TROPICAL RESOURCES

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In this Issue

Articles

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Yale Tropical Resources Institute:
Envisioning Synthesis and Synergy

Mission

The Mission of the Tropical Resources Institute is the application of interdisciplinary, problem-oriented, applied research to the creation of practical solutions to the most complex challenges confronting the management of tropical resources worldwide. Lasting solutions will be achieved through the integration of social and economic needs with ecological realities, the strengthening of local institutions in collaborative relationships with international networks, the transfer of knowledge and skills between local, national, and international actors and the training and education of a cadre of future environmental leaders.

Vision

The problems surrounding the management of tropical resources are rapidly increasing in complexity, while demands on those resources are expanding exponentially. Emerging structures of global environmental governance and local conflicts over land use and environmental conservation require new strategies and leaders who are able to function across a diversity of disciplines and sectors and at local and global scales. The Tropical Resources Institute aims to build linkages across the natural and social sciences and among government agencies, academia and practitioners, enabling the formation of successful partnerships and collaborations among researchers, activists and governments. The Tropical Resources Institute seeks to train students to be leaders in this new era, leveraging resources, knowledge, and expertise among governments, scientists, NGOs and communities to provide the information and tools this new generation will require to equitably address the challenges ahead.

Dear Readers,

This issue of the Tropical Resources Bulletin encapsulates the core strength of the Yale School of Forestry and Environmental Studies (F&ES) — a tremendous diversity and richness in the personal stories and interests of its students, yet all are anchored in a shared concern for the relationship of humanity with the environment. Moreover, epitomizing as well the vision and mission of the Tropical Resources Institute (TRI), this issue highlights the work of eleven of TRI's 2008 Fellows. They have gone beyond their previous academic training to delve deeper into the complexity of environmental problems, collaborating in the field with scientists and policymakers, businessmen and cooperatives, and communities and individuals to better understand — and perhaps even propose solutions — to the environmental problems facing us all.

In our first article, Sara Enders and Jordan Macknick explore the possibility of bringing together different stakeholders across the national boundary between the Honduras and Nicaragua to manage a common watershed, emphasizing that managing that landscape requires an understanding of the social, political, and economic factors that are also at play.

Our next three articles explore questions of the environment in the nexus between local identity and the globalizing forces of trade and tourism. Sarah Osterhoudt explores an attempt of Madagascar's vanilla farmers to write their own guide to vanilla cultivation as an assertion of their own identity. Mark Evidente suggests how a community that lives in a protected landscape in the Philippines can manage tourism development in a manner that generates economic opportunities, while preserving both the landscape and identity of its people. Rachael Teel discusses how notions of traditional culture, environment, and gender are both communicated and romanticized in Fiji's tourism industry.

Other TRI fellows explore the social and environmental dynamics in and between cities, farms, and protected areas. In Brazil, Norio Takaki delves into the waste management of the cities of Porto Alegre and Brasilia and how informal trash pickers, while performing a crucial environmental and social task, remain marginalized by mainstream society. Also in Brazil, but now in São Paulo, Chris Finney observes how poorly framed laws fail to adequately protect landscapes and create their own set of environmental and social problems. In Argentina, Janet Lawson and Tal Ilany suggest that agroforestry, when coupled with both governmental and cooperative initiatives, can reduce pressures to clear primary forests while improving the livelihoods of farmers.

Our last two articles examine the nexus of human and animal interactions. Meg Selby, working in Madagascar, finds that successful conservation of the red ruffed lemur requires not only the involvement of all stakeholders, but their continued investment in and assessment of the process of conservation. Lastly, Meghna Agarwala examines patterns of Indian wolf adaptation to agricultural settlements and whether the current conservation strategies will truly protect the wolf.

These articles convey some of the breadth but hardly the full diversity of research pursuits within F&ES, yet they capture the continuing need to explore the relationship of humanity with the environment. We the editors have enjoyed working with the authors to bring to you these articles, and we hope you enjoy reading this issue.

Mark Richard Evidente, MEM '09
Heidi Jump, MESc '10

2008 TRI Fellows in this Issue

Twenty-five Tropical Resources and three Compton Fellowships were awarded in 2008 to support research in tropical and subtropical areas around the world. Eleven fellows and their work are highlighted in this issue of the TRI Bulletin.

Meghna Agarwala *(India)* studied natural and environmental sciences at University of Pune and Jawaharlal Nehru University in India. She then worked for Wildlife Trust of India coordinating a small grants program and Nature Conservation Foundation studying snow leopard ecology, before enrolling in the Master's of Environmental Science program at Yale. After graduating from F&ES, Meghna plans to pursue a PhD at Columbia University, looking at possibilities for reconciling human–wildlife conflicts.

Sara Enders *(Honduras and Nicaragua)* graduated from Yale with a BS in Geology and Geophysics, where research on biogeochemical cycles and an internship at the International Rice Research Institute in the Philippines spurred her interests in environmental chemistry and sustainable development. Sara worked in the White Mountains for the Appalachian Mountain Club and as a Research Analyst for The Cadmus Group, Inc. before returning for an MESc from the Yale School of Forestry and Environmental Studies.

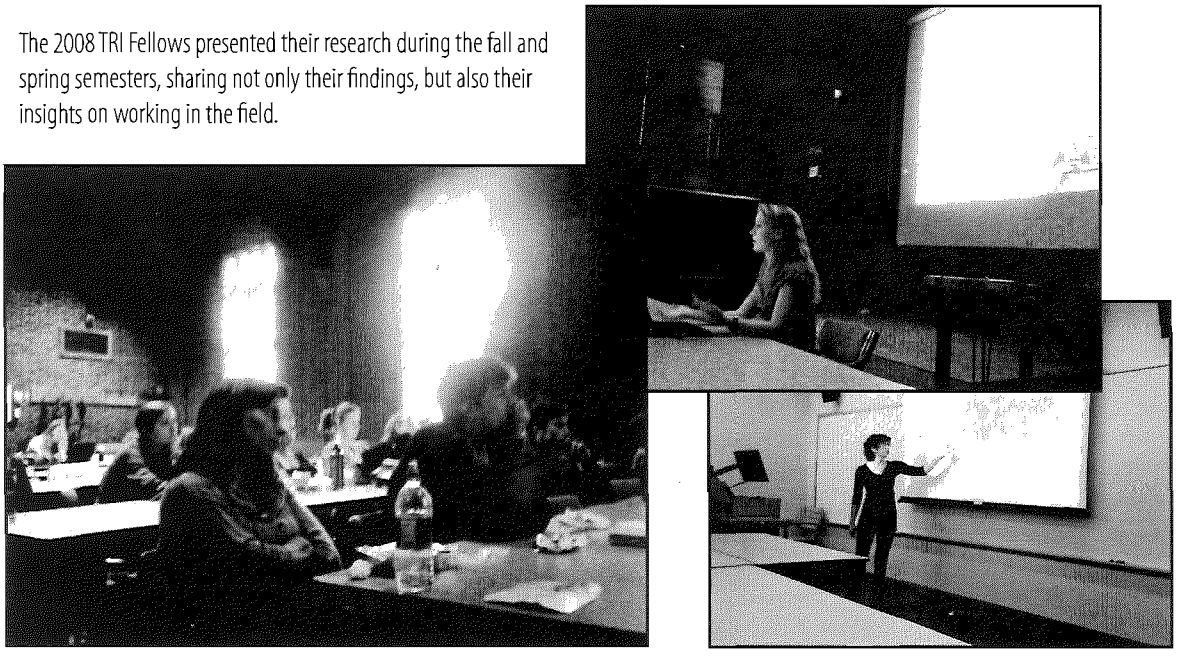
Mark Evidente *(The Philippines)* focused on environmental policy for land use and climate change, and on the interaction between business, government, civil society, and communities to advance environmental goals while pursuing environmental management studies at Yale. He previously worked as Director for Legislative Affairs for Philippine Senator Richard J. Gordon, drafting legislation for tourism development that integrated environmental, cultural, and economic perspectives into planning mandates. Prior to that, he was an Associate at the Philippine law firm SyCip, Salazar, Hernandez and Gatmaitan. He holds degrees in political science and law from the University of the Philippines.

Christopher Finney *(Brazil)* is a candidate for the Master of Environmental Management at the Yale University School of Forestry and Environmental Studies and the Certificate in Latin American Studies. He intends to pursue further study in Urban Planning or work in a related field.

Tal Ilany *(Argentina)* is completing a Master of Forest Science degree at Yale's School of Forestry and Environmental Studies. Her focus is primarily on soil and forest ecology and agroforestry and plans to pursue a PhD in these subjects. Before coming to Yale, Tal worked on a project to improve environmental education curricula in higher education. She holds a BA from Carnegie Mellon University where she studied studio art.

Janet Lawson *(Argentina)* is a second–year Master of Environmental Science candidate at the Yale School of Forestry and Environmental Studies. Her research focuses on agricultural policy and development. Before coming to Yale, she served as an agricultural

The 2008 TRI Fellows presented their research during the fall and spring semesters, sharing not only their findings, but also their insights on working in the field.



extension volunteer with the Peace Corps in Paraguay and worked in environmental education at the Chicago Botanic Garden. She holds a BS in Foreign Service from Georgetown University.

Jordan Macknick *(Honduras and Nicaragua)* graduated from Hamline University with degrees in Mathematics and Environmental Studies. He worked for an organic food supply–chain company in the Netherlands and a non–profit wind energy company in Minnesota before starting a Master's of Environmental Science program at Yale's School of Forestry and Environmental Studies. At F&ES he has split his time analyzing world energy use trends and studying transboundary water management.

Sarah Osterhoudt *(Madagascar)* is a second year PhD student in the combined degree program between F&ES and Anthropology at Yale University. She is also a joint doctoral student with the New York Botanical Garden. Sarah is currently conducting research in Madagascar, where she and her husband were Peace Corps volunteers. Her research includes working with small–scale vanilla and clove farmers to investigate community change, global markets, knowledge production, and environmental identities. Sarah has also worked with agrarian communities in Bolivia, Nicaragua, Chile, and Peru.

Meg Selby *(Madagascar)* earned a Bachelor of Liberal Arts with a concentration in Environmental Studies from the Wilkes Honors College. She has worked on animal care and wildlife education with the Busch Wildlife Sanctuary, rehabilitating Florida native wildlife, and teaching local communities about habitat and species conservation. Meg has also worked as a primate keeper at the Palm Beach Zoo, where exhibit development, animal care, and public programs led her to pursue an interest in wildlife conservation and community development at the Yale School of Forestry and Environmental Studies. Meg is working towards a Master of Environmental Science with a concentration in social ecology.

Norio Takaki *(Brazil)* is a 2009 candidate for the degree of MEM from the Yale School of Forestry and Environmental Studies. He has a Bachelor's Degree in Japanese Language and Culture from the University of California, Berkeley. His personal and professional interests are centered around urban sustainability issues, with a focus on the integrated management of water resources. Norio's goal upon graduation is to employ the skills and knowledge he acquired at Yale to the task of improving potable water supply, sanitation, and aquatic ecosystems health in cities of the developing world.

Rachael Teel *(Fiji)* holds a BA in environmental studies with a concentration in anthropology from Vassar College. Prior to her arrival at F&ES, Rachael spent four years working in the wildlife film industry. During this time she was employed by the Jackson Hole Wildlife Film Festival and by PBS's Nature series. She hopes to improve her Fijian and complete a longer ethnographic study on the islands in the near future.

In Pursuit of Participatory, Science–Based, Transboundary Management in the Shared Headwaters of Honduras and Nicaragua

Sara Enders, MESc 2009 *and* Jordan Macknick, MESc 2009

It wasn't unusual to be up at 6 am in our corner of Central America, where the southeastern Honduran mountains meet the peaks of northwestern Nicaragua — outside the shadows, the sun was up each day at five. It was rare, though, to trek past those waiting for the bus, driving cows, or washing clothes as we carried homemade meter sticks, baggies of ice, and Ziploc–encased plastic bottles. And as our dusty sneakers darkened at a misplaced footfall while we collected water samples that July morning, it was positively exhilarating to think that on both sides of the border, 60 other people in 13 teams of school children, farmers, and government officials were spread out along the stout trunk and trickling tendrils of the bi–national Río Coco, wetting their feet and doing the exact same thing.

Mountains are the birthplace of rivers, and these mountains parent two important offspring. The Río Negro flows south out of the high Honduran mesas of Cacamuya, to run most of its course through Nicaragua before crossing back into Honduras and feeding the shrimp harvested by Nicaraguans, Hondurans, and El Salvadorans where it empties into the Golfo de Fonseca (Figures 1 and 2). Down the other side of the mountains, the Río Coco flows northward towards the Caribbean, forming as it does 500 km of the Honduras–Nicaragua border after a few unhurried meanders on the Nicaraguan side. The mountains are recognized as an important zone of recharge for these rivers, which run for long stretches through semi–arid climes. The steep topography squeezes rain out of the air while the forest cover and root mass help store the rainy season's moisture through the dry spells. These forests are locally famous for their wildlife, and include uncommon ecosystems, such as the dry tropical pine forest and patches of cloud forest primary growth. Deforestation, through timber harvesting and fires, is a recognized problem on both sides of the border (Tribunal Centroamericano del Agua, 2004), and is given priority in environmental management laws, through implementation suffers.

Figure 1. A view from Nicaragua into Honduras of the shared mountains and forests defining the political boundaries between these two countries.

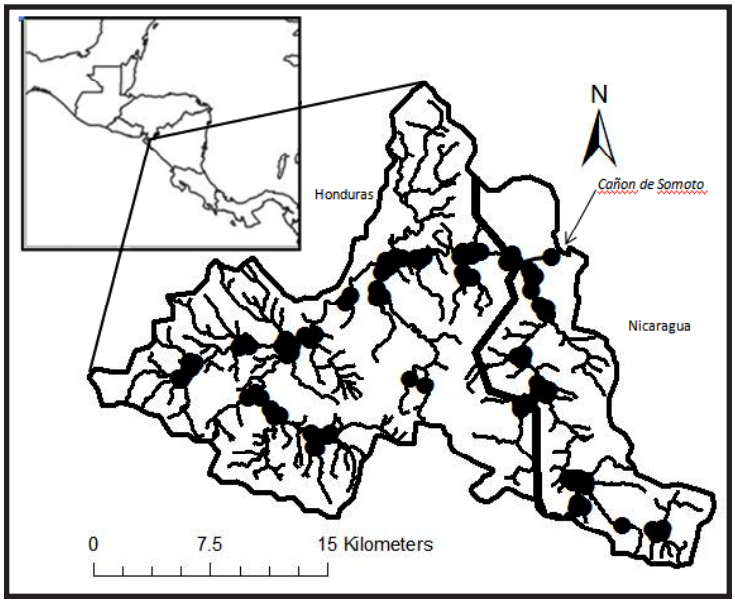


Figure 2. Map of the studied region, the bi–national watershed of the Río Coco which drains to the Cañon de Somoto. Sample site locations are indicated by circles.

The bi–national basin, blessed with natural bounty and beauty, is also home to pockets of extreme poverty. Unemployment rates are sky–high, and the primary occupation in this area is subsistence farming. Wealthier residents can afford pesticides, fertilizers, and diesel pumps for irrigation, which increase productivity and allow some to sell their crops to foreign markets. These productivity improvements come at a cost, however, especially to the already stressed water resources. Poorer farmers are finding themselves with less land per capita due to population increases, prompting them to clear forested land to increase their productivity. There is great concern that the actions of farmers and cattle–ranchers in riparian areas are diminishing the quantity and quality of available water. Further, as populations in urban areas have increased faster than infrastructure development, problems with water distribution and treatment regularly leave urban residents without tap water for long stretches and result in a clamor for new sources. Wastewater is discharged to waterways largely untreated. Authorities on both sides of the border have recognized the importance of this area as well as the severe problems it is facing, and have been working independently to improve land management. Both countries have established national parks in the region that partially protect the headwaters of the Río Coco and the Río Negro: La Reserva de La Botija and Cerro Guanacaure in Honduras, and Tepesomoto-La Patasta and Cañon de Somoto in Nicaragua. But land use regulations are flouted due to failure of enforcement and to corruption; deforestation and chemical usage is still common in the protected areas. Furthermore, the management plans of the protected areas have been stalled by bureaucratic procedures and by a lack of funding. Thus these parks are largely "paper parks;" parks by name only.

The two countries face similar management problems despite having different legal and political structures governing water and natural resources. Communication and coordination among the various agencies in both countries is wanting, and data is seldom shared. Systemic problems in governance persist, providing great challenges to local authorities.

