



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Teaching Notes
Revised July 22, 2017

Authors:

- Jennifer Penner, Department of Psychology, Hendrix College¹
- Peter Gess, Department of Politics and International Relations, Hendrix College
- Noelle Beckman, Biology Department, Utah State University

Please let us know how you use the case and any suggestions you might have. We love feedback!

Summary:

Through an exploration of the history, implementation, and current state of the Three-Wattled Bellbird Biological Corridor (BBCP) in Costa Rica, this case engages students in a hands-on exploration of how different stakeholders work together to address conservation problems. Students will come away from the case study with a deeper understanding of how the social and natural sciences intersect to inform public policy and conservation practices, the value of corridor building as a conservation tool, and the ways in which we value and balance the needs of humans and the rest of the natural world. The case is scalable from a couple of class sessions to the majority of a semester, depending upon instructor choice of modules and assignments. It targets second-year university students in a multidisciplinary course, but may also be used in any course (e.g., political science, biology, environmental studies, ecology) exploring conservation issues.

Learning Goals:

1. Understand the structure and behavior of the human and natural systems within the Bellbird Corridor.
2. Value collaboration among interdisciplinary and transdisciplinary team-members in developing solutions to such problems.
3. Recognize the importance of scale and context in addressing socio-environmental problems

Learning Objectives:

Learning objectives are provided below in the case study modules.

Introduction to Biological Corridors and Costa Rica

What is a biological corridor and why should you care?

Most animals require a broad range of resources to survive and reproduce. These resources can include food, protection from predation, nesting sites, and mates, among many others. For many animals, these resources are not contained in a single, isolated location. Consequently, animals may defend large territories to ensure they have the resources they need. In addition, animals may move away from their natal site to reproduce (i.e., they disperse) and/or often move seasonally to resource-rich regions during

¹ Corresponding author: 1600 Washington Ave., Conway, AR 72032 USA (penner@hendrix.edu).



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

the breeding season (i.e., migration). In other words, to survive and reproduce, animals often move within a large, contiguous area of natural habitat through the year and throughout their lives. Thus, when large swaths of habitat are divided into smaller fragments and/or reduced in size, animals are forced to move longer distances, often across unknown or even impossible terrain to find resources, or they are constrained to smaller areas that lower their probability of survival and reproduction. This increased burden on animals can lead to lowered survivorship and reproductive rates and ultimately reduced population sizes and even extinction (Haddad et al., 2015).

The central problem is that the habitat fragments created by human activity (usually urbanization and agriculture) are often relatively small and therefore have fewer resources, and fragments are often isolated from each other and exist in a matrix of less suitable or inhospitable habitat (Haddad et al., 2015). Fragments usually have more edges, and these edges have modified environmental conditions, with increased light, more wind, and drier soils, compared to the interior of the fragment (Sih, Jonsson, & Luikart, 2000). Not surprisingly, small fragments sustain smaller animal populations that can be susceptible to lowered genetic diversity and extinction (e.g., Delaney, Riley, & Fisher, 2010).

As a conservation tool, biological corridors connect habitat that has been fragmented by human activity. When done effectively, and especially when they make use of naturally existing stretches of habitat (Gilbert-Norton, Wilson, Stevens, & Beard, 2010), corridors can facilitate the movement of organisms within otherwise fragmented landscape (Beier & Noss, 1998). If a corridor effectively promotes movement across habitat fragments, it can promote gene flow and the dispersal or migration of species from one patch to another (Gilbert-Norton et al., 2010), ultimately reducing extinction risk and supporting genetic diversity within populations and diversity of species.

Corridors differ in shape, size, and purpose. Some corridors are preserved from existing habitat. For instance, preserving existing streams or terrestrial habitats can sustain a corridor that animals are already using. Other corridors are man-made; constructing overpasses or underpasses across a highway or other busy thoroughfare allows animals to move safely between habitats without risk of being hit by automobiles.

To learn more about the science of corridors and its application in conservation, see:
<http://conservationcorridor.org/>

Why establish a corridor in Costa Rica?

Costa Rica is uniquely positioned geographically, biologically, and culturally for a biological corridor because of the rich and diverse habitats it contains. Approximately three million years ago, tectonic shifts resulted in the formation of a land bridge, now known as Central America, that connected the continents of North and South America. Over time, the land bridge was colonized with animals and plants from both North and South America during the Great American Interchange, leading to a high diversity of flora and fauna. The tectonic movement also created the mountain range which runs down the spine of North, Central, and South America. In Costa Rica, the mountain range created a geographic barrier between the east and west sides of the country as well as a variety of elevations, both of which have led to an amazing number of diverse habitats for animals and plants, including the latticework of mangrove swamps that occupy coastal regions, the tropical wet and dry forest, and the cloud and dwarf forests. Costa Rica, and



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Central America more generally, therefore, house a large and diverse number of plants and animals, including many endemic species—species that exist nowhere else in the world. For instance, while the United States is home to eight to ten species of hummingbirds, Costa Rica sports 52 different species. This high level of diversity makes Central America, including Costa Rica, a biodiversity “hotspot”. Importantly, the recent and significant reduction in habitat due to human activity, has led scientists to classify Central America, including Costa Rica, as an area of concern. Thus, biological corridors here have the potential to have an enormous impact—more “bang for the buck”.

