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An Analysis of Selected Upper-division Core Courses in the Haub School's Environment and Natural Resources Curriculum

By

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B.S. University of Vermont, 2012

Plan B Project

Submitted in partial fulfillment of the requirements
for the degree of Masters of Science in Natural Science
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Laramie, Wyoming

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Abstract

The Haub School of Environment and Natural Resources (ENR) is an interdisciplinary School at the land grant University of Wyoming (UW). This study begins to assess whether and how the Haub School is meeting specific learning objectives by analyzing student and alumni feedback related to two upper-division core courses in the ENR core curriculum. Current students and alumni were surveyed to determine their opinions regarding whether these courses achieved selected learning outcomes as well as the degree to which these outcomes were useful within their careers. Results showed that, categorically, students and alumni did not differ significantly in their high reported opinions regarding the efficacy of these courses to provide specified knowledge and skills, and with relevancy to their current or future careers. This study also reviews the state of environmental studies curriculum in higher education as described in current scholarly literature. Both the literature and respondents' qualitative responses revealed insight into the challenges, successes, and opportunities for this relatively new interdisciplinary field of study.

Acknowledgements

This project was quite the adventure, and was made possible with the support of numerous people. I would like to give a huge thank you to Sylvia Parker and Ana Houseal for their dedication to the success of each and every person in our program, and for providing limitless support along the way. I would also like to thank Maggie Bourque and Doug Wachob for their early help in honing my initial thesis ideas; Melanie Matthews for her help with my survey platform and data acquisition; Josh Leonard for his informal edits and encouragement; my parents, Dave and Karen, and sisters, Rebecca and Jessica, for their endless support in my academic endeavors; my committee members, Doug Wachob, Jacqueline Leonard, and Andrea Burrows for their helpful input, and to my Teton Science graduate cohort for their cheerful attitudes and wonderful friendship. Last but not least, I would like to thank my committee chair, Courtney Carlson, for her guidance and reassurance, replying to emails on weekends, talking through my ideas, and encouragement. I could not have done this without all of you, so thank you once again!

Table of Contents

LIST OF TABLES v

LIST OF FIGURES vi

CHAPTER 1: Introduction 1
- Context and Rationale 1
- Goals of the Study 4
- Research Questions 5

CHAPTER 2: Literature Review 6
- Educational Program Evaluations 6
- Environmental Studies in Higher Education 9
- Summary of Literature Review 17

CHAPTER 3: Methods 19
- Study Participants 20
- Data Collection 21
- Data Analysis 22
- Study Limitations 23

CHAPTER 4: Results and Analysis 25
- Survey Responses and Reliability 25
- Differences Between Alumni and Current Students 26
- Career Placement 26
- Educational and Career-relevant Objectives 27
- Quality of Instruction 31
- Summary of Results 32

CHAPTER 5: Discussion 33
- Conclusions 33
- Implications and Recommendations 35
- Summary of Discussion 39

REFERENCES 40

APPENDIX A: Key Terms and Definitions 44

APPENDIX B: Haub School Learning Outcomes 46

APPENDIX C: Survey Questions 48

List of Tables

Table		Page
1	Breakdown of Survey Respondents by Graduation Year	25
2	Comparison of Reported Alumni Career Sector and Current Student Desired Career Sector	27
2	Average Responses to the Statement: "I feel that the selected Haub School courses helped me to"	29
3	Average Responses to the Statement: "I have found these elements to be useful within my career/ I feel these elements will be useful in my future career"	30

List of Figures

Figure		Page
1	Haub School ENR Major & Minor Course Requirements	2
2	An Illustration of Suggested Environmental Studies Curriculum Structure	18
3	Alumni Responses to Overall Rating of Quality of Instruction in Haub School Courses	31
4	Current Student Responses to Overall Rating of Quality of Instruction in Haub School Courses	31

Chapter 1:
Introduction

Context and Rationale

In this study, the primary investigator examines curricula within the Haub School of Environment and Natural Resources, an interdisciplinary school at the land grant University of Wyoming (UW). The School hosts academic programs in environment and natural resources, environmental systems science, sustainability, and outdoor leadership.

According to the Haub school's website:

> The Haub School of Environment and Natural Resources gives students the skills and tools to build sound, innovative, lasting solutions to our most complex environmental and natural resource challenges. Solving natural resource challenges…is the most critical work of our time. Our students craft real-world solutions, and our graduates go on to become leaders and problem solvers. ("Academic Programs", 2016)

Furthermore, the stated mission of the Haub School is to advance the understanding and resolution of complex environment and natural resource challenges through fostering students' skills for communication, critical thinking, and collaborative problem solving. ("About Us", 2016)

In this study the primary investigator examined only the concurrent undergraduate major and minor in Environment and Natural Resources (ENR), which is always offered in conjunction with another primary major at UW. Both the major and minor in Environment and Natural Resources (ENR) at the University of Wyoming require a core course progression consisting of five courses, two of which are of interest in this study.

Specifically, the researcher chose to evaluate ENR 3000, Approaches to Environmental Problem Solving, and ENR 4900, Environmental Assessment, because in both students must synthesize interdisciplinary content to address current environmental issues. The researcher determined that these courses embodied the goals of the Haub School's ENR program and therefore merited further investigation.

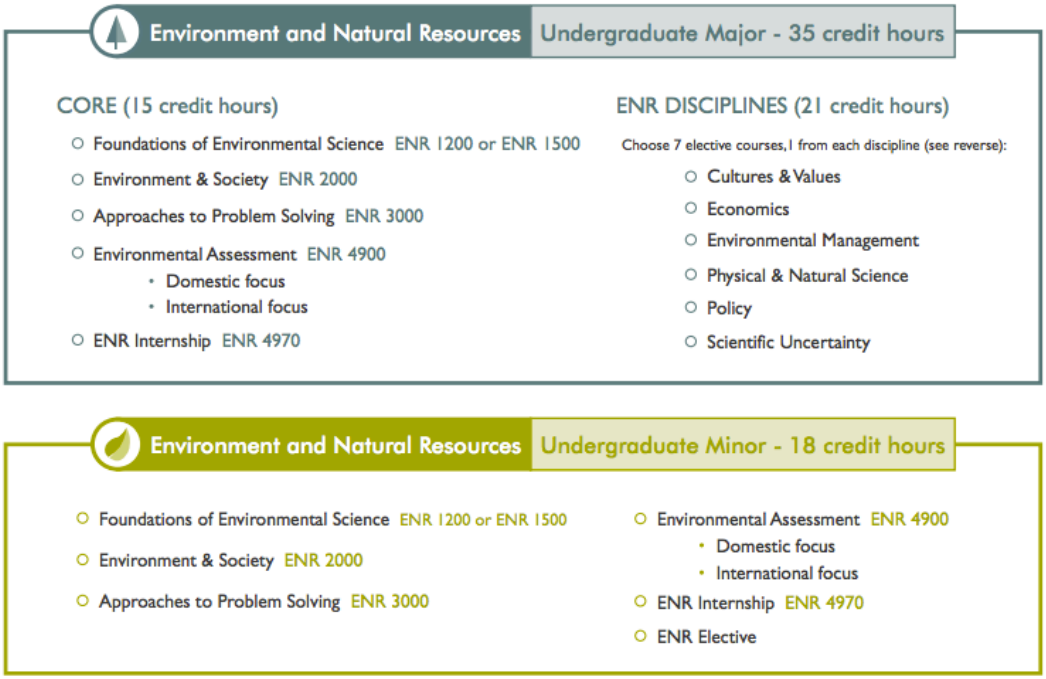


Figure 1: Haub School ENR Major & Minor Course Requirements

The first of two upper-division core courses, ENR 3000, Approaches to Environmental Problem Solving, aims to prepare students to solve structurally complex natural resource issues in the face of uncertain knowledge and conflicting values. Student learning objectives specific to this course include:

- Understanding the characteristics of natural resource problems;

- Learning the ideal process of public problem solving and decision making in the context of current real-world issues;
- Using environmental assessment and adaptive management as tools for effective problem solving; and
- Surveying collaborative problem-solving approaches across a variety of spatial and temporal scales while respecting a diversity of vested interests, cultures, and values (DeWolf & Smutko, 2016).

The second upper-division core course and final course in the ENR major or minor, ENR 4900, Policy in Practice/Environmental Assessment, builds upon the learning objectives of ENR 3000. Students compare environmental problem-solving processes and familiarize themselves with the associated legal and regulatory frameworks. During the programmatic years under investigation in this study, students in ENR 4900 typically completed a semester-long, team-based, collaborative research project. According to instructors of the course, this allowed them to delve into a relevant environmental issue via problem-based learning; students sought out multiple perspectives on the issue, facilitated a mock public meeting, and practiced critical thinking in order to develop and present a solution with a defensible rationale (Stoellinger, 2016).

