Conservation Bridge: Enhancing the Management of National Parks and Protected Area Though Collaborative, Real-World Learning, Research, and Practice[1]

James P. Lassoie [2, 3], R. Jamie Herring [4], and Karim-Aly S. Kassam [5]

ABSTRACT

Intractable global problems, such as the loss of biodiversity, degradation of ecosystem services, and devaluing of cultures that possess the knowledge of how to conserve the natural world, continue to escalate worldwide, driven by unprecedented environmental, socio/economic, and cultural changes. In the long-term, society's hopes for successfully addressing these problems rest with its academic institutions, where creative approaches to preparing the next-generation workforce of scientists, practitioners, and policy-makers must transcend disciplinary 'silos' and provide interdisciplinary, authentic (i.e., real-world) learning experiences.

This paper presents a new approach for helping the conservation community better meet this daunting challenge. A tested, innovative Internet-based platform called Conservation Bridge, which supports interdisciplinary conservation education by using multi-media, real-world case studies, is discussed. This initiative is building collaborative working relationships between universities and conservation practitioners, including those managing parks and protected areas, to create real-world case studies that connect field professionals to classrooms worldwide. Hence, Conservation Bridge links a broad professional community with young scholars who are seeking experientially-based educations in preparation for careers in conservation and sustainable development. In exchange, it also provides the professional community access to the research and education benefits associated with contemporary universities worldwide.

This paper summarizes the conceptual basis and pedagogy underpinnings for the Conservation Bridge system, discusses its effective use in college-level teaching, and argues for enhanced involvement by the conservation community, especially the managers of parks and protected areas. Our overall goals are to develop meaningful collaborations among academic institutions, agencies, and organizations committed to building a sustainable future for conservation and the protection of the Earth's critical biodiversity and related ecosystem services. Specifically, we seek to possibly incorporate the needs of the Korean National Park Service into the expanding Conservation Bridge network of collaborating university, governmental, and non-governmental conservation professionals.

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2 Corresponding Author

3 International Professor of Conservation, Department of Natural Resources, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853; E-mail: lassoie@cornell.edu.

4 President, HabitatSeven, Inc., 5729 36th Ave, NE, Seattle, WA 98105; E-mail: Jamie@habitatseven.com

5 International Associate Professor of Environmental and Indeginous Studies, Department of Natural Resources and American Indian Program, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14853; E-mail: karim-aly.kassam@cornell.edu

INTRODUCTION

Marked increases in human populations associated with the development of sedentary communities and agriculture initiated the dawn of modern civilization over 10,000 years ago. Widespread human impacts on the natural world, which began in earnest during the Industrial Revolution (ca. 1750-1850), greatly intensified during the 20th Century leading to major social, economic, and cultural changes worldwide. However, this period also experienced a concurrent decline in environmental quality as natural resources were increasingly exploited for human development. It is now widely accepted that we have entered an informal geologic period, the Anthropocene, where human activities are significantly affecting natural processes that lead to global impacts (Crutzen & Stoermer, 2000). This has resulted in redefining the Earth's terrestrial and aquatic biomes (e.g., WWF's temperate grasslands, savannas, and shrublands; boreal forests/taiga; and tropical, subtropical moist broadleaf forests; streams and rivers; and large lakes) as being anthropogenic biomes that account for their human-altered conditions (Ellis & Ramankutty, 2008). In sum, the consequences of such ecosystem changes are determining the future of human wellbeing.

Sponsored by the United Nations, the Millennium Ecosystem Assessment (MEA) during the first half-decade of the 21st Century provided a detailed appraisal of the conditions of and trends in the world's ecosystems and the services they provide, and identified options to restore, conserve, and enhance their sustainable use. This assessment clearly documented that "...human actions are depleting Earth's natural capital, putting such strain on the environment that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted. At the same time, the assessment show[ed] that with appropriate actions it is possible to reverse the degradation of many ecosystem services over the next 50 years, but the changes in policy and practice required are substantial and not currently underway" (MEA, 2005).

The MEA provides credibility for the many scientists, practitioners, and governmental officials who are presently calling for sustainable development that optimizes trade-offs among economic, social, and environmental outcomes, and for collaborative, international efforts that address the causes and consequences of global climate change (e.g., United Nations Framework Convention on Climate Change; see: http://unfccc.int/2860.php[6]). Critical to our current discussion, the MEA also emphasizes the critical importance of biodiversity and related ecosystem services, identifies the role of parks and protected areas in their protection and maintenance, and provides a context for a new approach to conservation that acknowledges and addresses interdisciplinary complexity and the need for building collaborative partnerships.

Importance of Biodiversity and Maintenance of Ecosystem Services

Although difficult to quantify, conservative estimates suggest that 27,000 species are lost annually, or 74 per day, or three every hour (Wilson, 1999). Along with the loss of species, ecosystem services that underpin this diversity as well as human wellbeing, such as freshwater, pollination, carbon sequestration, and aesthetic quality are themselves being degraded at alarming rates (Soulé, 1985; Hooper et al., 2012). Hence, conservation biology has been defined as a crisis discipline (Soulé, 1985; 1986) where success is "...measured not only by the quality or quantity of scientific work produced but also by the degree to which it meets the objective of conserving diversity" (Niesenbaum & Lewis, 2003).

6 The authors strongly encourage readers to access the websites provided in this paper, as they are central to the discussion. This is especially for *Conservation Bridge* (http://www.conservationbridge.org).

Role of National Parks and Protected Areas

Beginning in 1872 with the establishment of Yellowstone National Park in the United States, governments worldwide have established parks and protected areas to serve as refugia for biodiversity and ecosystem services (Dudley, et al., 2011). The International Union for Conservation of Nature's classification system for protected areas (IUCN, 1994) recognizes this important function, as well as the interdependent role humans serve in shaping nature (Table 1). Most certainly, the conservation practitioners and governmental officials responsible for managing parks and protected areas are on the frontlines in the battle to assure the long-term sustainability of Earth's precious natural capital (Kareiva, et al., 2011).

Table 1.

IUCN Protected Areas Categories System[1] (modified from IUCN, 1994)

- Ia **Strict Nature Reserves** are set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values.
- Ib **Wilderness Areas** are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
- II **National Parks** are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
- III **Natural Monuments or Features** are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove.
- IV **Habitat/Species Management Areas** protect particular species or habitats and management reflects this priority. Many areas will need regular, active interventions to address the requirements of particular species or to maintain habitats.
- V **Protected Landscape/ Seascapes** are areas where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural, and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
- VI **Protected areas with sustainable use of natural resources** conserve large ecosystems and habitats together with associated cultural values and traditional natural resource management systems.