What is the Three-Wattled Bellbird Biological Corridor Project?

The Three-Wattled Bellbird Biological Corridor (BBCP) initiative began in 1992 as an effort to establish a corridor to protect the three-wattled bellbird (*Pájaro Campana*). The bellbird is a large, iconic bird (*Pájaro Campana*) that attracts attention for its size, call, and unique morphology. Thus, the bellbird is culturally and economically significant, and it attracts ecotourists and other birders from across the world. The species is endemic to Central America and moves seasonally throughout Costa Rica and neighboring countries along both sides of the Continental Divide. Since the bellbird migrates seasonally to or through unprotected areas, it has suffered significant reductions in population size that is presumably due to recent habitat fragmentation. Most of the loss is a consequence of agriculture and tourism development along the Pacific Slope (Allen, Lines, & Hamilton, 2008). The primary focus of the Bellbird Corridor Project is to connect a patchwork of natural and protected areas on the Pacific Slope of the Tilarán Mountains, which run down the spine of northwest Costa Rica. The aim is to connect habitat ranging from the high-elevation (1850 m) cloud forest located on the Continental Divide in the Monteverde Cloud Forest Reserve, through seven life zones, all the way down to the coastal mangrove swamps of the Gulf of Nicoya. The Corridor covers an area of about 67,000 hectares (close to 165,000) and includes the watersheds of three rivers (Monteverde Institute, 2017). The initiative has been or is currently under the supervision of seven different organizations that span the academic, nonprofit, and international sectors. While the project began as an effort to monitor, protect, and sustain bellbird populations, its wide-ranging effects led to an expansion in 1997 to encompass species throughout Costa Rica and Panama.

Thanks to the strong ecotourism sector of the economy, Costa Rica houses many protected areas in the form of parks and preserves. However, these areas are often isolated, fragmented by patches of land that have been deforested due to farming and tourism development. Over the past two decades, BBCP members have worked to increase connectivity between fragments by working to improve the management of current protected forests, acquiring new protected habitat, reforesting habitat that is currently deforested, and increasing the incentive to farmers, members of the travel industry, and other community members to reforest their land (Allen et al. 2008).

The BBCP governance structure consists of three types of members: founding, associate, and ally. Founding members are individuals or institutions in the region committed to conservation, environmental management, applied research, education, and sustainable community development. Original members include the Arenal-Tempisque Conservation Area, the Costa Rican Conservationist Foundation, the Monteverde Conservation League, the Monteverde Institute, the Monteverde Reserve-Tropical Scientific Center, the Santa Elena Reserve and the University of Georgia-Costa Rica. Associate members share the same conservation and environmental commitments, and affiliate to support the



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

work of the BBCP. Finally, allied members support specific efforts of or provide resources for the BBCP (Corredor Biológico Pájaro Campana, 2016).

The decision-making body for the BBCP is the General Assembly; it consists of the founding and associate members, and gives rise to the organizing council. The council employs an operations coordinator, and oversees the work of four committees: biodiversity, conservation and use of natural resources, local management and environmental education, and administrative management and coordination. Each committee works to build partnerships and commitments among public, private and nonprofit entities to achieve conservation goals (Corredor Biológico Pájaro Campana, 2016).

For example, the Biodiversity Committee's goal is to promote the conservation of biodiversity and restore connectivity among ecosystems in partnership with local and institutional actors. To do this, it establishes joint action plans for conservation and restoration with private individuals and firms, nongovernmental organizations, local organizations and public bodies located within the BBCP. The Committee then performs research and implements an action plan to close conservation and habitat gaps in the Corridor (Corredor Biológico Pájaro Campana, 2016).

Social, Cultural, and Political Factors

Costa Rica is often celebrated as a conservation and tropical paradise. National Parks and other protected areas conserve nearly 25% of the land, with another 25% in commercial timber. Its rich biodiversity make it a key destination for tourism, with over 2.5 million foreign tourists generating more than \$2.8 billion in revenue in 2015 (Dyer, 2016). This is impressive for a country slightly smaller than West Virginia and a population of 4.8 million.

But Costa Rica has not always been so progressive. Environmental protection and conservation laws date back to the colonial period and proliferate through the first half of the twentieth century; however, such laws often lacked teeth and were seldom enforced. In fact, prior to the 1960s, Costa Rica had the highest deforestation rate in Central America. The frontier economy in Costa Rica followed a familiar pattern: commercial loggers would take the most valuable timber, small subsistence farmers would follow and burn the land for monocropping, and soil degradation and erosion would result. Once the shallow topsoil was lost—a minister of environment once joked that topsoil was Costa Rica's leading export—small farms would give way to large cattle ranches. The Institute of Lands and Colonization often cleared land for farmers; land was often worth more if so "improved." In 1987, forest cover in Costa Rica reached an all-time low of just 21%. Much of the remaining forests existed in small, noncontiguous parcels resulting in fragmented habitat (Wallace, 1992).