If transmitted effectively, the comprehensive knowledge, skills, and perspectives in these two core courses should prepare Haub School graduates to succeed in a broad spectrum of careers. In theory, interdisciplinary training should equip Haub School alumni entering the workforce to address environmental issues while considering social, natural, economic, and political implications (Jones & Merritt, 1999). the primary

investigator was interested in whether or not these core courses have been effective to these ends.

Goals of the Study

The goal of this study is to assess whether the Haub School of Environment and Natural Resources is meeting its stated learning objectives[1], as well as those recommended in current environmental studies literature, via the aforementioned upper-division core courses. Additionally, the primary investigator aims to discern which, if any, of these identified knowledge and skill sets have relevance in the workplace by collecting and analyzing the perspectives of current students and alumni regarding course content and career applicability. Do current students and alumni report that in these courses they gained the "ethical and holistic thinking, understanding of natural resource complexities, and comprehensive problem-solving skills" that the courses strive for ("Academic Programs", 2016)? Is student learning situated within a broadly relevant environmental studies framework[2]?

Ideally, when the desired learning outcomes for the ENR major or minor are met, students can transfer ENR skills and knowledge into their future careers. The researcher hopes to gain insight into the overall efficacy of these core courses. Are these courses meeting Haub School goals to prepare students for professional success? If so, by what means (for instance, through transmission of knowledge, skills, or both)? The results may be useful to Haub School faculty and administrators as they determine whether and how to modify these important courses. There is little recent literature regarding best

[1] See Appendix B for the Haub School's stated learning outcomes.

[2] For definitions of these and other key terms, see Appendix A.

practices for determining curricular outcomes using programmatic evaluation within collegiate environmental studies programs. This study will help to fill that gap.

Research Questions

1. Do Haub School students report that their upper-division core courses are effectively achieving desired educational and career-relevant outcomes?
2. Do alumni & current students significantly differ in their evaluation of the upper-division core courses' educational and career-relevant outcomes?

Chapter 2:
Literature Review

This investigation of the efficacy and professional applicability of learning objectives in the selected Haub School courses is of course contextualized by broader trends in collegiate environmental studies. The following section presents a review of literature relevant to this field.

In the literature review, these key concepts are examined:

- The history, goals and challenges associated with educational program evaluation;
- The history of environmental studies, an emerging field in higher education; and
- An exploration of recommended curricular elements for a successful environmental studies program, including interdisciplinary programmatic content, emergent themes, and effective delivery and pedagogy.

Educational Program Evaluations

Definition

In general, educational program evaluation can be defined as "the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve or further develop program effectiveness, inform decisions about future programming, and/or increase understanding" (Patton, 2008, p. 39). Program evaluation takes place within a broader institutional setting, and

can often generate evidence to justify the program's worth and assure funders and administrators that resources are being used expediently (Carleton-Hug & Hug, 2010).

History

Program evaluation is a relatively new development in education, with the first studies performed in the first half of the 20th century. It was not until 1965 that the federal government of the United States passed The Elementary and Secondary Education Act mandating evaluation in K-12 public schools (Weiss, 1998).

Often programmatic assessment takes place in order to ensure that accreditation standards are met. Although the U.S. Department of Education does not require institutions of higher education to be accredited, in order to participate in federal student aid programs colleges and universities must receive this accreditation recommended by the National Advisory Committee on Institutional Quality and Integrity (NACIQI), (NACIQI, 2016). At the institutional level, universities conduct review and analysis regularly: an accreditation agency will determine whether programs are sufficiently rigorous and effective following an evaluation process (NACIQI, 2016). Some academic programs, such as those in business and management fields, have program-specific accreditation. For instance, the Association to Advance Collegiate Schools of Business (AACSB) is an organization that has accredited 399 graduate and undergraduate management programs in the United States in the past 80 years (Miles et al., 2004). The academic field of environmental studies does not have an accrediting body, which presents both challenges and opportunities for programmatic curriculum design and assessment.

Challenges and Goals

When embarking upon an academic program evaluation, it is imperative that administrators and faculty understand the challenges and goals of the process. Because the field of environmental studies is incredibly diverse, environmental studies programs must establish clear learning goals and desired curricular outcomes before effective evaluation can occur. Ideally, evaluation criteria should directly align with these learning goals and outcomes (Carleton-Hug & Hug, 2010).

Diverse contextual factors in environmental studies, such as concurrent majors and a wide variety of co-curricular internship experiences, can confound program evaluations. It can therefore be difficult to determine whether learning occurs within or outside of an academic program (Carleton-Hug & Hug, 2010).

Interestingly, the principle of adaptive management, from natural resource science, has also been recommended for use in educational evaluation (Williams et al., 2007s). Adaptive management is a systematic process in which continual improvements are achieved after learning from and changing management based upon previous outcomes (Williams et al., 2007s). It can be a best practice for long-term improvement of curriculum, allowing faculty and administrators to make small changes, observe or test the effects of the changes, and use results to inform future curricular modifications and actions (Jenks et. al., 2009; Monroe, 2010). For the same reasons, longitudinal studies, when possible, should also be employed (Monroe, 2010).

Environmental Studies in Higher Education

Defining the field

Environmental studies is a broad interdisciplinary academic field focusing on the complex natural and built environments of our earth, as well as the interactions and relationships between them. Practitioners often aim to solve contemporary environmental problems (National Center for Education Statistics, 2016). An environmental studies curriculum commonly pulls from knowledge and methods based in, but not limited to, the following fields: ecology, biology, anthropology, chemistry, economics, statistics, political science, engineering, philosophy, and sociology (Soule & Press, 1998).

Given the breadth of environmental studies, determining and meeting uniform learning objectives within the discipline is a special challenge. For instance, environmental studies as a discipline is theoretically and practically complex, and some even argue that it lacks a singular focus (Caviglia-Harris & Hatley, 2004). The immense academic scope of environmental studies includes a spectrum of potentially conflicting ideologies, problem definitions, analyses, and favored solutions, which complexity can pose challenges for students, faculty, and administrators alike (Clark, 2011; Soule & Press, 1998). Furthermore, programmatic content and objectives often closely overlap with those in environmental science, ecology, and broadly focused natural resource science programs (Soule & Press, 1998). While this literature review focuses primarily on environmental studies, it also addresses some content related to environmental science, ecology, and natural resource science in higher education.

Emergence of the academic discipline

Environmental studies is unique as an academic field as it grew out of the parallel social movements of environmentalism and academic experimentation in higher education. Environmental concerns began to enter mainstream American political life as early as the nineteenth century (Dunlap, 2014). Collegiate environmental studies programs in the United States began to emerge in the 1960s, alongside the dawn of the modern American environmental movement (Dunlap, 2014). This coincided with academic experimentation and growth within institutions of higher education in general, and with a higher student demand for socially relevant curricula (Soule & Press, 1998). The first national "Earth Day" was celebrated in 1970, and throughout that decade, subjects relevant to environmental studies were dispersed across various other disciplines that studied the environment in one way or another. It was not until the 1980s that independent programs in environmental studies emerged (Tilbury, 1995). By the early 1990s, many educators in these new collegiate environmental studies and natural resource programs were becoming strong proponents of using holistic, interdisciplinary approaches within this evolving field (Manning, 1998). Currently, demand for interdisciplinary environmental science and studies programs is rapidly increasing nationwide, with many institutions developing new programs each year (Vincent, 2010).

Program content and emergent themes

Ideally, a collegiate level environmental studies curriculum should be comprised of a few discrete, intentional components that encompass programmatic goals within its core course progression. If delivered in an effective manner, this curriculum should adequately prepare students for their desired post-graduate careers (Manning, 1998).

Some researchers have suggested that an overarching theme can lend coherence to otherwise diffuse environmental studies curricula. For instance, Spelt et al. (2009) and Cortese (2003) recommend incorporating principles of sustainability into curriculum through interdisciplinary, systems-thinking perspectives. They posit that this approach can overcome two problems—the tendency to compartmentalize knowledge and to oversimplify complex systems—that are common in higher educational environmental degree programs (Cortese, 2003; Spelt et al., 2009).