The Proposal

Recognizing that current efforts to protect the headwater ecosystems in this region were ineffective, protected area expert Pablo Martínez de Anguita assembled a diverse team of experts to investigate the potential of a bi–national protected park to address economic development and natural resource conservation in the transboundary region. This team included academics from Universidad Rey Juan Carlos in Spain, Pace Law School in New York, and the Yale School of Forestry and Environmental Studies, together with local NGOs in Nicaragua (La Familia Padre Fabretto) and Honduras (Amigos de La Botija) and government representatives from both countries. The team's objective is to promote better land management and alternative livelihoods through improving the availability of microloans, and ecotourism while enforcing best management practices in zones of restricted land uses. The proposed Peace Park would envelop the four existing parks in the region,

creating one large protected area with biological corridors for wildlife and different zoning regulations for urban and rural areas (Martinez et al., 2008). This idea received endorsement by the International Union for Conservation of Nature and Natural Resources (IUCN) in October, 2008 at the 4th World Conservation Congress, with the passing of our co–authored "Motion CGR4.MOT060: Establishment of a Peace Park between Honduras and Nicaragua." By giving local landowners economic incentives to keep the forests intact and the water resources clean, it is hoped that land management practices would improve with a Peace Park and that the primary employment in the area would shift away from high–input, low–yielding agriculture and cattle ranching, in favor of practices with greater yields for land–owners and better environmental protections.

Local enthusiasm and initiative has carried the project since its inception. Stakeholders on both sides of the border have been working together and holding periodic bi–national meetings where the goals for the park and for the region are discussed openly. The peaceful and respectful tone of a bi–national stakeholder meeting in July 2008 deeply moved us. At the outset, time was taken to sing each country's national anthem and each of the fifty–odd stakeholders present introduced his– or herself and relevant interests to the rest of the group. Because many watercourses, including the two major rivers Río Coco and Río Negro, traverse the political boundary between the countries, conflicts between upstream and downstream users can become international disputes. This happened three years ago when upstream Honduran farmers placed impoundments on the Río Comali and drastically cut inflows to the Río Coco, causing Nicaraguan officials to demand their removal. The necessity for these countries to share water resources also makes water a potentially unifying point around which bi–national ecosystem may be based.

The Project and Our Results

Despite fears of diminished and dwindling water resources that threaten broad regional interests and the health of local inhabitants, there is near total absence of data and an incomplete understanding of how much water is available and where pollution comes from. Characterizing point source and non–point source water pollution was the focus of our research. Point source pollution is discharged to a waterbody from a concentrated outflow such as a sewer pipe or a factory outfall; non-point source pollution on the other hand is diffuse in its origin and is conducted to waterbodies via a landscape's hydrologic pathways — chemicals applied to agricultural fields and feces dropped by grazing cattle are two examples.

Water quality data has obvious local relevance for those who bathe in, drink from, and irrigate with the river water. Moreover, as water drains down a slope it carries with it information about the quality of the soil and its management; sampling the mouths of tributaries tells us about the sustainability of the activities in the catchment. Finally, water quality information would be important for the development of ecotourism attractions within the proposed peace park.

To answer the questions of whether and how a transboundary protected area could improve access to quality water resources, two points must be addressed. First, it is essential to understand the character and sources of water contamination and the quantity of water available for sustainable withdrawal. Second, the relationships between current activities and water resource impairment or protection should be demonstrated. Such information is necessary to justify imposing restrictions on livelihoods of local inhabitants, to determine where limited resources should be directed to maximally improve the situation, and to determine if compensation for environmental services is appropriate.

In order to obtain thorough coverage of our region of interest, we focused our analysis on one of the two river systems that originate in this region, the Coco. We expect, however, that because of similarities in topography and ecology, our results will also inform management of the Negro. While water quality in the Negro, which drains to the tri–national fisheries in the Golfo de Fonseca, has received greater attention from the scientific community and national governments (e.g. Ward, 2000), it is the Coco on which local populations more closely depend — giving it perhaps greater power to galvanize local attention. The Río Coco provides 70% of the domestic water to the Honduran city of San Marcos de Colón and it also passes through the Nicaraguan tourist attraction Cañon de Somoto. Furthermore, the two primary tributaries to the Río Coco join together just two kilometers from the international border and five kilometers upstream of the Cañon de Somoto, providing an interesting case study of international coordination. The Honduran tributary, the Comalí, travels

Figure 3. Participants from Nicaragua's Ministry of the Environment, students, and local citizens traverse varied landscapes on their way to collect water samples from a tributary of the Río Coco.

from the waterfalls of La Botija through San Marcos de Colón and irrigated farm fields before crossing the border to bend through bedrock and boulders to meet the Nicaraguan tributary, the Tapacalí.

Using Geographic Information System (GIS) software, we delineated sub–watersheds and mapped tributary networks of the Río Coco. We classified land uses — forest, pasture, basic grain cultivation, horticulture — from satellite images. Once in the region, we spent many weeks driving from pavement to gravel to mud or rutted boulder fields, at times getting stuck or blowing multiple tires, ground–truthing our land use classifications and scouting our sampling sites, before actually taking any samples. Here we finally climbed down into the steeply incised valleys which give the mountainsides the texture of deeply grooved molars, which before we had only seen through satellite images. Our goal was to find access routes to the confluence of every significant tributary to the Tapacalí and Comalí, which we could link together in a sampling circuit that could be completed in as little time as possible (see "snapshot" methodology of Grayson et al., 1997). We timed our sampling with the Canícula, (which translates as the "dog days of summer"), a month long break from an otherwise rainy season that falls roughly between July 15 and August 15 each year, to minimize the confounding effects of discriminating precipitation on the chemistry of the rivers.

We calculated that it would have taken the two of us eight days to visit and sample the 90 sites that would let us peer into each corner of the watershed that drains to the Río Coco and the Cañon de Somoto. And it would stretch credulity to claim that these samples were taken simultaneously, given the long timeframe and the potential for rainfall. Instead, to take the samples simultaneously, we conducted recruitment and training of community members leading up to a coordinated collection of water samples at 90 sites by 13 teams of two to five people within a four–hour window on a single day. Channel width, depth, and velocity measurements were taken at each site to calculate water discharge and determine the presence of pollutants and nutrients (Figures 3 and 4).

In addition to generating a dataset that we could not have produced working alone, this process capacitated the local community to continue monitoring beyond the period of this study. Such a community monitoring program would both fill a knowledge gap in a region in which very little water quality monitoring is done by the government and increase awareness and empowerment of stakeholders with respect to their water resources. We brought equipment for bacteria analysis and collection bottles with us from Yale, and transported samples for nutrient, pesticide, and metals analysis back to the U.S. with us, but all of the equipment for water volume measurements we constructed from simple materials available locally. We supplemented our analytical equipment with incubator space generously loaned by a national Nicaraguan water utility and hospital. From the quality of our data and the enthusiasm of participants, we conclude that community monitoring of a similar nature could readily continue in this region, with a little capital investment.

We conclude from our results that catchments with greater forest cover prevent nutrient loading of the waterways from fertilizer and animal wastes. Water nutrient ratios, key controls on aquatic community species composition, may be changing in response to increasing quantities of crop and ranch land. The most important source of pollution revealed by our analysis, however, is bacteria from wastewater discharges from the Honduran city of San Marcos, a mere 10 km upstream of the Cañon de Somoto. As a result, bacteria levels in the Cañon de Somoto, a popular Nicaraguan swimming hole, fluctuate widely to as much as ten times greater than levels recommended by the United States Environmental Protection Agency for recreational water bodies. As the Nicaraguan government is in the process of developing the Cañon de Somoto as an international tourist attraction, the need for joint Nicaraguan-Honduran management of this stretch of river is clear.

The Prospects for the Future

Any recommendations for transboundary management of the Río Coco watershed must consider the social, political, and economic conditions of the area in order to be effective. The motivations of the local people and government are obviously crucial. As Honduras is the upper riparian state of the Río Coco, it has no urgent motivation to ensure that water entering Nicaragua is sufficient. This has manifested itself in Honduras' lack of wastewater treatment in the water it discharges into the Río Coco, its plans to dam a major tributary of the Río Coco to provide San Marcos de Colón with more potable water, and its lack of enforcement of agricultural regulations along the Río Coco. While Honduras is the upper riparian state in regard to the Río Coco, land management in Nicaragua does affect the state of forests and land in Honduras; numerous forest fires originate in Nicaragua and blow into Honduras' protected areas. Nicaragua has done little to prevent these fires from spreading across the border. In this way, both Nicaragua and Honduras negatively affect the other country's environment and water resources through a lack of adequate management, and both countries independently lack the motivation to address this inadequacy. It is possible that by creating a transboundary protected area that encompasses the river's watershed and the site of the Nicaraguan forest fires, these activities will be addressed simultaneously in a mutually beneficial management opportunity.

We recommend not only technical changes, such as repairing the San Marcos wastewater treatment facility and improving riparian zone protections, but also more extensive changes that affect the way decisions are made in the region. These changes includes incorporating more people into the decision–making process, addressing the asymmetrical regulatory structure of the two countries that could hamper coordinated efforts, and developing a systematic way to share data between the two countries. We hope to assist in any way we can with local efforts to improve ecological monitoring and management, and to attract attention to the needs and opportunities of the region, using the IUCN resolution as an important vehicle.

Figure 4. Local citizens, members of the environmental education NGO Enrich the World, and international volunteers collect water samples in the mountains of La Botija in Honduras. (photo: Thomas Kraeger)

There are calls from mayors and from citizens for a road connecting La Botija and Tepesomoto-La Patasta, high above the Pan–American Highway, in order to improve communication and access to eco-tourism sites in this region. Such a road would surely pass by the house of Juan Ramon, a dedicated grains and vegetable farmer whose property kisses both countries. A new road would bring in more citizens who would be interested in trying his wife's special cuajada cheese or buying his daughter's pine–needle baskets, while also allowing his grandchildren's schoolteachers to have a safe and reliable means of entering the region. A road could accelerate deforestation, or such development could improve the outlook for the pine and oak forests and the white–faced monkeys of Ojochal if funding follows resolutions and local participation in monitoring and coordinated international management is maintained. If our mornings of simultaneous sampling, which brought together regular citizens and government officials from both sides of the border in an act of solidarity and recognition of their shared need to protect their water, is any indication of things to come, you may soon find yourself talking to a smiling Juan Ramon and seeing the white–faced monkeys of Ojochal, while the bi–national rivers flow all around you.

Acknowledgements

Thanks are due to many in support of this effort, and we have space to list only a few here: At Yale, to our faculty advisers Shimon Anisfeld (Sara) and Susan Clark (Jordan), to Sean Johnson for support with logistics and assistance with the vision, and to Helmut Ernstberger, Jonas Karosas, and Jed Holtzman for significant laboratory assistance. In Honduras, thank you to the directive of the organic coffee cooperative of San Marcos de Colón (COCASAM) and especially Ridoniel Rodríguez and Horacio Ruíz; Thomas Kreuger and Fernando Tercero of the local NGO Enrich the World; Jorge Betancourt, Roberto Vallejo Larios, and Eduardo Lagos of the development NGO INADES; the family of Mario Vallejo Larios for housing us; and to Adelid Montoya for continued guidance and repeatedly coming to our rescue. In Nicaragua, thank you to Kevin Marinacci, Jairo Escalante, and many others at the NGO La Familia de Padre Fabretto; to Orlando Lagos of BCIE; to Douglas Benavidez of MARENA; and to Roger Solis and Jose Rivera at ENACAL, Estelí. Heartfelt thanks and admiration for the energy and commitment go to the dozens of volunteers who collected water samples with us. Funding was provided by fellowships from the Tropical Resources Institute in addition to grants from the F&ES Globalization Internships and Research Fund, the Council on Latin American & Iberian Studies, and the Leitner Fund.

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Writing Knowledge:
Re-articulations of Vanilla Production in Imorona, Madagascar

Sarah Osterhoudt, PhD candidate

Introduction

When I arrived in the village of Imorona on the northeastern coast of Madagascar this last summer, several local vanilla farmers immediately started talking to me about a new project. They had decided to write and publish a small booklet about cultivating and curing vanilla beans, emphasizing organic techniques. The booklet would be made available to local farmers. I was already friends with many of the farmers who were organizing the book project, having previously lived with my husband in the town as Peace Corps volunteers. Returning to the rural village for pre–dissertation research, I was pleased to hear about the idea to produce a book about vanilla, as it continued the project I had worked on previously — to establish more direct linkages between rural vanilla bean farmers and U.S. markets, in part through assisting farmer groups to obtain organic certification.

Families in the village of Imorona, which has about 2500 residents, have been cultivating vanilla for approximately one hundred years. Most vanilla cultivators own their own small plots of land, and plant vanilla vines as a part of diverse and complex agroforestry systems which include rice, clove trees, fruit trees, coffee plants, cassava, sweet potatoes, and palm trees. The clove and vanilla harvests provide families with most of their cash income for the year. Over the past seven years, however, international vanilla bean prices have dropped by over ninety percent. This drop in the vanilla bean prices has significantly affected the ability of farmers to adequately provide for the basic needs of their families.

Acting Knowledge

As an orchid, vanilla requires constant attention and care and is considered along with saffron to be the most labor–intensive crop in the world. Working closely with vanilla producers in Imorona for two years, I began to notice certain characteristics of the knowledge and specialized skills involved in the delicate cultivation and curing process. Knowledge about vanilla is passed down through apprenticeship models, either formal or informal. Much of this shared knowledge is nonverbal — when showing me how to hand–pollinate a vanilla flower, for example, people demonstrated the process using very few words (Figures 1 and 2).

Throughout the cultivation and curing cycle there are many interactions between the senses and knowledge production. Successful farmers learn sensitive, tactile maneuvers at each stage of production. In hand–pollination delicate flower parts are pressed together with exactly the right degree of pressure. Vanilla beans are squeezed to determine their ripeness. Before blanching the green vanilla beans, farmers dip their hands into the hot water to gauge its temperature. Cured black beans are stretched and shaped and tied into bundles. Bundles are smelled

Figure 1. A family out in their field hand–pollinating vanilla flowers.

Figure 2. A young girl practicing the hand–pollination of vanilla flowers.

and sorted by the strength of their fragrance. All told, each vanilla bean is probably touched hundreds of times before it leaves Imorona for other markets.

In producing vanilla, therefore, farmers must exercise their senses as a skill. Their ability to accurately monitor the information conveyed by the senses has important consequences on the quality of one's vanilla harvest. These skills are learned over time through practice, experience, and mentoring. Vanilla production thus represents what Taussig (1992) calls the "tactility of knowledge," whereby people know things through touching and experiencing them. The senses are thus for vanilla farmers "the switching place where the structure of experience and the structure of knowledge converge and cross" (Seremetakis, 1994). Over time, such uses of the senses become increasingly automated and habituated.

The knowledge of vanilla production also represents a form of "metis" knowledge (Scott, 1998). This type of knowledge includes practical skills, and is often referred to as know–how, common sense, or as having a knack for something. It is "acquired intelligence" that is plastic, adaptive and "exceptionally difficult to teach apart from being engaged in the activity itself" (Scott, 1998). It is also mostly passed down through oral forms, as opposed to written forms.

Writing Knowledge / Power

When I returned to Imorona last summer, I was therefore somewhat surprised to hear that the farmers were planning to write about their knowledge of vanilla farming. Farmers explained to me that they decided to embark on the project to teach other farmers, especially younger farmers, about the complicated process of obtaining organic certification. The previous year, when we had all worked together to obtain certification, we soon realized that the inspection process involved a large amount of paperwork. Recognizing that the process of organic certification largely depended on writing, the farmers responded by producing their own written document. The decision to produce a written document contrasts with the uneasiness that Imorona farmers often exhibit towards writing. Many individuals struggle with literacy and have come to associate writing and documents with cumbersome government bureaucracy.

Who has the power to write things down and to create the official written record often coincides with who exercises the most political and economic power in a society (Skaria, 1996). In the process of organic certification, for example, the inspector was the only person who wrote down information about the farmers and their fields; the farmers themselves only answered questions. Thus, by proactively producing a written booklet about vanilla, and by plan

ning to make the document available to all Imorona residents, the vanilla producers could be seen to be balancing out the inequities of representation. They showed that they too wrote things down and codified knowledge.

Translations

A team of thirteen men and women was assembled to oversee the writing of the booklet. The team included older farmers from several local farmer associations, a representative of a local NGO, the two new Imorona Peace Corps volunteers, the local "wordsmith" who was known for his adeptness at speech making, the president of the local women's association, and a local agricultural technician who had helped the farmers with their organic certification the previous year (Figure 3).

Overall, the book was an exercise in translating the metis knowledge of vanilla production into written form — something that is extremely tricky to do. This process of translation sparked a lot of in–depth discussions, as farmers compared their cultivation techniques with one another and debated which version was "best." Thus, the plurality of techniques morphed into one "official" version. The knowledge recorded for the pamphlet also included quantitative descriptions and measurements. For example, when writing about blanching the vanilla beans, the farmers did not only write that one should test the water by hand, but also asked the technician what temperature the water should be. He told them, and this temperature was added into the description, thus creating a blend of metis and quantified "scientific" knowledge.