It would take time to restore forests to their current coverage. An important political moment occurred in 1948, when Costa Rica became the first nation in the western hemisphere to do away with its armed forces, instead opting to commit national resources to social services, including health care and education. Conservation would quickly follow, with a combination of monetary support from the global north (including the Philadelphia Conservation League, Sierra Club, The Nature Conservancy and Friends of Nature), local interests, and international and local scientists. Eventually three national parks were established in 1970. In 1977 an independent park service was created, and by 1978 the park system had grown to include 17 protected units. The first director of the national parks, Mario Boza, had witnessed ecotourism successes first hand when visiting the US national parks as a student a decade before; now he



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

successfully “sold” the need for the parks by linking resource sustainability to economic prosperity (Wallace, 1992).

Ecotourism continues to be the most important foreign exchange earner in the country; the total contribution of travel and tourism was 12.6% of GDP in 2015, and is expected to continue to rise. Further, the industry supports 12.2% of total employment (World Travel & Tourism Council, 2016). Conservation areas in Costa Rica protect twelve out of sixteen life zones and 5% of the world biodiversity (about one half million species). As ecotourism presents opportunities, there are also related challenges. For example, how to increase eco- or green tourism and prevent more destructive forms of tourism? How to protect local customs and traditions, as well as local labor and profits against multinational corporations? As the economy develops, how to develop in a sustainable way? How to respond to competition from other industries, including commercial agriculture and timber? And how to ensure that governmental policies are clear and enforced?

Ecotourism is also very important economically in the region of the BBCP. Allen and his team (2008) studied the types of ecotourists visiting the Monteverde area in 2004-2005. In the dry season, from November to May, older, more affluent tourists visit the area, primarily for birdwatching. In the green season, June to October, younger, less affluent tourists visit; these tourists come to experience nature, but also adventure tourism options such as ziplining. The researchers found, in 2005, that tourism equated to nearly a \$63 million economic value (direct economic impact only, and does not consider indirect or nonmarket effects). Further, a full 28% of tourists responded that if the bellbird and resplendent quetzal (*Pharomachrus mocinno*, another iconic and protected bird) disappeared from the area, they would not visit, which would result in a loss of more than \$17.5 million (Allen et al., 2008).

The Monteverde Cloud Forest Reserve is the gem of ecotourism in the region. But there are other resources as well, such as additional forest reserves. Further, the University of Georgia operates a research, education, and ecotourism center in the area. Many local farmers and cooperatives in the area are cultivating using sustainable techniques and providing eco- and agri-tourism opportunities (authors' personal observations).

References

- Allen, B., Lines, L., & Hamilton, D. (2008). The economic importance of extending habitat protection beyond park boundaries: a case study from Costa Rica. In *The George Wright Forum: Journal of Parks, Protected Areas, and Cultural Sites*, 25(1).
- Beier, P., & Noss, R. F. (1998). Do habitat corridors provide connectivity? *Conservation biology*, 12(6), 1241-1252.
- Corredor Biológico Pájaro Campana. (2016). Puente de Vida: Del manglar al bosque nuboso. Retrieved from: <http://cbpc.org/>.
- Delaney, K. S., Riley, S. P., & Fisher, R. N. (2010). A rapid, strong, and convergent genetic response to urban habitat fragmentation in four divergent and widespread vertebrates. *PLoS One*, 5(9), e12767.
- Dyer, Z. (January, 2016). Costa Rica tourism sets new record with 2.6 million visitors in 2015. Retrieved from: <http://www.ticotimes.net/2016/01/16/costa-rica-welcomes-2-6-million-tourists-2015-hits-new-record>.
- Gilbert-Norton, L., Wilson, R., Stevens, J. R., & Beard, K. H. (2010). A meta-analytic review of corridor effectiveness. *Conservation biology*, 24(3), 660-668.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

- Haddad, N. M., Brudvig, L. A., Clobert, J., Davies, K. F., Gonzalez, A., Holt, R. D., ... & Cook, W. M. (2015). Habitat fragmentation and its lasting impact on Earth's ecosystems. *Science Advances*, 1(2), e1500052.
- Monteverde Institute. (2017). Three-wattled Bellbird Biological Corridor. Retrieved from: <http://www.monteverde-institute.org/biological-corredor.html>.
- Sih, A., Jonsson, B. G., & Luikart, G. (2000). Do edge effects occur over large spatial scale. *Tree*, 15(4), 134-135.
- Wallace, D. R. (1992). *The quetzal and the macaw: the story of Costa Rica's national parks*. Sierra Club Books.
- World Travel & Tourism Council. (2016). Travel & Tourism Economic Impact 2016: Costa Rica. Retrieved from: <http://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2016/costarica2016.pdf>.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Module 1: Socio-Environmental Systems Mapping

Module Overview

This module includes group brainstorming, small group work, and discussion. Some lecture will enhance student understanding of real-world S-E complexity, as well as the value of comprehensive systems mapping.

