Doctoral Dissertation Research: Subsistence Hunting in an Anthropogenic Swidden Landscape in Southern Belize

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Problem Statement

Can landscape modifications by swidden farmers enable sustainable hunting in tropical environments? Or does sustainable hunting depend on the presence of protected areas to serve as wildlife refuge? The purpose of this project is to investigate the relationship between swidden agriculture and subsistence hunting and determine the relative importance of anthropogenic landscapes and protected areas for sustainable hunting.

Whether or not hunting in the tropics is sustainable has typically be determined by using population growth models to estimate maximum sustainable harvests (Robinson and Redford 1994). However, these models have been widely criticized for being too static, narrowly focused population dynamics, and disconnected from habitat characteristics that are relevant to wildlife (Ling and Milner-Gulland 2006; van Vliet and Nasi 2008). These criticisms have helped to expand the focus of research on hunting from the population dynamics of individual species to patch and landscape scale habitat features that support wildlife communities that are resilient to hunting pressure (van Vliet *et al.* 2016). An early example is the source-sink model which proposes that landscapes which contain areas where wildlife can breed under low hunting pressure (the source) and then disperse into areas with greater hunting pressure (the sink) may be more sustainable (Novaro *et al.* 2000). The source-sink model depends on the presence of habitats with minimal human impacts and has been used to emphasize the role of protected areas in wildlife conservation (Naughton-Treves *et al.* 2005).

Recently, it has been argued that patchy landscapes with a diversity of habitats are critically important for supporting the nutritional needs of wildlife and increasing biodiversity (van Vliet *et al.* 2016; Bliege Bird 2015). Two examples of a patchy landscape is the landscape mosaic that emerges from histories of swidden agriculture (Downey 2010) and patch burning (Bird *et al.* 2016). These anthropogenic mosaics have been associated more productive hunting returns (Smith 2005; Parry *et al.* 2009) and may be an example of the keystone role of humans as ecological engineers (Bliege Bird *et al.* 2013). If habitat heterogeneity is necessary for resilient wildlife communities, then swidden agriculture may play a critical role in creating heterogenous landscape mosaics.

The focus of this research project is the possibility that sustainable hunting could arise in landscapes where the farming and fallowing cycles associated with swidden agriculture produce a swidden mosaic that supports meta-populations of game species (Hanski 1999) by creating a source-sink system (Holt 1985). To investigate this possibility, my research will focus subsistence hunting and determine the relative importance of anthropogenic swidden mosaics and protected areas for hunters and for wildlife. Previous studies have focused on the preferences and productivity of neotropical hunters (Smith 2005; Parry *et al*. 2009, Peres *et al.* 2000) and have used hunting returns to infer the relative importance of anthropogenic landscapes and protected areas. However, to understand the impact of swidden on populations of game species, it is critically important to couple hunting networks across the landscape with patterns of dispersal and habitat selection by game species.

Thus, to build on previous studies of hunting in tropical environments, I will focus on the following research objectives:

1. Identify hunting locations by equipping hunters with GPS tracking devices
2. Collect hunting logs and conduct focal follows to document hunting behavior and estimate hunting returns
3. Monitor wildlife habitat selection and estimate wildlife abundance using a sensor network of trail cameras
4. Conduct ecological surveys using fixed width line transects to triangulate foraging and breeding behavior of game species
5. Compare hunting pressure, breeding locations, and wildlife abundance in forest fallows and protected areas
6. Conduct semi-structured interviews with hunters to learn about hunting site selection

I will conduct these research activities in the forests surrounding the Q'eqchi' Maya village of Crique Sarco where my advisor and I have previously worked. Crique Sarco is an ideal location to study these dynamics because it is a buffer community to the Sarstoon Temash National Park and through previous research, our research lab has collected a remotely sensed map and a chronosequence that represents the history of farming activities in the communal lands adjacent to the national park going back more than 50 years.