The farmers also learned from the NGO representative that vanilla was a *vahiny*, or non–native, plant. She explained that vanilla was originally from Mexico, and was brought to Madagascar by the French around 1840. In the draft of the pamphlet, the section on the history of vanilla left out the role of the French entirely — saying only that vanilla was a "child" of Mexico that "brought itself" to Madagascar. The removal of French traces from the vanilla narrative was also illustrated in the attention that the participants paid to the exact wording of the pamphlet. The group decided to use only Malagasy words taken from their local dialect. In their discussion, it soon became apparent that many of the words used for vanilla cultivation were actually French derivatives and not "real" Malagasy words. The participants debated over what Malagasy word to use for French terms such as "supple" "orchid" and even "shelf." Especially interesting was the discussion on how to translate the concept of "organic" itself, commonly referred to as *bio* from the French *biologique*. After much discussion, the participants agreed to use the phrase *voly–zanahary* which means "crops from God." The deliberate decision to remove all traces of the French echoed the observations of the anthropologist Maurice Bloch (1998) that, for the Malagasy, speaking in French is often associated with the experiences of colonial

Figure 3. Participants at the booklet–writing workshop.

subordination. Bloch also noted that the language of administration is often conducted in French, and this is certainly true of organic certification paperwork. By writing their own documents in the local language, rural farmers were claiming some power over how their knowledge was catalogued.

Projects aimed at making a population more "modern" often act as homogenizing influences, and this can partly be seen with this booklet project (Scott, 1998). Knowledge was quantified and taken out of its larger social and environmental contexts. One "official" version of how to cultivate vanilla was decided upon. Vanilla was no longer a multi–faceted, socially significant entity, but a collection of specific, focused techniques. Although much of the "metis" details are lost in translation, I argue that the vanilla booklet does not signify an overall "loss" of metis knowledge itself. Rather, the process of writing the booklet represented a deepening of metis. Sitting in the room together, the participants learned a new type of "practical" knowledge: how to write a pamphlet. They were experimenting with ways to respond to the changing situations of the global vanilla market. In this way, the booklet exemplified the shifting, adaptive, multi–layered nature of metis in action.

The pamphlet project also illustrates how experimenting with new forms of knowledge can be both globalizing and localizing. In responding to the "global" discourse of organic certification, the booklet deliberately framed its discussion as local to Imorona. It did not try to erase the localness of the growers' knowledge — in contrast, the booklet often made particular references to Imorona. The committee wanted to include photos from Imorona in the booklet, not generic illustrations. The project goal was thus not to erase "Imorona–ness" to make their vanilla global, but to emphasize the "on–siteness" of vanilla production. It was not a "shadow" of global discourse — a metaphor often used to describe African engagement with global entities (Ferguson, 2006). Rather, it was very much its own, active, deliberate production.

Conclusion

Overall, the strategic layers of action represented by this pamphlet suggest that rural farmers in Imorona are exhibiting proactive agency in a globalizing world. This agency is seen through the lens of vanilla production. Such power is often denied to rural Africans, who are instead described as being "swept up" in globalization in a way that they lose their sense of place, or as "being left behind" by globalization in a way that keeps them static. The vanilla book project, in contrast, can be seen as an attempt for rural farmers to put themselves literally at the center of global discourse. In writing about organic vanilla production, then, the thirteen individuals were experimenting both with knowing things and with ways of knowing things. Overall, we can hope that all this attention to knowledge will have some practical metis effect — namely, that the next round of the organic inspection will proceed smoothly, which will subsequently give families more viable options to find markets for their crops.

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Present Opportunities and Future Crises:
Managing Tourism Development at the Chocolate Hills, Bohol, the Philippines

Mark Richard Evidente, MEM 2009

Introduction

One thousand two hundred sixty eight hills — near perfect upturned bowls just 30 to 60 meters in height, covered in grass that turn a deep brown in the light of a summer's sunset — these are the Chocolate Hills, evoking images of Hershey's kisses spread out as far as the eye can see, spanning six towns on the island province of Bohol in the Philippines (Figures 1 and 2).

A deck in the town of Carmen provides the best view of the landscape. In 2006, over three hundred thousand people climbed up to the deck, marveled at the landscape, and took pictures. It was projected that there would be more than half a million people trekking up to that view deck by decade's end, yet one town councilor said that those projections are already outdated. "We had two million people last year," he claimed. Aside from the view deck in Carmen (and a less prominent one at Sagbayan), the rest of the area remains separate from, and perhaps even indifferent to, tourism. But with an international airport being constructed a mere two hours away, the sheer economic potential of millions of tourists coming to the Chocolate Hills is likely to radically transform this landscape. This probable transformation may cause social and environmental crises. However, it also presents an opportunity to plan and define sustainable development today in a manner that is relevant to the people of Bohol.

To explore how a sustainable development strategy can be planned for the people and the landscape, I conducted a number of semi–structured interviews with national and local government officials, farmers and tourists, as well as representatives from religious, tourism, environment, and agriculture organizations. I also analyzed existing management policies and human ecology studies of the area. I seek here to make brief policy recommendations that can be explored in greater depth in a subsequent paper.

Figure 1. The Chocolate Hills.

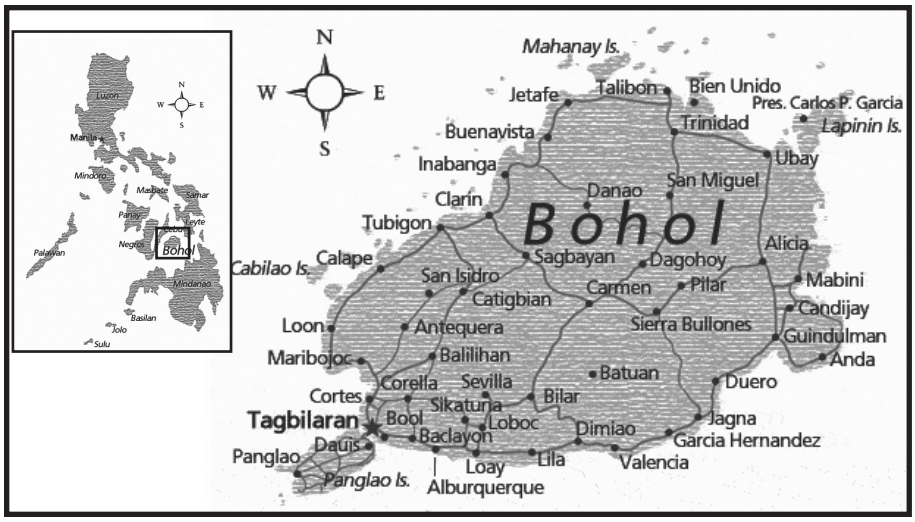

Figure 2. Bohol Island. (The Philippines, inset) Source: Jeroen Hellingman http://www.bohol.ph. The Chocolate Hills Protected Area spans the towns of Carmen, Batuan, Sagbayan, Sierra Bullones, Valencia, and Bilar.

Background

The Chocolate Hills is a karst landscape — a terrain dominated by soluble bedrock (Van Beynen and Townsend, 2005) — where limestone forms both the bedrock and the hills, and rich soil fills the valleys. This landscape holds a large amount of water directly recharged from rainfall and surrounding upland forest watersheds within the limstone (Uhlig, 1980), allowing intensive wet rice cultivation (Figure 3). Relatively drier parts of the area are planted to corn, taro, bananas, coconuts, sweet potato, mangoes, coffee and cacao (Urich, 1993).

The Chocolate Hills cannot be readily classified as a pristine environment. The landscape consists of a patchwork of hills, farms, and lowland forests. It had been settled and altered by humans for at least five hundred years, if not for millennia (Urich, 1993). In the last few decades, the adoption of new agricultural technologies, systems of land ownership, and agrarian reform has profoundly changed the relationship of communities with the landscape, generating pressures on both. A long–running insurgency and counter–insurgency campaign on the island has affected how government perceives the communities that lived in the hinterlands, at the peripheries of political and social structures (Urich et al., 2001). The recent push for development in fact was partly fueled by the desire to address the roots of the rebellion. Yet amid these changes, rich endemic biodiversity exists in this landscape.

Recent research is finally bringing more light to Bohol's biodiversity. There are at least 1,312 flora and fauna species on the island, but in a recent survey of 500 shrub samples from a protected watershed, 187 of these were unknown (PPDO, 2004). New tree (Fernando et al., 2009), fern (Barcelona et al., 2006), and bat (PPDO, 2004) species have recently been identified, and there may be 18 new bird species (PPDO, 2004). The tarsier *(Tarisus syrichta)*, one of the world's smallest primates, has long been the icon for Bohol (Figure 4). More extensive research into its ecology is now being pursued (Neri–Arboleda et al., 2002). Amid the richness of the landscape and the social transformations happening within it, however, the prospect of tourism development adds a new dimension to the relationship between the people and the land.

Bohol is already one of the most important tourism destinations in the Philippines because of its blend of both natural and cultural attractions (PIDS, 2004, PPDO, 2004). Despite a national tourism governance structure divided between competing offices, and an unclear devolution of powers to local government, Bohol has benefited from broad–based public and private sector support for tourism. Bohol's development strategy has caused a decline in poverty incidence and, in just five years, what was once the one of the poorest provinces is now of median income (NSCB, 2005). However, much of the economic activity occurs around the capital city and beach areas. The attention of local and national governments, organizations, and aid agencies is focused on resort development and waste management, and on balancing dive tourism with subsistence fishing. Inland communities at and around the Chocolate Hills remain poorer than those at the coast (NSCB, 2005), surviving on small landholdings for rice and corn farming. Despite having acquired

land through agrarian reform, farmers are burdened with the weight of increasing costs of farm inputs, sending children to school, recovering from sickness, and burying the dead. In the absence of new economic opportunities, what little land they have will be lost. It is because of this poverty that governments see tourism as a chance to push economic growth in the island's interior, but given a lack of resources, they have yet to focus on and formulate an approach to manage development.

The Chocolate Hills had long been recognized as one of nation's picturesque landscapes. It was only in 1997, however, in the wake of controversial quarrying at one of the hills, that President Fidel Ramos brought the area under National Integrated Protected Areas System (NIPAS, Republic Act No. 7586) through Presidential Proclamation No. 1037. The protected area covered the entire landscape of hills and valleys, spanning parts of six municipalities, for a total area of 14,145 hectares. The responsibility of managing the area was given to the national Department of Environment and Natural Resources (DENR) and local Protected Areas Management Boards (PAMB), which had representatives from local governments, indigenous communities, non-government organizations, and local communities from within the protected area.

Figure 3. Rice cultivation at the town of Batuan.

The law requires extensive consultations in the declaration and management of a protected area. However, placing the landscape under NIPAS met considerable opposition. While NIPAS in fact allows for different kinds of zones and uses within a protected area, it was perceived by residents as an attempt to take away their rights to the land (Urich et al., 2001). President Gloria Arroyo issued another proclamation in 2003 that removed the flat land between hills from NIPAS coverage, while retaining a 20-meter buffer zone at the base of each hill (Presidential Proclamation No. 333-2003). Today, only the hills and their buffer zones are under the DENR. The municipalities, with their broad powers under a Local Government Code, have jurisdiction over valleys, subject to a considerable degree of supervision from the provincial government.

Findings and Discussion

It is difficult to find a central theme that can unite most stakeholders behind one development strategy. The DENR sees its mandate in terms of preventing illegal logging in buffer zones and in the remaining forest patches around the hills. On the other hand, some in the tourism sector complain that DENR does its job too well as some of the trees have reached a height that now obstructs the view of the landscape. The provincial and municipal governments dispute the management and development of, and revenue sharing from, the view deck at Carmen. Some of those interviewed believe that seasonal, managed grass fires were essential to the local ecology and the maintenance of the appearance of the hills. Others dispute this claim. Many in the private sector are critical of the recent yet unappealing renovation of the hotel on the view deck, and how expansion plans of the view deck complex will be implemented in relation to a broader strategy for the Chocolate Hills.

Generating consensus appears difficult, but creating a strategy for the area begins from recognizing that the Chocolate Hills comprises the entire landscape. Its ecology embraces not only the hills, or the patches of forest and agricultural land between the hills, but also the diversity of human activity within it. Many of those interviewed recognize this in various degrees. When asked what kind of development they would like to see in the area, most preferred some economic activity that somehow integrated tourism yet nevertheless remains

rooted in agriculture. Almost all reject a landscape that becomes dominated by structures of concrete and steel.

Policymakers thus tend to reject particular definitions of "modernity" in favor of something guided by a sense of "sustainability", but it is difficult to assess how widely the community shares this view. Despite the richness of traditional architecture — particularly highlighted in a recent photographic survey (Luspo and Manalo, 2008) — residents with new affluence are likely to trade their wooden ancestral homes for concrete structures. Fortunately, with the help of a leading corporate foundation, some families outside the Chocolate Hills area have chosen to preserve their colonial period homes and convert these to cafes or hostels for tourists. Similarly, many farmers hope that their children would get jobs in the city or abroad as sailors, domestics and nurses rather than inherit and develop the family landholdings. Recent initiatives however from both organizations and government in organic agriculture have captured farmers' interest with their lower costs and comparable yields. But the crucial link of producing crops for the tourist trade has yet to be explored.

Navigating through the quagmire of different stakeholders stymies the development of a comprehensive strategy, yet this same complexity encourages dynamic governance. The first proclamation designating the Chocolate Hills Protected Area was, despite an intent to create a comprehensive strategy, was flawed for three reasons. First, it countered a movement toward decentralization by placing core responsibility with the DENR, while relegating local stakeholders to ineffective support roles in the PAMBs. Second, it did not include national and local tourism–oriented stakeholders despite the importance of the landscape for tourism. Third, it did not engage the predominantly agriculture–oriented community in defining environmental management goals. On the other hand, the second proclamation reduced the coverage of the first to protect the most important feature of the landscape, while creating opportunities for local governments and other stakeholders to define management that is relevant to the community.

The opportunity for consensus thus exists in the crucial middle where the grand idea of sustainable development meets the gritty realities of the community. An understanding of the Chocolate Hills as a landscape, and an idea of development that

Figure 4. The Philippine Tarsier (Tarsius syrichta)

appreciates this, can be the foundation for tourism planning. More importantly, from this consensus, leadership is necessary to turn plans into reality.

Recommendations

Managing the landscape begins with managing the land. The six municipalities, through NIPAS, are already part of a governance system that protects the hills themselves. However, under the Local Government Code, they and the provincial government must also coordinate their land use priorities for the valleys in a manner that preserves the landscape. Municipalities have broad powers of land use planning, zoning, and enforcement, and provinces have the duty to coordinate these. Both have shared or complementary powers on the environment, agro–industrial development, and on tourism planning, development, promotion and regulation. The provinces have a responsibility to enrich culture and the arts. At the intersection of these powers and duties, it appears well within the provincial council's powers to create a coordinative body for the Chocolate Hills area for municipal governments and other stakeholders to gather, build consensus, and collectively plan and manage the area.

Based on my understanding of the consensus that exists, I now propose a framework for the land's management. Ultimately, tourism provides a lens by which the inherent virtues of the landscape and the

people who shape and belong to it can come into focus. Keeping this in mind, my framework consists of three points:

First, local agriculture must shift from primary food production to high value products linked to tourism. This will allow people to benefit from the opportunities generated by the industry. For example, families that produce rice might be encouraged to make rice cakes and pastries; a coordinated shift to sustainable agro–forestry can likewise be pursued to focus on high–value crops. In both cases, government agencies and organizations can support cooperatives with the development, standards enforcement, and marketing of sustainable and organic products. As these farms and cooperatives develop, the farming and production processes themselves can be integrated into part of the tourism experience. Finally, agencies and organizations must encourage stores, hotels and restaurants to buy from these cooperatives and thus support the local community.

Second, the national environmental and agricultural departments and various organizations must collaborate to develop sustainable agro–forestry. This collaboration is necessary to preserve and expand forest cover. Drawing artificial boundaries between farms and forests is inappropriate when people have settled, used and shaped both for hundreds of years. The PAMB and local governments can encourage collaboration between the national environmental and agricultural departments, and bring organizations to help manage buffer zones and slopes as sustainable agro–forestry zones. This will generate the economic incentive for farmers to protect and increase the forest cover of the landscape.

Third, preserving the landscape entails zoning and building regulations that protect and encourage a traditional, and often a more sustainable, built environment. The rejection of a landscape dominated by steel and concrete points to an instinctive awareness that traditional structures are as much a part of the landscape as the people themselves. With the recent completion of a survey of traditional Bohol architecture, local governments should require that structures follow this template. It will be essential, however, that zoning ordinances allow for intermediate uses between various land classifications. In areas designated as agricultural or agro–forestry zones, people and cooperatives should be allowed to have commercial and processing activities at a scale greater than the restrictive definitions of "backyard" or "cottage" industry if these activities are integrated into the provincial tourism effort and the environmental impact is properly managed. A coffee farm, for example, may be allowed to have lodging, restaurant and processing facilities, particularly if cultivation is done organically and waste is processed into methane for fuel and compost for fertilizer. Lastly, more than simply regulating kinds of use, emphasis should be placed on how structures blend into the overall landscape. Regulations should focus on the height of structures, the footprint they have on the land, and the materials used for their construction.