Estimated Class Time: two hours (with optional out-of-class work)

Student Learning Goals and Objectives

This module is designed to especially meet these student learning goals and student learning objectives:

- Goal: Understand the structure and behavior of the human and natural systems within the Bellbird Corridor.
 - Objective: Identify the components in the Bellbird socio-environmental system and the dynamic relationships among them.

- Goal: Value collaboration among interdisciplinary and transdisciplinary team-members in developing solutions to S-E challenges.
 - Objective: Evaluate the socio-environmental considerations from the perspectives of the different groups of people who impact and are impacted by the Bellbird Corridor.

Class Plan and Activities

Introductory Concept Mapping

Concept mapping is a useful tool for understanding complex challenges such as those which led to the creation of the Bellbird Corridor. If you are unfamiliar with concept mapping as an educational and modeling tool, we recommend resources provided by the Florida Institute for Human & Machine Cognition:

<http://cmap.ihmc.us/>

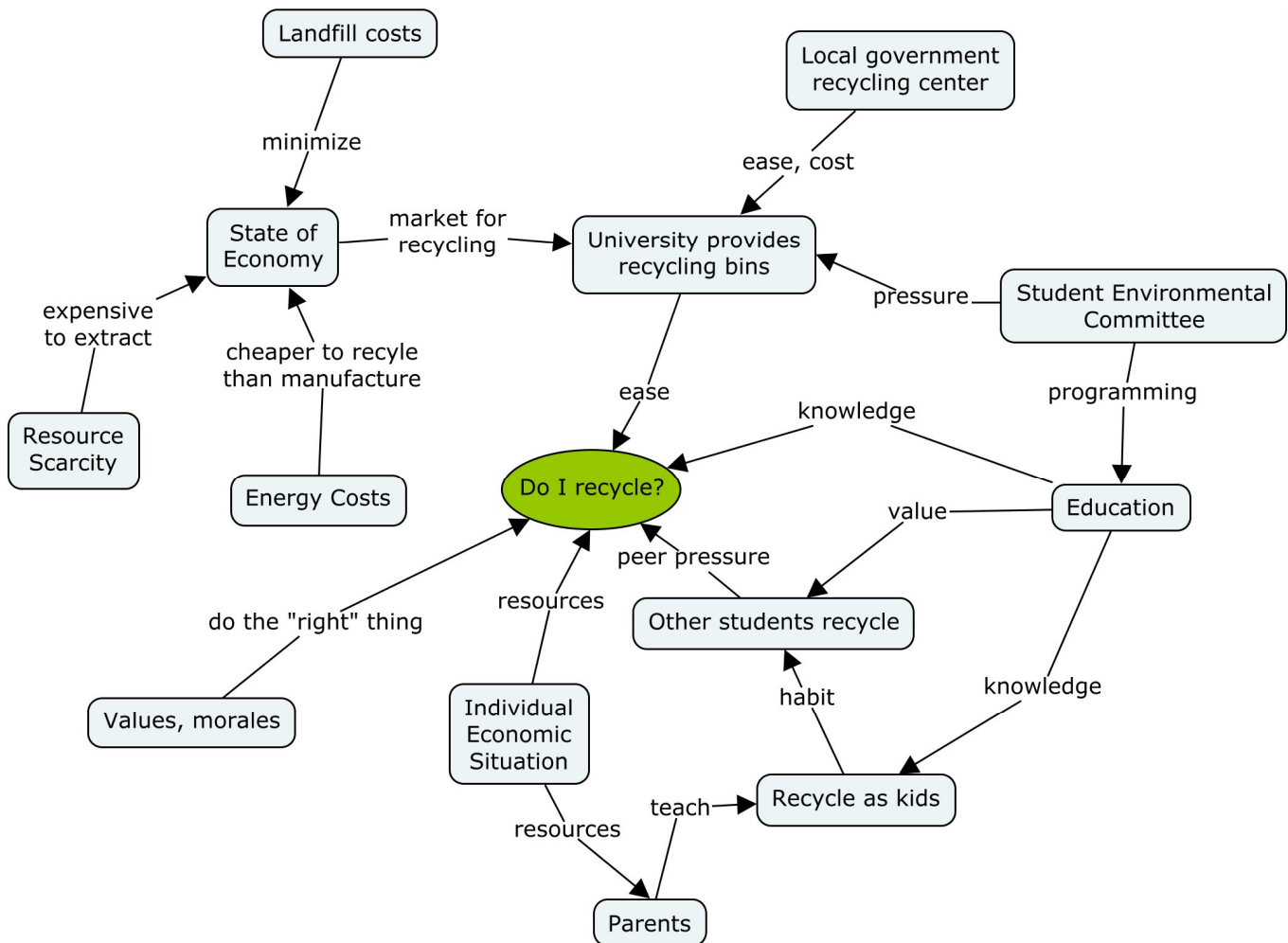
More specific guidance on adopting concept mapping for teaching about complex socio-environmental systems is provided by the National Socio-Environmental Synthesis Center:

