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Implementation of Conservation Approaches in Human-Dominated Landscapes:  
The Path of the Tapir Biological Corridor Case Study, Costa Rica

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Introduction

One of the main problems of protected areas is their isolation within fragmented and often human-dominated landscapes (Powell et al. 2000; Sánchez-Azofeifa et al. 2003). Biological corridors have been proposed as a strategy for maintaining plant and animal populations in fragmented landscapes by connecting isolated patches with strips of habitat (Bennett 2003; Tewsbury et al. 2002), but their efficacy is still highly controversial (Tewsbury et al. 2002). Overall, most studies supporting the use of corridors seem to be either built more on intuition than on empirical evidence, or they are too species and landscape specific (Beier and Noss 1998; Tewsbury et al. 2002). Additionally, studies addressing the effect of fragmentation on wildlife conservation in the tropics have focused mostly on the fragments themselves, ignoring species distributions in surrounding areas, particularly those dominated by humans (Ricketts et al. 2000; Hughes et al. 2002; Daily et al. 2003; Horner-Devine et al. 2003; Pereira et al. 2004).

Therefore, research is needed to assess the effectiveness of biological corridors as connectors within fragmented landscapes and consequently their usefulness as conservation tools.

Despite being recognized as having one of the most developed protected area systems worldwide (Groom et al. 2005), isolation of most of these sites in the fragmented landscape remains a major challenge in Costa Rica. The Path of the Tapir Biological Corridor (PTBC) is an example of a local initiative aiming to achieve connectivity between large protected areas. Development and deforestation in the region have created a fragmented, human-dominated landscape that constitutes the main barrier to achieving biological conservation in the region. My research objective in the PTBC is to assess the effect of the landscape’s different components on the conservation of mammal and bird species, keeping in mind that land-use patterns, political and socio-economic aspects may be limiting factors as well.

In this paper I present the PTBC as a case study of a conservation approach in a human-dominated landscape. I describe several aspects of the corridor, such as its design and implementation, conservation programs, threats to biodiversity, stakeholder engagement and economic incentives. In developing the paper, I held occasional interviews with the main participants involved in process. I also participated in environmental education activities organized by the local NGO ASANA (Amigos de la Naturaleza del Pacifico Central y Sur de Costa Rica), which coordinates the PTBC, and in a workshop organized by Lindsay Cannet from
the Tropical Agricultural Research and Higher Education Center (CATIE). Finally, I focused on the PTBC analysis of data presented in books written by Bennett (2003), Anderson and Jenkins (2006), and Hilty et al. (2006).

**Background on the Path of the Tapir Biological Corridor**

The PTBC is located in southwest Costa Rica and is a part of the Mesoamerican Biological Corridor (MBC). The corridor’s main objective is to create a network of sites favorable to fauna and flora between the forests of the Osa Peninsula and Golfo Dulce, including Corcovado National Park. These forests connect with those located in the Los Santos Forest Reserve in the Talamanca Mountain Range (Figure 1). The PTBC area covers approximately 82,000 ha, inhabited by 10,000 people in 55 rural communities. This mosaic of human-dominated land uses includes primary and secondary forests, native and exotic forest plantations, agriculture, pastures, bamboo, oil palm plantations, ecotourism projects and others.

The PTBC is one of Costa Rica’s most diverse regions, as was confirmed by a Rapid Ecological Assessment. A total of 2,700 plant species representing 10% of the country’s total plant diversity were identified, as well as 173 mammal, 26 amphibian, 46 reptile and 191 bird species (ASANA-TNC 2000). Moreover, 400 avian species were found in the area in the last three annual bird counts. The PTBC provides habitat to some endangered animal species such as margay (Leopardus wiedii), ocelot (Leopardus pardalis), jaguar (Panthera onca), scarlet macaw (Ara macao), spider monkey (Ateles geoffroyi), squirrel monkey (Saimiri oerstedii), great curassow (Crax rubra), and endemic tree species such as quira (Caryodaphnopsis burgeri).

Conservation in the region has been undertaken through seven National Wildlife Refuges and more than 30 private nature reserves, all of them established after 1995 (Ewing, J, pers. comm., June 2006). Most local people work in agriculture, and recently ecotourism has been gaining importance as an alternative source of income. However, as land prices have increased, land ownership is shifting from local farmers to wealthy foreigners. Costa Ricans have either become employees of the new owners, or migrated to larger cities in Costa Rica or to the United States and Europe. This poses a new challenge for the region, as...
protected areas are interspersed with private lands. Therefore, in order to avoid land use change and ensure connectivity among all protected areas, it is essential that the corridor’s conservation plan provides adequate incentives to landowners, particularly as land is bought and sold.