The combination of these three points, implemented through a mixture of policy tools, can contribute to maintaining the character of the landscape, while integrating the community into a tourism strategy that builds on the positive qualities of that landscape.

Conclusion

Unplanned development often results in a plague of social and environmental problems even amidst a seeming economic boom. In the context of tourism, communities can become alienated and dispossessed as non-residents buy up land and develop an industry for which residents do not have the requisite skills to be employed, often with the locals turning instead to crime and prostitution. Also, the industry that develops often copies ideas from somewhere else, echoing a different environmental context. This can lead to practices that exceed the local ecology's carrying capacity and destroy the uniqueness of the landscape.

The Chocolate Hills presents the opportunity to build on its immense tourism potential and allow the community to benefit while averting a social and environmental crisis. It is essential that the entire area, despite overlapping jurisdictions and mandates, be treated as one landscape where all stakeholders are engaged in planning, implementation, and enforcement. I believe that there is a sense of awareness of the area as a landscape, and that this can be a foundation for new policies.

A set of policies that encourages a shift to higher value agricultural activities can allow the community to remain true to its relationship to the land and preserve the landscape, while allowing the people to benefit from tourism. Through this approach, the people of the Chocolate Hills can avert future crises by seizing the opportunities offered by the present.

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Fijian Culture on Display:
Traditional Ecological Knowledge at the Arts Village Cultural Center

Rachael Teel, MESc 2009

Introduction

Fiji is frequently described as a land of breathtaking natural beauty and strong traditional culture. These representations portray the islands as the enduring archive of a glorious natural history, where man and nature have lived in harmony for thousands of years (White, 2007). The following paper examines how and why this association is promoted at one of Fiji's largest cultural tourism destinations — the Arts Village Culture Center (AVCC).

The AVCC is a popular tourism attraction situated in the heart of Pacific Harbor, halfway between the Coral Coast and the capital city of Suva, on the island of Viti Levu. According to the nation's most recent tourism development plan, the region saw more than 12,000 tourists in 2005 (Fiji Ministry of Tourism, 2007). Today, the program at the AVCC caters primarily to foreign visitors and offers a full day of activities, including a firewalking show, temple visit, and island boat tour. In this study, I consider the presentation of traditional ecological knowledge (TEK) on the AVCC's island boat tour. Loosely defined, TEK is indigenous knowledge about the environment that has been passed down through the generations. TEK should be thought of as fluid and dynamic. However, cultural tourism representations of TEK tend to confer a sense of timelessness on a community's relationship with the natural world. The following analysis shows that the AVCC's display of gendered TEK links indigenous culture to the land in just this way, and creates a distinction between the tourist and the toured that validates the authenticity of the island boat tour experience.

Methods

The information presented in this paper was gathered during three months of ethnographic fieldwork during the summer of 2008. While in Fiji, I conducted interviews, engaged in participant observation, and performed archival research as I studied how tourists and tour operators perceive and present the relationship between nature and indigenous culture on the Fijian islands. As part of this larger project, I spent five weeks living in a hostel dormitory at the AVCC. During this time, I participated in the AVCC's full day of shows and tours on fifteen separate occasions. On the tours and in the hostel, I conducted semi–structured interviews with thirty–

Figure 1. AVCC performer shows a female tourist how to weave a fan from a coconut frond.

Figure 2. AVCC performers try to start a fire.

five English–speaking tourists and twelve employees. These interviews focused on the general attraction of the Fijian islands, the specific appeal of the AVCC, and the impressions and opinions of AVCC visitors and employees. Finally, I conducted interviews with the Fijian and Australian managers of the AVCC, gathering in–depth information about the history and administration of the site.

In the field, I found there was a certain amount of ambiguity "betwixt and between tourism and ethnography" (Bruner, 2005). In many ways, I was a tourist. I took photographs, asked questions, and visited my chosen sites with other sightseers. At the same time, the length of my stay and the frequency of my tours allowed me to become something of a temporary local to the staff members who saw me day in and day out. In effect, it was the duality of my position — tourist to some, quasi–local to others — that gave me the opportunity to build relationships with overseas visitors as well as Fijian performers and tour operators. In the sections below, I use this insight to describe the AVCC's island boat tour from a tourist's point of view, before reflecting on the experience from an ethnographic perspective.

The Island Boat Tour

At ten o'clock in the morning, tickets are purchased and the tour group is assembled. Once gathered, we are escorted down a path and into a modified drua, or double–hulled canoe, which can accommodate up to twenty–four passengers. After taking our seats, two male polers wearing grass skirts and coconut husk accessories board the boat. Positioned on either end of the canoe, the polers guide the drua around a large, manmade island at the center of the Arts Village complex. A third man in similar costume sits cross–legged at the front of the boat and introduces himself as our guide.

The physical setting of the boat tour is separate from the rest of Arts Village. As our canoe follows the river around the bend, the concrete complex of the Cultural Center falls out of sight and out of mind. Mimicking the boat's apparent movement into the interior of Viti Levu, we are told by our guide that we are also drifting into the past. Traveling along the river, our boat follows the shoreline of the island and pushes through an overgrowth of reeds to reveal a collection of huts (*bures*) on the left, and a lush green landscape on the right.

During the hour–long boat tour, we — the tourists — are invited to observe and participate in two kinds of TEK. At four of the seven open–air bures, female actors in traditional attire describe how their ancestors made pottery, wove mats and fans, and created bark cloth known as masi. At these huts, our tour guide encourages interactive exhibition. Questions are welcome, and we are repeatedly invited to visit the island and have a go at handicraft production, joining the women as they weave coconut fronds into fans and print masi cloth with traditional dyes and patterns (Figure 1).

The second category of TEK on display is decidedly more masculine, focused on weaponry, fishing, and the construction of canoes. Voyeurism

is stressed over participation at these three bures. At the canoe building bure, for example, our guide explains how indigenous Fijians used fire to build seafaring druas more than one hundred feet long. To bring this narration to life, the two polers enter the hut and attempt to start a fire by rubbing a small piece of wood into a larger, stationary log (Figure 2). Once the friction from the wood produces a sizeable pile of smoking cinders, the proto–fire is collected into a hollow, wooden container filled with coconut husks. The polers then blow gently into the container, willing the husks to ignite.

At the AVCC, feminine TEK is focused on experience and masculine TEK is focused on exhibition. Our tour group is invited to exit the boat and learn about Fijian TEK through hands–on participation at most of the women's huts. However, at the men's bures, members of our group are invited to "take in the show" where fire is created, weapons are displayed, and fishing techniques are described in great detail. I examine the implications of this division in the following section.

Discussion

According to Charles Menzies and Caroline Butler, "Traditional ecological knowledge is the term used to describe the knowledge and beliefs that Indigenous peoples hold of their environments that is handed down through the generations" (Menzies and Butler, 2006). With this definition in mind, how and why is TEK employed by Fiji's cultural tourism industry? The island boat tour's presentation of TEK provides valuable insight about the kinds of narratives that can be constructed at cultural tourism destinations.

On the one hand, the tour's display of TEK links Fijian culture to the natural environment. On the other, it also encourages the creation of a distinction between the tourist and the toured. The combined effect of these two narratives produces a timeless version of indigenous culture that links all Fijians, past and present, and places them in opposition to modern, Western tourists. This kind of manipulated narrative is common in Fijian tourism. As Carmen White points out, "Tourism discourse in Fiji began with advertisements by foreign enterprises, including offshore businesses and airlines, which immediately incorporated western constructions of the carefree, dutiful 'island native' living in balance with nature" (White, 2007).

Today, the AVCC is one of many tourism destinations that continues to make use of the popular narrative linking nature and culture. On the island boat tour, material goods produced by TEK are used to enforce this essentialized version of Fijian heritage. Our guide notes that the handicrafts made by the women were and are made from natural materials like local palm fronds, native trees, and Fijian clays. The same kind of construction is also emphasized at the masculine bures, where weaponry, fishing nets, and even fire are all created from local, natural materials. Through the heavy promotion of their "natural" construction, mats, masi, and fire become powerful symbols of the Fijian peoples' connection to their land.

The narrative that links Fijian nature and culture extends beyond physical objects, however. On the island boat tour, the presentation of knowledge is just as important as the presentation of physical goods. As noted above, the tour divides the exhibition of indigenous knowledge into two distinct categories — the masculine and the feminine. Though both categories use the display of material objects to emphasize the supposed relationship between nature and culture, they do so by employing different styles of presentation; feminine TEK focuses on participation and masculine TEK invites voyeurism from afar.

Despite a fundamental difference in presentation, involvement and observation both encourage a narrative that distinguishes Fijian culture from the (presumably) Western cultures of the tourists on the boat. In the feminine bures, it is the close proximity between inexperienced students and native teachers that highlights cultural difference. In the masculine bures, it is the distance between those who perform and those who observe that emphasizes the intended distinction. According to White, tourists respond to both styles because "Fiji tourism promotion…caters to tourists' presumed quest for authenticity through othering mechanisms that hinge on differentiation" (White, 2007).

Discussing gendered categorization and othering in the South Pacific, Shirley Lindenbaum writes: "The stereotype of the noble savage had always contained within it its mirror opposite, the ignoble savage…the dualism became gendered in the form of the beautiful, enticing siren and the malicious, bestial cannibal, a distinction that, as colonial intentions became more focused, would be extended to civilized, white Polynesians and savage, black

Melanesians" (Lindenbaum, 2004). In Western eyes, Polynesia represents the feminine, noble savage and Melanesia is equated with the masculine, ignoble savage.

White expands on this distinction when she notes that Fiji spans Polynesia and Melanesia both physically and ideologically; thus, "Fiji is uniquely positioned in discursive practices that contrast Polynesian and Melanesian 'primitivity.' As Fiji straddles Polynesia and Melanesia geographically, a stipulated admixture of Polynesian and Melanesian influences has driven a thematic dichotomy on the primitive other in Fiji tourism" (White, 2007). Fiji's tourism industry, then, "manages to harness Polynesian signifiers" while marketing "opportunities for a tantalizing gaze upon vestiges of ignoble savagery" (White, 2007). The industry's ability to draw on symbols of the feminine Polynesian and the masculine Melanesian allows for the creation of distinct tourism narrative, as evidenced by the gendered duality on display at the AVCC. The island boat tour's two forms of presentation — participation and voyeurism — validate the authenticity of the experience by enforcing separate yet related distinctions between Western tourists and Fijian locals.

Conclusion

In this paper, I have argued that the Arts Village Cultural Center's island boat tour uses TEK to connect the displayed activities of indigenous actors to the imagined activities of their ancestors. Tour operators use physical objects and traditional knowledge to build on existing preconceptions and draw attention to the supposed connection between Fijian culture and the land. Displaying masculine and feminine categories of TEK side by side, the island boat tour portrays Fijian culture as a combination of Polynesian and Melanesian, noble and ignoble, and feminine and masculine. The success of this mixture relies on a romanticized association between nature and culture that is promoted by the AVCC and by the wider Fijian tourism industry.

Acknowledgments

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The Emergence of Trash Picker Cooperatives and the Challenges to Social Inclusion

Norio Takaki, MEM 2009

Introduction

Street scavenging, or informal trash picking, has become an increasingly conspicuous activity in low and middle–income countries. Rural poverty and unemployment — resulting to a large extent from the mechanization of agriculture — contributes to the strong movement of peasants toward cities (Andersson, 2005). This creation and migration of poverty places tremendous pressure on urban centers for generating jobs and providing basic services and infrastructure to accommodate fast–growing populations. Trash picking thus emerges as a strategy for survival where jobs for unskilled labor are scarce and "waste" is amply available (Medina, 2007). Brazil is a particularly emblematic case in this regard both in terms of its high rates of urbanization — 83% (Population Reference Bureau, 2008) — and of its large population of trash pickers — estimated at 400 thousand by Forum Lixo e Cidadania, a national NGO that provides support to trash pickers (Silva, 2007).

Improvements in technologies to reprocess recyclable materials, combined with dramatic increases in waste outputs have contributed to transforming recycling into an economical and environmentally appealing alternative to extracting raw materials. This has led to the emergence of "waste" as a valuable commodity, much in contrast with its earlier status as an environmental externality and hazardous inconvenience. Recovery rates for aluminum in Brazil, for example, are among the highest in the world, exceeding even those of developed countries (ABAL, 2008). But this environmentally salutary fact, if contemplated through a broader socio–political and economic prism, reveals a not–so–commendable reality. To a large extent these rates are high because aluminum cans, being amongst the more valuable recyclables, are intensely sought after by street scavengers. Because of the low social status and economic fragility of this group of people, the activity of informal trash picking raises concern, as it exacerbates historical patterns of inequality.

In recognition of the challenges posed by this phenomenon to the development of urban societies and economies, some Brazilian municipalities and the federal authorities have enacted legislation aiming to integrate solid waste management practices with other spheres of urban planning. Some of these legislations' effects are the official recognition of trash picking as a profession and the financial support for the formalization of the activity through the

Figure 1. Workers sorting household trash at Cavalhada cooperative in Porto Alegre

formation of cooperatives. The Integrated Solid Waste Management Program of the city of Porto Alegre, for instance, is one of the earliest examples of such types of policies. Its 18–year experience provides a solid reference point for assessing the challenges facing Brasilia, which plans to implement an integrated solid waste management of its own. The present work compares municipal waste management practices in these two cities in examination of the professed potential of cooperatives to serve as mechanisms for social inclusion of trash pickers. It describes major advances and still present challenges the two cities face in efforts to establish a socially inclusive, integrated model of solid waste management.

Methods

I chose Brasilia and Porto Alegre because they share fundamental cultural and economic traits that render them comparable despite their differences in terms of regional history. They are also faced with urban paradigms and challenges typical of large metropolitan areas of the developing world. At the same time, they represent two distinct stages of development in urban solid waste management. I conducted my fieldwork from early June to mid–August 2008, with the first phase taking place in Porto Alegre from June 6 through 30. The remaining period was spent studying the solid waste management situation in Brasilia. Through semi–structured interviews and participant observation, I collected data of the cooperative worker's quality of life and work in Porto Alegre. In Brasilia, data collection was accomplished through interviews and participant observation in meetings with various stakeholders.

During my stay in the capital I spoke with various people associated with an organization, CENTCOOP[1], and was invited on numerous occasions to attend and observe meetings among cooperative leaders and between the organization, government institutions, and the University of Brasilia. CENTCOOP represents and gives administrative and legal support to all the cooperatives in Brasilia, was created in Brasilia in 2006. These meetings provided me with a solid understanding of the intricate lines of interest operating in the field of recycling as well as the interactions amongst the various actors of this network. This allowed me to see the internal and external difficulties most cooperatives in Brasilia face for creating cohesion amongst themselves and legitimizing their activities vis à vis society and the government.

Field Observations

Porto Alegre

With the creation of an integrated solid waste management program in 1990, the working conditions of many trash pickers in Porto Alegre have improved. Groups that worked out in the open on illegally settled land prior to the program now have a roof to work under and adequate infrastructure to perform their duties. The organizational and technical support provided by government and NGOs has also allowed for some degree of professional empowerment. The formation of cooperatives creates mechanisms of democratic participation that support personal and political improvement. It should be noted, however, that there have not been studies documenting the changes in income that have taken place after the creation of cooperatives.

Despite these positive results, three key factors take away some of the merit of the program. Firstly, the high dependence of the cooperatives on the municipal cleaning agency limits the program's success. The majority of the waste the trash pickers separate is provided by the cleaning agency while a small portion is donated directly by private businesses or government agencies. This generates patterns of dependency that places the cooperatives that are not on good terms with the cleaning agency at a disadvantage (Fortes, 2006). Secondly, the high dependence and limited bargaining power of the cooperatives relative to the buyers/middlemen is concerning. It is rather surprising that direct sales to industry have not evolved into common practice, since both the cooperatives and industry stand to gain by eliminating the middleman. Because cooperatives have neither logistical nor organizational means to scale up production, they continue to sell to the middlemen, whom control prices and make the lion's share of the profits. Thirdly, the low level of interaction among the cooperatives weakens them politically and prevents the constructive exchange of experiences and ideas. The fragmentation of groups of people that share the same social political and economic plight leaves them at a great disadvantage in terms of negotiating their claims and objectives.

Brasilia

Porto Alegre's model — with almost two decades of an integrated solid waste management system — highlights some of the obstacles facing

Brasilia's integrated waste management program. The same disjointedness seen among the trash pickers in Porto Alegre also affects the different parties of trash pickers in Brasilia. In terms of infrastructure and equipment, however, Brasilia still lags far behind. The majority of the cooperatives do not conduct formal book keeping, and only half operate in built environments — the other half work under the elements on illegally settled land. The majority is engaged in patron–client relationships with the only buyer of recyclables, many of them being financially indebted to this company[2]. Indebtedness also takes the form of "favors", as is the case in which the buyer "lends" them company trucks. There is federal money earmarked for the construction of triage units and purchasing of equipment, but it awaits disbursement because most cooperatives do not have a place where they can legally build. And while all of the cooperatives have received a compactor to press their materials, those cooperatives without a land title or use concession cannot access the electrical grid and thus are unable to use the equipment.