1 See http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/ for additional details

Context for Contemporary Conservation

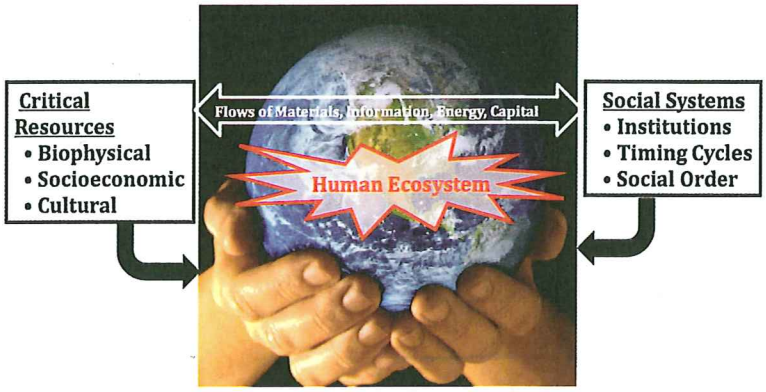
Coupled Human and Natural Systems

Solutions to biodiversity loss and the degradation of ecosystem services necessitate that social, political, cultural, and economic forces are linked to bio/physical processes, which makes conservation inherently interdisciplinary (Lewis, 2003; Kassam, 2009; Lassoie & Sherman, 2010). Hence, the outcome orientation of conservation requires that multiple disciplines, such as ecology, natural resources, sociology, communications,

law, economics, agriculture, and others be integrated to help guide actions required to preserve nature. This is the essence of the growing discussions about 'coupled' natural and human systems (CHANS) (Force et al., 1997; Machlis et al., 1997; Liu, et al., 2007; Lassoie and Sherman, 2010). Central to such considerations is an acceptance that humans are an integral part of natural ecosystems, thereby directly linking social and natural systems (Figure 1). Therefore, CHANS are characterized by (1) involving complex interactions and feedbacks between human and natural systems; (2) engaging biological, physical, and social scientists around common questions; (3) allowing the use of various tools and techniques from many disciplines, (4) being content-specific and illustrative of long-term temporal dynamics; and (5) necessitating an understanding of the controlling influences of organizational, spatial, and temporal couplings (Liu et al., 2007).

Figure 1.

Coupled Human & Natural Systems(CHANS) (modified from Machlis et al., 1997)



Partnerships for Conservation

Today's conservation organizations fully recognize that the challenges of protecting biodiversity and ecosystem services in the face of modern development pressures worldwide demand forging new, collaborative, and effective partnerships (e.g., The Nature Conservancy, http://www.nature.org/aboutus/ourpartners/index.htm; World Wildlife Fund, http://www.worldwildlife.org/what/partners/index.html; UNESCO World Heritage Centre, http://whc.unesco.org/en/pact/). The applied nature of conservation means the list of potential collaborators is rather extensive, including government agencies and non-governmental organizations (NGOs), business and industry, researchers and practitioners, and students and teachers. Typically, these various professional groups will have very different and possibly conflicting goals for their involvement in conservation, which necessitate the development of a carefully designed planning process that builds consensus and a common focus (McNeely, 1995).

In addition, local human communities outside the professional conservation system must also be brought into the fold for several reasons. First, the root causes of biodiversity loss and ecosystem degradation are human perturbations and therefore the behaviors underlying them must be understood and possibly changed (Wood et al., 2000). Second, indigenous ways of knowing are informed not only by socio/cultural systems and the presence of other living organisms, but also by the physical elements of the ecological system. Thus, local knowledge provides invaluable insights into changing ecological systems (Kassam, 2009), landscape level ecological changes (Scherr & McNelly, 2007), and shifting species composition (Nabhan, 1997), among others. Third, the increasingly well-documented unity between biological and cultural diversity provides an argument that subsistence practices are not only compatible with the conservation of biological diversity, but in many cases increases diversity (Harmon, 2001; 2007; Maffi, 2005; Kassam, 2009).

Basic to the development of meaningful partnerships is a widespread understanding that they form and prosper based not only on the extent of active participation, but also on the relative functioning of reciprocity (Wilmsen, 2006). Clearly, all participants must gain from collaboration even though specific benefits might vary among partners. Furthermore, all involved must understand and address both the keys to building an effective partnership and the potential downsides of doing so (Table 2).

Table 2. Characteristics of Partnerships

Keys to Building Positive Partnerships are that they:

- do something useful
- are appropriately long lasting
- are built on honesty, trust, humility, and friendship
- are appropriately defined
- provide appropriate levels of defined reciprocity
- are enjoyable and interesting

Potential Problems are that they:

- depend on external funding streams
- typically attract modest funding
- can suffer from the whims of donors
- may uncover conflicts of interests and different priorities among partners
- are often time consuming
- commonly have a relatively low output of rigorous research publications
- may lack continuity over time

Need for Collaborative, Real-World Learning, Research, and Practice

The coupling of ecological and human systems in an interdisciplinary fashion to achieve the outcome of protecting biodiversity and ecosystem services presents major challenges for the conservation community. Even well prepared conservation professionals typically find their time limited and ready access to rapidly developing research findings difficult. They can easily identify real-world problems as they experience them daily, but they likely lack the time, expertise, and/or financial resources to adequately address them. In contrast, those in academic institutions have the know-how or the means to achieve it, time, incentives, and easy access to relevant information, but may have difficulties identifying problems and setting priorities for conservation actions at specific locations. In short, this creates an opportunity for communities of inquirers, such as teachers and researchers, to engage communities of practitioners, such as managers and policy-makers.

The education of a future conservation workforce also faces daunting challenges that are not being adequately met. As Niesenbaum & Lewis (2003) argue: "We need new case studies, readings, assignments, and course structures, coupled with rigorous assessment of the extent to which they promote the skills and knowledge needed by future conservation biologists." Innovative approaches that integrate disciplines need to be developed, assessed, and widely implemented to overcome major obstacles inherent to academic institutions (Niesenbaum & Gorka, 2001; Niesenbaum & Lewis, 2003) - among which are the following.

Lack of Contact with the Global Conservation Community

Due to financial and geographical constraints, university education has limited connections to the international community. While most universities offer study abroad opportunities and courses with global perspectives, the costs in time and money for such programs are prohibitive for the majority of students, and courses with global

outlooks rarely connect students to people in other geographical locations. Conservation and sustainable development problems are global and transcend national and cultural boundaries. Therefore, students must develop skills to work across real and perceptual barriers that retard effective, collaborative problem-solving.

To successfully educate students in conservation fields, curricula must change to transcend entrenched disciplinary specializations. Such changes need to connect students to real-world situations, build proficiencies beyond being able to collect data and understand abstract principles, and provide skills to work within a culturally-rich, international context.

Transcending Entrenched Disciplinary Specialization

Interdisciplinary education itself is notoriously difficult, especially at the undergraduate level, as a result of the entrenched tradition of disciplinary specialization (Jacobson & McDuff, 1998; Hall & Weaver, 2001; Salasfky et al., 2002). Complex conservation solutions require that we rise above these disciplinary boundaries and move beyond their limiting 'silos of speciality'.

Operationalizing an Interdisciplinary Theoretical Framework

Interdisciplinarity requires a robust theoretical framework as an umbrella for study and research that can embrace multiple disciplines without minimizing or excluding the important contributions of specialized fields. This has been historically hard to achieve because of entrenched disciplinary boundaries that enhance competition for funding and professional 'stature', which further promotes disciplinary dominance (Machlis, et al., 1997; Easterling & Polsky, 2004; Lambin, 2005).