Although it is difficult to find any one template or standard for what an environmental studies curriculum should include, there are at least four recommendations that crop up repeatedly in the literature. First, Ginger et al. (1999), who have published multiple studies analyzing the University of Vermont's environmental studies program, and Simons et al. (2014), who examine how interdisciplinary environmental degrees apply to careers in the natural resources profession, argue that core courses should focus on the complex interactions between social, economic, political, and natural systems, as well as the individual structure and function of each. Second, Junyent and Ciurana (2008), who have presented an environmental studies model for European and Latin American universities, advise that curricula should also address conflicts and complements between these realms. They suggest incorporating relevant case studies to contextualize local issues within global problems and solutions whenever possible. Third, Junyent and Ciurana (2008), among others, stress that risk assessment skills and problem-solving techniques should be explicitly modeled. Finally, Soule and Press (1998) recommend a strong basis of knowledge in ecology, biology, chemical sciences, economics, policy, natural history, risk analysis, statistics, and research methods. All four

of these curricular attributes—the analysis of socio-ecological systems, local to global case studies, risk assessment and problem-solving skills, and scientific content—are present in the Haub School's upper-division core course objectives.

Effective delivery

In "Seven Principles for Good Practice in Higher Education", Chickering and Gamson (1989) state "what is taught, after all, is at least as important as how it is taught" (p. 3). Effective delivery of all environmental studies material, and especially core course content, is critically important. Instruction across core curricula should follow a relevant progression that incorporates continual synthesis and systems thinking strategies throughout to promote critical thinking overall (Ginger et al., 1999; Vincent 2010). Instructors should also demonstrate a consistent relationship between theory and practice (Junyent & Ciurana, 2008). In an interdisciplinary environmental studies classroom it is particularly important for instructors to respect all learning styles and promote students' active participation in construction of knowledge, especially given the greater diversity of student strengths, expertise, and backgrounds in interdisciplinary courses (Junyent & Ciurana, 2008). This can be achieved through project-based scenarios and exposure to natural settings through field courses or internships. In these "real world" settings, instructors can also foster students' decision-making skills and introduce them to issues associated with diversity of scale, socio-cultural contexts, and complexity (Junyent & Ciurana, 2008; Soule & Press, 1998). Cavaglia-Harris and Hatley (2004) add that team teaching is another effective way to bridge multiple perspectives and areas of expertise in environmental studies courses.

Interdisciplinarity

Researchers tend to agree that higher education environmental studies programs should be holistic and interdisciplinary in order to produce graduates with broad experiences and skills. Students ought to be able to integrate theory, knowledge, and practices from across disciplines to solve complex problems (Ardoin, 2006; Cavaglia-Harris & Hatley, 2004; Spelt et al., 2009; Vincent, 2010). Ginger and Wang (2000) and Spelt et al. (2009) define interdisciplinary education as a synergistic, integrative educational approach that emphasizes synthesis and connections between disciplinary components in a problem-oriented, contextual manner.

While interdisciplinary learning tends to complement multidisciplinary approaches well, it should not be confused with multidisciplinary education, which is an additive educational approach that addresses a topic from the perspective of multiple disciplines without necessarily working towards connecting or synthesizing these different perspectives (Ginger & Wang, 2000; Spelt et al., 2009). It is important to note that research in the realm of interdisciplinary higher education is still limited and exploratory in nature. There is a particular need for more research examining the efficacy of interdisciplinary teaching strategies in higher education (Spelt et al. 2009).

Manning (1998), writing about environmental studies program graduates, said that students often lacked the ability to apply interdisciplinary approaches to contemporary environmental problems. He warned that students could emerge from undergraduate education with some abilities specific to a primary discipline, but with limited capacity to integrate knowledge across disciplinary boundaries in order to address complex problems. With many employers of environmental studies program graduates

emphasizing integrative, interdisciplinary knowledge, environmental studies programs must address these competencies in order to prepare their students for careers (Manning, 1998).

In a program such as the Haub School's ENR program, where students pair the major or minor with studies in another discipline, the core curriculum aims to enhance and integrate the knowledge and insight students bring to the program from their past and concurrent experiences (Academic Programs, 2016). Manning (1998) emphasizes that as graduates face the contemporary environmental problems of our modern world, single-disciplinary, specialized education simply does not enable students to succeed in the process of finding solutions. Soule and Press (1998) posit that "interdisciplinarians," by contrast, are capable of understanding the individual nuances of multiple disciplines and therefore can interact and communicate effectively with a wide range of professionals from many fields.

Given these trends, the demand for interdisciplinary degrees is increasing exponentially within the United States (Vincent, 2010). Vincent (2010) observes that successful interdisciplinary environmental studies programs facilitate skill development in cooperation, communication, analysis, creativity, decision-making, critical thinking, and synthesis—all skills in demand in the contemporary workplace. Biox Mansilla et al. (2000) go even further to suggest that interdisciplinary higher education in general results in "a cognitive advancement… in ways that would have been impossible or unlikely through single disciplinary means" (p. 219).

This interest in interdisciplinarity notwithstanding, some researchers argue that division of information into specialized disciplines is still necessary to comprehend

increasingly complex bodies of knowledge (Ginger & Wang, 2000). In other words, interdisciplinary programs depend on strong disciplinary content and expertise (Ginger & Wang, 2000).

Despite the resounding support for interdisciplinary environmental studies education, faculty and program administrators face challenges when it comes to translating these interdisciplinary philosophies into practice. One of the most confounding is the tension between depth and breadth (Ginger et al., 1999; Simons et al., 2014). According to Soule and Press (1998) too much breadth can hinder the goal of environmental studies, which is "to educate ecologically literate, responsible citizens who are problem solvers and agents of constructive social change" (p. 397). Therefore, they recommend a focused core curriculum to ensure depth of crucial content, with requirements that students take courses outside the environmental studies department to ensure breadth (Soule & Press, 1998). On the contrary, Ginger et al. (1999) contend the opposite, arguing the need for increased breadth across disciplinary knowledge within the field of environmental studies, ideally integrating as much of the process and content as possible while recognizing that some disciplinary boundaries will persist. Regardless of the curricular philosophy a program follows, interdisciplinary instructors still encounter practical difficulties. For instance, it is difficult to find textbooks that incorporate multiple disciplines. This means that many instructors are tasked with finding discrete materials and integrating them, increasing the overall workload for interdisciplinary faculty as compared to their single-discipline counterparts (Caviglia-Harris & Hatley, 2004).

Institutional barriers present another challenge for those who wish to advance interdisciplinary environmental studies education. Cortese (2003), for instance, criticizes the structural aspects of our current higher educational system for having highly specialized disciplines, impeding interdisciplinary education, and hindering students who wish to gain the tools to address the complex issues that currently face graduates once they enter the workforce. In order to overcome this at an institutional level, "a paradigm shift towards a systemic perspective emphasizing collaboration and cooperation" is required (Cortese, 2003, p. 16). An example of this shift could be the establishment of interdisciplinary programs within a university, such as the Haub School, whose premise is to facilitate the integration of multiple disciplines and ideas. The responsibility to truly implement an interdisciplinary program often falls upon the typically highly specialized faculty or instructors. Simons et al. (2014) note that "integrating material across disciplinary boundaries makes demands on instructors…requir[ing] time and goodwill to define content…and an intellectual commitment to understanding the frameworks used outside one's own discipline, to explore what it means to cross disciplinary boundaries, and to define integrative thinking in systematic ways." (Ginger et al., 1999, p. 21) Additionally, Caviglia-Harris and Hatley (2004) point out that the responsibility to make a concerted effort to tie together the seemingly dissimilar threads of multiple disciplines in order to create a cohesive experience falls upon the instructors as well. Interdisciplinary environmental studies programs formulated as a way to produce graduates that could remedy many identified issues within the realm of natural resources and the environment. However, the structure of our current system of higher education, in which effective interdisciplinary higher education is often under-supported or even

marginalized, can hinder or prevent students from acquiring the tools and strategies necessary to address these complex issues facing the world today (Cortese, 2003; Vincent, 2010; Vincent & Focht, 2009).

Summary of Literature Review

Environmental studies is a broadly defined field that is relatively new in American higher education, with curricular foci, learning outcomes, and pedagogical practices that are hardly standardized across programs. However, a review of current literature suggests that there are some common recommendations for successful environmental studies programs. Namely, curricular content should include:

- A clear focus on complex interactions between social, political, economic, and natural systems with an understanding of the structure and function of each;
- Case studies and project-based learning activities to contextualize relevant issues and solutions;
- Modeled risk assessment strategies and problem solving techniques; and
- Methods, tools, and knowledge from a variety of relevant disciplines.

