

Wildlife-Friendly Farming and Crop Resilience in Southern Costa Rica

Marie Bouffard, Lauren Manzo, Cameryn Brock, Julia Dagum, Bret Folger

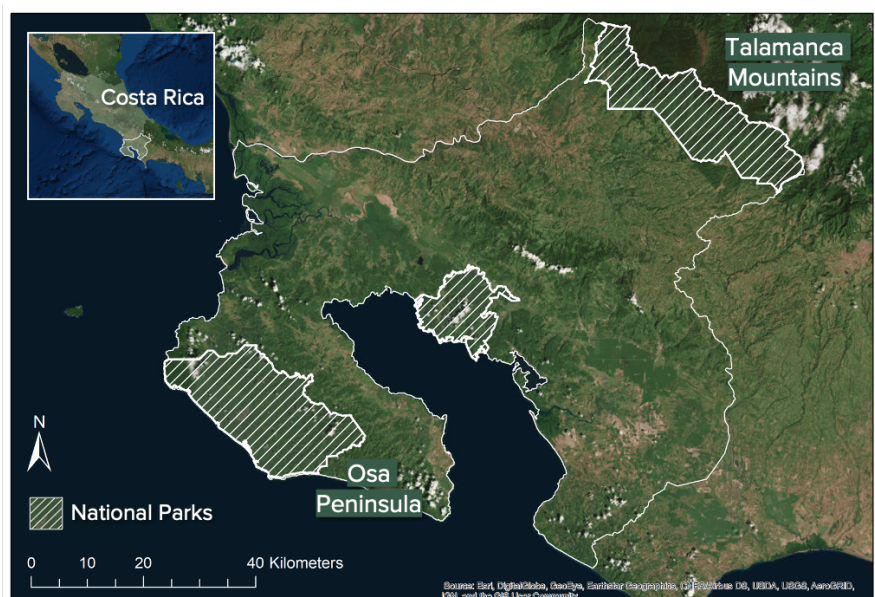
Advisor: Dr. Ashley Larsen | Client: Hilary Brumberg and Rodrigo de Sousa, Osa Conservation
Spring 2021



Agricultural expansion and urban development over the last 100 years has led to substantial fragmentation in southern Costa Rica, threatening the region's outstanding biodiversity. This region is critical for the livelihoods of smallholder farmers and for wildlife movement between the heavily forested Osa Peninsula and Talamanca Mountains (Figure 1), particularly for forest dependent and wide-ranging species like the jaguar. To support both the environment and the community for the long term, the region needs a holistic approach to sustainable agriculture that considers all stakeholders. **In this project, we employed spatial analyses and reviewed scientific literature to evaluate 1) the key barriers to jaguar movement, 2) the environmental and socio-economic impacts of five regionally available eco-certifications, and 3) how suitability for three important crops will shift under climate change.** Our results will contribute to the work of our client, Osa Conservation, to conserve Costa Rica's outstanding biodiversity while enhancing the region's economic opportunities.

Habitat fragmentation continues today and has led to two disconnected jaguar populations in the Talamanca-Osa region, greatly reducing the viability of the smaller population. Jaguars are particularly vulnerable to fragmentation because they are forest dependent and wide ranging, and therefore require large areas of undisturbed habitat. To reconnect the jaguar populations, managers must understand the barriers to movement and the utility of specific management actions to reduce those barriers. We used multiple connectivity models to predict regional jaguar movement. We identified the highest barriers to movement and examined the efficacy of using wildlife-friendly farming practices to improve connectivity. Our results suggest that large roads and extensive swaths of pastureland hinder jaguar movement and that adoption of wildlife-friendly farming practices has little effect on jaguar connectivity on its own. We recommend future actions to improve regional connectivity and suggest prioritizing major roads and pastureland.

Figure 1. Study area map of the Talamanca-Osa region. Our focal area, the Talamanca-Osa region in southwest Costa Rica, extends from the Osa Peninsula to the Talamanca Mountains. The study area contains three national parks (from west to east): Corcovado National Park, Piedras Blancas National Park, and La Amistad International Peace Park.



Integrating conservation in working landscapes can play a key role in mitigating the impacts of habitat loss and fragmentation. Wildlife-friendly farming practices may decrease resistance to wildlife movement, but these practices are often costly to implement. In principle, eco-certifications can lower the financial barriers by allowing farmers to generate economic benefits through price premiums and increased market access. We conducted a review of the scientific literature to evaluate the ecological, economic, and social impacts of eco-certifications available in the Talamanca-Osa region of southern Costa Rica. We found that environmental, economic, and social impacts from adopting eco-certifications can vary substantially depending on the context of each individual farm or region. Further, eco-certifications broadly can provide benefits, but a net economic benefit is not guaranteed and there are often substantial trade-offs among environmental, economic, and community impacts. Communication of our results will allow farmers to better evaluate their potential to benefit from eco-certifications based on each farm's unique context.

Rising temperatures and changing precipitation patterns associated with climate change stand to strongly affect farming and food systems in the Talamanca-Osa region. As climate change intensifies, suitable ranges for the quality and survival of important regional crops may shift and necessitate crop switches, farm expansion, or farm relocation. To explore the expected shifts, we analyzed future crop suitability for three crops in the Talamanca-Osa region: coffee, cacao, and pineapple. Biological data on crop presence and environmental data on environmental factors, such as average annual temperatures and precipitation levels, provided the basis for predicting present and future suitable crop habitat in the region. We conducted a suitability analysis for our focal crops using crop presence, data on environmental and biophysical factors, and Maxent species distribution modeling software. We found that under climate change, suitability for coffee is expected to shift to higher elevations (mountainous regions) and suitability for cacao and pineapple is expected to expand in lowland regions. Our results can benefit both farmers and conservation organizations; farmers can use our predictions to inform long-term planning, and organizations can use the projected shifts coupled with information on important areas for connectivity to plan priority areas for protection and identify key restoration sites.

Strategic long-term planning for sustainable farming in southern Costa Rica requires information on how to support wildlife with on-farm practices, how to incorporate wildlife-friendly farming practices in an economically feasible way, and how crops will be influenced by climate change. Our analysis will provide farmers and governmental and conservation organizations with the information needed to promote sustainable farming in the region, benefitting both farmers and wildlife.