Transcending the 'Ivory Tower' of Academia

With its outcome-orientation, conservation must be directly connected to society, as its measures of success are the impacts such work has on the real-world (Niesenbaum & Lewis, 2003). This is problematic since the separation between knowing and doing has conventionally been the hallmark of university learning that focuses on abstract concepts de-contextualized from their circumstances in the real world (Resnick, 1987; Herrington & Olivier, 2000; Kassam & Tettey, 2003; Kassam, 2009).

Focus on Book Learning Rather Than Learning in Action

Academic institutions put a premium on book learning rather than action learning. However, knowing how to collect data and reiterate abstract concepts in and of itself will not solve today's complex conservation problems. Although useful, conservation practitioners need other skills such as the ability to think critically; communicate orally and in writing; participate in group decision-making; advocate for conservation; translate science for the general public; and work within dynamic political, social, economic, and cultural contexts (Cannon et al., 1996; Brewer, 2001; Whitten et al., 2001; Niesenbaum & Lewis, 2003;). The importance of interdisciplinary research and education demands a professional maturity to not only excel in one's own field, but to transcend one's own understanding to see value in the work of those in other disciplines (Kassam, 2009).

CONSERVATION BRIDGE

The Conservation Bridge Project was initiated in 2007 to address the challenges just discussed by developing an innovative Internet-based platform to connect university students from around the world to each other and to conservation scientists and practitioners working in real-world contexts. This project not only helps educate the next generation of conservation professionals, but it also provides the current workforce timely access to research information critical in the protection and management of the Earth's natural resources.

As discussed further in the remainder of this paper, Conservation Bridge has been established as a proof-of-concept over the past five years and is now well positioned to become widely adopted in classrooms worldwide. Furthermore, the system is well-suited to meeting the management objectives of the wider conservation community, in this particular case, the Korean National Park Service (KNPS). Hence, we will conclude by arguing for incorporating the KNPS into the Conservation Bridge network by illustrating the benefits such a partnership will bring to meeting the management needs of this agency.

Development

Rationale and Pedagogy

Viable solutions to the tradeoffs that will confront future decision-makers in the wide range of professional capacities bearing on the conservation of biodiversity and ecosystem services will depend upon collaboration across assorted disciplines, multiple sectors, and diverse cultures. The consequent challenges for educators are at least threefold. First, they must educate students across the broad fields related to conservation such as ecology, natural resources, sociology, business, communications, economics, and others to have an interdisciplinary understanding of CHANS. Second, educators must help develop skills required to work within cross-cultural settings. Third, they will need to develop mechanisms to equip students with problem-solving skills to deal with diverse, uncertain, and dynamic situations.

New educational opportunities presented by Internet-based collaborative tools can provide a solution to these challenges. Thus, the concept for Conservation Bridge (CB) was formed to facilitate communication and education opportunities involving many universities and various field sites where conservation innovations are occurring that are using approaches that integrate human and ecological systems. Two related educational strategies underlie CB: authentic learning and service learning.

According to Resnick (1997), the hallmark of university education has been the separation between knowing and doing. Studies show that the abstract knowledge around which universities typically focus their curricula is not directly useful in real-life contexts (Bransford, et al., 1990; Brown, 1997; Herrington & Oliver, 2000). The lack of this applied context separates the learner from the results of their learning, forcing students to focus on facts rather than processes. Driscoll (2002) argues that learning requires context to be relevant, necessitates that students are mentally active, have a method for reflexive thought, and have a social community where they contribute their learned skills and knowledge to a larger enterprise. These requirements can be realized by providing students with an authentic learning experience.

Authentic learning is defined as an educational strategy that focuses on embedding students within a real-world framework that exposes them to complex problems (Lombardi, 2007). These learning environments are inherently interdisciplinary as "...they must bring into play multiple perspectives, habits of mind, and ways of working within a community" (Lombardi, 2007). Learned skills include being able to synthesize information, use judgment to distinguish reliable from unreliable information, and have the flexibility to work across disciplinary boundaries to generate innovative solutions (Herrington, et al., 2002). This social theory of learning focuses on making connections between students and a broader social community (Driscoll, 2002; Kassam, 2010). By embedding students within an authentic learning environment, they are provided more internal motivation to learn and retain knowledge because they see a direct applicability to future endeavors.

Service learning calls for a similar experiential approach to education, but with a tighter connection to the real-world by having students producing useful outcomes for various communities outside of academia. "Service-learning programs are distinguished from other approaches to experiential education by their intention to equally benefit the provider and the recipient of the service as well as to ensure equal focus on both the service being provided and the learning that is occurring" (Furco, 1996). To accomplish these dual goals, service-learning programs must have some academic context and be designed in a way that "...ensures that both the service enhances the learning and the learning enhances the service" (Furco, 1996). These experiences provide a social context where students can contribute to the practices of a social community.

McDade (2002), Herreid (2005), and others have demonstrated that using case studies to educate students fosters critical thinking by employing information analysis to solve complex problems. Problem-solving is enhanced by providing a rich contextual framework that encourages collaboration and an assemblage of thinking in interdisciplinary terms (Lombardi, 2007; Kassam, 2010). The Internet now offers opportunities to place students within these real-world contexts to offer them authentic learning experiences (Herrington, et al., 2003; Barh & Rohner, 2004). It can also facilitate learning by providing real world contexts that engage learners in solving complex problems that provide educational environments where students contribute their learned skills in service of larger enterprises (Duffy & Cunningham, 1996; Honebein, 1996; Driscoll, 2002).

The way Internet technology is designed for this purpose, however, will determine its effectiveness. By tying online case studies directly to people working on real-world projects, we believe that a deeper level of reality will be generated, providing an even greater authentic learning experience. By connecting students to each other and to conservation practitioners through collaborative and social networking technologies familiar to students, we further believe that a diverse and rich intellectual community will be created allowing students to become personally and socially involved in a collaborative learning process.

Internet Platform and Case Studies

To test these hypotheses, we obtained competitive funding from the Cornell

Information Technology Faculty Innovation in Teaching Program in April of 2007 to build and test a beta version of the CB system. For this test, a simple website was created and populated with six multimedia case studies based on conservation projects from around the world (Table 3). Each case was developed collaboratively with a conservation partner, including various NGOs, a governmental agency, and three academic institutions. The beta site was then used during the following fall semester to support an upper-division international conservation

course at Cornell University taught by J. Lassoie. A major project assignment associated with this course had six student teams each review a different CB case study and then address a set of relevant questions posed by the conservation practitioner involved in that case. At the end of the term, student evaluations (N = 16) were administered through an online survey that tested how well the CB system created an authentic learning environment. Results indicated that the system increased the students' sense of engagement with the course, increased their level of participation, enhanced collaboration, and increased students' motivation to learn and complete their work. These positive results were used in designing three successful proposals (two from the US Department of Agriculture and one from US National Science Foundation) that supported the further development of the CB system.