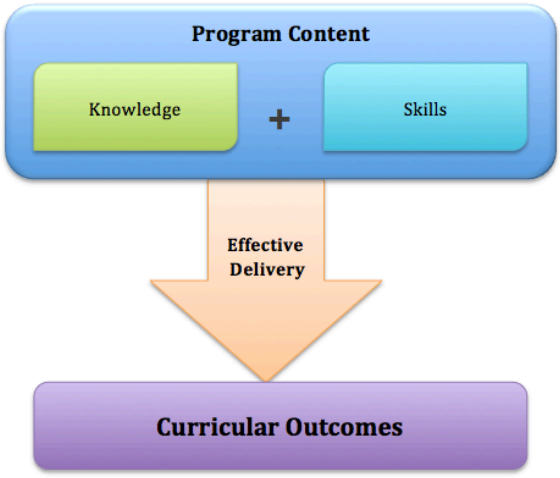
Elements of effective delivery include:

- An emphasis on continuity between relevant topics within a focused core progression;
- Incorporation of strategies to engage students in continual synthesis across disciplinary boundaries to promote critical thinking;
- Respect for a wide variety of learning styles and differentiated instructional techniques; and

- A link between theory and practice.

Key guidance from the literature is synthesized in figure 2 below. Namely, if programs integrate relevant skills and useful knowledge, and instructors deliver such skills and knowledge effectively to their students, students are likely to achieve programmatic learning outcomes.

Figure 2: An Illustration of Suggested Environmental Studies Curriculum Structure



In summary, interdisciplinary approaches to education have distinctive advantages, especially when curricula emphasize real-world problem solving and complex critical thinking. Research also reveals the many practical challenges that occur when attempting to implement such curricula, noting that incorporating career preparation into interdisciplinary studies can be especially challenging. Additionally, interdisciplinary education carries the burden of an increased tradeoff between breadth and depth of curricular content.

Chapter 3:
Methods

In order to evaluate the perspectives of current students and alumni regarding how well the upper-division core courses taught specific knowledge and skills, and to what extent those were useful in respondents' current or future careers, the primary investigator created a survey that synthesized learning objectives identified within both the Haub School's objectives[3] as well as the current reviewed literature.

The survey assesses respondents' reported knowledge related to planning, management, and the structure and function of ecosystems within political, economic, and cultural constraints, because the research suggests these represent some of the most critical knowledge students in environmental studies programs ought to attain. Furthermore, multiple authors stated that students should be able to understand the cultural, historical, philosophical and ethical contexts of environmental issues in the complex interface between human and natural systems (Smith & Williams, 1999; Vincent, 2010), so these areas were also surveyed.

Desired skill outcomes that the primary investigator highlighted within the literature include: (a) the ability to think critically, (b) communicate effectively, (c) work well with others as a team, and (d) solve multifaceted environmental problems to sustain the cultural and ecological integrity of our planet (Hungerford & Volk, 1990; Manning, 1998; Woodhouse & Knapp, 2000). Past researchers also posit that increased knowledge and confidence in these skills can increase the willingness of graduates to be flexible, adaptable, and responsive to constantly shifting social, economic, and political variables

[3] See Appendix B

as they attempt to solve environmental problems, which commonly play out within complicated contexts of conflicting interests and values (Jones & Merritt, 1999; Rowe, 2002).

The primary investigator used these components from the literature, blended with the Haub School's own learning objectives, to compile eleven skill and knowledge sets to evaluate in this survey. The eleven knowledge and skill sets were further grouped into the following categories for analysis: knowledge, decision-making, and soft skills:

- *Knowledge components* included topics surrounding understanding cultural, historical, philosophical & ethical contexts of environmental issues as well as the interfaces between them.
- *Decision-making components* included topics such as the ability to address problems in a manner that integrated practices, theory, knowledge, and methods from more than one discipline, as well as critical and systems thinking strategies.
- *Soft skill components* included the ability to work well with others and being flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables.

Study Participants

In February 2016, the primary investigator sent an internet link to a voluntary Institutional Review Board-approved survey. This was delivered via email to 77 Haub School undergraduate students who had taken ENR 3000, Approaches to Environmental Problem Solving, and ENR 4900, Environmental Assessment, in the past year. It was also sent to 84 alumni who graduated from the Haub School between 2009-2013, having

completed similar upper-division core courses. There were two reasons for selecting 2009 as the first year under evaluation: first, the basic content and structure of the two core courses has essentially not changed from 2009 to present, and second, the primary investigator was interested in the effect that at least three years in the workforce would have on graduates, and so chose not to survey more recent graduates. The primary investigator obtained potential participants' email addresses from the Haub School alumni database and current student database, with appropriate permission. Additionally, the primary investigator offered the opportunity to have participant's names entered into a raffle to win one of two $50 gift cards as a survey incentive.

Data Collection

The survey[4] contained both quantitative and qualitative questions. Section one asked participants: (a) which of the specified courses they completed at the time of the survey, (b) the name of their primary concurrent major with environment and natural resources, (c) their past or anticipated graduation year, and (d) any additional degrees they had acquired, if applicable. For alumni respondents only, section two gathered information on the respondent's employment status and sector, and asked them to indicate whether it was related to their degree or not. In section two, current students were asked to report their expected post-graduation employment status and sector, as well as relevancy to their degree. Section three solicited participant reflection on the upper-division core courses—specifically, respondents were asked whether those courses helped them to develop specified skills or knowledge that were highlighted in the literature, as well as to what degree they felt those elements are or will be useful within

[4] See Appendix B

their careers. The questions in this survey were created based on recommendations for program outcome evaluation in Carol Weiss' book, "Evaluation" (1998). As perceived overall quality of instruction can largely influence these responses, the final question asked participants to rate instructional quality.

Data Analysis

In order to ensure reliability of the surveys, the primary investigator performed a Cronbach's alpha test on the Likert scale questions in section three regarding course efficacy and applicability. In order to determine if there were statistically significant differences between student and alumni perspectives regarding course efficacy and applicability, the primary investigator analyzed the Likert scale responses using unpaired, two tailed t-tests. The responses were converted from a rating scale ranging from strongly disagree (1) to strongly agree (5). To ensure that there was not data wash out, in addition to comparing student and alumni responses to the entire efficacy section and the entire applicability section, the primary investigator also compared their responses within each of the three sub-categories (knowledge, decision making, and soft skills) for both efficacy and applicability sections using two-tailed unpaired t-tests. These Likert scale responses were also averaged for each question by participant type (current student vs. alumni) and analyzed to inform overall reported program efficacy in each respective category.

The primary investigator used qualitative responses solely for the purpose of contextualizing and clarifying the quantitative responses in my own analysis; nonetheless they provide valuable information should another researcher choose to analyze these data in the future.

Study Limitations

This study is constrained by a few factors beyond the primary investigator's control, including sample size, instructional quality, respondents' loyalty to the program, and the investigator's own student status.

Due to the nature of this study as a Plan B project, the time frame of the entire study was reduced to about four months. The sample size was constrained by the sheer number of candidates that fit the criteria of being either a current student within the program having completed a core course in the past year, or an alumnus having graduated between 2009 and 2013 (three to seven years ago). The primary investigator reached out to candidates twice via email during a three-week period. As the survey was voluntary, response rates were not within my control.

Quality of instruction within the program, although addressed in the survey, is not a focus of this study. Every student in the Haub School evaluates quality of instruction through mid- and end of semester evaluations. The primary investigator acknowledges that perceptions regarding quality of course delivery and instruction could influence respondents' reported skill and knowledge acquisition. Furthermore, multiple instructors have taught each of the core courses across the seven-year span that this survey covered, and therefore some inherent variety in the nature of course instruction exists.

Additionally, it is possible that student and alumni loyalty to the program was another confounding factor that could possibly influence respondents' answers to survey questions.

Interpretation of qualitative data has the potential to be biased, as the primary investigator is affiliated with the Haub School of Natural Resources. Therefore,

qualitative data is only used within the discussion to clarify quantitative results, and no formal conclusions will be drawn from it.

In spite of these limitations, ideally this study will help Haub School faculty and administrators to assess the efficacy and career applicability of the upper-division core courses with respect to programmatic learning goals (Preskill, 1994).

Chapter 4:
Results and Analysis

Survey Responses and Reliability

The primary investigator received 19 current student and 20 alumni responses to the full survey, which indicates a 25% response rate for current students and a 24% response rate for alumni. There was a fairly even distribution across graduation years of alumni, and most of the current student respondents reported that they plan to graduate this semester. The Cronbach's Alpha test indicated that both the course efficacy (11 items, $\alpha = .90$) and applicability (11 items, $\alpha = .84$) sections of the survey were internally consistent and reliable.

