Conservation and Economic Vitalization through Silvopasture in Nicaragua
Dow Distinguished Awards for Interdisciplinary Sustainability Competition

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Partner Organization: Paso Pacifico (Conservation Non-Profit)

Project Scope

Our intention with this project to investigate and document instances of cattle ranching in the Rivas Isthmus of Nicaragua where viable conservation habitat is created or preserved. Our team completed three months of data collection on seventeen cattle farms on the Pacific Coast side of the Rivas Isthmus in order to gather an accurate representation of 250 km² with significant conservation interest. Our ultimate goal is to combine conservation interests in a high-quality matrix of dry tropical forest species with sustainable development interests for improved economic opportunity for cattle ranchers. Looming large behind our efforts, we observed many instances of damages that climate change has already exacerbated. The region has suffered a multi-year drought and climate predictions indicate more frequent droughts in the formerly dry tropical forest ecosystem. We predict that pursuing strategies that share ecological and economic benefits will develop into a critically needed long-term adaptation approach for this region.

Figure 1. Map of the Rivas Isthmus area of study
After our data collection in Nicaragua, we recognize the immediate economic opportunity in improving existing cattle health and the potential opportunity in aligning conservation interests with incentives and increased ecotourism. We also recognize the likely dual benefits of an educational campaign that disseminates best practices of ranchers in the region and advertises assistance that our partner, Paso Pacifico, can provide. The expanded project implementation and evaluation plan that follows is directed to achieve our overall goal and build upon this rationale.

Progress and Achievements

To date, our greatest accomplishment has been completing our fieldwork successfully. We studied 17 farms within the Rivas Isthmus of Nicaragua. On these farms, we collected data from over 110 isolated trees in cattle pasture and 83 cows. We also collected a total of approximately one kilogram of dry biomass gathered from our sites for nutrient analysis. We documented 472 bird visits to trees and 424 individual bird behaviors including perching, foraging, preening, vocalizing, nesting, and mating. In addition, we collected roughly ten hours of rancher interviews which allow us insight into experiences and interests that will help us to improve the livelihoods of farmers as well as the planet through alternative land management techniques. All of these data have now been entered and are ready for analysis. The data collection allows our team to analyze the conservation value of different rancher’s management practices and the resulting health of their cattle. The intensive data collection process has given us an unique look into the range of rancher land management practices and the range of likely economic and ecological returns.

Project Plans

Moving forward, our first priority is to analyze the wealth of data that we’ve collected. Through our analysis, we expect to identify significant relationships between ecological factors like bird visitation and tree species and economic factors like land management and cattle health. We believe the current level of data is sufficient to begin to identify these relationships. However, data collection will continue to be a part of our project through monitoring of ranches and surveys of ranchers.

Post-analysis, we plan to pursue the completion of a few important deliverables, pending further funding. Firstly, we intend to produce an informational pamphlet/brochure for farmers as an analog, simplified version of our decision-based tool. We realized that an online or computer-based tool may be unavailable for farmers in the Rivas Isthmus, however we think it may be useful for Paso Pacifico and/or any farmer and stakeholders who might have computer access. Both products still will focus on three key areas of concern: ecological restoration, carbon sequestration, and economic viability. In addition to the inputs mentioned in our first proposal, we now realize that pasture quality is likely a significant factor that we will approximate through a combination of biomass and grass cover. Through this tool, we aim to provide suggestions based Pareto optimal solutions considering all desired characteristics. We can extend our assistance by designing workshops on seed collection and tree propagation, detailed below. We expect deforested pasture to be more susceptible to droughts thus forcing greater investment into maintenance by
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ranchers. To preserve the economic potential of cattle ranching, we would educate ranchers on mixes of pasture seed and tree species that confer drought tolerance to their land.

Finally, in addition to the deliverables mentioned above, we expect to produce a manuscript for publication by April 2017 and a policy recommendation to submit to Nicaraguan government representatives around the same time.

Implementation Plan

Learning and improving seed collection skills in particular will provide farmers with the tools to be self-sufficient in terms of reforestation within their properties. Brochures would include region-specific information on silvopastoralism, best land management practices, and benefits to having high bird diversity on cattle ranches. Information on Paso Pacifico’s workshops and trainings would also be included. We would supply these brochures to Paso Pacifico for their distribution to local farmers. With regards to the workshops, our team would work with Paso Pacifico to organize and fund a series of sessions on seed collection for pasture and trees, as well as workshops on tree propagation once the seeds are collected. These workshops would also integrate cost-benefits for specific trees and economic planning for tree growth, such as when to grow trees to minimize water costs. Lesson plans would integrate our findings with local knowledge. Paso Pacifico either owns or shares numerous properties around the Rivas Isthmus where workshops could occur, and these sites could be set up as examples silvopastoralism. After workshops are set up and running smoothly we will transition organization to Paso Pacifico and potential future University of Michigan students.