**Design, planning and implementation**

To implement an effective corridor there are several key factors: definition of concrete goals, appropriate design and management, identification of obstacles, support through the process and development of effective incentives (Bennett 2003; Anderson and Jenkins 2006; Hilty et al. 2006). Conservation awareness in the PTBC began early in the 1980s, and the creation of ASANA was the first step to implement the corridor. ASANA has not only addressed conservation issues, but has also worked to develop community-based sustainable projects. In 1996, the idea of the PTBC was first brought to consideration, but it was officially recognized by Costa Rican authorities only in 2000. The corridor design encompassed high elevation lands to protect water sources for local consumption and a matrix of high and lowlands to protect habitat for hundreds of species. The PTBC is one of the few projects where a Rapid Ecological Assessment was carried out to justify its importance as a conservation and development tool in Costa Rica (Ewing, J. pers. comm. July 2006).

The strategy for the creation of the PTBC consisted of three elements. The first encourages landowners to formally create one of several types of biological reserves: a) National Wildlife Refuges like Hacienda Barú and La Merced; b) informal reserves with no particular government recognition such as Oro Verde Biological Reserve and Rafiki Safari Lounge; c) land held in reserve through payment for environmental services (PES); d) land protected by environmental easements. A second element encourages and assists landowners in the protection of their reserves. This is accomplished through environmental education in surrounding communities, and by creating covenants that allow the National Parks Foundation (NPF) to hire official park rangers whose salaries are later reimbursed by reserve owners and neighbors. The final element encourages the creation of natural corridors along rivers, streams and fences in lands not currently in reserve, allowing connections between forest
patches. This is being accomplished through environmental education and public awareness (Ewing, J. pers. comm. October 2006).

The PTBC organizations strive to achieve four major goals: (1) restore natural habitats to encourage the return of terrestrial and marine endangered species such as the leatherback sea turtle (*Dermochelys coriacea*) to the forests and beaches they inhabited half a century ago, and protect existing species by allowing local populations to become more robust, (2) halt deforestation and restore forests in order to complete the corridor and protect water sources, particularly in watersheds and groundwater recharge zones (Photograph 1), (3) encourage local communities to value resources and use them sustainably, and (4) create interconnecting forest reserves between the existing network of forest and wildlife reserves.

Specific conservation programs have been developed by the PTBC organizations to accomplish its goals in the region. These are important steps in the implementation of the corridor’s design (Anderson and Jenkins 2006). The main programs include: (1) Environmental education in more than 32 schools and workshops for local adults help build a better understanding of sustainable forest management (Photograph 2). In addition, within the PTBC road signs caution drivers about the presence of wildlife species and inform people about the existence of the corridor (see Photograph 3). (2) Promotion of land conservation areas through Payment for Environmental Services (PES) is done in collaboration with the government (for more details about PES see Redondo-Brenes and Welsh 2006). (3) Community-development projects provide better revenues to local people through sustainable agricultural practices. (4) Coordination for the development of aqueduct associations ensures proper watershed management and supply of drinkable water to locals. (5) Training and approval of 130 voluntary local game wardens provides an *ad honorem* patrol for the regions. (6) Efforts are done to monitor and protect sea turtles and other flora and fauna species. To date, some of those programs are working well and others still need more funds to be properly implemented.

Despite these programs, biodiversity in the region is still threatened by development, deforestation, illegal logging, poaching, hunting and lack of law enforcement. Foreigners and tourism projects are being attracted to this area, as real estate developers buy the land from
locals. Cutting the forest and building new roads and residential areas result in increasing fragmentation. Moreover, despite a reported decrease in hunting over the last three decades (Ewing, J, pers. comm. June 2006), the problem persists because hunters continue to come from communities outside the corridor.

Another main constraint for the PTBC to achieve biological conservation is insufficient funding. During a workshop in June 2006, local people mentioned that they lacked the funds to continue some current projects and to implement new ones. Other problems such as weak law enforcement, some cases of corruption by government organizations and little interest in controlling these factors, still persist in the region. In fact, local farmers highlight the authorities’ negligence to enforce the law against developers and other landowners as one of the obstacles to success of the PTBC.

**Stakeholder engagement and economic incentives**

Large-scale conservation projects in private and human-dominated landscapes require participation of local people and they have to receive economic incentives to ensure their support (Anderson and Jenkins 2006). Support to the PTBC project by its participants stems from the fact that they were taken into consideration during the design of the corridor’s objectives. For example, since water quality and quantity are important issues for the people of the region (Welsh 2006) and a water protection approach has proved to be an effective tool for biodiversity conservation as well (Redondo-Brenes and Welsh 2006; Redondo-Brenes 2007), the corridor leaders chose to include water as a priority in their plan.