Despite these challenges, there is significant potential for a more successful integrated solid waste management system in Brasilia. As mentioned above, CENTCOOP is an umbrella organization for cooperatives, providing them with local political representation, logistical, administrative, and legal support, and negotiated prices of materials. In addition, CENTCOOP is trying to establish a central warehouse from which to sell production by all affiliated co–ops. This centralization has the potential for direct negotiation with industries without a middleman. Ideologically CENTCOOP is well grounded on principles of democratic participation, and embraces goals of economic and administrative self–sufficiency, capacity building, and political independence. Whether or not its mission statement will crystallize in the real world will depend to a large extent on the continued action of a network of organizations (Bank of Brazil Foundation, Caritas, NGOs, University of Brasilia) in terms of providing capacity building, technical and legal advising, and some financial support during the period of establishment of the cooperatives. Without the prospect of achieving self–sufficiency, the potential of the cooperative system to empower trash pickers will be undermined. Also important is the leadership role that the president of CENTCOOP embodies. His or her charisma and diplomatic skill is essential for fostering cohesion and trust amongst the groups of cooperatives.

Conclusion

Despite the overall improvements in waste management in Porto Alegre, the effects of the city's integrated model on the lives of trash pickers working in cooperatives fall short of the professed goals. The occupation is still highly marginalized, incomes vary amongst the different cooperatives, with the majority falling below Brazil's minimum wage (which is less than 200 US dollars per month), there is high worker turnover, provision of education and capacity building is minimal, job security or health care benefits are nonexistent, no cooperative is a self–sustaining enterprise, and favoritism on the part of the government agency generates competition and causes fragmentation amongst the cooperatives.

These facts demonstrate that well–meaning policies in and of themselves are not enough to change social behavior and political practices; a structure of checks and balances needs to be in place to guarantee transparency, accountability, and the equitable distribution of political leverage and economic bargaining power. Furthermore, notwithstanding the various degrees and definitions of social inclusion (ranging from the basic economic inclusion in the form of a job to equal access to public services to the acceptance of minority groups by

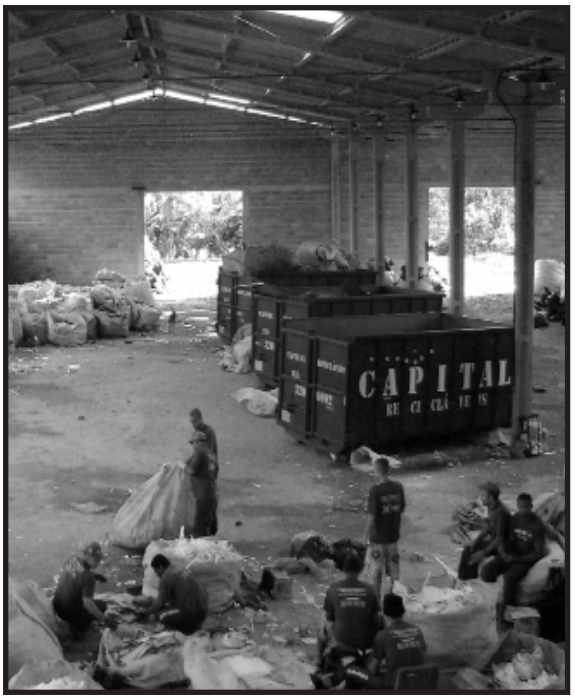

Figure 2. Interior of a cooperative's sorting unit in Brasilia. The workers are wearing uniforms provided by the sole buyer, Capital.

mainstream society and the state), the stigma associated with the work of trash picking propagates patterns of exclusion.

I contend that in this particular occupation, where the material waste from society converges with the economically obsolete, the displaced and dispossessed people of Brazilian society, true social inclusion is not possible without public participation in the form of separation of household garbage from solid recyclables (which would signal acknowledgement of the trash pickers work). Effective separation at the household level would greatly increase recovery rates due to lowered contamination of solid waste by 'wet' organic matter and facilitate the work of trash pickers at the triage units. The very notion of development and social change by way of top–down "social technologies" is critiqued here. This critique is particularly meaningful in the context of Brasilia, the quintessential Brazilian example of a Utopia that hoped to promote social change through formulas of spatial configuration[3]. Furthermore, questions are raised regarding the wisdom of the waste management policies of both cities (and of federal policies themselves) in pushing for the eradication of informal street scavenging while offering alternatives that have not been proven to be effective from the socio–economic standpoint.

A constructive tactic to take is to raise awareness about the valuable social, environmental, and economic contributions of the trash pickers. They are agents of their own inclusion by pursuing an honest form of income, perhaps one of a few available to them. The trash pickers are environmental agents, for reasons already explained elsewhere; they are an essential part of an economic production chain. Through their low pay they subsidize commercial operations and supply a service that in certain countries is seen as a duty of the government, and which thus far in many cities in Brazil has been provided virtually free of charge to the state. Implementing a solid waste management system faces the challenges of overcoming entrenched social attitudes and historical practices of waste management to enable a viable system that is both healthful and beneficial to the environment and the trash pickers.

Notes

[1] Central de Cooperativas de Materiais Reciclaveis do Distrito Federal

[2] This company holds a monopoly on the commercialization of recyclables, that is, all recyclable materials in the Federal District are sold (directly or through middlemen) to this company, which then sells directly to industry.

[3] Brasilia's urban plan and architecture reflect high modernist principles of spatial order and configuration by which class distinctions are minimized. For example, residential buildings look the same from the outside, regardless of the professional rank of occupants.

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Improving Brazilian Land Use Law:
A Case Study of Plantation Forestry in Southern São Paulo

Christopher Finney, MEM 2009

Years before this study began, I was an environmental educator a few miles north of the study area. My daily commute involved crossing a stream that was so laden with human waste from nearby slum settlements that the stream bubbled with methane — and this stream flowed straight into the municipal water supply. Local knowledge holds that the slums were the direct result of overly–restrictive zoning laws intended to protect the watershed in the 1970s. These laws prohibited essentially all productive uses, eliminating any economic incentive for landowners to manage their property. After private owners lost interest in their land, the slum settlements took over. Because the slums were illegal from the beginning, no sewer lines or other infrastructure was ever installed.

The desire to protect the watershed thus resulted in unintended human and environmental consequences, demonstrating the need to integrate both economic and environmental perspectives in solving many of São Paulo's most pressing problems. Sustainable forestry offers one such solution. Local law however must be carefully formulated to support sustainable forestry within the context of regulating land use. This case study directly addresses the regulatory issues that must be addressed in southern São Paulo. I hope it also sheds useful light on the myriad other situations in which environmental and economic issues require integrated, pragmatic solutions.

Background

São Paulo, Brazil, is the world's third most populous city with over 18 million residents (Torres et al., 2005), and southern São Paulo in particular experiences population growth in excess of 8% per year (Tesch, 2008). The area of study, the Capivarí–Monos Environmental Protection Area, occupies the southernmost 25,000 ha of the city. This area is an important source of ecosystem services; its watershed provides approximately 24% of the city's potable water, as well as wildlife habitat, carbon sequestration, and soil protection (Braga et al., 2006). Geographically, the study area provides a buffer between São Paulo and the Serra do Mar State Park, the largest legally protected tract of Atlantic Forest, a global biodiversity hotspot (Meyers et al., 2000).

The Capivarí–Monos is classified as an Environmental Protection Area (APA)[1], a participatory governance system in which municipal officials and local representatives share authority for land use regulation. Land uses in the study area include small farms, native secondary forest, native primary cloud forest, natural grasslands, and active and abandoned commercial plantations of pines (*Pinus* spp.) and eucaplypts (*Eucalyptus* spp.).

By focusing on the regulations governing plantation forestry in the Capivarí–Monos, this article explores the use of the term "sustainability" as a legal test in Brazilian environmental legislation. While the area is subject to unusually restrictive environmental legislation, this study shows that "sustainability" does not adequately guide land use classification, and proposes that standards from independent certification organizations be adopted instead.

Sustainability in Brazilian Environmental Law

Brazilian environmental law frequently uses sustainability as a legal test to determine whether a given land use is permitted. In the study area, the most restrictive land use regulations are defined in terms of sustainability, and are applied to zones in the study area that contain a large proportion of São Paulo's natural land cover and commercial plantation forestry (Figures 1 and 2).

In the Capivarí–Monos, two zones are of particular importance and cover a majority of the area. The Wildlife Zone (ZVS)[2] is defined as "portions of the municipal territory of great importance for the protection of hydrological resources and biodiversity, such as alluvial planes, significant remaining patches of Atlantic Forest herein delimited, as well

Law or Legal System	Purposes	Use of "sustainability" as a legal test
National System of Conservation Units (Federal Law 9,985 / 2000) orders types of natural preserves (including APA and State Park, below)	• Establishes criteria and norms for the creation, implementation and management of Conservation Units. • Objective IV: "encourage natural resource-based sustainable development"	• Defines sustainable use as: "use of the environment such that the permanence of renewable environmental resources and ecological processes is assured, maintaining biodiversity and other ecological attributes, in a socially and economically viable manner. • Several types of Conservation Units are defined in terms of sustainability: *National forest*: "basic objective is multiple sustainable use of forest resources and scientific research, with an emphasis on methods for the sustainable use of native forests." *Extractivist Reserve*: "commercial use of timber resources is permitted only on a sustainable basis" Wildlife Reserve: appropriate for scientific research on "sustainable economic management of faunal resources" *Sustainable Development Reserve*: home to local peoples "whose livelihoods are based on sustainable systems of natural resource use" *Biosphere Reserve*: an international model for "integrated, participatory, sustainable management of natural resources"
"Law of the Atlantic Forest" (Federal Law 11,438 / 2006)	"The general objective of the protection and use of the Atlantic Forest Biome is sustainable development, the specific objectives are protection of biodiversity, human health, landscape, aesthetic and tourism values, the hydric regime, and social stability."	• Defines sustainable use as: sustainable agroforestry activities practices on small or rural family landholdings that do not fundamentally change the character of the vegetative cover and do not harm the environmental function of the area • Agencies must "assist traditional populations and small landholders with the sustainable management and use of native plant species." • The government shall "encourage, with economic incentives, the protection and sustainable use of the Atlantic Forest Biome."
Serra do Mar State Park (2006)	To ensure the full protection of the flora, fauna, and natural beauty.	• Buffer zone (APA Capivarí-Monos): intended "to create and implement projects and activities that seek sustainable development for the region"
APA Capivarí-Monos (Municipal Law 13.136/2001)	Encourage the sustained use of natural resources; protect biodiversity; protect hydrological resources and remaining patches of Atlantic Forest, among others	• Wildlife Zone and Sustained Use Zone: permits "sustainable agroforestry management activities" • Agricultural Use Zone: "intended to encourage the sustainable development of resident communities in the APA"
Municipal Zoning (Municipal Law 13.855 / 2004)	"To encourage regional development based on economic activities that are compatible with the production of water, watershed infiltration areas, and sustainable rural activities; expansion of protected lands… [and] to ensure water quality and a water supply."	• Special Agricultural Protection Zone: permits "sustainable management" without further clarification • Protection and Sustainable Development Zone: permits "uses that are environmentally compatible with sustainable urban development… sustainable management [among others]."
Executive Decree 45.817/ 2005	"To define and detail the classification of given activities within different [zoning] categories of use and groups of activities."	"Nonresidential uses compatible with sustainable development" include "sustainable forest management" and "sustainable management activities… such as agroindustry, agroforestry activities, and agriculture"
Directive 01/2006	Regulates forestry in the region of study within the above legal regimes	"Necessary environmental measures will be determined in order to ensure the retention of cover and sustainability of the property."

Figure 1. Brazilian environmental law formulated in terms of sustainability.

as the headwaters of waterways of special interest to the water supply." Similarly, the Conservation and Sustained Use of Natural Resources Zone (ZUS)[3] is defined as "areas in which the moderate and self–sustaining use of the biota may be permitted, when regulated to ensure that natural ecosystems are maintained." Both zones permit "*sustainable agroforestry management activities*, duly licensed by the appropriate agencies" (italics added).

The question of what constitutes sustainable agroforestry management is problematic. Applied to forestry, sustainability can be viewed either in a narrow sense, focusing strictly on the ongoing yield of products from a single plot, or broadly, by considering the social, economic and environmental effects locally and at the landscape scale (Evans, 1999). Brazilian law defines sustainability broadly; in the National System of Conservation Units (Federal Law

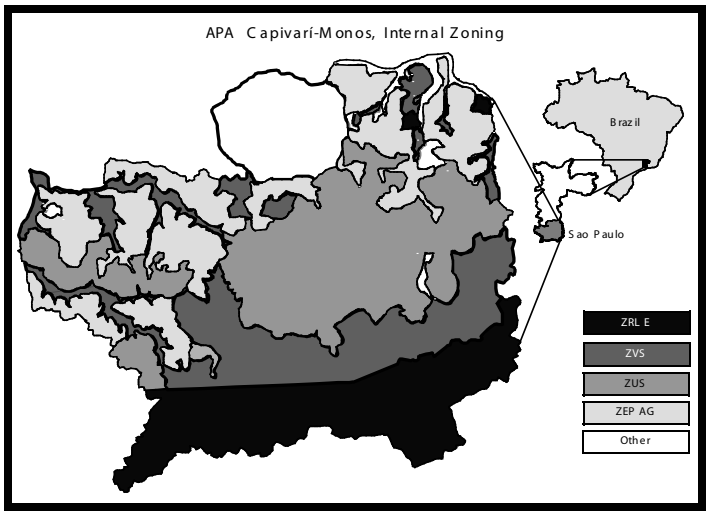

Figure 2. Zoning in the APA Capivarí-Monos. ZRLE refers to a state park, ZVS is a wildlife zone, ZUS is a zone designated for the sustained use of natural resources, and ZEP AG is set aside for special agricultural activities.

9.985/2000) — which regulates the APA and thus governs the CVS and ZUS — sustainability is defined as "use of the environment such that the permanence of renewable environmental resources and ecological processes is assured, maintaining biodiversity and other ecological attributes, in a socially and economically viable manner." This definition fails, however, to provide a meaningful legal test in differentiating between the fine, but significant, gradations within land uses such as plantation forestry. The following examinations of "industrial" forestry (intensively–managed exotic monocultures) and "native" forestry (commercial plantation forestry using native timber species, sometimes incorporating mixed species designs) illustrate this problem.

Overall sustainability of forestry

Working with a narrow definition of sustainability, which considers only the permanence of timber productivity on a given piece of land, most forestry can be considered sustainable. Although soil nutrient loss threatens future productivity in some systems, this is often a consequence of management decisions, rather than the intrinsic nature of forestry (Evans, 1999). However, under a broad definition that considers social, economic, and environmental impacts, forestry may or may not be considered sustainable depending on specific management decisions. A determination of "sustainability" is further complicated when forestry is compared to other possible land uses; measured in terms of overall environmental services for instance, plantation forestry represents a more sustainable land use than degraded pasture, but a less sustainable land use than maintaining natural forest (Evans, 1999).

With proper management, plantation forestry can have several positive effects. First, it can provide ecosystem services by enhancing watershed function and biodiversity (Montagnini, in press). Second, forestry provides economic returns, increasing property values and counteracting the trend toward subdivision and occupation of land, providing a key argument for the retention of this land use in southern São Paulo. Third, managed forestry reduces pressure on native forests by producing timber at higher rates than do natural forests, although complete product substitution is unlikely (Sedjo and Botkin, 1997; Oliver and Mesznik, 2005). Last, forestry can provide a buffer zone for protected lands, thus reducing anthropogenic and physical edge effects (Ries et al., 2004).

Industrial plantation forestry

Heavily–managed monocultures of exotic species represent one extreme of a spectrum of plantation strategies. Pine and eucalypt plantations are present in the study area and much of tropical Latin America. Both species, however, interfere with the biodiversity of native land cover in the Atlantic Forest biome. In the adjacent Serra do Mar State Park, pines and eucalypts are considered invasive species (PESM, 2006) posing a particular threat to the biodiversity of natural montane fields. Marsden et al. (2004) found only eight species of birds in 31 eucalyptus plantations located within 7 km of intact Atlantic Rainforest, compared to 111 species encountered in adjacent intact rainforest and 59 species encountered in fragments of native forest.

Eucalypt plantations also threaten watershed function. In southeastern Brazil, the water table fell 2.5 m over the first nine years of a eucalyptus plantation (Soares and Alameida, 2001). In a review of the effects of forestation in the tropics, Scott et al. (2005) report consistent evidence that water use exceeds annual precipitation considerably when eucalypt plantations occur on deep (>8m) soils, particularly in seasonal environments, as well as "overwhelming evidence" of reduced annual surface water yield relative to grassland and scrub in the subhumid tropics, subtropics, and temperate zones.

Given that the legal objectives of the APA Capivarí–Monos are to "protect biodiversity; hydric resources, and remaining Atlantic Forest", and considering these plantations have negatively affected these ecosystem functions within and near the study area, they appear incompatible with management goals for the area. Whether they should be permitted by land use regulations should be reviewed.