Table 3. **Initial Conservation Bridge Case Studies Developed in 2007**

Conservation Partner	Location	Focus
EcoAgriculture Partners (NGO)	Kenya	Maintaining ecosystem services in agricultural landscapes
School for Field Studies (Academic institution)	Kenya	Maintaining healthy range lands for indigenous pastoral uses
Government of Bhutan (government agency)	Bhutan	Mitigating human-wildlife conflict through innovative insurance/compensation programs
Natural Capital Project (The Nature Conservancy, Stanford University, and the University of Minnesôta) (NGO and academic institutions)	China	Implementing payment for ecosystem services plan to maintain healthy water systems and to provide livelihoods for subsistence farmers
The Nature Conservancy (NGO)	Idaho, USA	Developing programs to mitigate invasive species and their impacts on cattle ranching areas and bio-diversity and developing strategies for local communities to battle invasive plants
The E.L. Rose Conservancy (local land trust NGO)	Pennsylvania, USA	Mitigating the impacts of suburban development, mining, and gas exploration on agri-cultural and natural landscapes

Application and Results to Date

Website and Case Study Development

The beta version of CB was extensively revised (v. 2.0) and is currently an open access site available at www.conservationbridge.org (Figure 2). Fifteen case studies are now posted on the website and ten are currently being developed (Table 4). These will all be added to CB by the end of 2012. Planning for the development of additional cases during 2013 is underway.

Figure 2.

Screen-Shot of www.ConservationBridge.org

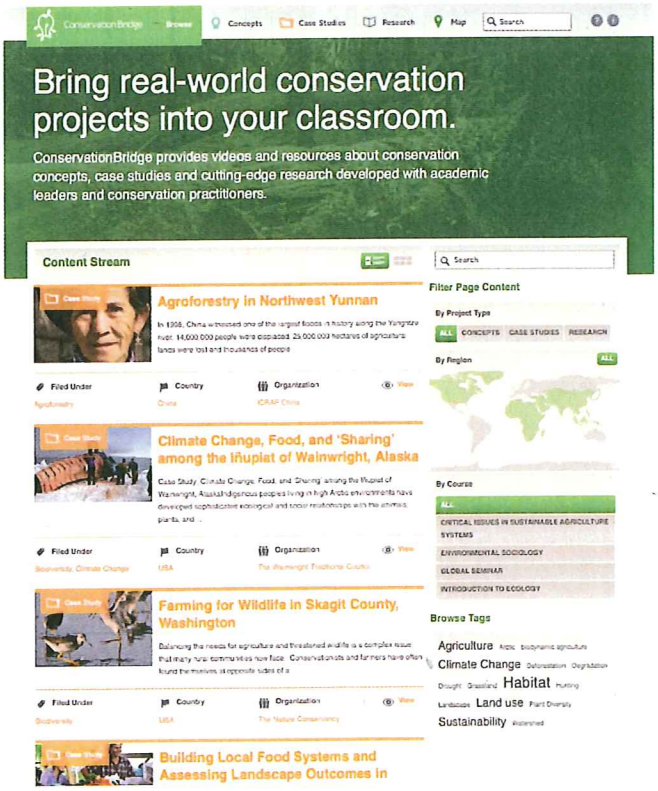


Table 4.

Conservation Bridge Case Studies Currently Being Developed

Conservation Partner	Location	Focus
Wildlife Conservation Society (NGO) and Zambia Wildlife Authority (governmental agency)	Zambia	Examines how an Integrated Conservation and Development Program) is functioning using small-scale farming, value added processing, and diverse farming methods to protect wildlife and improve people's lives.
IUCN-China (NGO)	China	Examines IUCN's approach for restoring the Miyun watershed by improving forest management and harvesting practices and enhancing the livelihoods of local residents in order to protect Beijing's dwindling water supply.
Friends of Nature (NGO)	China	Examines the results of an ecotourism project initiated in 2003 in a small rural community facing rapid development .
University of Central Asia	Tajikistan	Examines the interrelationships between sacred sites and biodiversity conservation.
University of Central Asia	Tajikistan and Afghanistan	Examines how knowledge of medicinal plants are tied to the protection of plant biodiversity in the Pamir Mountains,.
The Nature Conservancy	USA	Examines Conservation Farming practices in the Pacific Northwest and how it can protect migratory bird flyways.

Table 4. Conservation Bridge Case Studies Currently Being Developed

Conservation Partner	Location	Focus
Native Seeds/SEARCH	USA	Examines the importance of agri-cultural diversity and seed saving.
Cornell University	USA	Examines how biocultural diversity can be incorporated into Northern Forest resource management.
USAID	Cambodia	Examines innovative financial structures for bird conservation.
ARC	UK	Examines the interrelationships between the world's largest religions and conservation.

Use In the Classroom

During Academic Years 2008-09, 2009-10, and 2010-11 the CB system was used to support portions of various environmentally-oriented courses at Cornell University, as the website was being revised and new cases added to the site. In addition, CB was used to strengthen multiple-institutional student interactions in a collaborative seminar on sustainable development (see: www.globalseminar.org), which involved students from Beijing Normal University (China), Earth University, University of Melbourne (Australia), Uppsala University (Sweden), Zamorano (Honduras), and Cornell University (USA). End-of-term assessments were limited to using Standardized Cornell Course Evaluations that provided relative rankings of various aspects of each course. Despite the technical difficulties associated with the evolving website, CB was general viewed as a unique and useful addition to each course.

During academic year 2011-12 the CB website (v 2.0) was fully functional and it was used to support two very different types of courses at Cornell University. In addition, independent management consultants specializing in evaluating education and technology (see: www.eduinc.org) were hired to conduct a detailed evaluation of the effectiveness of using CB in both courses. The assessments involved mixed methods protocols that yielded specific learning outcome metrics specific to each course.

Introductory Courses

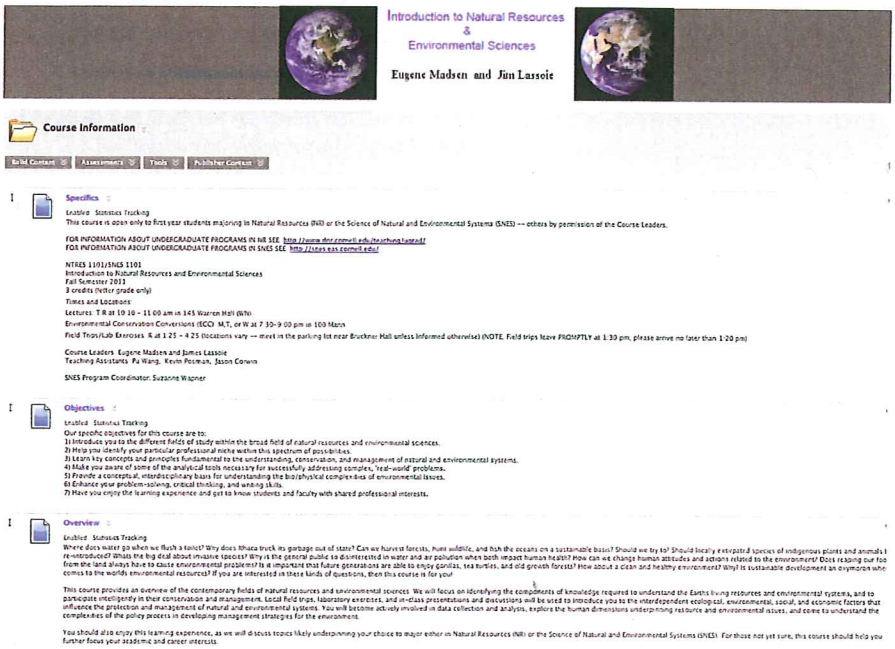
Undergraduate students interested in preparing for careers in conservation and sustainable development are typically action-oriented individuals who desire meaningful experiential learning opportunities and pursue a variety of majors, including ecology, conservation biology, environmental sciences, and natural resources. Common to such curricula is an overview, introductory course that presents basic concepts, principles, and practices, thereby preparing students for more specialized courses that follow. Furthermore, these courses are often large in size, and by necessity they must focus on "book learning rather learning in action." Small-group discussion sections and/or fieldtrips are often used to overcome the limitations of such large lecture classes. We believed that the CB system would be effective in helping focus small-group discussion sections associated with such introductory courses by providing authentic learning opportunities centered around the study and discussion of real-world environmental conservation case studies.