<http://sesync.org/concept-mapping-a-technique-for-teaching-about-systems-and-complex-problems>

This case study's target population of second-year undergraduate students is unlikely to possess much knowledge—or at least sophistication—of concept mapping. The first step of the activity is to lead the students through a concept mapping exercise involving a simplification of an issue or situation with which they are familiar. As an example, we have chosen recycling on campus as the concept, as students are familiar with the college environment and the process of recycling. As you walk the students through the question, “Do I recycle?”, you may develop a concept map something like this:



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica



Note that this concept map was created with the free Cmap software downloaded from the Institute for Human & Machine Cognition website. You may demonstrate the software during the class mapping process or simply draw it out on a white or blackboard.

It is not important that the students come up with all of the elements above, and indeed, the class concept map may appear very different. Importantly, the students should think comprehensively about the elements affecting the central question, as well as the interdependence of those elements.

Generate Bellbird Corridor Elements/Nodes

Next, have the students generate important elements or nodes of a concept map for the Bellbird corridor. Begin with the question, "What affects the health of the Bellbird Corridor ecosystem?" At this point, address first the biophysical or environmental world. Then move on to the social world. At the end of the group exercise, the list may appear something like:



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Biophysical/Environmental	Social
Landscape and Geology	Population and Demographics
Forest Cover and other Vegetation	Economy/Livelihood
Habitat Fragmentation	Agriculture
Forest Age (Primary or secondary forest)	Education
Species Diversity and Number	Pollution
Climate/Weather	Global Warming
Climate Change	Ecotourism
Disease/Health of Animals and Plants	Culture
Water Resources	Happiness
Erosion	Laws and Policies
Surrounding Habitat	External Actors
	Surrounding Land Use

At this point it is best to be as comprehensive as possible. No factor should be discounted, even though they may not all appear in the subsequent mapping activity.

It may be helpful for students to also brainstorm the list of human actors involved. Some possibilities include:

- farmers (subsistence, small-scale, industrial)
- ranchers
- educators/researchers
- ecotourism practitioners
- tourism industry (hotels, restaurants, shops, transport, entertainment)
- tourists
- philanthropists
- local and international non-governmental organizations (nonprofits)
- environmentalists
- children/schools
- local and national government officials
- residents/land owners
- foresters

While the list is being generated, the students can “perspective take” by understanding how each actor affects and is affected by the corridor project.

Concept Mapping the Bellbird Corridor

Divide the class into two groups: environmental and social. With the nodes previously identified, have the students in each group concept map the effect on corridor ecosystem health from either the environmental or social focus. They may need some help conceptualizing the connections and interrelations among the elements. The mapping activity may identify secondary and tertiary elements affecting the previously brainstormed nodes. Since the two groups will share their work with the entire class, have them use flipcharts, separate whiteboards, or concept mapping software which can be displayed through an lcd projector. Another possibility is to take photos of student work and display them through the projector.

Using your preferred method (flipchart, whiteboard, mapping software, or photographs), display the work of the two groups for the entire class. Now, have the students discuss in their small groups the interdependence between the social and environmental systems so that they are prepared to connect the two maps in the next step.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Finally, bring the two groups back together. Ask them to add arrows linking the two systems. Follow up by asking students for final thoughts about the complexity of the system. Encourage them to think in terms of the diversity of people involved.

Assessment

1. Instructor checks that students have adequately described the complexity of the structure and behavior of the Bellbird Corridor through the process of concept mapping. Perhaps most importantly, have students progressed in their understanding of the complexity of the Bellbird Corridor as well as the usefulness of the concept mapping as a tool? The final map should be easy to read and logical, with the appropriate interdependencies identified.

You may find a rubric helpful in assessing student learning. You may find examples of concept map rubrics here:

<https://teach.its.uiowa.edu/file-resource/860>

2. Instructor checks that students understand and can describe the various perspectives of the people affecting and affected by the Bellbird Corridor. This should be clear through the brainstorming activity listed above.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Module 2: Understanding the Corridor as Conservation Tool

Module Overview

This module uses the jigsaw method to have students explore the individual motivation of different stakeholders, discuss these diverse perspectives in small groups, and achieve consensus through cooperative problem-solving. Students will understand the value of a biological corridor as a conservation tool through designing one in collaborative groups.

For an overview and more details of the jigsaw method, see <https://www.jigsaw.org/>.

Estimated Class Time: three to four hours (with out-of-class work). We implement this module by having the students work in stages, across three class sessions. During the first class session, students explore stakeholder perspectives and then follow up by conducting further research on their own, outside of class. They reconvene during the beginning of the second class session to refine their stakeholder perspective based on their research. Then, for most of the second session, students meet with their transdisciplinary group to develop a management plan. They present their management plan to the class in a 10 minute PowerPoint presentation during the beginning of the third class. Some work outside of class may be required between the second and third classes to prepare for the presentation.