Table 1: Breakdown of Survey Participants by Graduation Year

Graduation Year	Number of Participants	Participant Type
2009	5	Alumni
2010	1	Alumni
2011	5	Alumni
2012	7	Alumni
2013	2	Alumni
2016	13	Current Students
2017	6	Current Students

Differences Between Alumni and Current Students

The primary investigator found that current students and alumni having graduated within the past three to seven years report similar efficacy and applicability ratings regarding the two upper-division core courses, ENR 3000 and ENR 4900. Additionally, the lack of statistically significant difference between current students' and alumni perceptions of the career applicability of coursework implies that students see themselves as well prepared for their careers post-graduation (course efficacy: t (20) = 0.19, p = 0.85; course applicability: t (20) = 1.66, p = 0.11)[5].

Career Placement

As shown in Table 2 below, current students' career expectations align well with alumni's current career sectors. These following self-reported responses demonstrate that the majority of Haub School graduates surveyed are successfully securing gainful employment within their intended career field. Additionally, the alignment between current students' desired career sector and the current career sectors of alumni (see Table 2) suggests that the Haub School is preparing students to pursue their desired post-graduation goals.

[5] See Table 3 and 4 for t and p values comparing alumni and current student ratings by sub-category

Table 2: Comparison of Career Sector as Reported by Alumni and Desired Career Sector as Reported by Current Students

Career Sector	Percent of Current Student's with this desired career sector post-graduation	Percent of Alumni currently working in this career sector
Federal, State or Municipal	26%	28%
Forestry/Natural Resources (for-profit)	16%	17%
Non-Profit	11%	6%
Education	16%	22%

Educational and Career-Relevant Objectives

The results of this study demonstrate that both current students and alumni are reporting that the upper-division core courses are effectively achieving specific educational outcomes identified within this study. Additionally, the results demonstrate that both current students and alumni are reporting that the specific educational outcomes identified within this study are applicable to their current or expected future careers.

As shown in Table 3, as compared to alumni, current students generally reported relatively higher ratings for knowledge and soft skill components, whereas alumni rated decision-making skills gained through the upper-division courses slightly higher than did current students.

Table 4 reveals that alumni consistently rated the utility of course elements in their careers slightly lower than current students rated the *anticipated* utility of course elements in their future careers, although the responses of both groups fell between the "agree" to "strongly agree" rating. Alumni had the ability to compare what they learned

in the courses to their current job, while current students were simply hypothesizing how useful these knowledge and skill sets would be in a future career, which could perhaps explain this result.

Overall, the courses evaluated in this study received fairly high scores regarding efficacy and career applicability. Most average reported ratings fell between the "agree" (4) to "strongly agree" (5) categories. The only rating to fall below into the "neutral" (3) rating category was from current students in response to a question asking whether the Haub School upper-division courses enabled students to "arrive at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues." This decision-making component encompasses the very heart of what environmental studies practitioners aim to achieve, and the literature suggests it is one of the most difficult skills to learn and implement.

In response to both the course efficacy and career applicability sections, survey respondents rated the acquisition of "soft skills" most highly, followed by the "decision-making" category and finally the "knowledge" category. It is noteworthy that "soft skills" were the most highly ranked outcomes in both the curricular and career-relevancy categories, suggesting a possible programmatic strength. The very slightly lower ratings in the "knowledge" category could be related to the context; decision-making skills are likely more often employed repeatedly through time while rote knowledge components may be used less frequently once student's time in a specific course focused on that content passes.

Table 3: Average Responses to the Statement:
"I feel that the selected Haub School courses helped me to…"

On a 5 point scale, where 1= strongly disagree and 5 = strongly agree	Current Students Average (n= 19)	Alumni Average (n= 20)	Combined Current Student & Alumni Weighted Average (n=39)	Two-tailed, unpaired T-Test Result comparing Current Students to Alumni
Understand the interface between social & natural systems (knowledge)	4.37	4.25		T= .54 P=.64 (no significant difference)
Understand cultural, historical, philosophical & ethical contexts of environmental issues (knowledge)	4.11	4.05		
"Knowledge" average rating	**4.24**	**4.15**	**4.12**	
Address problems in a manner that integrated theory and knowledge from more than one discipline (decision making)	4.21	4.05		T= .68 P= .51 (no significant difference)
Address problems in a manner that integrated practices and methods from more than one discipline (decision making)	4.00	4.10		
Arrive at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues (decision making)	3.84	4.10		
Utilize systems thinking in decision making (decision making)	4.26	4.05		
Find creative solutions to problems (decision making)	3.90	4.40		
Think critically (decision making)	4.42	4.40		
"Decision-Making" average rating	**4.10**	**4.18**	**4.14**	
Work effectively with others (soft skills)	4.32	4.50		T=.92 P=.41 (no significant difference)
Be flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables (soft skills)	4.32	4.00		
Develop a personal code of core environmental values & ethics (soft skills)	4.32	4.00		
"Soft Skills" average rating	**4.32**	**4.17**	**4.25**	

Table 4: Average Responses to the Statement: "I have found these elements to be useful within my career/ I feel these elements will be useful in my future career"

On a 5 point scale, where 0= strongly disagree and 5 = strongly agree	Current Student Average (n=19)	Alumni Average (n=20)	Combined Current Student & Alumni Weighted Average (n=39)	Two-tailed, unpaired T-Test Result comparing Current Students to Alumni
Understand the interface between social & natural systems (knowledge)	4.47	4.00		T= 2.9 P=.10 (no significant difference)
Understand cultural, historical, philosophical & ethical contexts of environmental issues (knowledge)	4.37	4.20		
"Knowledge" average rating	**4.42**	**4.1**	**4.26**	
Address problems in a manner that integrated theory and knowledge from more than one discipline (decision making)	4.37	4.30		T= 1.04 P=.32 (no significant difference)
Address problems in a manner that integrated practices and methods from more than one discipline (decision making)	4.56	4.25		
Arrive at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues (decision making)	4.47	4.15		
Utilize systems thinking in decision making (decision making)	4.00	4.00		
Find creative solutions to problems (decision making)	4.30	4.30		
Think critically (decision making)	4.56	4.55		
"Decision-Making" average rating	**4.38**	**4.26**	**4.32**	
Work effectively with others (soft skills)	4.63	4.65		T=.34 P=.75 (no significant difference)
Be flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables (soft skills)	4.53	4.45		
Develop a personal code of core environmental values & ethics (soft skills)	4.21	4.05		
"Soft Skills" average rating	**4.45**	**4.38**	**4.41**	

Quality of Instruction

The survey results confirmed that the quality of instruction in the Haub School is generally rated very highly. This could be influencing the generally high ratings of students and alumni alike regarding educational and career outcomes of the curriculum. As demonstrated in the figures below, 95% of alumni and 89% of current students surveyed rated the overall quality of instruction within Haub School of ENR courses to be "good" or "excellent," with "excellent" being the most highly rated category in both instances. Additionally, neither group rated the overall instruction below a rating of "average."

Figure 3: Alumni Responses to Overall Rating of Quality of Instruction in Haub School Courses

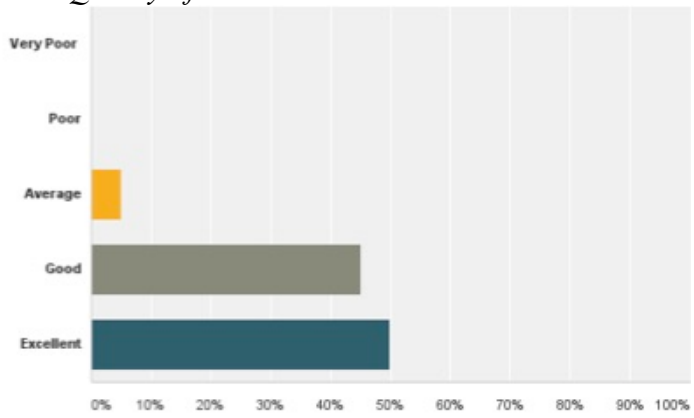
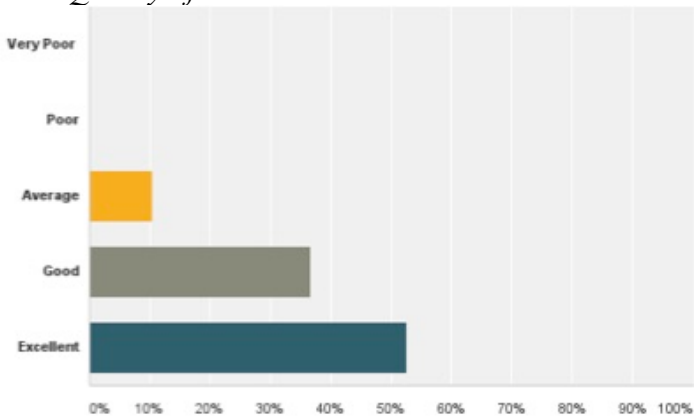


Figure 4: Current Student Responses to Overall Rating of Quality of Instruction in Haub School Courses



Summary of Results

Using an internally reliable survey to test alumni and current student perspectives regarding two upper-level core courses in the Haub School of ENR curriculum, the primary investigator concluded that:

- Current students and alumni generally maintain similar perspectives regarding the efficacy and applicability of these courses.
- In response to statements about the efficacy and career applicability of these courses, survey respondents primarily indicated that they agree or strongly agree.
- Across both efficacy and career applicability sections, alumni and current students alike gave the highest ratings to the "soft skills" subcategory, followed by "decision making" and finally "knowledge." This demonstrates relative strengths and challenges of the program.
- A large majority of survey respondents indicated that they felt the overall quality of instruction within the Haub School of ENR was "good" or "excellent."
- The majority of alumni surveyed are finding gainful employment following their graduation from the University of Wyoming with an ENR degree.
- There is alignment between the reported career sector of surveyed alumni, and the desired future career sector of current students, potentially indicating that Haub School graduates are well prepared to pursue their preferred careers.