Silvopastoral practices require dedication, which can be encouraged with government support. Neighboring Costa Rica offers an incentive program for reforestation and maintaining pre-existing trees in agroecosystems. In order to encourage that such steps be taken in Nicaragua, we plan to write a policy recommendation for Paso Pacifico to submit to the Nicaraguan government sharing our findings and educating leaders on the issues that face farmer welfare and biodiversity in the Rivas Isthmus. These issues tie strongly to the region's tourism and beef production, both of which are of interest to the Nicaraguan state.

Timeline

A display of our future timeline can be seen below with major milestones for implementation and deliverables occurring mainly in 2017. This timeline assumes that we receive funding and can realize our full implementation plan. Upon analyzing our data, the team will assess if a second trip to Nicaragua is necessary. We intend to complete all data analysis and work with Paso Pacifico to create a fully detailed implementation plan by the end of 2016. We hope to see the launch of our implementation by February 2017. Our informational brochure will be completed by January 2017, prior to the launch of implementation such that Paso Pacifico can release brochures alongside the start of workshops. By March 2017, we plan to have a draft of our manuscript completed, as well as a finalized decision-making tool for Paso Pacifico. By April 2017, our team will have completed all tasks and have a finalized manuscript to be submitted for publication.
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<tr>
<th>Task</th>
<th>FA 2016</th>
<th>JAN 17</th>
<th>FEB 17</th>
<th>MARCH 17</th>
<th>APRIL 17</th>
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<tr>
<td>Data analysis</td>
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<td>Decision-making tool</td>
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<td>Manuscript and Policy recom</td>
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Budget

Our budget includes the financial resources needed for printing brochures, organizing and funding workshops, hiring a programmer for the creation of our decision-based tool, and a stipend for the undergraduate member of our team. While the graduate students on this project receive course credit for their effort, the undergraduate receives no form of compensation which is a hardship to him. In order to make it easier for him to remain involved in the project, we seek to provide him with a stipend equal to the cost of one credit of coursework. Workshops will be staffed by Paso Pacifico and potential local experts on silvopastoral techniques. Funding for workshops will cover staffing, food, materials, and transportation costs. Our decision-based tool will likely require a knowledgeable programmer, whom we could source from within the University’s student body and pay a competitive wage.

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<th>Estimated Budget</th>
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<td>Brochure</td>
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<td>Workshops</td>
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<td>Stipend</td>
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<tr>
<td>Programmer (Decision-based tool)</td>
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<td><strong>Total</strong></td>
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With 50 percent of our estimated budget, we can create a brochure, workshop lesson plans, and pay a programmer. We would need to significantly reduce the number of workshops that would be realized within the timeframe of our project, potentially threatening the success of transitioning the workshops to Paso Pacifico and future SNRE master's projects.

Skill Gaps

Our team draws skills from a variety of backgrounds including conservation ecology, environmental justice, engineering, policy, and sustainable systems. While most of our backgrounds include exposure to statistical analysis, we recognize that our large dataset might require some further understanding on the subject matter. We intend to seek assistance with more advanced techniques from the Center for Consulting for Statistics, Computing, and Analytics Research (CSCAR). We also recognize that our
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Analysis and decision-based tool may necessitate further knowledge on programming languages should advanced software programs need to be used. Help on this subject can also be found at CSCAR, however should we need further assistance for making our decision-based tool, we hope to have funds available to hire a programmer. We are confident that with our current skillset and the assistance of university resources we will be able to comprehensively analyze and evaluate our findings. The creation of a computer-based decision making tool will also require programming skill beyond our team’s capacity. To address this gap, we have budgeted to work within the University of Michigan system with a computer science student or students interested in programming applications towards sustainable development.

Evaluation

We hope to achieve the following over the next three years:

- Distribute brochures to at least 50 local ranchers
- Reach at least 100 landholders through seed collection and tree propagation workshops
- Landholders will plant at least 1000 native trees throughout the Rivas Isthmus using skills they gained from workshops
- Increase dairy production to a profitable level on a per rancher basis
- Publish our results in a peer-reviewed journal