To test this hypothesis we designed a series of small-group discussion sections (called Environmental Conservation Conversations, ECCs) to supplement an introductory course that is required for all first-semester environmental sciences (see: http://snes.eas.cornell.edu/) and natural resources (see: http://dnr.cornell.edu/cals/dnr/undergraduate/index.cfm) majors at Cornell University (Fall Semester 2011; N = 55; Table 5). Each included a pre-session assignment, which required reviewing a specific CB case and writing a short essay that addressed pre-determined questions related to the case, a 90-minute structured discussion,

and a post-session essay on an issue that arose during the discussion. Appendix A provides assignment details supporting an ECC that addressed the creation of a network of marine protected areas in the Philippines (Figure 3).

Table 5.

Screen Shot from Course Website for NTRES/SNES 1101



Appendix A.

Sample Environmental Conservation Conversation (ECC) Supporting Small-Group Discussions in NTRES/SNES 1101 *Introduction to Natural Resources and Environmental* (Fall Semester 2011)

Appendix A-1.

Pre-session Assignment and Discussion Guidelines Environmental Conservation Conversations (ECC) #6 *Creating Networks of Marine Protected Areas in Lamit Bay, Philippines*

October 17, 2011
7:30-9:00 pm
135 Emerson

Participating Professor: Jim Lassoie

Guest Specialist: Mr. Paul Simonin, PhD student in Natural Resources studying the effects of nonnative species on fish population dynamics in lakes who is also working on a coral reef rehabilitation and management project in Sulawesi, Indonesia (See: http://paulsimonin.wordpress.com/2011-sulawesi-indonesia/)

Participating TA: Kevin Posman

Participating Students: 11 students participated

Pre-session Assignment:
DUE: Please submit the assignment as an e-mailed attachment to NRSNES1101@gmail.com BEFORE the beginning of the ECC session (Oct.17; 7:30 pm).
Note: You may want to bring a hard copy to the discussion session to use as a reference.

a. Review the documentary video and Overview/Background information at: http://www.agriculturebridge.org/case/Creating-networks-of-marine - protected-areas-in-Lamit-Bay--Philippines

Appendix A-1.

b. Supplemental readings:

- McClanahan, T.R. 2010. Effects of Fisheries Closures and Gear Restrictions on Fishing Income in a Kenyan. Conservation Biology 24(6): 1519-1528.
- Weeks, R., et al. 2009. Effectiveness of Marine Protected Areas in the Philippines for Biodiversity Conservation. Conservation Biology 24(2): 531-540.

c. Based on the video, summary, and the supplemental readings write an essay of 300-400 words that addresses the following question from of ONE perspective of sustainability (environmental/ecological, social/cultural, or economic/livelihood). What are the conditions/assumptions that must be met to assure the long-term sustainability of marine protected areas (MPAs) and why are they important?

d. Review the Game Plan below and be ready to discuss the issues!

Game Plan for session on Oct. 17:

Scenario:

A large conservation organization has been asked by the Indonesian Government to develop a proposal for a comprehensive monitoring program for the second largest MPA in Indonesia (see: http://www.opwalltrust.org/index.php?option=com_content&view=article&id=60&Itemid=81).

Its focus must be on sustainability, so the proposal needs to address critical social/cultural, environmental/ecological, and economic/livelihood issues. In specific, it must identify what to measure and why, the monitoring methodology to be used including a timeline, and budgetary needs.

Session Schedule:

7:30 pm: Introductions

7:35 pm: Large group discussion of ECC #6 Pre-Session Assignment – Kevin & Paul

7:45 pm: Small Group Discussions – In the role of the conservation organization introduced in the scenario above, the class will be divided into three proposal-writing teams (social/cultural, environmental/ecological, and economic/livelihood). Each team will identify three key variables that must be monitored and explain why they are critical for the sustainability of the MPA. The team will also propose a monitoring methodology for each variable, which includes a timeline and costs.

8:15 pm: Large Group Discussion – Teams will report-out and discuss their respective contributions to the proposal – Paul will lead the discussion

8:45 pm: Closing Discussion – Paul, Keith, & Jim will lead the discussion

9:00 pm: End

Post-session Assignment:

DUE: October 24th on or before 11:59 PM. Please e-mail the assignment as an attachment to NRSNES1101@gmail.com.

You will write another 300-400 word essay reflecting on specific points developed and discussed during this evening's session. Kevin will post additional details on Blackboard before mid-night tomorrow (Tuesday, October 18th).

Appendix A-2.

Appendix A-2: Post-session Assignment
Environmental Conservation Conversations (ECC) #6
Creating Networks of Marine Protected Areas in Lamit Bay, Philippines