According to Newcomer (2002) the PTBC participants can be grouped into three main in-country clusters: community organizations, government and landowners. Community organizations include cooperatives, foundations, women’s groups, environmental groups, agricultural groups, community development associations and the PTBC Coordinating Committee. The government is represented by a local liaison between the PTBC program and the Ministry of Environment (MINAE). National ministries and municipal government agencies have direct interests and influence on the program (Newcomer 2002). The PTBC consists of three municipalities (Aguirre, Osa, and Perez Zeledón), and three conservation areas (ACOPAC, ACLA-P, and ACOSA) led by MINAE, but to date only the municipality of Aguirre, and the conservation areas ACOPAC, and ACLA-P to a lesser extent, are supporting their conservation and development initiatives. Finally, landowners can be divided into those...
who participate in conservation and those who don’t. The latter, mostly developers, constitute one of the main threats to biodiversity conservation in the area. A fourth group not mentioned by Newcomer (2002), consists of individuals and institutions that fund specific conservation and development projects within the PTBC. Among them are AVINA Foundation, Cedarena Land Trust, Costa Rica Conservation Trust, the Mesoamerican Biological Corridor Coordinating Committee and the United Nations Development Programme (UNDP).

Participation of local landowners and their willingness to maintain forest cover will determine the future success of the PTBC project. The fate of the existing biodiversity in the region depends on landowners’ management decisions, so attractive economic incentives are necessary to ensure their engagement in conservation practices (Anderson and Jenkins 2006). The PTBC organizations help landowners find these incentives for sustainable land management. For example, they offer guidance in obtaining PES from the government (to date more than 3,500 ha of forest are under protection through PES), funding for community-development projects and technical assistance to address water management and other conservation issues. Additionally, local landowners can benefit from conserving their lands through ecotourism (Valenciano, C. pers. comm. July 2006).

**Final remarks: recommendations to the PTBC organizations**

Of the more than 30 corridors in Costa Rica, only six currently have well-defined organizations with boards of directors and are implementing their conservation programs in the field. The PTBC is one of them (Cannet, L. pers. comm. June 2006). This section will discuss those limiting factors that still need to be addressed in order to accomplish conservation and community development objectives in the PTBC.

Lack of public awareness limits the implementation of the corridor’s design (Anderson and Jenkins 2006). According to Welsh (2006), less than 50% of the local people interviewed within the corridor in 2005 knew or had heard about the PTBC. Thus, it is essential to work more in promoting the corridor at a local level. Well-defined leadership is one of the PTBC’s strengths, which should be linked to strong institutional coalitions and broad public support (Anderson and Jenkins 2006) in order to ensure long-term success.

Law enforcement needs to be strengthened as public support for the corridor implementation process grows (Anderson and Jenkins 2006). Sustainable resource management along the whole corridor requires support from municipalities and conservation areas not currently working within the PTBC objectives. As mentioned above, strong institutional coalitions are fundamental to accomplish conservation goals, especially in human-dominated landscapes. Since only municipalities and MINAE can make decisions about new infrastructure development, their participation is the key to achieving conservation in the region. Only they can control development projects to avoid further habitat fragmentation, and do more careful land-use planning within the PTBC.

The PES scheme currently used in the region to encourage conservation needs some re-structuring. Poor funding, medium-term time frames (e.g. PES contracts range from five to 10 years), and some mismatch between conservation areas defined by MINAE and conservation priorities within each region, are some of the flaws of the program. Thus, either the government should create a better framework for the PES, or the PTBC organizations should look for alternative funding sources to provide economic incentives to owners willing to preserve their land.
To date, most of the biological information for the corridor is lacking. It is important to evaluate how the PTBC may affect native species in the landscape. What can serve as connectivity for one species may act as a barrier to movement for other species (Bennett 2003; Hilty et al. 2006). This issue will be addressed in my dissertation thesis, studying mammal and bird species and their habitats within the corridor. It is essential to establish which species are present, what their habitat requirements are, and how much of it is available. Meanwhile, the PTBC organizations need to continue working on habitat conservation and restoration. Food sources for different wildlife species should be established to avoid conflicts with local farmers. And given that the PTBC region is bisected by roads, building road-crossing structures could provide connectivity between flora and fauna populations and decrease road kills.

Costa Rican institutions and international NGOs need to realize the potential broader implications of the PTBC’s conservation effort. The corridor aims to provide connectivity for flora and fauna between Corcovado National Park and other large protected areas. Unless this is achieved, most large endangered species in Corcovado will become isolated and doomed to extinction in the long run. However, while millions of dollars are being invested in the adjacent Corcovado, poor external economic support currently limits many of the PTBC’s conservation programs. So not only do they require more external support but all organizations within the corridor need to make a clear and concerned effort to accomplish the desired connectivity.

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References