Native plantation forestry and mixed plantations

In contrast to industrial plantation forestry, commercial plantation forestry using native species in the neotropics can improve soil nutrient content, provide habitat for birds, insects, and mammal species, increase native seed rain and recruitment, protect soil nutrients, repress invasive grass species, and provide positive financial returns (Montagnini, 2001; Montagnini, in press). The Manequinho Lopez and Cotia nurseries, which are owned by the municipal government of São Paulo, grow many species recommended for reforestation in the Atlantic Forest Biome, indicating the potential viability of their use in the study area (Figure 3).

Mixed species designs, especially those involving non–timber forest products, can provide additional ecosystem services and reduce landowners' economic risk. In a recent meta–analysis, Piotto (2008) showed that mixed–species systems increase the growth of timber species. Mixed agroforestry systems provide earlier returns on investment by including understory crops such as heart–of–palm (*Euterpe edulis*) (Montagnini et al., 1997). Because illegal harvesting has reduced heart–of–palm to a threatened status in the adjacent Serra do Mar State Park, mixed plantation strategies in the study area may provide significant benefits by reducing illegal harvest while increasing seed availability. Further,

Scientific Name	Local Name
Aspidosperma sp. ‡	peroba
Astronium sp. ‡	guaritá
Balfourodendrum riedenalium ‡	marfim
Bombax sp.	paineira
Cedrela sp. ‡	cedro
Cabralea canjerana	canjerana
Caesalpinia echinata ‡	pau brasil
Cordia sp. ‡	louro
Dalbergia nigra *	jacarandá negra
Enterolobium sp. ‡ *	tamboríl
Hyeronima alchorenoides	licurana
Hymenaea sp. ‡	jatobá
Inga affinis	ingá
Inga veriscens	ingá
Nectranda sp. ‡	canela
Platypodium elegans	jacarandá
Schizolobium sp. ‡	licurana
Tabebuia sp. ‡	ipê
Maytenus ilicifolia	espinheira santa
Peltophorum dubium ‡	faveira
Bastardiopsis densiflora	louro-branco
Parapiptadenia rígida ‡	paraguaio
Anadenantera macrocarpa ‡	angico

Figure 3. Native timber species of the Atlantic Rainforest (Barth, in press; Brewer et al., in press). ‡ Species currently available at municipal nurseries of Manequinho Lopez or Cotia. * Nitrogen fixing species.

heart–of–palm seeds are an important food source for key seed dispersers such as toucans, which may increase seed dispersal of other native plant species. This dispersal makes heart–of–palm systems catalysts of forest restoration by increasing natural regeneration in nearby degraded areas and within plantations (Parrotta et al., 1997; Montagnini, in press). This second generation of natural regeneration — facilitated by improved growing conditions and increased seed dispersal — can be retained in the forest understory. Like natural rainforest understory trees, this natural regeneration is "released" when the first generation of plantation trees is harvested, and can be managed as a productive semi–natural forest or conserved for other values.

Discussion

Brazil is commonly considered to have an exemplary environmental legal regime, which is ineffective primarily because it is unenforced (Laurence et al., 2001; Soares–Filho et al., 2006). In the study area, however, the current legal regime is ineffective partially because of language which is too ambiguous to provide guidance regarding land use. Sustainability provides an especially problematic legal test in relation to borderline land uses, such as plantation forestry, which may be either sustainable

or unsustainable based on the definition of the term and the management of the forest. In the study area, improving the coherence and enforceability of the legal structure, rather than its restrictiveness and enforcement per se, is key to improving environmental governance. This interpretation follows other studies, which concluded that streamlining policy and governance is important to reducing illegal forest activities worldwide (Tacconi et al., 2003).

The current regulatory structure requires that sustainability be considered a single variable with only two categories: sustainable and unsustainable. Sustainability, however, is a composite of different environmental services such as habitat value, watershed protection, soil protection, carbon sequestration, seedling recruitment, and cultural values (Figure 4). Each service varies along a continuous gradient because outcomes depend on specific management decisions, even within a single land use type. Further, land uses may be ranked differently depending on the weight given each environmental service. This makes simple yes–or–no determinations impossible, reducing the viability of sustainability as a legal test. An approach is needed that bridges the gap between means and ends — one that allows the goal of sustainability to be approximated despite the elusiveness of a definition of sustainability that meets the complexities of real world situations.

Recommendations

Given the recognized importance of the study area as a source of ecosystem services, and considering the problematic structure of current regulations, the City of São Paulo needs greater specificity in its regulations on permissible forms of land use. Because numerous management decisions — including choice of species, planting density, use of chemical inputs, thinning regime, understory clearance, rotation length, harvest methods, and treatment of slash — affect the ecosystem services provided by forestry, regulations to address all of these decisions would be highly complex, making voluntary compliance and enforcement difficult. Such regulation would also increase plantation costs without providing additional financial returns, undermining the efficacy of these forests as an economic barrier to human occupation.

Rather than create independent forestry regulations, the City of São Paulo should consider incorporating a forest certification system (such that of the Forest Stewardship Council) into local legislation for zones in which the stated purposes of existing legislation aligns with certification requirements. In other words, São Paulo should make otherwise voluntary standards mandatory in key watershed areas. This approach is modeled on the increasing incorporation of green building standards (such as Leadership in Energy and Environmental Design — LEED) into municipal law in the United States. Boston, MA, for example requires that certain classes of buildings be LEED certifiable (Sussman, 2008). Such an approach may offer important advantages to the city, certifying organization, and landowners. The city would benefit because the certifying organization would take responsibility for site inspection, enhancing the enforceability of standards and providing key human

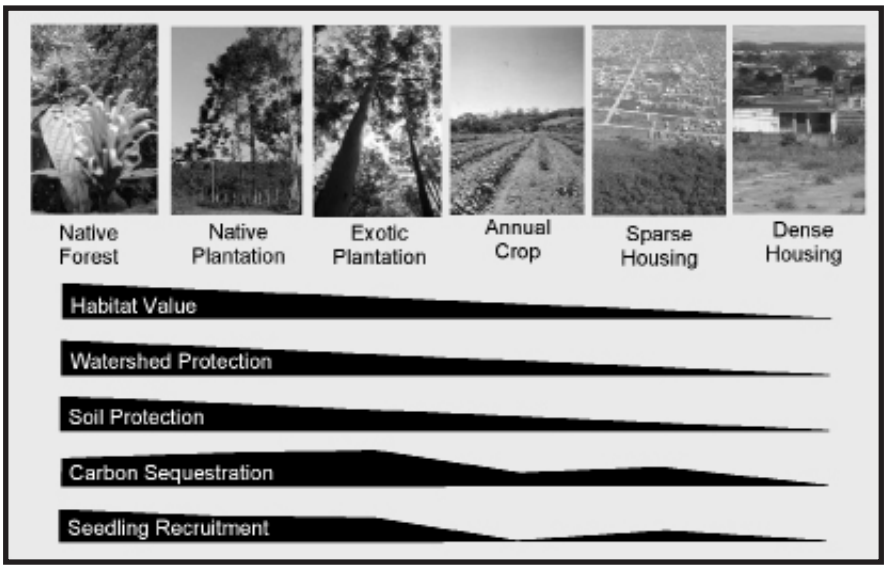

Figure 4. Sustainability of local land uses depicted as a set of di erent ecosystem services which vary along continuous gradients.

resources. Additionally, refinements in best practices are incorporated into municipal law automatically as the certification standard is amended. The certifying organization would benefit from increased participation, especially in Latin America, where participation is limited because the costs of improved management typically outweigh the financial benefits of certification (Gullison, 2003). Finally, although both traditional regulation and mandatory certification impose regulatory and economic burdens on landowners, mandatory certification is preferable because it can increase the market value of timber products, partially or completely offsetting the economic burden of regulation. In environmentally sensitive areas, such as southern São Paulo, which require some form of regulation to protect environmental services, such as habitat and watershed function, mandatory certification can provide a preferred option to multiple stakeholders.

Notes

[1] Area de Proteção Ambiental
[2] Zona de Vida Silvestre
[3] Zona de Conservação e Uso Sustentado dos Recursos Naturais

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The Future of Small Yerba Mate Farmers in Argentina:
An Opportunity for Agroforestry

Tal Ilany, MFS 2009, *and* Janet Lawson, MESc 2009

The legacy of Argentine agricultural policies has left an imprint on both the livelihoods and landscapes of yerba mate farmers in Misiones, Argentina, leading to a current state of land consolidation and degradation. Every year, 12,000 hectares of Atlantic Forest are cut down in Misiones Argentina, with only 44% of the original 2.7 million hectares of Atlantic Forest in Misiones remaining. Endemic deforestation in Misiones is a result of agricultural and economic policies that give rise to extreme forest exploitation and land conversion to monoculture plantations (Carrere, 2005).

One of the most widely planted agricultural species on small farms in Misiones is the native *yerba mate* (*Ilex paraguariensis* St. Hill), the leaves of which are steeped and served as a traditional beverage. Of the 19,000 yerba mate farmers in Misiones, over 80% are small farmers with less than 10 hectares (Vasquez, 2007). While the global trade of yerba mate is estimated at US $1 billion (Heck and Mejia, 2007), many small farmers struggle to make a profit from the crop due to low market prices and declining yields. This article explores how a combination of agroforestry management and agricultural policy can support farmers' livelihoods and maintain the quality of the land.

Regional Background

The Atlantic Forest extends throughout Brazil, Paraguay, and Argentina and is listed by Conservation International as one of the world's biodiversity hotspots, a fragile ecosystem with high levels of endemic flora and fauna. A major threat to this forest is exploitation from clear cutting to accommodate agriculture, livestock, and roads (Leal and Gusmão Câmara, 2003). Only 8% of the original Atlantic Forest remains and Misiones contains the largest continuous expanse (Figure 1; Holz, 2005). Using yerba mate agroforestry management in Misiones offers a way to strike a balance between preserving the forest while supporting farmers' livelihoods. Agroforestry increases nutrient cycling, soil organic matter and microbial populations reducing the need for farmers to clear forest for new fertile land.

Methods

During the summer of 2008 the authors worked in Misiones, Argentina in the department of Montecarlo, exploring the following questions:

1. How have government agricultural policies shaped the land use and agricultural practices of small and medium–sized yerba mate farmers over the past century?

2. Can burgeoning global niche markets create new opportunities that support both agricultural sustainability and the livelihoods of small and medium yerba mate farmers?

3. Which agricultural systems will provide farmers with the adequate crop yield while simultaneously ensuring long–term soil health?

To answer these questions, Tal implemented a study to explore soil fertility in yerba mate agroforestry systems, while Janet initiated research to explore the political ecology of land use changes for small yerba mate farmers. Tal sampled a total of twenty plantations, ten of which were monocultures of yerba mate and ten were agroforestry systems of yerba mate intercropped primarily with parana pine *(Araucaria angustifolia*). She sampled one forest site, with no recorded history of clearing, to provide a baseline control of soil nutrients typical to a regional secondary forest. She collected soil samples at two depths, measured diameter at root collar for yerba mate and diameter at breast height and live crown height for intercropped species. She is currently analyzing soil and root samples for nutrient content. Janet completed thirty semi–structured interviews with yerba mate farmers, agriculture extensionists, government officials, and university professors in

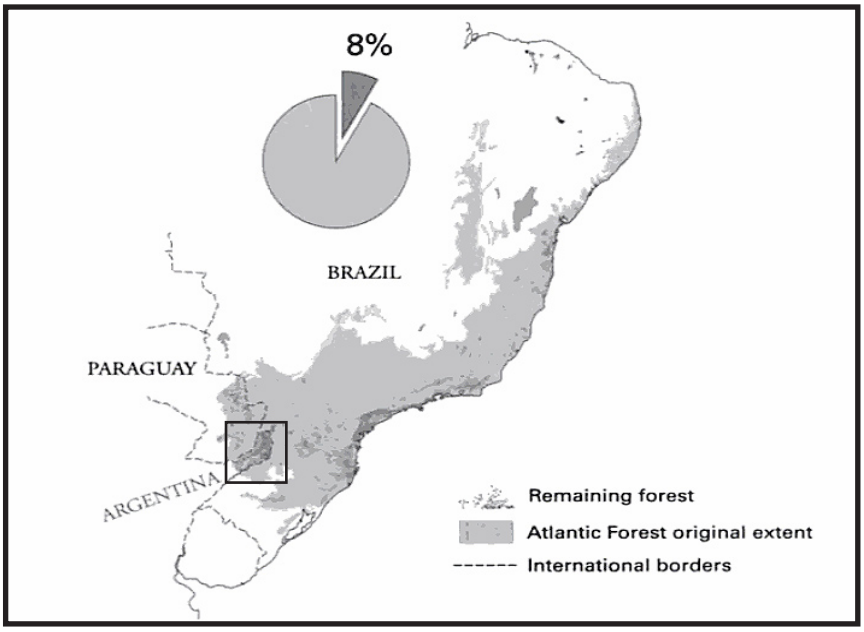

Figure 1. The province of Misiones, located in the square, contains the largest remaining continuous expanse of Atlantic Forest. Source: Leal 2003.

Argentina. She asked a series of questions to evaluate land–use history and allocation, the agricultural techniques employed, and the political economy of yerba mate production.

Yerba Mate and Agroforestry

Agroforestry is a management system that utilizes combinations of trees, crops, shrubs, grasses, and animals on the same piece of land. The combination of species increases nutrient cycling, provides optimal biological interactions between plants, lowers the risk of financial loss from crop failures, and yields multiple products (Parrotta et al., 1997; Workman et al., 2002). In Misiones, while yerba mate can be grown in agroforestry systems, it is more commonly planted in monocultures. From an environmental and economic standpoint, it is important to determine whether yerba mate grown in shade conditions affects productivity and soil fertility. This information can help improve management practices of the crop.

In Misiones, common timber tree species found intercropped with yerba mate include araucaria, eucalyptus (*Eucalyptus camaldulensis*), various types of pines (*Pinus taeda* and *P. elliottii*), and kiri (*Paulownia tomentosa*) (Figure 2). Of these, araucaria is the only one native to the region and is often found growing with yerba mate in the wild. While other studies look at a variety of native tree species intercropped with yerba mate, more research is required to fully understand the consequences of such systems (Eibl et al. 2000; Montagnini et al., 2006).

While there is minimal research on the specific growing requirements of yerba mate in agroforestry systems, we can look at species with similar growing attributes and examine both ecological and economic benefits of growing them in agroforestry systems. Two globally important products, coffee (*Coffea arabica*) and cacao (*Theobroma cacao*), are commonly managed using agroforestry throughout the tropics. In the natural forest setting, yerba mate, coffee, and cacao are intermediate trees and tolerate partial shade. However, when these species are cultivated on an industrial scale, they are often planted in full–sun monocultures. To determine what enhances both ecological and economic values of these crops, an exploration of light and nutrients interactions in agroforestry systems is necessary.

Nutrients

Maintaining soil nutrient levels in plantations can be challenging, especially on the low fertility and acidic soils of Misiones. Because the leaves of yerba mate are harvested annually, the plants are very demanding of soil nutrients and over time these plantations decrease in productivity. Mycorrhizae, a soil fungus that forms symbiotic relationships with plants, can be very important for nutrient and moisture sequestration, especially in low quality soils (Cardoso and Kuyper, 2006). Since systems with

more species diversity tend to promote more mycorrhizal associations, agroforestry may be an opportunity to encourage these relationships and maintain soil fertility over longer periods of time.

A study looking at coffee production examines mycorrhizal relationships with phosphorous and yield. Trees inoculated with mycorrhiza show increases in initial yield and growth when phosphorous is added in moderate amounts (Siqueira, 1998). While yerba mate is not known to form mycorrhizal relationships, some potential intercropping species like araucaria are known to do so. As araucaria is already generally well suited for the nutrient deficient soils of Misiones, it may be used to improve site conditions for yerba mate.

Light

Predictability and yield security are necessary for success in agricultural production. This success can only come from an understanding of how plants thrive within an environment. Light is a driving force of plant development and is integral to the formation of the nutrients and caffeine in yerba mate, coffee, and cacao. The tradeoffs between photosynthetic benefits and biotic factors must be carefully understood in order to fulfill production goals.

Recent evidence suggests that growing yerba mate in shaded conditions increases the amount of mineral material in the leaves, producing a higher–value product (Jaques et al., 2007). Yerba mate under a 75% shade tends to have higher amounts of caffeine and nutrients in leaves, woody stems, and fruits than when the tree is grown in full sunlight (Esmelindro et al., 2004; Jacques et al., 2007). In a study by Coelho et al. (2006), where yerba mate is grown under three different light levels (93%, 41% and 5%), caffeine and theobromine leaf concentrations increased with shade, while production rates were reduced by more than half. If leaf chemical concentration and yield are shared goals, then the intermediate shade conditions of an agroforestry system might provide ideal outcomes. Intercropping yerba mate with overtopping timber trees may therefore produce a higher quality product, but the amount of shade must be regulated in order to maintain desired production rates. Results from similar research with cacao and coffee reinforce the benefits of mixed systems for small farmers (Somarriba et al., 2001; Zheng and Ashihara, 2004; Zuidema et al., 2005).