Student Learning Goals and Objectives

This module is designed to meet these student learning goals and student learning objectives:

Goal: Value collaboration among interdisciplinary and transdisciplinary team-members in developing solutions to such problems.

Objective: Identify the benefits and challenges of inclusive participation in addressing Corridor issues.

Objective: List contributions—and strengths and limitations—from important disciplines; the whole is better than the parts.

Objective: Re-evaluate the socio-environmental considerations from the perspectives of the different groups of people who impact and are impacted by the Bellbird Corridor.

Class Plan and Activities

Overview

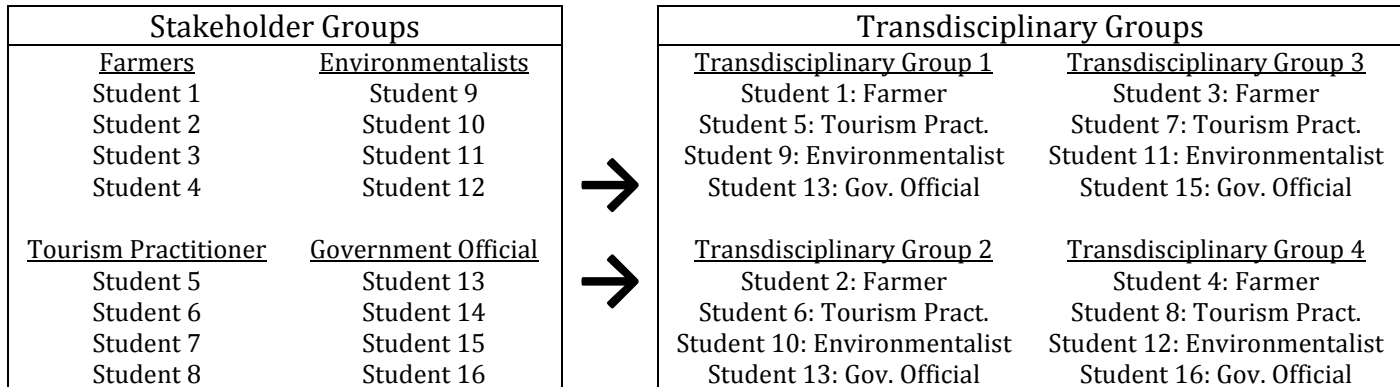
The class will first be subdivided into “Stakeholder Groups”, where all members of a specific group will be assigned a stakeholder role. After learning the expertise, needs and perspective of the assigned



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

stakeholder role, the class will be rearranged into “Transdisciplinary Groups,” with each group containing one of all the stakeholder roles.

For example:



Formation of Expert Groups

How you generate expert and then the following transdisciplinary groups will depend greatly on your class size. You have great flexibility, but you want to maintain stakeholder diversity in each transdisciplinary group (with a minimum of four different stakeholders per each disciplinary group).

During Module 1, the students brainstormed the list of human actors involved with the corridor. Clearly you won't be able to create an expert group for each stakeholder generated. Instead, “prioritize” the list by highlighting the actors that are likely to have the largest stake and interest in the project, or those that are likely to be the most vocal. You will also want to be sure to create “controversy” by including actors traditionally on differing sides of environmental protection and conservation.

Once you have decided on the stakeholders to be represented by the students, you may randomly assign the students in your class to each group. As an alternative, you may create stakeholder groups that are diverse in gender, ethnicity, race and ability.

During the first class session, have the students work within their stakeholders groups to discuss how the stakeholder they are representing would feel about conservation and environmental protection in general, and the biological corridor specifically. Encourage them to develop specific profiles (i.e., a man or woman of a specific age who has a specific way of living) of individual people so that they can identify more closely with their stakeholder's life challenges and connection to the corridor. Encourage students to be creative in their role development and to take on the identity of the stakeholder, much like an actor would. Prompt them with leading questions (see Student Handout):

1. What exactly is at stake for me with the implementation of the bellbird corridor?
2. What are my basic needs? My more advanced needs?
3. What do I do and how do I make a living? What is my daily routine like?
4. What issues are the most important to me?



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

5. What is my connection to the natural world around me? To other stakeholders and community members?
6. What might my role be as a family member, community member, and citizen of Costa Rica?
7. What is my economic situation? Is it easy or difficult for me to support myself and my family?
8. How do I weigh the present and the future?

Emphasize that students should empathize with the role they are playing, and take a Costa-Rican place-based perspective and worldview of the person they are representing. The Bellbird Concept Map generated in Module 1 may serve to stimulate discussion (and the groups may want to modify the map). After having the groups discuss, ask them to further research the stakeholder role outside of class so that they can work with their group to refine the role during the next class. Encourage them to consult online resources, material covered in other classes (for instance, many of our students utilize content from their sociology and biology classes), and each other to develop their role outside of class. Now, allow the students to reconvene briefly (we do this at the beginning of the second class session) to refine their stakeholder profile.