Chapter 5:
Discussion

Conclusions

Educational Outcomes and Career Relevancy

Overall, present Haub School students and alumni reported in agreement that the upper-division core courses are indeed succeeding in their effectiveness to convey the skill and knowledge components evaluated in this study, as derived from relevant literature.

One emergent theme the primary investigator drew from the qualitative responses was that the core course progression modified and reinforced student values, giving them knowledge necessary to address contemporary environmental issues. As one respondent stated: “I strongly believe that my ENR degree has helped me become a better problem-solver, team member, and critical thinker. It helped me understand the complexity of many issues, especially those related to people and the natural world.”

The primary investigator was also able to determine that current students and alumni believe that the skill and knowledge components identified in this study were very useful within their future or current careers. Furthermore, survey respondents cited examples of problem-based learning projects included in the core courses being directly instrumental in securing their current jobs, which aligns well with aforementioned recommendations by Junyent and Ciurana (2008). Reinforcing Spelt et al. (2009) and Cortese’s (2003) claims that interdisciplinary skill sets can prepare graduates for a wide variety of careers, respondents’ comments such as “my current job doesn't deal very

much with the environment, but the skills of critical thinking and working with many different groups of people and ideas helps me all the time" demonstrate that even for the ENR graduates that go on to careers outside of the environmental realm, curricular outcomes are still applicable. This could be due to course emphasis on transferrable knowledge sets, thought processes, and skills, as opposed to specialized rote content, which may have a narrower scope of applicability.

Quality of Instruction

Survey respondents positively evaluated the overall quality of instruction in the Haub School's core courses. As Ginger et al. (1999) and Vincent (2010) highlight the significant impacts that instructional quality has upon learning outcomes, it is important to once again emphasize that the high perceived quality of instruction reflected in this study may have impacted respondents' positive evaluations of the course's educational and career-relevant outcomes. This reinforces the notion that curricular outcomes are best achieved through effective instruction, as revealed in the literature review. Soft skills such as teamwork and communication likely were achieved by utilizing student-centered and active-learning pedagogical strategies, such as project-based learning and real-world scenarios, as which were recommended by many of the authors cited in chapter two.

Curricular Emphases

There was little agreement among current students and alumni about what skills and knowledge should be emphasized in the Haub School ENR curriculum. Some respondents wished that the upper-division core courses had explored regulatory policy more thoroughly, especially relationships between state governments, industry, and local citizens. Others would have preferred a greater focus upon the legal ramifications of

management issues. These were directly contrasted by respondents that said they would have preferred less focus on policy and more time and curriculum dedicated to principles of ecology, natural science, and cultural issues. Other topics that respondents indicated would have enhanced their core course experience included a greater focus on relevant local issues, more worldwide and theoretical context, risk analysis, and analytical writing within an ENR context. This study reinforced the ultimate depth versus breadth tradeoff that interdisciplinary programs navigate given finite restrictions on course contact time and content, as already presented by Ginger et al. (1999), Simons et al. (2014), and Soule & Press (1998).

Implications and Recommendations

Best Practices for Haub School of ENR Programmatic Assessment

Although this case study only sampled about 25% of the current students and alumni across seven graduating classes, the primary investigator believes this study has confirmed that the Haub School undergraduate ENR program has met its identified curricular goals and outcomes through effective delivery of relevant knowledge and skills. The primary investigator would recommend that the Haub School continue to include frequent programmatic evaluations, incorporating feedback while maintaining curricular content and objectives that align with current best practices for environmental studies programs nation and world-wide. Additionally, ensuring and maintaining curricular transparency around objectives and foci can ensure that students selecting this program in the future have educational and career goals that are aligned with those of the Haub School ENR program.

Standardization vs. Establishing Best Practices

The discipline of environmental studies lacks a standardized accrediting body and a uniform curriculum. This has resulted in a wide diversity of scholarship and practice among many universities around the world. Although environmental studies is not a pre-professional field, some steps are being taken towards regional standardization and accreditation by organizations such as the Association for Environmental Studies and Sciences (AESS) in the United States and the Ambientalización Curricular en la Educación Superior (ACES; Curriculum Greening of Higher Education, acronym in Spanish) model in Europe and Latin America.

However, standardization itself is a controversial route to pursue for the discipline of environmental studies. Although standardization would allow easier and more accurate program evaluations on a large scale, it would significantly decrease the ability of students to select a unique program with a focus that fits their specific goals and interests within such a broad discipline. Perhaps this is not a significant factor, however the primary investigator recommends further research into student motivations in selecting environmental studies as a program of study, as current peer-reviewed literature is lacking in this area.

Manning (1998) states that "there is no ideal curriculum," (p. 189) and Vincent (2010) adds that flexibility is a key attribute of interdisciplinary environmental studies programs, allowing students to match their interests. In Ginger et al.'s (1999) study, three different environmental studies curricula were implemented with varying emphases, which resulted in ambiguous findings. This leads the primary investigator to a conclusion that all facets of environmental studies curriculum are important, a tradeoff will occur

between depth and breadth, different institutions may tailor their core curricula to varying student needs, and all are valid. This conclusion, in turn, suggests that an establishment of best practices, rather than standardization of curricula, is the path that the discipline of environmental studies should follow. Therefore, perhaps professional societies and groups, such as the Council of Environmental Deans and Directors (CEDD), are much better tailored to the diverse structure and content that is encompassed within this unique field of study. These groups work to unify, but not standardize, curriculum via creating best practices and relative agreements about central ideas. Then again, creating best practices for such an amorphous field will be a serious challenge. This will need to be addressed in future studies, especially as the field of environmental studies continues to gain popularity worldwide.

Perhaps at this point in time, case studies are the best way to address the individual successes and areas for growth within each autonomous program. Then, as more case studies accumulate, it can conceivably inform a broader, more cohesive knowledge base about environmental studies curricula from which to move ahead with larger forms of assessment and creation of best practices. Therefore, as Patton (2008) indicated, case studies such as this one can be relevant and helpful to program administrators to inform effectiveness of individual programmatic goals and objectives as well as to determine whether students are being prepared for a successful career post-graduation.

Continued Evaluation

Given the themes apparent in the literature, combined with the results of this study, environmental studies programs should aim to create a curriculum that is informed

by recent studies and captures the best available instruction practices and techniques. However, these programs should also tailor their curriculum to the needs of their students based upon the strengths of their faculty. As standards or best practices in environmental studies curriculum are not established, many programs would be challenged to design towards a specific curriculum. If internal programmatic objectives are clearly set, environmental studies programs *can* be successful; however there will always be content tradeoffs. These programs can ensure successful achievement of set objectives through frequent programmatic evaluation and case studies, embracing the ecological practice of adaptive management within the curriculum and instruction. Finally, with the relatively new status of environmental studies as an academic discipline, it would behoove programs to remain cognizant of potential disconnects between theory and practice common in interdisciplinary education. This will ensure that graduates are prepared for their careers with relevant, practicable experience.

In the end, perhaps there is no single curricular framework that should apply to every program. As long as best practices are being achieved, the uniqueness of each program could truly be an important way to broaden the knowledge and skills of students who will someday move into rapidly changing careers connected to the environment. Moreover, this diversity within the discipline could serve as a source of resilience in the face of continual societal change. Standardized, static skill sets geared towards specific careers can put students at a serious disadvantage if that career changes or ceases to exist in 5-10 years. Providing curriculum that emphasizes transcendent skill sets such as problem solving, systems thinking, and decision-making may be more beneficial for students in a changing society.

