natural resource managers working at the public-private land interface.

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Figure 4.



Note. Pre vs. post-course survey results from student taking part in our course, where students responded to questions pertaining to comfort in communication on a Likert scale of agreement between 0 and 7. Asterisk above paired bars indicates a significant difference ($p < 0.05$) existed between pre- and post-course survey responses.

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