Transdisciplinary Group Work

Now, rearrange the students into the transdisciplinary groups, making sure that each group contains one of each stakeholder group. Again, this can be done randomly or according to diversity preferences.

Each group will spend the majority of the class session to develop and produce a management plan detailing the proposed bellbird corridor. Ultimately the plan should address these issues (see Student Handout):

1. What are the goals/aims of the corridor?
2. What will the Corridor look like? Consider the shape and borders of the area.
3. How will the Corridor work? What is the organizational and management structure? Who is in charge? Who has a voice?
4. What are the rules governing the corridor? What are the enforcement mechanisms?
5. How will you know if the corridor is working? Is there a plan for gathering data and assessing progress?
6. How much will the plan cost? Who pays for it? Where does the funding come from?

Students will likely need time outside of class for research and collaborative group work. Discussions may dictate revisions to the concept map. Ultimately each group will present their findings to the class in the form of a 10 minute PowerPoint presentation that they will deliver at the beginning of the next class session. We suggest that each presentation consists of:

- a title slide;
- six issue slides dedicated to the components listed above (one slide for each); and
- a references slide.

Groups can be advised to spend about one minute per issue slide (far less for the intro and references slide), leaving a few minutes for questions from the rest of the class.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Assessment

1. The third Student Learning Objective (Re-evaluate the socio-environmental considerations from the perspectives of the different groups of people who impact and are impacted by the Bellbird Corridor) can be evaluated through the transdisciplinary group management presentations. Students should demonstrate perspective-taking. This rubric may prove useful to assess student goal attainment:

Student Role	Absent (0 points)	Basic (5 points)	Proficient (10 points)
Stakeholder as Individual	No indication that student identifies or understands characteristics, concerns, values of stakeholder	Student demonstrates basic understanding of stakeholder's values and concerns, but only superficially, or conflates with own perspective	Student "becomes" stakeholder, providing several examples of way stakeholder would think and act
Stakeholder as Community Member	Student does not respond to other student-stakeholder perspectives (as stakeholder would)	Student is able to appropriately react to and consider some of the other stakeholders some of the time (inconsistently)	As student "becomes" stakeholder, consistently responds to and interacts with other students as expected of the role
Stakeholder and Environment	Student does not indicate an understanding of the way the stakeholder depends upon or interacts with the surrounding environment	Student indicates partial or inconsistent understanding of stakeholder's perception and value of the surrounding environment and nature	Student demonstrates through examples a thorough understanding of the way stakeholder values and interacts with the surrounding environment

2. The first and second Student Learning Objectives can be best assessed through class discussion. Ask students to reflect on the benefits and challenges of inclusive participation in addressing Corridor issues. The discussion should detail contributions, strengths and limitations of important stakeholders. Other questions for students to address through class discussion:
 - a. Discuss any barriers or difficulties during the process in working with complex socio-environmental problems and developing group consensus through collaboration.
 - b. How did your thinking and ideas evolve?
 - c. How and why did your questions and arguments expand, narrow, or shift in focus?
 - d. How did discussions with other people help you form your ideas?



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Module 3: Do Scale and Context Matter?

Module Overview

This module presents students with the opportunity to demonstrate mastery of the key concepts of socio-environmental synthesis, concept mapping, and biological corridor as a conservation mechanism. Students will apply what they have learned in Modules 1 and 2 to a new location in order to explore concepts of scale and context and then present their corridor plan to the class.

Estimated Class Time: varies according to depth of assignment. We require students to prepare a detailed written report (see detailed "Module 3 Student Handout") and oral presentation that they work on incrementally throughout the last four weeks of the semester, with most of their work being done outside of class. Throughout the four weeks, we spend our time teaching related course content and discussing and giving instructions for various aspects of the corridor proposal. The students' work culminates in a 15-20 page paper and a 30 minute PowerPoint presentation. This project comprised 30 percent of the students' grades in our course. However, instructors could easily reduce the scale and size of the assignment and/or modify the focus to reflect specific course content/goals by extracting one or two of the major components of the corridor plan to assign to students.

Student Learning Goals and Objectives

As this is a summative exercise, students should meet all three learning goals of the case. However, Module 3 is especially designed to focus on this student learning goal and objective:

Goal: Through exploration of the challenges in the Bellbird Corridor, recognize the importance of scale and context in addressing socio-environmental problems.

Objective: Explain the value of the corridor as a conservation tool and its applicability to other locations and contexts.