DUE: October 24 before 11:59 pm emailed as an attachment to NRSNES1101@gmail.com

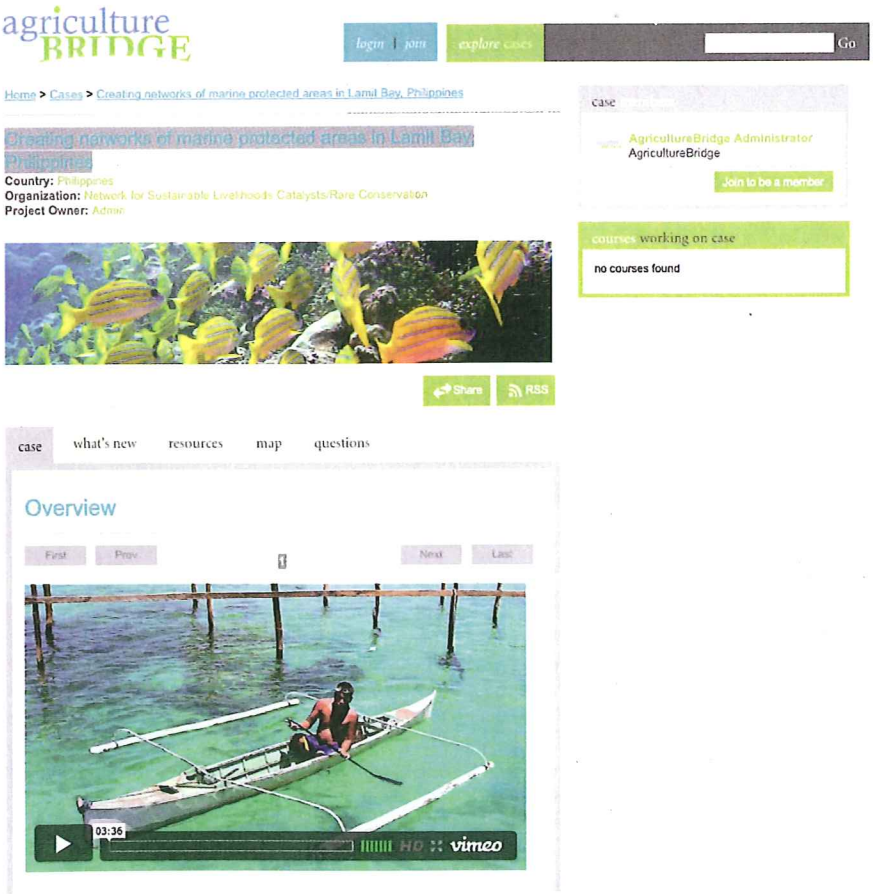
General: Write a 300-400 word essay that addresses the questions by reflecting on specific points you read about and discussed during the evening's session.

Specific: During our evening discussion, we frequently touched on the role ethics and values play in conservation, both in how they have directed our personal interests in marine conservation issues, and in environmental governance in general ("love, money, or fear"). In your essay, discuss the ethics and values of local citizens and outside conservationists who are directing the marine management schemes we explored (in Indonesia and the Philippines). In our Indonesian scenario (where Paul is working – see NOTE below), how might this organization more explicitly quantify (measure) these values (e.g., with money?) so to more effectively achieve and measure the "success" of their conservation efforts?

NOTE: In your response, you may also consider the content of this article: http://www.bbc.co.uk/news/science-environment-12121077

Figure 3.

Screen Shot of Case Study – Creating Networks of Marine Protected Areas in Lamit Bay, Philippines (N.B., Agriculture Bridge is a companion website that presents ecoagriculture case studies)



Advanced Courses

Environmental sciences curricula characteristically build from a foundational series of required bio/physical and socio/economic courses (e.g., mathematics, statistics, biology, physics, earth sciences, economics, sociology, psychology, and political sciences) to advanced courses focused on synthesis and application (e.g., ecology, conservation biology, climate change science, and natural resources and environmental management, conservation, and sustainable development, respectively). This latter selection of courses is most relevant to preparing both undergraduate and graduate students for specific conservation careers, so the importance of providing authentic learning experiences well-grounded in real-world problem-solving is paramount. Hence, interdisciplinary, capstone courses are common in most environmental science curricula (e.g., a simple Google search on 27 July 1012 yielded ~157,000 'hits'). We believed that the CB system would be very well suited to support such courses.

To text this hypothesis we designed a new, capstone synthesis course required for last-semester seniors majoring in International Agriculture and Rural Development (see: http://cals.cornell.edu/admissions/academics/majors/international-ag-and-rural-development.cfm), Case Studies in International Ecoagriculture and Environmental Conservation (Spring Semester 2012; N = 20; Table 6), that featured the use of CB case studies The course also was open to seniors majoring in environmental sciences and natural resources as long as they met the prerequisite of having had 'significant' international experience (a minimum of eight weeks of continuous work overseas).

Table 6.

NEW COURSE FOR SPRING 2012 IARD/NTRES/SNES 4940:
Case Studies in International Ecoagriculture and Environmental Conservation

3 credits, letter grade only

Prerequisites: Senior standing in IARD, SNES, or NR and international experience
Others, including graduate students, by permission (contact J. Lassoie)
Course is capped at 30 students

Days/Times/Locations:
Lectures: Mondays, 2:55-4:10 pm, 135 Emerson Hall
Laboratory: Thursdays, 2:30-4:25 pm, 122 Mann Library

Instructors: James Lassoie (Natural Resources; JPL4@cornell.edu)
Peter Hobbs (Crop & Soil Science, IARD; PH14@cornell.edu)

Teaching Assistant: Pu Wang (PhD Student, Natural Resources)

Course Support: Louise E. Buck (Natural Resources; Ecoagriculture Partners)
Suzanne Wapner (SNES)

Description: This senior seminar course is for students who have developed significant international focuses to their undergraduate programs, which include relevant overseas experience(s). Supported by lectures and discussions, students will work in small groups to examine real-world case studies of on-going ecoagriculture and conservation projects in Africa, Latin America, Asia, and the United Sates using two new Internet-based learning systems (www.agriculturebridge.org and www.conservationbridge.org). Student teams will address complex interdisciplinary questions of sustainability by working collaboratively with an identified practitioner who is directly involved in the case study project being examined. This will ensure that classroom activities address actual constraints and problems being faced by local people associated with each case. Out-of-class work is expected and a final written team report and a class presentation are required. Students also will be expected to present a seminar discussing their past international experience(s).

Zambia june, 2009

Five teams of four students each worked directly with collaborating practitioners using e-mail, Skype, telephone, and if possible face-to-face meetings to examine the case, and then to address specific research questions and produce final products specifically requested by the practitioners (Table 7). Appendix B provides an example of these assignments, this one developed by Dr. Sonam Wang for the Human-Wildlife Conflicts in Bhutan case study. At the end of the term student teams presented their findings to the class and submitted their final reports for evaluation. These were graded by the teaching staff based on completeness and scholarship and then sent to the practitioners for their assessments of accuracy and applicability to their specific needs, which will eventually be communicated to the student teams (understanding that as graduating seniors, they are all currently elsewhere).

Table 7. **Cases Used for Team Assignment in IARD/NTRES/SNES 4940 Case Studies in International Ecoagriculture and Environmental Conservation (Spring Semester 2012), (see: http://www.conservationbridge.org/ for case studies)**

Case #1

Location: Bhutan
Title: Human-Wildlife Conflicts in Bhutan
Practitioner: Dr. Sonam Wang, Director
Organization: Royal Education Council, Bhutan (http://www.rec.org.bt/)

Case #2

Location: China
Title: Sustainable Alpine Rangeland Management on the Tibetan Plateau
Practitioner: Dr. DONG Shikui, Professor
Organization: Beijing Normal University, Beijing, PCR (http://www.bnu.edu.cn/bnueng/index.html)

Case #3

Location: Kenya
Title: Capturing New Market Opportunities for Farmers in the Kikuyu Escarpment
Practitioner: Mr. David Kuria, Director
Organization: Kijabe Environmental Volunteers (KENVO) (http://www.kenvokenya.com/)

Case #4

Location: New York, USA
Title: Building local food systems and assessing landscape outcomes in Ithaca, NY
Practitioner: Ms. Joannna Green, Director
Organization: Groundswell Center for Local Food and Farming (http://www.groundswellcenter.org/)

Case #5

Location: Washington, USA
Title: Farming for Wildlife (FFW) in Skagit County, Washington
Practitioner: Ms. Julie Morse, Project Ecologist
Organization: The Nature Conservancy (http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/washington/explore/farming-for-wildlife.xml)

Appendix B.