Summary of Discussion

In conclusion, upper-division Haub School undergraduate core courses are meeting objectives focused on in this study, which were derived from both the literature's recommended best practices for environmental studies curriculum as well as Haub School-specific identified curricular objectives. These objectives are reported as being relevant to survey participant's broad array careers. Additionally, high reported quality of instruction in the Haub School could have influenced other positive ratings within the survey, reinforcing the literature's conclusion that effective instruction is a necessary component to achieve curricular goals. Finally, qualitative results demonstrated the tradeoff between depth and breadth already highlighted by Ginger et al. (1999), Simons (2014), and Soule and Press (1998).

The primary investigator recommends that Haub School faculty and administrators continue to conduct frequent academic program evaluation, ensuring alignment with current best practices for environmental studies curriculum while maintaining curricular transparency to current and prospective students. Although there seems to be tension within the field of environmental studies between standardizing curricula and establishing best practices, given the great diversity of environmental studies program foci as uncovered in the literature review, the primary investigator would recommend moving forward with establishment of best practices in the field. Finally, the priary investigator would recommend that more case studies similar to this one are undertaken at a variety of institutions in order to work towards the creation of current best practices and to more clearly define the field of environmental studies.

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Appendix A:
Key Terms and Definitions

Adaptive management: a systematic process in which continual improvements are achieved through learning from and changing future management based upon previous treatment outcomes (Williams et al., 2007).

Environment and Natural Resources: An interdisciplinary academic program major and minor within the Haub School that focuses on skill development in critical thinking, communication, and collaborative problem solving within the context of ecological, social, economic, and political boundaries related to complex environmental issues (Academic Programs, 2016).

Environmental Studies: A broad interdisciplinary academic field focusing on the complex natural and human-built environments of our earth, as well as the interactions and relationships between them to work towards solving contemporary environmental problems (National Center for Education Statistics, 2016).

Environmental Systems Science: An interdisciplinary academic program major within the Haub School that focuses on the physical, biological, and human components of earth systems using scientific methods to examine spatial and temporal patterns in order to analyze complex environmental problems (Academic Programs, 2016).

Interdisciplinary Education: A synergistic, integrative educational approach that emphasizes synthesis and connections between disciplinary components in a problem-oriented, contextual manner, which complements multidisciplinary approaches well (Ginger & Wang, 2000; Spelt et al., 2009).

Multidisciplinary Education: An additive educational approach that addresses a topic from the perspective of multiple disciplines without necessarily working towards connecting or synthesizing these different perspectives (Ginger & Wang, 2000; Spelt et al., 2009).

Outdoor Leadership: An academic program minor within the Haub School that emphasizes leadership skills, field ecology, applied experiences, and wilderness first aid (Academic Programs, 2016). According to Martin, outdoor leadership has a broad scope, encompassing a field of study as well as a profession. Core competencies include: foundational knowledge, self awareness, decision-making, facilitation, environmental stewardship, program management, and risk-management (Martin, 2006).

Sustainability: "The quality of…not depleting natural resources, and thereby supporting long-term ecological balance" ("Sustainability", 2016). This is also an academic minor within the Haub School that allows students to explore these principles of sustainability through a general, food systems, or energy-related track.

Systems Thinking: A complex problem-solving approach that identifies interrelationships between components, and focuses on emergent qualities and leverage points within the system to influence solutions (Daniels & Walker, 2001).

Program Evaluation: "the systematic collection of information about the activities, characteristics, and outcomes of programs to make judgments about the program, improve program effectiveness, and/or inform decisions about future programming" (Patton, 2008).

Project Based Learning: A diverse teaching model that centrally organizes constructivist, student-driven learning around relevant projects (Thomas, 2000).

Appendix B:
Haub School of ENR Stated Learning Outcomes

***Specialization & Integration*:** Complement disciplinary depth with a broad exposure to ENR-related disciplines and approaches.

- Ability to effectively incorporate knowledge of a primary discipline into interdisciplinary ENR problems and effectively communicate across multiple ENR-related disciplines.
- Broad familiarity with the scientific, economic, policy/legal, and human dimensions of ENR issues, including the strengths and limitations of individual disciplines.

***Spatial & Temporal Perspective*:** Understand the temporal and spatial characteristics of ENR challenges.

- Familiarity with current and anticipated ENR problems from local to global scales.
- Familiarity with the history of conservation and environmental movements.
- Competency in articulating the changing role of science in environment and natural resource management.
- Competency in articulating how ideas about environment have developed in relation to economic, historic, geographic, & political processes.

***Policy*:** Recognize the content and implications of past and current ENR policies.

- Familiarity with major US policies related to the environment, including the Clean Air Act, Clean Water Act, Endangered Species Act, National Environmental Policy Act, and familiarity with their results and limitations.
- Competency in conducting comparative analyses of US and international environmental policies and agreements.
- Understanding of possible implementation pathways for environmental policies, including adaptive management, collaborative decision-making, and traditional public processes.

Cultures & Values: Appreciate the diversity of ENR perspectives and experiences, including the role of personal and collective value systems and structural inequalities in shaping those perspectives.

- Familiarity with the major environmental justice issues in the US and abroad.
- Understanding of multiple valuations of environmental resources, including aesthetic, biological, and economic.
- Understanding of how values and knowledge about cultural/natural systems vary across place and time.
- Ability to identify the origins and implications of his/her own ENR value system.
- Competency in utilizing tools to effectively participate as a citizen and a leader in an array of ENR challenges through critical thinking and self-awareness.

Complexity, Risk & Uncertainty: Understand that ENR problems inherently involve complexity, risk, and uncertainty.

- Proficiency in reading and interpreting scientific data and statistical analyses in order to understand the role of scientific probability/uncertainty in environment and natural resource management.
- Appreciation of the inherent complexity of ENR challenges resulting from the diversity of interests.

***Professional & Academic Skills*:** Acquire specific skills necessary to succeed in a range of ENR professions and/or graduate and professional school, especially proficiency in written/oral communication, applied problem solving, and collaborative approaches.

- Effective writing skills for multiple audiences and purposes, including in styles appropriate for scientific, persuasive, and grant writing.
- Ability to critically evaluate the quality and potential biases of information sources.
- Proficiency in speaking clearly and effectively.
- Ability to identify and define multifaceted problems succinctly and outline approaches to solving them.
- Demonstration of strong collaboration skills and the ability to work with others from varied backgrounds to solve problems.
- Ability to engage in meaningful self-directed inquiry and learning.

Appendix C:
Survey Questionnaire

Participant Consent Form

You are invited to participate in a research study to assess elements of curriculum within the University of Wyoming's Haub School of Environment and Natural Resources. Specifically, you will be asked to provide feedback on two upper-division core courses in the environment and natural resources major and minor, ENR 3000[6], ENR Approaches to Problem-Solving, and ENR 4900[7], Environmental Assessment[8]. You are being invited to complete this survey because you have been identified as a current student or an alumnus that has completed these courses.

This is a research project that I, Ashley Andersen, will complete to satisfy partial requirements for a Master of Science in Natural Science & Environment and Natural Resources from the University of Wyoming. As the Responsible Project Investigator (RPI), I will be studying the courses in the ENR major and minor that utilize interdisciplinary, experiential, and problem-based approaches within the framework of environmental studies and sciences (ESS) instruction. By evaluating the skills and knowledge students and alumni report gaining in these courses, we may be to assess whether and how these courses prepare students for success in their future career endeavors.

Participation in this study entails completion of a questionnaire using the Survey Monkey platform online. All data collected will be entirely anonymous and analyzed to evaluate these core courses in relationship to career preparedness. The questionnaire will take approximately 15 minutes to complete. There are minimal risks to participants involved in this research study. The potential risk of disclosure of the information outside of the research would be related to possible embarrassment and will not impact the reputation or employability of the participants. To minimize these potential risks participants will be identifiable only to the RPI and Supervising Faculty Member. No identifying features will be associated with the final written report. Surveys will be anonymous and conducted electronically to reduce personal identifiers and the privacy of participants, therefore, the risk in this study is minimal, not more than ordinarily encountered in daily life. You may choose to withdraw from the study at any point in time. You may opt out of the study for any reason by simply not completing/submitting the survey. Staff and

[6] Formerly ENR 4000, Approaches to Environmental Problem-Solving

[7] Colloquially known as Environmental Assessment, this course is listed in the catalog as ENR Policy in Practice.