Intercropping yerba mate with araucaria or other native species can provide increased soil organic matter and nutrient cycling, pest and weed control, and heightened levels of secondary com-

Figure 2. Yerba Mate intercropped with araucaria in Misiones.

pounds in the leaves. Small farmers in Misiones can use these agroforestry techniques to maintain soil fertility over the long–term. These techniques reduce the need to clear new land while providing another source of income from the harvestable timber. Overall, agroforestry systems appear to provide many ecological benefits and have the potential to generate economic opportunities for small farmers and the results of Tal's research can be used to weigh the benefits of using yerba mate agroforestry systems in place of monocultures in Misiones.

Policies and Profitability for the Small Farmer

During the past two decades, yerba mate farmers faced plummeting market prices that made it difficult to support themselves solely through yerba mate production. Following a large shift in economic policies in 1991, the yerba mate industry was deregulated and land was increasingly converted to high–density yerba mate plantations. This precipitated a steep decline in yerba mate prices, plummeting from 20 cents per kilo in 1991 to two cents in 2000 (Rosenfeld and Martinez, 2003). As a result, the National Institute of Yerba Mate (INYM)[1] was created in 2002 to set prices for the harvested green leaf (INYM, 2008). Although the price set by INYM in 2008 was 52 cents per kilo for the harvested green leaf, the ten largest firms that collectively control 80% of the market are able to drive down prices despite the rhetoric of the INYM. Farmers are often compelled to sign papers with the drying mills or cooperatives saying that they were paid the official price despite having in fact been paid much less.

In response to this price decline, some family farmers are now accessing new and growing markets, particularly those for organic and fair trade products from agroforestry systems. For these alternative markets to become viable in supporting yerba mate agroforestry as an agriculturally sustainable and economically stable option for small farmers, three important conditions must be met: (1) the creation of an effective government agricultural policy that supports small farmers in Argentina; (2) the development of institutional capacity to enable small farmers to access alternative markets; and (3) the increased diversification of crops and agricultural products produced on small farms.

Building an Argentine agricultural policy to support small farmers

In order to support the livelihoods of small farmers, the state must foster policies that create economic and social conditions that encourage a shift towards environmentally sustainable yerba mate production. Some recent initiatives are noteworthy. First, the Misiones provincial government created the Center for Yerba Mate Transactions (CTYM)[3] within the Ministry of Agriculture in order to develop accountability in the transactions between the farmer and the yerba mate drying, grinding, and packaging facilities (CTYM, 2008). While mechanisms for tracking these transactions are still being developed by CTYM, it will hopefully integrate transparency into yerba mate production and processing and ensure that farmers are paid the official price set by INYM. Second, while the National Institute of Agricultural Technology (INTA)[3] has been completing research on agricultural techniques to increase yields in yerba mate monoculture systems, it should also look at sustainable agroforestry techniques on small farm systems and determine which techniques are most suitable for small farmers. Third, INTA and INYM currently have fledgling programs for small farmers on soil conservation. These extension programs reach only a small audience and should be significantly broadened. All these initiatives involve instituting mechanisms for transparency in the yerba mate production chain and promoting research and agricultural field training for environmentally sustainable agroforestry techniques.

Developing institutional capacity for accessing new markets

Some larger family farmers — those that have both the capital to invest in agroforestry systems and the capacity to process, package, and export their yerba mate — have successfully tapped into niche markets for shade–grown and organic yerba mate in Misiones. Two of the larger family farms I visited this summer (each with more than 75 hectares of yerba mate) incorporated native trees in their yerba mate fields and exported certified organic yerba mate. However, these farmers have outside funding and support, as well as significantly more land and capital invested in their yerba mate plantations than the average small yerba mate farmer.

Given that small farmers often do not have the capital or the capacity to make costly investments in their agricultural systems, processing equipment, or marketing, how can the small farmer take advantage of a niche market that supports sustainable agroforestry? Cooperatives of small yerba mate farmers have had varied success in implementing sustainable agroforestry practices and accessing niche markets. The Cooperative Río Paraná based in Oberá, Misiones, was marketing their yerba mate nationally as fair trade and organic, but it has not been able to pay their farmers the official price set by INYM. The cooperative is paying back loans and lacks the capital to purchase drying and processing equipment and build storage facilities. While a cooperative structure can create a mechanism to obtain the capital for processing equipment, they also must have the institutional capacity to maintain relationships with foreign business partners that import shade–grown yerba mate. Government support is necessary to strengthen existing cooperatives. This support will give small farmers access to capital and training, allow them to invest in an agroforestry system, and take advantage of the opportunities provided by niche markets.

Diversification

The most important benefit of yerba mate agroforestry systems is its emphasis on diversity. With a variety of subsistence crops, gardens, fish farming, animal husbandry and alternative cash crops, small farmers will be better equipped to support themselves and their families despite market fluctuations. Combining coherent agrarian policies with agroforestry systems, will hopefully lead to a framework for economic justice and environmental sustainability within the yerba mate sector. These policies have the potential to promote the revitalization of yerba mate livelihoods and the conservation of Argentine landscapes.

Conclusion

Yerba mate production in agroforestry systems may be a profitable venture for small farmers. However, the long–term viability of this crop hinges on a combination of ecological and economic factors, specifically the maintenance of soil quality and the development of alternative markets and agricultural policies. Agroforestry systems may provide options for these farmers by diversifying the crops they produce, improving soil quality, and allowing access to alternative markets. Agroforestry can be ecologically beneficial, but requires farmers to follow certain management schemes to ensure profitability. Given the complexity of agroforestry management, educational programs must be available to small farmers whether they are offered through government extension, non–profit organizations, or private ventures. With supportive agricultural policies, agroforestry management can provide a future for small farmers in Misiones while sustaining the quality of the land.

Notes

[1] Instituto Nacional de la Yerba Mate
[2] Centro de Transacciones de la Yerba Mate
[3] Instituto Nacional de Tecnología Agropecuaria

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Negotiated Meanings of Red Ruffed Lemur Conservation in Masoala National Park, Madagascar

Meg Selby, MESc 2009

Introduction

In summer of 2009, I traveled to the northeastern rainforests of Madagascar to study the role of red ruffed lemurs (*Varecia rubra*) (Figure 1) in biodiversity conservation of the region. Because the lemurs are not isolated in their settings, I want to understand the social and decision processes involved in lemur conservation, not just the biology of the species itself. I am interested in how biodiversity conservation in Masoala National Park, Madagascar, is being enacted by a variety of actors with their own goals and agendas of conservation and development. I argue that achieving conservation and development in Masoala National Park is a struggle for the actors involved because their goals are not only unclear but also unshared. Uneven access to knowledge and resources has obstructed a cooperative process. The continuation of prohibited activities in the park, uncertain gains in population of the endangered species, and a reduction of nongovernmental organization (NGO) support is evidence of the struggles.

Background

Masoala National Park began as part of an Integrated Conservation and Development Project (ICDP) in 1993 and became a national park in 1997 (Kremen et al., 1999). ICDPs are supposed to create local support for conservation by providing development services and economic gain to communities affected by protected areas. Scientists designed the park boundaries to protect the largest remaining tract lowland rain forests and the habitat of the endangered species that live there (Kremen et al., 1999). International support for the creation of the park included the Wildlife Conservation Society (WCS) and the Bronx Zoo. Both organizations were significant NGO donors and decision makers working with the Malagasy government in establishing the park (Cohn, 2000). WCS originally ran park operations, but the park is now run by the governmental park service ANGAP[1]. The park is separated into core, multiple–use, and buffer zones. The core regions are identified as primary, old growth forests valuable for protecting high concentrations of biodiversity.

Biological population assessments of several indicator species were used to prioritize regions most vital to species survival and thus conservation. The red ruffed lemur was the most influential indicator species due to its large habitat range, dependence on old growth trees for nesting, and high profile image (Kremen et al., 1999). The northwest extent of the red ruffed lemur's range is unknown (Vasey, 1997). It is possible that the park contains almost the entire habitat range of red ruffed lemurs, so successful conservation of the species is framed in terms of the park's success (Vasey, 1997). Conservationists further hope that protecting the lemurs will simultaneously preserve habitat and resources

Figure 1. A red ruffed lemur.

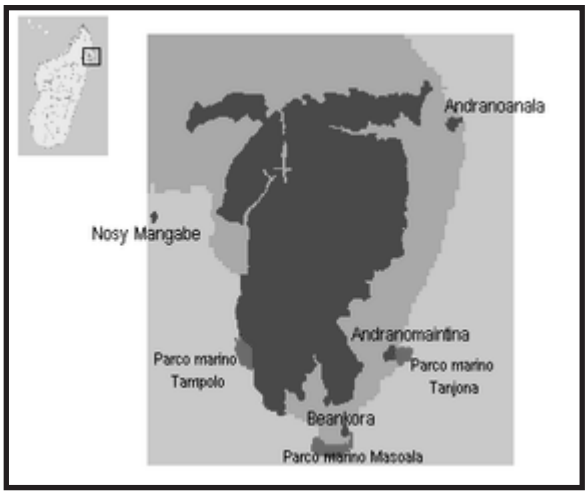

Figure 2: The Masaolo National Park and Tampolo Village (Madagascar, inset). Source: http://www.IUCN.org

required by many other endangered species as well (Vasey, 1997).

The *Betsimisaraka*, which can be translated as "the many inseparable," are the dominant ethnic group in Masoala, and have had a long history of cultivating rice in the region. The Betsimisaraka rely on forest resources for their livelihoods, so the inclusion of multiple–use and buffer zones in the park allow some resource extraction while protecting the core area.

Shifting cultivation of rice, known as *tavy* in Malagasy, is identified as the primary cause of habitat destruction and environmental degradation threatening red ruffed lemurs and other endangered species in Masoala (Novy, 1997; Kremen et al., 1999; Styger et al., 1999). Despite national laws against the practice of tavy in forested regions and the efforts of ICDPs to discourage tavy and offer alternatives, the Betsimisaraka continue tavy within the boundaries of Masoala National Park (Hekkala et al., 2007). The tavy brings the Betsimisaraka in conflict with the lemurs. My research sought to ascertain whether or not ICDPs and park officials had been able to encourage local support for conservation of red ruffed lemurs.

Methods

I conducted my research in Masoala National Park and Tampolo village (Figures 2 and 3), amongst the Betsimisaraka. I worked closely with the ANGAP guides to contact the agency officials in the region and meet many of the local community members living in and around the Antongil coastline of Masoala National Park. One of the guides stayed with me for the entirety of my research in the park. I carried out participant observation, semi–structured interviews, and transect walks of the park circuits, or guided paths. The interviews were centered on discussion of the value and population size of red ruffed lemurs, how individuals had benefited from or been harmed by the park's existence and its ICDPs, and how they viewed the government and NGOs involvement in the process. I recorded use of the park resources within the different boundaries of core, secondary, and peripheral zones. In addition, I monitored the presence of red ruffed lemurs by vocalizations and visual contact.

Results

Given my limited time in Masoala, it would be imprudent for me to claim a thorough understanding of all the successes and failures of the Park in conserving biodiversity. However, my experience suggests that each of the stakeholders have different agendas and that not all have had an equal voice or role in decision making. The benefits of development and conservation are not distributed evenly, and participation has not necessarily guaranteed improvement for all local community members. It appears that there has been insufficient reflective evaluation by NGOs and ANGAP of their projects.

The red ruffed lemurs, on which the park's boundaries were designated, are still poorly understood ecologically (Vasey, 1997). Long–term dynamics of reproductive frequency, energy strategies, ranging habits, and thorough population censuses are still required. Achieving success in terms of maintaining a stable population of this endangered species is threatened by a lack of knowledge of what the species depends on for its continued survival. The park guides, who have the most regular encounters with the lemurs, are not directly involved in research, tracking, or data collection. Researchers study species and ecosystem processes that inform how decisions regarding the land use are made, but could improve efforts to share their results with the local communities.

The local communities are most affected by the land use regulations that were designed to protect the lemurs. Moreover, they utilize some of the same resources as red ruffed lemurs. The Betsi

misaraka value the red ruffed lemur for its cultural presence in their lives, but in times of hardship some individuals rely on the red ruffed lemur as a source of protein. They also recognize that the lemur attracts tourists to their villages, bringing cash into the local economy. However, tourism is unsteady and precariously linked to actions beyond Betsimisaraka control. Thus, tourism as an income strategy is problematic and may undermine conservation goals. Therefore, the Betsimisaraka value red ruffed lemurs for multiple, but at times conflicting, reasons.

The government, and by inclusion ANGAP, is interested in conserving the red ruffed lemur as a means of ensuring that development aid resources enter the region. By preserving the Masoala rainforest, the government gains a voice in an international community as a protector of a biological hotspot. However, since the end of the initial 15-year plan for the ICDPs no new plan has been enacted in its place. ANGAP is struggling to maintain the resources necessary to manage the park, encourage tourism, and keep local support, and no new aid packages are on the way.

The Wildlife Conservation Society has shifted its attention and resources to a newly created adjacent protected reserve, Makira. WCS is interested in the protection of the red ruffed lemurs as a means of promotion of the agency itself and as a charismatic species for conservation in general. WCS speaks of its role in the park as a success. This view is seen in their promotion on the ground in Madagascar and in the United States at their newly created Masoala Rainforest exhibit in "Madagascar!" at the Bronx Zoo in New York City. That WCS has shifted its attention to the protected reserve called Makira may reflect their disengagement with the long–term needs of species conservation and of the continual complexities of achieving local support and positive outcomes for the Betsimisaraka.

Figure 3. Tampolo Village.

The conflict between the Betsimisaraka and the land use regulations established for lemur conservation is apparent within the park's core zones. I recorded observations of resource use in the park's core zones. Resource use included slashes in the bark of trees to collect sap to seal houses and boats with, and holes dug in the ground to collect tubers or saplings. I observed tree trunks that bore scars of a hatchet, marked for felling or begun but interrupted. There were man–made irrigation streams towards the rice paddies and I witnessed several women collecting palm fronds.

I observed several groups of red ruffed lemurs in the forest canopy along the park paths on consecutive days (unknown whether they were the same or different individuals or groups), and heard territory vocalizations between 7 and 9 o'clock in the morning for the eight days I stayed near Tampolo. I received variable accounts as to their fluctuating presence in the forests from locals, with some individuals reporting an overall decline in red ruffed lemur populations in the last ten years, and some reporting a drastic increase. Formal censuses are more than ten years old (Vasey, 1997). Conflicting accounts may be in part due to the interviewees trying to anticipate the reply they thought I was hoping to hear, and may in part be related to exposure by people to various areas of the park and therefore to the home ranges of the red ruffed lemurs. Also, since laws prohibit capturing or hunting lemurs, the answers may also be indicative of how the locals interpret the legitimacy of the laws, of their fear of retribution, and of my authority (or lack there of).

Discussion

The red ruffed lemur has had an influential role in the design and management of Masoala National Park. However, the ecological roles and biophysical processes of the species are still inadequately understood. From this study it is uncertain

whether the population of red ruffed lemurs has benefited from the creation of the park in 1997.

The local communities bear the heaviest burden of change on their lives to preserve the species. ICDPs include them in the social process as beneficiaries of development projects rather than informants. The local communities' cooperation is perhaps the most important factor in the long–term protection of the Park's biodiversity, yet the other stakeholders treat them less as participants than recipients. The government and NGOs hold the most power in the process, receiving information from scientists and researches, but they each have their own goals of wealth and promotion that do not encourage self–evaluation, sharing knowledge, or reflexive thinking. The consequence is that they may compromise the efficacy of conservation efforts, evidenced by continued resource extraction from core zones.

Guides are in a precarious role as implementers and community members, part–time and underfunded intersections between local and extra–local. They interact with the governments, NGOs, tourists, and are themselves locals and intimately connected with the families and friends who surround the park. The guides' job security relies on the presence of tourists. While the researchers are back at their universities producing scholarly work that will influence the policies, the guides are the ones who see the red ruffed lemurs in the trees. The guides observe all that has come to pass in Masoala. Unfortunately, they are given almost no voice in the decision making process.

Conclusion

As a researcher attempting to both understand and further contribute meaningful ideas to a target issue, the most continual problem is of balancing the topic so that all relevant pieces are included without getting so lost in the nuances that conclusions are unable to be reached. I have found this to be a continual learning process throughout my fieldwork. While I cannot be certain I found the right balance, based on my experience I believe that successful species based conservation requires active and equal participation towards a common goal by all actors. The red ruffed lemur, the image of conservation and development in Masoala National Park, seems more of a pivoting point for actors to defend their individual goals rather than focus for a unified attempt to preserve the biological richness found there.