Intellectual Merit

This research project makes two primary intellectual contributions: (1) hunting pressure and habitat modification have been associated with defaunation and species loss. However, these conclusions are typically based on production models that do not incorporate feedbacks between hunting and habitat modification. Although hunting pressure has a direct negative impact on wildlife, anthropogenic modifications have the potential to create ecological edges that benefit wildlife. Thus, a feedback relationship may exist between hunting and swidden that balances or even enhances forest landscapes. This research will develop a model of hunting and swidden as an integrated system and use it to identify mechanisms that lead to negative feedbacks (coexistence and sustainability) and those that lead to positive feedbacks and unstable levels of resource use and habitat modification.(2) Within anthropology, hunting and swidden agriculture are two subsistence practices that are typically studied separately, because each is thought to encompass distinct kinds of human-environment relationships. This research focuses the links between these practices by viewing swidden agriculture and hunting as an integrated system. Identifying cross-scale feedbacks between agriculture and hunting can yield insights that contribute to our understanding of subsistence transitions. Beyond these merits, there is long standing criticism about the view that humans are detached and separate from ecosystem. One way to engage this criticism is to develop theory that explicitly places humans within trophic interactions that are relevant to ecosystem functioning (e.g., Dunne et al. 2016, Crabtree et al. 2019). My research engages with the call to "restore the ecological function of people" (Bliege Bird and Nimmo 2018) by theorizing about the role of human subsistence activities as an integral part of a tropical socio-ecological system.

Broader Impacts

Previous research connections and pilot research in Crique Sarco village in southern Belize have positioned this research project to have multiple broader impacts. First, Q'eqchi' and

Mopan Maya communities in Belize recently won international court cases that substantiated their claims to communal ownership of Maya lands throughout western and southern Belize (Medina 2016). The Maya Leaders Alliance -- a body of 39 village leaders (*alcaldes*) -- is now faced with task of deciding how to manage these lands and their natural resources (Gahman et al. 2020). I will provide descriptive scientific information to the Maya Leaders Alliance by preparing a written report. I will also work with the Village Council and the Crique Sarco Alcalde to prepare a community presentation so that the community can use this information as they consider institutions and management of resource use. Second, I have had conversations with individuals in Crique Sarco who have expressed interest in our research being used for educational purposes. Many resident particular enjoy the photographs of wildlife that capture in our trail cameras. One way that I will contribute to interest is by creating a laminated poster that contains photographs of wildlife from our camera trap survey. I will provide this poster to the schoolhouse and to the community center for students and village residents to use and learn about wildlife. Third, because this research takes place in and around a buffer community, it has received support from the Sarstoon Temash Institute for Indigenous Management (SATIIM) -- an indigenous NGO that is responsible for managing the national park that is adjacent to our study site. One product of my investigation around the national park will be a descriptive report that will highlight management issues for consideration by SATIIM. In addition to these impacts, a final impact is that funding this dissertation proposal will contribute to the development of a young scholar in he pursuit of a PhD. An important outcome of this research is the role it will play in the future instruction and mentorship that could be provided by the Co-PI.

Literature Review

The world's forest ecosystems are undergoing a process of defaunation that is resulting in the loss of local and global biodiversity (Dirzo et al. 2014). Two drivers of defaunation are believed to be 1) hunting, which frequently associated with the presence of "empty forests" (Wilkie et al 2011; Young et al 2016), and 2) habitat modification, which puts constraints on available wildlife habitat (Fischer and Lindenmayer 2007). The relevance of hunting and habitat modification to defaunation processes increases the urgency of studying secondary forests created by swidden cultivation, as these forests as both heavily modified and used as locations subsistence hunting.

A charged debate has centered on whether indigenous hunters use local ecological knowledge and cultural norms to conserve natural resources (Pimm 1991, Redford 1991, Alvard 1993, Smith and Wishnie 2000, Hunn et al. 2003). With respect to hunting, researchers have been particularly concerned with the age and reproductive history of prey that are chosen for harvest (Alvard 1995a, Hill and Padwe 1997) and the impacts of different hunting technologies on wildlife conservation (Alvard 1995b, Koster 2008a). Reviews of these literatures find, unsurprisingly, that there are a variety of sustainability outcomes associated with indigenous hunting (Hames 2007, Copolillo and Borgerhoff-Mulder 2005). In some cases, conservation is enabled by the accumulation of intimate knowledge about the life cycles of species over long histories of interaction (Berkes 2017). In others, conservation is an unintentional by-product of the technologies used or the population sizes of the human group in question (Hill and Padwe 1997). The general consensus among anthropologists and conservation biologists alike has been that subsistence hunting typically exhibits unsustainable harvest patterns (Smith and Wishnie

2000, Hames 2007) that result in defaunated “empty forests” surrounding human settlements (Wilkie et al. 2011; Redford 1992).