Example of Team Assignment for IARD/NTRES/SNES 4940 *Case Studies in International Ecoagriculture and Environmental Conservation* (Spring Semester 2012)

Case: Human-Wildlife Conflicts in Bhutan

Website: http://www.conservationbridge.org/casestudy/human-wildlife-conflicts-in-bhutan/

Organization: Royal Education Council, Bhutan

Practitioner: Dr. Sonam Wang* (E-mail: wangsonam@gmail.com)

Student Team: four students

Basic Question:

What should the Government of Bhutan do to protect wildlife biodiversity and rural livelihoods?

Sub-questions:

1. The Bhutan National Human-Wildlife Conflicts Management Strategy, published in 2008, was based on the then available knowledge of human-wildlife conflicts in Bhutan and elsewhere. What new knowledge has emerged worldwide, including Bhutan, that is now relevant to the programs outlined in the Strategy?

2. Chapter 2 of the Strategy outlines an integrated approach to addressing human-wildlife conflicts in Bhutan by linking conservation with development using integrated conservation and development programs, environmental education, and ecotourism. Since the development of the Strategy, a new integrated conservation approach has emerged, the use of payment for ecosystem services (PES). Based on successful programs elsewhere, design a PES scheme that would address human-wildlife conflicts in Bhutan.

3. Bhutan's move to democracy in 2008 "...may open a new process for concentrating local resistance to conservation policies, possibly leading to detrimental changes to certain wildlife populations" (Strategy, pg. 2). How might the Bhutan Government incorporate the democratic process into its nine model sites (Strategy, Ch. 8) to garner local support for conservation?

Final Product:

Develop an annotated bibliography as an addendum to the Bhutan National Human-Wildlife Conflicts Management Strategy that provides updated references for each chapter. Develop a PowerPoint presentation, with supportive references, that could be used to interest buyers and sellers of ecosystem service that would address Bhutan's human-wildlife conflicts. Prepare a proposal to the Bhutan Government that emphasizes the importance of local participation in the nine model sites, including a structure and process for doing so.

* Dr. Sonam Wangyel Wang was appointed the Director of the Royal Education Council (REC) on December 1, 2011. He is the past Chief of the Nature Conservation Division ion the Department of Forestry, Ministry of Agriculture. Dr. Wang holds a PhD and MS from Cornell University, and Masters in Public Administration from Harvard University. He believes that education plays a pivotal role in building globally competitive positive citizenship and is dedicated to working hand-in-hand with partners to realize the noble vision of REC by making the already good schools great. While there is some disagreement over whether Bhutanese education has improved or declined over time, and how well it measures up to international standards, there is little disagreement over whether the education system should be improved. In general, education issues include; sufferings from equal access by all sections of the society, quality teachers with high dropout rates and affordability thereby perpetuating the educational gap between rich and the rural poor. Aside from being a researcher and an author, Dr. Wang has practiced his passion for education by maintaining active affiliations with international institutions including Cornell, Montana, Oxford, the Smithsonian Institution, etc. where he has mentored and taught both college students and professionals.

Course Evaluations

A comprehensive evaluation conducted by Edu, Inc. assessed student motivation, understanding, and self-efficacy (i.e., confidence) and the relative usefulness of the CB system, and provided suggestions for improving its use in the future; comments from teaching staff and practitioners also were solicited (Appendix C). Although a detailed final report from Edu, Inc. is forthcoming, preliminary results strongly support the ability of the CB system to promote positive learning outcomes (Table 8).

Appendix C. **Questions Developed by Edu, Inc. during 2011/2012 to Evaluate the Educational Benefits of using Conservation Bridge (CB) Case Studies**

Appendix C-1.

CB CASE STUDIES SUPPORTING SMALL-GROUP DISCUSSION SECTIONS SUPPORTING AN INTRODUCTORY COURSE ON ENVIRONMENTAL SCIENCES AND SUSTAINABILITY (NTRES/SNES 1101; Fall Semester, 2011)

A. STUDENT EVALUATION QUESTIONS:

- **Supplemental questions to standardized 'Bubble Form' evaluation Likert Scale: 1 = "completely disagree"; 5 = "completely agree"**
  1. Relative Metric: Reviewing and discussing CB case studies was a good use of time.
  2. Motivation Metric: I am more motivated to learn about environmental issues after participating in CB case studies than from reading textbooks and journal articles.
  3. Understanding Metric: The CB case studies increased my understanding of environmental topics.
- **Written comments**
  1. Understanding Metric: In what ways did the CB case studies provide opportunities for more in-depth considerations of environmental topics?
  2. Self-Efficacy Metric: Describe ways that the CB case studies increased your ability to consider environmental topics.
  3. Suggestions Metric: Please offer suggestions to improve the use of CB case studies.

B. PRACTITIONER EVALUATION QUESTIONS:
Practitioners were not directly involved.

Appendix C-2.

CB CASE STUDIES SUPPORTING A SENIOR CAPSTONE TEAM RESEARCH SEMINAR IN INTERNATIONAL CONSERVATION AND RURAL DEVELOPMENT (ECOAGRICULTURE) INVOLVING DIRECT INTERACTIONS WITH FIELD PRACTITIONERS (IARD/NTRES/SNES 4940; Spring Semester 2012)

A. STUDENT EVALUATION QUESTIONS:

- **Supplemental questions to standardized 'Bubble Form' evaluation Likert Scale: 1 = "completely disagree"; 5 = "completely agree"**
  1. Relative Metric: Reviewing and discussing all of the case studies at the beginning of the semester was a good use of time.
  2. Understanding Metric: I gained a lot from listening to the presentation of the other team reports at the end of the semester.
  3. Understanding Metric: The ability to interact with a practitioner in the field improved the educational experience.

Appendix C-2.

4. Motivation Metric: I am more motivated to learn about ecocagriculture/environmental conservation issues by completing the case study assignment than from reading textbooks and journal articles.
5. Understanding Metric: The case study assignment increased my understanding of ecocagriculture/environmental conservation topics.

- **Written comments**

1. Understanding Metric: In what ways did the case study assignment provide opportunities for more in-depth considerations of ecoagriculture / environmental conservation topics?
2. Self-Efficacy Metric: Describe ways that the case study assignment increased your ability to consider similar complex ecoagriculture / environmental conservation topics in the future?
3. Suggestions Metric: Please offer any suggestions to improve the case study assignment.
4. Self-Efficacy Metric: Describe the benefits of the real world connections provided by working with the practitioner supporting your case study.
5. Suggestions Metric: Describe any problems you encountered while working with the practitioner supporting your case study
6. Suggestions Metric: Provide suggestions to improve working with practitioners in future courses.

B. PRACTITIONER EVALUATION QUESTIONS:

(Online survey of practitioners who worked directly with students and received and reviewed their final products; focuses on gaining a better understanding of the value and challenges of participating in the Conservation Bridge case studies with the students.)