[8] Prior to 2013, students took these two courses in a year-long sequence known as "the Capstone."

faculty of the Haub School of Environment and Natural Resources may use results of this study to modify curriculum to better meet the needs of their students. Electronically submitted questionnaires will be stored on a password-protected computer and only the RPI and the Supervising Faculty Member will have access to the raw data. The data collected through the questionnaire will be entirely anonymous and thus your responses will not be able to linked back to you. This will help protect your privacy and confidentiality. The data will not be used for any research purposes other than those stated above. The data will be stored up to 3 years and then be destroyed. If you have any questions about the research or participation in the research please contact: Ashley Andersen (aander78@uwyo.edu) or Courtney Carlson (Courtney.Carlson@uwyo.edu). If you have questions about your rights as a research subject, please contact the University of Wyoming IRB Administrator at 307-766-5320.

- By selecting this response, I am acknowledging that my participation is voluntary and my refusal to participate will not involve penalty or loss of benefits to which I am otherwise entitled, and I may discontinue participation at any time without penalty or loss of benefits to which I am otherwise entitled. To terminate participation in the study, I will simply refrain from submitting the form.

Alumni Survey:

Part 1 – Tell us about your environmental and natural resources (ENR) studies at the University of Wyoming (UW)

1. Which ENR core courses did you complete?
   - ENR 3000 ENR Approaches to Problem-Solving, formerly ENR 4000
   - ENR 4900 ENR Environmental Assessment: Domestic, also called ENR Policy in Practice

2. Did you earn a major or minor in ENR?
   -Major
   -minor

2 b. What concurrent major/minor did you pair with your ENR major or minor?

_____

3. Please select the year you earned your undergraduate degree(s) from the University of Wyoming
   - 2012
   - 2011
   - 2010
   - 2009
   - Other _____

3. If applicable, please list any additional degrees you completed before or after your undergraduate studies at UW (include degree, major or field of study, institution name, and graduation year, e.g. MS Environmental Studies, ABC University, 2016)

Part 2- What you are doing now

1. Are you…

	Related to your ENR studies	Not related to your ENR studies
Employed in a full-time, permanent position		
Working in a seasonal or part-time position		
In graduate or professional school		
Serving in AmeriCorps, Peace Corps, SCA, or another volunteer position		
Unemployed		
Other		

2b. If applicable, what is your current career sector?

- Federal government
- State government
- Regional/municipal/county government
- Forestry/Natural Resources (for-profit)
- Retail/Sales
- Agriculture
- Law
- Media/Arts/ Design/Entertainment
- Construction or Maintenance
- Financial
- Healthcare
- Nonprofit
- Military
- Education
- Other _____

Part 3- Skills & Knowledge

I feel that the Haub School of ENR core courses helped me develop the ability to…

KNOWLEDGE:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Understand the interface between social & natural systems					
Understand cultural, historical, philosophical & ethical contexts of environmental issues					

DECISION MAKING	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Address problems in a manner that integrated theory and knowledge from more than one discipline					
Address problems in a manner that integrated practices and methods from more than one discipline					
Arrive at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues					
Utilize systems thinking in decision making					
Find creative solutions to problems					
Think critically					

SOFT SKILLS	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Work effectively with others					
Be flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables					
Develop a personal code of core environmental values & ethics					

Comments: _____

2. I have found these elements (knowledge and skills developed in the Haub School core courses) useful within my career:

KNOWLEDGE:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Understanding the interface between social & natural systems					
Understanding cultural, historical, philosophical & ethical contexts of environmental issues					

DECISION MAKING	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Addressing problems in a manner that integrated theory and knowledge from more than one discipline					
Addressing problems in a manner that integrated practices and methods from more than one discipline					
Arriving at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues					
Utilizing systems thinking in decision making					
Finding creative solutions to problems					
Thinking critically					

SOFT SKILLS	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Working effectively with others					
Being flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables					
Developing a personal code of core environmental values & ethics					

Comments:_____

3. If you could change or add any content to the ENR core courses to make them more relevant to your current or future career, what would it be?

4. Please rate the quality of overall instruction within ENR 3000 ENR Approaches to Problem-Solving

Very Poor……Poor……Average…..Good….Excellent

5. Please rate the quality of overall instruction within ENR 4900 ENR Environmental Assessment: Domestic, also called ENR Policy in Practice

Very Poor……Poor……Average…..Good….Excellent

Please rate the quality of overall instruction within the Haub School

Very Poor……Poor……Average…..Good….Outstanding

Comments: _____

Current Student Survey

Part 1 – Tell us about your environmental and natural resources (ENR) studies at the University of Wyoming (UW)

1. Which ENR core courses did you complete?
   - ENR 3000 ENR Approaches to Problem-Solving, formerly ENR 4000
   - ENR 4900 ENR Environmental Assessment: Domestic, also called ENR Policy in Practice

2. Are you working towards receiving a major or minor in ENR?
-Major
-minor

3. What concurrent major/minor are you pairing with your ENR major or minor?

_____

3. Please select your expected undergraduate graduation year from the University of Wyoming:
   - 2016
   - 2017
   - 2018
   - 2019
   - Other _____

4. If applicable, please list any additional degrees you completed before your undergraduate studies at UW (include degree, major or field of study, institution name, and graduation year, e.g. MS Environmental Studies, ABC University, 2016)

_____

Part 2- Post-Graduation Plans

1. Immediately after graduating, which of these scenarios do you most likely foresee for yourself?

	Related to your ENR Studies	Not related to your ENR Studies
Employment in a full-time, permanent position		
Employment in a seasonal or part-time position		
Admission to graduate or professional school		
Service in AmeriCorps, Peace Corps, SCA, or another volunteer position		
Unemployed		
Other		

2. What career sector would be your preference within the first 1-5 years following your graduation?

- Federal government
- State government
- Regional/municipal/county government
- Forestry/Natural Resources (for-profit)
- Retail/Sales
- Agriculture
- Law
- Media/Arts/ Design/Entertainment
- Construction or Maintenance
- Financial
- Healthcare
- Nonprofit
- Military
- Education
- Other _____

Part 3- Skills & Knowledge

I feel that the Haub School of ENR core courses helped me develop the ability to…

KNOWLEDGE:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Understand the interface between social & natural systems					
Understand cultural, historical, philosophical & ethical contexts of environmental issues					

DECISION MAKING	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Address problems in a manner that integrated theory and knowledge from more than one discipline					
Address problems in a manner that integrated practices and methods from more than one discipline					
Arrive at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues					
Utilize systems thinking in decision making					
Find creative solutions to problems					
Think critically					

SOFT SKILLS	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Work effectively with others					
Be flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables					
Develop a personal code of core environmental values & ethics					

Comments: _____

2. I feel these elements (knowledge and skills developed in the Haub School core courses) will be useful in my future career:

KNOWLEDGE:	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Understand the interface between social & natural systems					
Understand cultural, historical, philosophical & ethical contexts of environmental issues					

DECISION MAKING	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Addressing problems in a manner that integrated theory and knowledge from more than one discipline					
Addressing problems in a manner that integrated practices and methods from more than one discipline					
Arriving at socially relevant, politically realistic, and economically viable solutions to environmental and natural resource issues					
Utilizing systems thinking in decision making					
Finding creative solutions to problems					
Thinking critically					

SOFT SKILLS	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Working effectively with others					
Being flexible, adaptable, and responsive to constantly changing environmental, social, economic, and political variables					
Developing a personal code of core environmental values & ethics					

Comments:_____

3. If you could change or add any content to the ENR core courses to make them more relevant to your current or future career, what would it be?

4. Please rate the quality of overall instruction within ENR 3000 ENR Approaches to Problem-Solving
Very Poor……Poor……Average…..Good….Outstanding

5. Please rate the quality of overall instruction within ENR 4900 ENR Environmental Assessment: Domestic, also called ENR Policy in Practice

Very Poor……Poor……Average…..Good….Outstanding

Please rate the quality of overall instruction within the Haub School

Very Poor……Poor……Average…..Good….Outstanding

Comments: _____

Draft of email invitation sent to 77 current undergraduate students & 84 alumni

Hello,

I am conducting an evaluation of curricular elements within the Haub School of Environment and Natural Resources, and request your help assessing what you learned while you were a student pursuing an ENR major or minor.

Please take a few minutes to take the survey in the provided link below.

https://www.surveymonkey.com/r/ENRalumni

https://www.surveymonkey.com/r/ENRstudent

It should take less than 10 minutes. Your anonymous input may be used:

1. To better understand the relationship of your education to career-preparedness.
2. To compare current students' experiences to those of alumni 3-6 years into their careers.
3. To inform Haub School staff and faculty curriculum planning.

By completing the survey, you will have the opportunity to enter into a drawing to win one of two $50 amazon.com gift cards.

Thank you, in advance, for investing ten minutes of your valuable time in this study.

Ashley Andersen
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Natural Science Education /
Environment and Natural Resources
University of Wyoming
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