One model that emphasizes spatial characteristics is the source-sink model of sustainable hunting (Holt 1985). This model argues a prey species are resilient to greater predation or hunting pressure if it can reproduce in a “source” habitat and disperse into a “sink” habitat. This insight has been used to argue that hunting may sustainable if protected areas exist that are adjacent to hunting grounds (Hill and Padwe 1997, Novaro et al. 2000). The presence of a protected area would allow populations of game species to rebuild (the source) and then disperse into areas with greater hunting pressure (the sink). In their conception of the source-sink model, Novaro et al. (2000) explicitly claim that areas of anthropogenic disturbance (e.g., swidden mosaics) are unlikely to be sources of breeding populations. This suggests that if an adjacent protected area exists, swidden fallows are an example of an ecological trap (Boonstra and de Boer 2014).

Studies of game hunting in swidden mosaics do find that farms and recently fallowed areas regularly attract species of deer, peccary, coati, and caviomorph rodents (Peres and Dolman 2000, Smith 2005, Cullen et al. 2001). A potential reason for this attraction is the increased nutrition available on ecological edges and increased biomass that is associated with swidden mosaics and secondary forests (Robinson and Bennet 2004, Balée and Balée 2013, Bruun et al. 2009). Unlike forest fragments, which creates islands of isolated habitat, swidden mosaics maintain a degree of connectivity that can offer refuge and dispersal pathways even for large game like the tapir (Dunn, Estrada, and Smith 2012).

Together, the habitat heterogeneity and connectivity in swidden forest fallows suggests that sustainable hunting may not depend on the presence of an adjacent protected area. Instead, swidden agriculture may serve as a kind of intermediate ecological disturbance (Roxburgh, Shea, and Wilson 2004). Intermediate disturbances are believed to facilitate forest succession and diversification processes in tropical ecosystems (Chazdon 2013). In Australia’s Western Desert, research with Martu hunter-foragers has shown that patch burning with fire is a kind of intermediate disturbance that is associated with more productive hunting returns (Bliege Bird et al. 2013). Counterintuitively, game species are more prevalent in recently disturbed and more heavily hunted areas, because with the use of fire, Martu hunters create niche for their prey species and they increase the overall “seral diversity” by facilitating vegetation succession (Codding et al. 2014, Bliege Bird et al. 2013). Moreover, generalized hunting strategies by the Martu have been linked to structure diverse food webs in the Western Desert (Crabtree et al. 2019).

The findings from the Western Desert are compelling, but they were developed in an arid desert ecosystem. Despite this difference, there are some important parallels to the proposed study system. In the neotropics of southern Belize, Q’eqchi’ farmers use fire to clear patches of forests for planting crops. As these fallows are left to regrow, they create a heterogenous landscape that with many ecological edges just like those in the Martu case (cf. Codding et al 2014). While it is clear from our pilot research that hunters use fallows, farms, and protected areas as hunting locations, it is unclear if game species regularly breed in the swidden mosaic or if they rely on the adjacent national park as a protected refuge. The goal of my dissertation research is to understand the relative importance of anthropogenic mosaics and protected areas both as habitat for game species and as hunting grounds for Q’eqchi’ hunters.

Research Design

Field Site and 2019 Pilot Project

I will carry out my research plan in Crique Sarco, a Q'eqchi' Mayan village with approximately 300 residents that is located in the Toledo District of southern Belize. Crique Sarco village is 1 of 8 villages that buffers the Sarstoon Temash National Park. The presence of this adjacent protected area makes Crique Sarco an ideal location to test questions related to source-sink dynamics. The national park is managed by the Sarstoon Temash Institute for Indigenous Management, a non-governmental organization that provided a letter of support for a pilot project that I conducted in the summer of 2019. During this pilot project, I interviewed local hunters to learn about game species, conducted a rapid assessment of vegetation, and worked with previous Sarstoon Temash park rangers to place 4 preliminary camera traps in 3 different stage of forest regrowth. The pilot interviews garnered support from local hunters, and the camera traps have successfully photographed 10 game species. This pre-dissertation project provides a foundation for future research, but the scale of the data collection must be significantly increased. The proposed dissertation research will complement and extend ongoing research in the HCLab by focusing on the specific dynamics of **hunting systems** as they relate to broader cultural norms, social networks, maize cultivation using swidden, and landscape-scale patterns that have been the focus of the PIs NSF CAREER project.