- **Assesses practitioners' perceptions of value**

1. In what ways did participating in the case study benefit you as a professional in your field?
2. How useful was participating in the case study for you as a professional?
   Not Useful Useful Very Useful
3. How much value did you gain from participating in the case study?
   No value Small value It was valuable It was extremely valuable

- **Assesses increased use of scientific literature**

1. In what ways did serving as a case study practitioner provide opportunities for use of scientific literature in your work?
2. How much did your use of scientific literature increase by participating in the case study?
   No increase Slight increase Increase Extreme Increase

- **Assesses practitioners' experiences**

1. In what ways did working with students provide opportunities for more in-depth consideration of your work?
2. Did working with students provide opportunities for collaborative problem solving?
   No Yes (If Yes please provide an example.)
3. What challenges did you face in working with students?
4. The amount of time it took to serve as a practitioner was:
   Modest Acceptable Excessive
5. How interested are you in participating as a practitioner in a future case study?
   Not interested Interested Very Interested Undecided

Edu, Inc. evaluators collaborated with course instructors to define four intended learning outcomes: value, understanding of key concepts, motivation, and self-efficacy. Evaluation results were very positive. The evaluation showed that students uniformly achieved or exceeded intended learning outcomes. Faculty reported superior student engagement and understanding compared to more traditional teaching methods. Students reported that the video-based case studies were more engaging than learning from textbooks and journal articles.

The study used a quasi-experimental design to investigate each outcome. Evaluation triangulated quantitative indicators from Standardized Cornell Course Evaluations and from student surveys with coded qualitative data from in-depth student and faculty interviews.

Standardized Cornell Course Evaluation: The analysis added three questions to the Standardized Cornell Course Evaluation (Table 8A). Students agreed that case studies were valuable, and demonstrated improved understanding of key course concepts. They also reported increased motivation. Ninety-four percent (64 of 72) said they felt more confident analyzing complex environmental issues after using CB.

Interviews and Student Survey: Edu, Inc. evaluators asked the same four questions in student surveys and interviews with students and faculty (Tables 8B and 8C). The results of these qualitative data were analyzed using thematic codes. Four unifying themes that describe the benefits of the courses emerged: real world, problem-solving, student-centered, and active learning.

Table 8.

Preliminary Results of Student Evaluations by Edu, Inc. Assessing Learning Outcomes Associated with the use of Conservation Bridge Case Studies during Academic Tear 2011-12 (see text for additional details)

A. Mean Scores from Cornell Standardized Course Evaluation

5 point scale: 5 = Completely Agree
1 = Completely Disagree
Average Standard Deviation (0.9)

Learning Outcome	**Students 1101** (n=54)	**Students 4940** (n=18)
Case studies good use of time (value)	3.5	4.3
Case studies increased understanding	4.1	4.2
Students more motivated by case studies	3.1	4.4

B. Sets of Common Themes from Student and Faculty Interviews and Student Surveys

Learning Outcome	**Themes**
Good Use of Time (Value)	Small groups, discussion vs. lecture, student-centered.
Increased Understanding	Students choose topic, videos more engaging.
More Motivated	Videos are more engaging than passive lecture, students choose topic of personal interest, active learning.
More Confident	Demonstrate real-world knowledge, critical thinking, problem solving, analyze complex issues, part of a team.

Four sets of common themes

Table 8.

C. Reported learning outcomes from student and faculty interviews (N=15)

5 point scale: 5 = Completely Agree
1 = Completely Disagree
(No standard deviation reported due to small sample size.)

Learning Outcome	Students	Faculty
Good use of time (value)	5.0	5.0
Students increased understanding	5.0	5.0
Students more motivated	4.5	4.2
Students more confident	4.5	4.5

Building a Global Conservation Community

As discussed earlier in this paper, building and maintaining effective partnerships are critical for the contemporary conservation movement owing to the urgent need to address the pressures and uncertainties arising from rapid development worldwide. The future of the CB system similarly depends on developing collaborative working relationships among academic institutions where new professionals are being educated and between these universities and the wider conservation community. Hence, we have argued for interconnecting classrooms worldwide and linking these classrooms to practicing conservationists in government agencies and NGOs through the development and use of CB.

Extensive refinement and testing of the CB website and its case studies have provided a positive proof-of-concept that the system is an effective tool for promoting authentic learning and providing visibility and research support for conservation organizations struggling with financial, labor, and time constraints in the face of steadily declining biodiversity and extensive disruption of Nature's ecosystem services. The Conservation Bridge Project is currently preparing to enter an enhancement and dissemination phase that will expand the use of the system into classrooms beyond Cornell University and its immediate collaborators. Internet research recently identified over 550 professors across the US who are teaching courses where the CB system might be useful. About 20% were sub-sampled via e-mail in April 2012 to solicit interest in continued involvement, which yielded a shortlist of about 30. A workshop was developed for the 2012 Ecological Society of America Annual Meeting in Portland, OR in early August that further identified potential academic collaborators. The CB instructors' network will be expanded across the US and internationally over the next five years. Hopefully, our participation in the 2012 IUCN World Conservation Congress will identify potential collaborators in the Republic of Korean and beyond.

It has been relatively easy to garner collaborative support for the development of CB case studies, as the advantages of doing so have been obvious to a wide variety of conservation professionals. However, the involvement of new practitioners is the 'life-blood' of the CB system, as without new cases and the continued renewal of current cases its educational value will quickly decline. Frankly, given the importance of national parks worldwide as centers for successful conservation, students using CB would benefit greatly from the addition of more case studies situated in such highly visible protected areas. In return, such involvement would highlight the value of parks and protected areas not only for their scenic and conservation values, but also as being valuable in the education of the next generation of conservation professionals. To this end, we would welcome active involvement in the CB system by the Korean National Park Service (KNPS) and others associated with conservation in this nation.

CONCLUSIONS

Conservation of the Earth's rich natural capital is facing unprecedented pressures arising from rapid changes in climate and socio/economic globalization. New approaches that emphasize conservation and sustainable development in the face of uncertainty and complexity are warranted - ones that must transcend the artificial separation between knowing 'what' (learning) and knowing 'how' (practicing) (Kassam and Tettey, 2003; Kassam, 2009; 2010). Faced with the demands of reality and the need to act efficiently and effectively, professionals like those in the KNPS represent the frontline in the battle to stem the loss of biodiversity and decline of ecosystem services so vital to the future of humankind. In contrast, students enjoy the relatively buffered microcosms of universities and are privileged with the time and structured incentives to question, learn, and explore, and are provided with access to the resources to do so. They also are dedicated to becoming conservation practitioners and to "making a difference" in the conservation of the Earth's vulnerable natural resources. The Conservation Bridge Project is dedicated to linking these communities for their mutual benefits and to forging a sustainable future for all peoples.

This paper has outlined the design and testing of an innovative educational network that builds on the collaborative strengths of the conservation community. The authors are dedicate to moving this initiative forward over the next five years, but the success of this effort depends greatly on those reading this paper. To this end we encourage future interactions with conservation professionals worldwide, including those associated with the Korean National Park Service.

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