Class Plan and Activities

Divide the class into small groups (3-5 students each). Each group will apply concepts learned in the previous modules to develop a biological corridor in a new location. Each group can take on a different location, or alternately, all groups can explore the same location. Group work can be presented as a written report or professional presentation (or both), depending on instructor preference. We require both. That is, we require each group to work as a team throughout the remainder of the Module to develop a corridor program, to complete a 15-20 page written report, and to prepare and deliver a 30 minute oral presentation for the class (20 minutes for content and 10 minutes for questions). See "Module 3 Student Handout" for details.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Assignment

The instructor has considerable flexibility in creating the assignment; this module can range from a one to six week activity for example, depending upon the depth of research and final product. As detailed in the Module 3 Student Handout, students will:

1. Identify a location for a new biological corridor to be implemented by submitting a one-page description of the proposed corridor location that briefly identifies the environmental (i.e., at risk species and ecosystems) and social context (i.e., historical, cultural, and political background) of the area. We then provide feedback on the submissions and discuss common strengths and weaknesses so that students can move forward with their corridor plans. This assignment could easily be modified for a single specific location that the instructor assigns or it can be implemented as we did, where students are allowed to identify their own location (as long as their location meets the goals spelled out in the Module 3 Student Handout).

It may prove most effective for students to apply the corridor concept to a location with which they are familiar. For example, as two of the authors of this case study are located in Arkansas, they could utilize the Buffalo National River for this module:

- <https://www.nps.gov/buff/index.htm>
- <http://bnrpartners.org/>
- <http://buffaloriveralliance.org/>

This is an especially effective location for this module as it is not without challenges and controversy:

- <http://www.arktimes.com/ArkansasBlog/archives/2016/09/02/agreement-reached-in-buffalo-river-hog-farm-testing>
- <http://www.agweb.com/article/lawsuit-filed-over-arkansas-hog-farm-near-buffalo-river-naa-associated-press/>
- <https://www.npca.org/advocacy/19-protect-buffalo-national-river>

For other non-local ideas that span the continent and the globe, <http://conservationcorridor.org/> provides many real-world examples that may be used for this module.

Interestingly, although we prompt our students with locations close to home, our students tend to come up with diverse corridor locations in terms of their size, challenges, ecosystems, and geographic locations.

2. Prepare a written report and an oral presentation that detail the following, as spelled out in the Module 3 Student Handout. The report should outline the aspects bulleted below, each of which corresponds to a major section of the assigned paper and presentation outlined in the student handout. The oral presentation should reflect a condensed version of the written report.
 - Background: Give background information on the social and environmental context of the location, including key human stakeholders along with relevant animals and ecosystems.



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

- **Activities:** Identify and describe the activities that the corridor will encompass, how the activities will impact human and animal behavior, and how the activities and their impacts will be monitored.
- **Organization:** Describe how the organization will be structured and how the corridor will be managed, including an outline of the staffing structure and budget.
- **Political feasibility:** Describe how local communities will view the corridor and how the organization will solicit local support and involvement.
- Create a management plan for the new location that addresses issues presented in Module 2 (as well as any additional components the instructor would like to add).
- A reference list.

Note: to facilitate timely progress on their proposal, we require students to submit the Background portion of their written report early on (approximately 3 weeks before their paper is due). We then provide feedback that we expect students to incorporate in their final product. We also require them to submit their written report one week in advance of their PowerPoint presentation to give them adequate time to develop and prepare for their presentation.

3. **Reflect.** To address the learning goal and objective of this module, students should also consider questions of scale and context. Toward this aim, after the students have presented their corridor proposals to the class, we pose and discuss the following questions:
 - What new or different challenges were created by this location, as compared to the Costa Rica Bellbird Corridor Project?
 - Does the set of stakeholders vary, and if so, how does this affect the management plan?
 - What are the unique aspects of this location's culture, politics, and economy, and how do they influence the management plan?

Assessment

See previous modules for assessment of the concept map, stakeholder identification, and management plan.

For the specific goal and objective for this module (recognize the importance of scale and context; applicability to other locations and contexts), students will demonstrate mastery by thoughtfully and effectively answering the three questions listed above. This rubric may help:



The Three-Wattled Bellbird: Corridor, Conservation, and Costa Rica

Element	Absent (0 points)	Basic (5 points)	Proficient (10 points)
New or Different Challenges	Group does not identify any new or different challenges	Group identifies new or different challenges but does not address these challenges	Group both identifies and addresses new or different challenges
Stakeholder Changes and Effects on Plan	Group does not identify changes in stakeholder makeup	Group identifies new and appropriate stakeholders but does not identify and address effects on plan	Group comprehensively identifies new stakeholders and their effects on plan; address these effects
Unique Aspects and Effects on Plan	Group does not identify the unique cultural, political, and economical aspects	Group identifies the unique aspects but not the effects on the management plan	Group identifies the unique aspects and the resulting effects on the plan; the plan addresses these effects

Additionally, you may wish to employ a simple evaluation form to allow students to peer-review the group presentations (see “Form for Peer Review of Module 3 Group Presentations” as an example; we “mail-merge” this form). We also allowed students to reflect upon their and their group members’ relative contributions to the project through the “Module 3 Group Project Self Evaluation” form.

Acknowledgement

This work was supported by the National Socio-Environmental Synthesis Center (SESYNC) under funding received from the National Science Foundation DBI-1052875.

Creative Commons License

Please feel free to use and modify this work for your non-commercial needs, as long as you credit us and license your new creation under identical terms.



This work is licensed under a
[Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).