Data Collection

Ethics approval will be obtained from the Ohio State University Institutional Review Board prior to data collection involving human subjects and data collection and management protocols will adhere to ethics guidelines. The appropriate research permits will be obtained in Belize through the National Institute of Culture and History and the Department of Forestry. With respect to fieldwork during the Covid-19 pandemic, at the time of writing, international travel and fieldwork will be permitted by OSU as of June 1, 2021 and vaccinations should be available by that time. We will work with the permitting agency in Belize and community leaders in the study villages to ensure that the research can be undertaken safely for the research and the communities.

Research Design

<u>Sampling.</u> This design proposes to work with all hunters within the village of Crique Sarco at least once and to focus data collection on the most active Q'eqchi' hunters in the village. Pilot interviews have been already been conducted with 6 hunters and it is clear from these conversations that many of these individuals are among the most active in the village. It is also evident from these pilot interviews that hunters frequently hunter in pairs, making it possible to sample more than one hunters per hunting trip. Because hunting is practices by a subset of individuals, an attempt to work with all hunters at least once is feasible (~15 hunters).

<u>Hunting returns.</u> I intend to use a variety of methods to collect data on hunting returns which will be used to estimate hunting pressure. When appropriate I will conduct focal individual follows (Altmann 1974) to measure search, acquisition, processing, and post-processing times (Alvard 1993) for hunted game. In addition, I will follow the methodology used by Koster (2006) and train research assistants to help administer questionnaires soon after hunters have come back from hunting trips. As part of the questionnaire, I will train

assistants to document the resources acquired by the hunter including gross weight, species, the number of individuals, and their reproductive status.

GPS data. I will equip hunters with Garmin GPSMAP 60csx devices to use when they travel on hunting trips. These data will allow me to investigate which forest areas hunters prefer for hunting. GPS data will also make it possible to model hunter movements and travel times through the forest landscape. The purpose of collecting data on hunter movements is to help assess the selection of hunting sites, a key step in determining relative hunting pressure throughout fallow lands and protected areas.

Camera Traps. To measure wildlife abundance, I need to expand the scale of my camera trap survey by placing 20 additional cameras in a representative sample of fallow regrowth stages and 10 within the Sarstoon Temash National Park. Camera traps will be used to create remote sensor networks (Kays et al. 2009) that collect images that can be used to estimate population densities and movement patterns for marked and unmarked game species alike (Moeller, Lukacs, and Horne 2018).

Transects. I will conduct line transects using the modified gentry plot method (Magnusson et al. 2005) which I employed in my pilot research. The modified gentry plot method was developed specifically for assessing floral structure and diversity in tropical forests. Additionally, I will work with trained research assistants to identify burrowing and breeding sites for important game species (e.g., *Cuniculus paca, Tayasu pecari*) following the methodology of Bliege Bird *et al.* (2013). Identifying breeding sites will provide a critical layer evidence about the relative importance of different habitats for wild game. While habitat use is often used in hunting studies, selection for breeding is an additional step that strengthen claims about the effects of habitat modification and hunting pressure.

Semi-structured interviews. I will conduct interviews with hunters about how they select locations to hunt and which locations are ideal for target particular species. Interviews will also be used to better understand the foraging habits of wild game. This emic perspective on hunting is important for understanding how Q'eqchi' hunters view the sustainability of their hunting activities and how wildlife should or should not managed. Interviews will also be used to collect demographic and social information including age, hunting experience, sources of income, education level, means of hunting, and household composition.

Social networks. In order to adequately assess hunting pressure, it is necessary to document not only hunting locations and yields, but also the networks of meat sharing that occur within the study location. Although it is only a subset of the study population that hunts, it is possible that they do so behalf of others in the village and redistribution their hunting yields using meat sharing networks. To understand this social aspect of hunt, I will collect hunting networks following the methodology of Koster (2011). I will document four kinds of network connection: sharing hunting information, resource transactions, sales of game meat, and hunting parties.

Research Schedule

Two tentative schedules are outlined below to build flexibility into the project due to health and safety precautions related to COVID-19 and vaccine rollouts for study communities.

Winter Schedule #1

- January 2022 – April 2022: Arrive for winter field season of setting cameras, conducting surveys and semi-structured interviews, training research assistant for ongoing hunting data collection during the follow year, and completing ecological fieldwork. Preparation for forest clearing occurs during this period.
- January 2023 – April 2023: Second field season to collect camera and hunting data and continue ethnographic fieldwork.

Summer Schedule #2

- March 2022 – June 2022: Arrive for spring/summer field season of setting cameras, conducting surveys and semi-structured interviews, training research assistant for ongoing hunting data collection during the follow year, and completing ecological fieldwork. Forest clearing and spring planting occurs during this time.
- March 2023 – June 2023: Second field season to collect camera and hunting data continue ethnographic fieldwork.

Hypotheses

Fallow classes represent various stages of regrowth based on the length of time that has passed since the area was last under cultivation. Thus, fallows fall on a continuum with one extreme being currently in cultivation (i.e., *milpa*) to forest fallows that have been left to regrow for more than 50 years. The limited age of regrowth is due in part to the land tenure history in this region during the colonial and postcolonial period (Downey 2015). In other ethnographic contexts, land tenure extends well beyond this 50-year mark and is accessible from detailed oral histories (Balée and Balée 2013). For this reason, protected areas that are adjacent to these forest fallows, which are not used for cultivation, are used to represent the other extreme of this continuum. Based on previous research by the PI, we have access to remote sensing dataset that has characterized these fallow classes and has ground truthed them with the help of Q'eqchi' research experts who are able to report the land use history (Downey et al, *in prep*). The overall goal of this study is to assess hunting pressure across different fallow classes in a swidden mosaic and compare variation in hunting pressure to variation in wildlife abundance and breeding sites in these same fallow classes. Previous studies that have considered similar questions about hunting in anthropogenic landscapes have used geographic information about hunting activities and successful kills as well as reports from hunters about which stages of regrowth are preferred and best for hunting (Bliege Bird et al. 2013, Codding et al 2014). These studies find that intermediate stages of regrowth are best for hunting returns because they provide enough habitat structure for wildlife to breed and forage (Bliege Bird et al. 2013) and that early succession stages – which are only associated with human activities – are the only locations where certain species can be found (Crabtree et al. 2019). Together these perspectives suggest the following hypothetical scenarios between hunting pressure, swidden disturbances, and wildlife habitat selection.

Hypothesis 1. Hunting pressure bears no relationship to patterns of wildlife abundance.

Under this scenario, hunters exhibit no clear preference for any particular fallow class and wildlife abundance is unrelated to hunting pressure. This pattern might arise if there is considerable individual variation in meat preferences that encourages hunters to partition hunting effort toward species that meet those preferences (Koster et al. 2010). Similarly, there are certain species that are protected based on national or conservation concerns.

The extent to which hunters abide by or ignore these protections may vary based on individual risk aversion. For this reason, hunting pressure may be spread across species and may have little effect on the distribution of wildlife.

Hypothesis 2. Hunting pressure and wildlife abundance are both positively associated with the age of fallow classes.

Under this scenario, wildlife select older forest patches and hunters preferentially target these areas due to the higher abundance. One interpretation of this pattern could be that species avoid recently disturbed areas. However, this pattern is unlikely to hold for all game species except for those that require mature arboreal structure for breeding (e.g., the great tinamou [*Tinamus major*]; Whitworth et al. 2018) or dense cover for movements (e.g., Baird's tapir [*Tapirus bairdii*]; Dunn et al. 2012).

Hypothesis 3. Hunting pressure positively predicts wildlife abundance and breeding in intermediate and mature fallow classes.

This scenario would replicate the findings of Bliege Bird et al. (2013) and Codding et al. (2014) and would imply that hunting pressure alleviates density dependent sources of mortality for wild game species (e.g., compensatory morality; Errington 1946; Peres and Dolman 2000). In other words, there is a rate of mortality which game species naturally face and by harvesting species, human compensate for this mortality and release species for the density dependent effect of competition.

Data Analysis

Bayesian statistical methods are appropriate for analyzing data from camera traps in order to estimate wildlife abundance and data on hunting returns. I will use Bayesian methods because I can control for the probability that an animal was present but not photographed, or present but not harvested. This is another way of saying that accurate models of hunting returns and wildlife occupancy both use a similar probability logic based on a overdispersed zero-inflated model likelihood (see McElreath 2020a and McElreath and Koster 2013). These models are constructed to first assess the probability that an animal is detected (either by a hunter or in a camera), and then subsequently, the estimated count of animals harvested or photographed. Bayesian techniques also allow us to incorporate prior knowledge, including knowledge gained from semantic networks and interviews with hunters, or knowledge about error in reporting or photograph wild game. By basing this probability on prior knowledge from the literature hunting and wildlife abundance, I can derive more accurate estimates. I have been trained to construct these Bayesian models using the `rethinking` package (McElreath 2020b) as well as the `brms` package (Bürkner 2017) using R software (R Core Team 2020)

Camera trap data will be organized using the R package `camtrapR` (Niedballa et al. 2016). Geospatial statistics are conventionally used to infer animal movements from trail camera sensor networks (e.g. Kays et al 2011). More recently, machine learning algorithms have been also been applied to detect these movements (Wang 2019) and can be especially useful for identifying individuals when the species have characteristic markings (Lahiri et al. 2011). I intend to use these methods to code photographs and generate the count data needed for a zero-inflated Poisson model described in the section above on Bayesian statistics. To analyze hunter movements, I can use descriptive geostatistics to understand relative use of fallows and protected areas but in order to understand the structure of hunter movements in the landscape, I will apply a least-cost path analysis (Greenberg et al. 2011). Least-cost path analysis will be used to calculate the distance that hunters travel on hunting bouts, a key measure for understanding hunting returns and site selection.

To analyze interview data, I will use thematic analysis and a semantic network approach. Thematic analysis is widely used to study ecological knowledge and livelihood activities (e.g. Oestreicher et al. 2014). I will code themes with the goal of revealing salient issues about hunting site selection and perceived sustainability of resource use. I will also work with my adviser as a second coder to help insure intercoder reliability in the thematic analysis. Semantic network analysis is method of analyzing text identify the probability of a link between concepts (Bernard and Ryan 1998). Semantic network analysis is often used for online communities (e.g. Veltri and Atanasova 2017). I intend to use semantic networks as a method for building an emic representation of the hunting ecology that may be partially revealed during interviews. Connections will be made between conceptual categories that co-occur in sentence structure or that refer to each other in interview discussion. The frequency of these co-occurrences, and whether references indicate positive or negative influences between concepts will be used as edge effects in the semantic network. This coding scheme will be particularly useful for described perceived trophic relationships and relationships between wild game and habitat characteristics.

Qualifications

The co-PI is currently a member of the Human Complexity Lab (HCLab) that is run by the PI Sean Downey. The proposed dissertation research will complement and extend ongoing research in the HCLab by focusing on the specific dynamics of **hunting systems** as they relate to broader cultural norms, social networks, maize cultivation using swidden, and landscape-scale patterns that have been the focus of the PIs NSF CAREER project.

Relevant Coursework and Analytical Skills

As a graduate student, I've focused on deepening my knowledge of anthropological and ecological theory and expanding my methodological and analytical toolkit. I have taken advanced courses in Bayesian statistics and social network analysis. These courses provided opportunities to use empirical data to practice analytical skills that are key to my proposed research. Additionally, I have completed coursework in Wildlife Ecology Methods that focuses on collect ecological field data using several field methods (point counts, fixed and variable width transects, etc.). The instructor for this course served on my committee to insure that I am trained in wildlife ecology. During my Master of Science, I completed an integrated minor that focused on community ecology, trophic interactions, and global ecological change. As part of this minor I completed coursework on Trophic Cascades which included a methodological component that taught students field methods for assessing habitat in forested ecosystems.

Relevant Field Experience

In spring 2018 and summer 2019, I conducted fieldwork in southern Belize. In 2018, I helped the PI implement an experimental common pool resource game to better understand the coupled social and ecological dynamics of swidden cultivation (Downey et al. 2020). The following summer, I conducted a pilot project in Crique Sarco with the goals of making key research connections and testing the feasibility of the ecological and ethnographic methods that I have proposed for this project. During my fieldwork, I visited the National

Institute of Culture and History and the Belize Forestry Department where I learned about the permitting procedure for social and ecological re- search. I also met with Froyla Tzalam, the director of the Sarstoon Temash Institute for Indigenous Management, to discuss my research, and received positive feedback and a letter of support. In the village, I participated in several planting rituals to learn about the locations used for swidden cultivation. I worked with the *alcalde* – the traditional Maya leader – to place four cameras that are still functioning after more than a year. In addition, I conducted preliminary interviews with six hunters. During those conversations, hunters invited me to accompany them on future hunting trips. Finally, I worked with research assistants to measure and identify >1800 plants in four stages of forest regrowth. I used this plant assessment to do a preliminary analysis of biodiversity and sampling effort that has been used to inform the proposed study design.