Note

[1] Association Nationale pour la Gestion des Aires Protégées

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Wolves in Agricultural Landscapes in Western India

Meghna Agarwala, MESc 2009 *and* Satish Kumar

Introduction

Imagine an open savanna. Antelope roam free, migrating with the seasons. Males guard their lek patches —areas for mating displays — as females idly graze. Stalking them stealthily are wolves, lions and cheetahs. All of this happens to a soundtrack of whistling wind and peacock calls.

Now, imagine the savanna is gone. There are people everywhere with crop fields, mills, and mines. Antelopes are so few in number that spiritual ascetics, famed for meditating on blackbuck skin, have to import deerskin to sit on (Rangarajan, 2001). The Asiatic lions are gone, restricted to a small population over 1,200 kilometers away. Asiatic cheetahs are extinct in India; their only population survives in Iran.

Figure 1. An Indian wolf *(Canis lupus pallipes)*

Yet, wolves are still here. These are not the large grey wolves we see in Arctic documentaries. The Indian wolf, *Canis lupus pallipes* (Figure 1), is a small sub–species of the grey wolf (Nowak, 1995) that separated from the main evolutionary branch 800,000 years ago (Sharma et al., 2004). Scientists are unsure of their total population numbers, but estimate that fewer than 3,000 individuals remain in the entire country (Jhala, 2000). For comparison, in the nineteenth century wolves were so numerous that over 200,000 skins were collected between 1875 before 1925 (Rangarajan, 2001). The Indian government has given the Indian wolf the highest protection status possible by listing it in Schedule 1 of its Wildlife (Protection) Act of 1972.

These wolves remain where their natural habitat of grasslands and open forests have been largely converted to agricultural fields. How do they survive? What do they eat? Where do their pups grow up? How do they co-exist with humans? In this paper I examine what factors influence wolf persistence in a disturbed and fragmented environment.

Wolves and Protected Areas

Throughout India pristine habitat has shrunk. Remaining patches are isolated (DeFries et al., 2005), separated by millions of humans and their livestock. India's protected area system aims to represent diverse habitat types and includes several patches of land with grasslands and open forests. However, wolves face a unique problem in India. In the western world, wolves symbolize wilderness and nature; as the top predators they are often flagship species for the conservation movement. In India, elephants, tigers, lions, and rhinos attract most attention, placing wolves lower on the priority list.

Of the 617 protected areas, there is only one for wolves (Singh and Kumara, 2006) — the Melkote Temple Wildlife Sanctuary. Its size is unexceptional at 49 square kilometers given that the average size

Figure 2. Map of Maharashtra in Western India, with Solapur District highlighted. Source: Geographical Survey of India.

for protected areas in India is 200 to 250 square kilometers (Marcot, 1992). Moreover, wolf territories range from 180 square kilometers (Jhala and Giles, 1991) to 300 square kilometers (Singh and Kumara, 2006). For wide–ranging carnivores, protected area networks are simply inadequate (Woodroffe and Ginsberg, 1998; Linnell et al., 2001), except as breeding centers (Jhala and Giles, 1991). Furthermore, competition with and predation by other predators (Karanth and Sunquist, 2000) has pushed wolves towards the edges of these protected areas. Notably in Melkote Sanctuary, leopards have colonized the sanctuary and no wolves remain (Singh and Kumara, 2006).

As India's population continues to grow, there is increasing demand and pressure for land. The country is also in the process of implementing the Forest (Dwellers) Rights Act 2006, expected to lead to de–notification of several existing protected areas. Thus, Indian wolves are partially excluded from the protected area system and a need exists to protect them in their current primary habitat: agricultural fields.

Wolves and Agriculture

Wolves have recolonized in parts of USA because of legislation that protects large carnivores and reforestation efforts (Linnell et al., 2001; Mladenoff et al., 1997). Further, wolves' ability to live in many habitats (Mladenoff et al., 1995), resilience to disease and human persecution (excluding use of poison),ability to move to new areas (Jhala, WII) live in agricultural fields (Jhala and Sharma, 1997) bodes well for their recovery. Fortunately, in India, endangered species are given complete protection by law inside and outside protected areas (Karanth et al., 1999) and relocation by people is the preferred resolution even for problem carnivores (Karanth et al., 1999; Chellam and Johnsingh, 1993; Karanth and Madhusudan, 2002). Thus, effective management outside protected areas can be envisioned for wolves.

However, in any ecosystem even moderate habitat destruction is predicted to cause a delayed but inevitable extinction of the dominant species (Tilman et al., 1994). This extinction may occur generations after habitat destruction (Burkey, 1995, Brooks et al., 1999, Hansen and DeFries, 2007). Thus, current or past habitat destruction of the savannah can cause wolves a future ecological cost, known as extinction debt (Tilman et al., 1994). However, the original model considered all altered sites as permanently unusable by the original species, an assumption that is not necessarily true. Species differ in their ability to live in different types and intensities of human land use (Hansen and DeFries, 2007). Indian wolves may be able to survive by living in agriculture lands, thus escaping extinction debt.

This research aimed to understand this continuing existence of wolves in altered habitat. The objectives of this study were: (1) Identify habitat features necessary for the continued existence of wolves in agricultural landscapes; (2) Analyze the role of human attitudes, culture, and compensation schemes in enabling wolf existence; and (3) Develop a model that would investigate whether external subsidies reduce vulnerability to extinction debt. This paper examines the first point.

Study Site

The study was conducted in semi-arid and drought-prone district of Solapur in Maharashtra, western India (Figure 2). Annual rainfall is low (569 mm) and concentrated during the monsoon season from June to October (496 mm) (Indian Meteorological Survey, 2007). Crops grown in the region are sorghum, barley, pigeon pea and groundnut, with wheat cultivation during rainy years, and sugarcane and pomegranate cultivation in irrigated areas.

Part of the study site was also located within Great Indian Bustard Sanctuary. Although designated as a sanctuary, most of the land is privately owned and managed. The Forest Department owns scattered patches of land (30 hectares to 300 hectares) both in the four *tehsils*, or counties, comprising the sanctuary and in adjacent *tehsils*. While some of these protected areas remain as grasslands, most of these have been converted into tree plantations of Babool *(Acacia catechu)*, Neem *(Azadirachta indica)* and an exotic species *(Gliciridia sepium)*.

The Maharashtra Forest Department began implementing a livestock compensation scheme for carnivore depredation in 2001 and a compensation scheme for crops damaged by blackbuck *(Antelope cervicapra)* or wild boar *(Sus scrofa)* in 2008.

Methodology and Research Design

The study site was divided into three groups: Karmala, Solapur, and Sangola (Figure 3), each with several randomly selected sampling units. One sampling unit comprised of one cluster of plantations, and its adjacent croplands, grazing lands, and villages. A sampling unit generally contained one or two villages and a few sub–villages.

Field surveys of tree and grass cover, density, and diversity , bedrock cover in plantations, grazing areas, and croplands were undertaken at each sampling unit. We quantified wolf scat, blackbuck territory markings, and disturbance in the form of cattle grazing. We also attempted to find wolf dens at each sampling unit.

We conducted 164 interviews quantifying livestock depredation by wolves, crop depredation by blackbuck, use of a compensation scheme, livestock mortality, and carcass availability for scavenging. Information was collected on perceptions of wolves, blackbucks, and compensation schemes. We interviewed people about traditional management of wildlife damage. Finally, we obtained information on seasonal abundance of wolves, blackbuck and wild boar.

Data on wolf presence was obtained from five radio–collared wolves from May 2002 until December 2004, in Solapur Group. Habitat study was extended beyond the Solapur Group to obtain a spatial scale where it would be possible to understand the ecosystem (DeFries et al., 2004) and identify sites where wolves were absent. Since annual Forest Department census was unavailable for sites of wolf absence, we calibrated both census and interview data against telemetric data.

Satellite images (LANDSAT) and maps from Geographical Survey of India and Geological Survey of India were used to identify distribution of plantations, grazing areas, crop diversity, water resources, soil diversity and potential disturbances such as industries. These classifications were verified by field surveys conducted from June to August 2008.

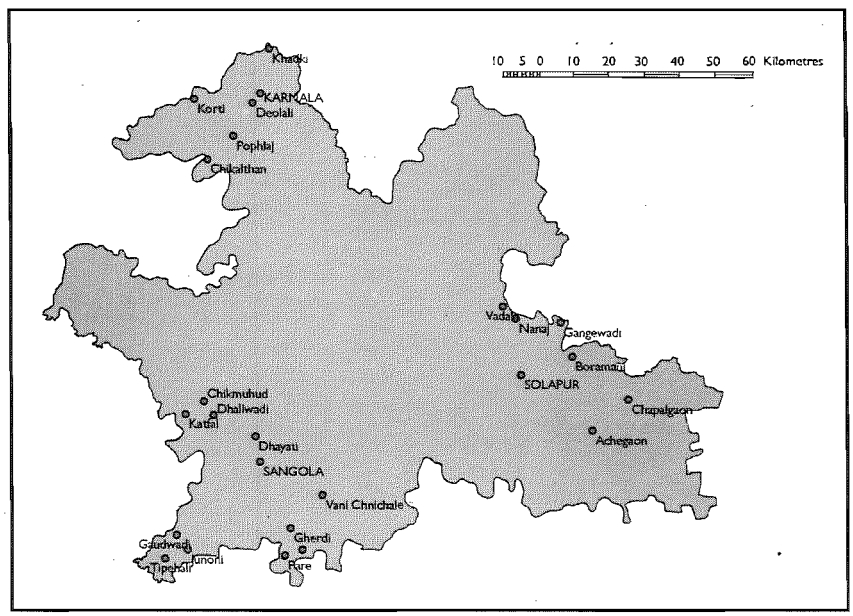

Figure 3. Sampling sites in Solapur District.

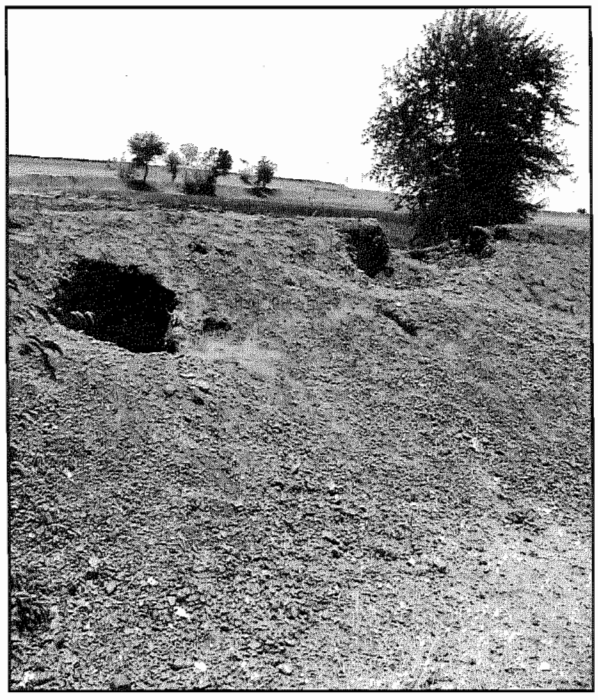

Figure 4. A wolf den at Mardi in a man-made berm dividing agricultural plots.

Results and Discussion

We found wolves present on tree plantations, in grazing areas and in rainfed agriculture areas, although wolf abundance varied with proportion of land use. Wolves had low abundances and only seasonal presence in more intensively cultivated agriculture areas under canal irrigation.

Denning sites

Surprisingly, this study found more wolf dens in man-made features and fewer dens in less disturbed plantations (Figures 4 and 5). Only three of eight dens used natural features, including both the dens located inside plantations, where access is restricted, and one den located outside the plantations whose terrain made access difficult. Wolves prefer remote areas that are free from disturbance as denning sites (Habib and Kumar, 2007). Tree plantations are protected and have access restricted, making them relatively free of disturbance compared to the surrounding agriculture. Yet, even in proximity to a plantation wolves built dens outside them.

Protected areas are often located in relatively harsh biophysical and less productive settings (Scott et al., 2001; Hansen and DeFries, 2007). In the study area, plantations had statistically significant more rock cover than adjacent areas. It appears possible that wolves (and foxes, whose dens they enlarge) find it difficult to dig dens in rocky plantation surfaces, and have to venture outside to crop-fields. The authors recommend further studies to confirm this observation. Further, berms within plantations are constructed with stone. Construction of cheaper earthen berms alongside traditional stone berms within plantations could significantly reduce den disturbance.

Prey Abundance and Scavenging

In this study, wolf abundance did not correlate with blackbuck population abundances. This was not surprising as wolves are present in the Sangola Group where no blackbuck are reported (Figure 6). However, wolf abundance was also independent of populations of small livestock such as goat and sheep. This lack of correlation is surprising because wolves are traditionally limited to small livestock prey. Wolves are unable to drag away carcasses of larger livestock, such as cattle. Yet, nearly 16% of wolf scats contained cattle remains, while wolves only hunted cattle 4% of times they hunted livestock. Logically, by excluding blackbuck, percentage of cattle hunting should be higher than 16%.

Interviews revealed that cattle are buried 80% of time and thrown out 15% of time. Wolves may be scavenging on discarded carcasses or digging up

Group	Sampling Unit	Den	Position	Natural	Land-use	Dist. to PA (m)	Dist. to road (m)
Sangola Group	Junoni	Junoni	Ridge	Natural	Plantation	0	500
	Haldahivade	Haldahivade	Berm	Natural	Plantation	0	200
Karmala Group	Poplaj	Poplaj	Berm	Man-made	Cropland	500	150
	Kada	Kada	Culvert	Man-made	Cropland	5000	15
Solapur Group	Nannaj	Nannaj	Ground	Natural	Grazing Land	690	915
		Mardi	Berm	Man-made	Cropland	150	43
	Achegaon	Achegaon	Berm	Man-made	Cropland	2000	285
	Sangvi	Sangvi	Berm	Man-made	Cropland	0	1131

Figure 5. Results of the wolf den study. PA refers to a protected area, whether plantation or grassland.

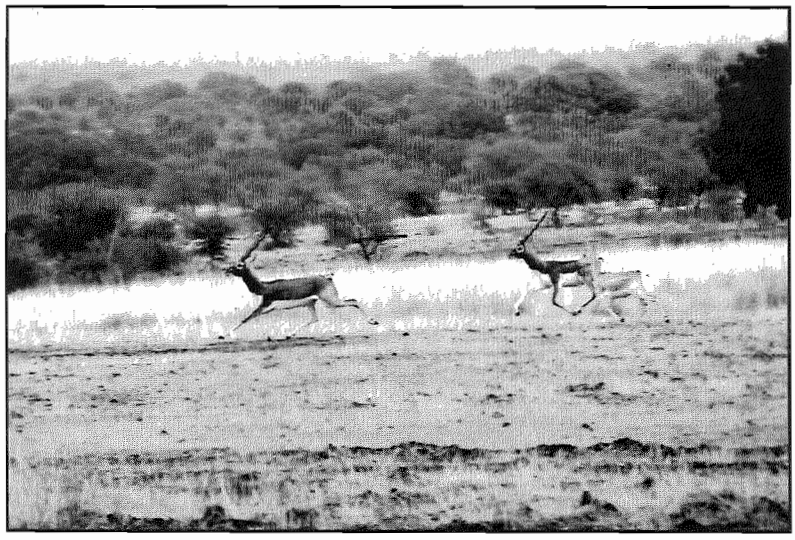

Figure 6. Blackbuck *(Antelope cervicapra)* are a major prey of wolves but are completely absent in some areas where wolves are found.

buried carcasses as reported from Europe (Meriggi and Lovari, 1996; Corsi et al., 1999). Although no scavenging has been reported from the study area yet, scavenging may account for the lack of relationship between wolf abundance and small livestock populations.

Human density and land-use

Wolf abundance was independent of human population density in this study. Woodroffe's (2000) claim that higher population density increases risk of carnivore extinctions has been intensely debated (Linnell et al., 2001). However, Woodroffe found no relationship between human population density and lion and cheetah extinction in India, and credited this to a more tolerant attitude towards carnivores. This train of thought is reflected in several analyses, which consider resource management prior to colonial rule as static and ideal (Rangarajan, 1996), and dependent on mutual tolerance based on centuries of coexistence.

However, India has not been an over-populated country with intensive resource management for long, which would necessitate this alternate reasoning for coexistence of wildlife. India's population in 1920 was 73 people per square kilometer and rapidly increased to 349 people per square kilometer in 2001. Therefore, independence of human and wolf density may be temporary. It is possible that wolf abundance will decline and exhibit an inverse relationship with human density in the future.

Conclusions

Wolf dependence on humans for suitable den sites and prey shows that animals appear to be adjusting to the available habitat. In the absence of more suitable habitat, this study clarifies some steps that would improve existing wolf habitat. However, we are still unsure if survival of wolf is temporary due to dual threat of further alteration of agricultural habitat and the existential threat of extinction debt.

Data analysis was incomplete at the time of this publication. For more results, see *Biological Conservation*, Special Issue, September 2009.

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Announcing the 2009-2010 Fellows

This year, TRI Fellows have again an exciting line up of research projects around the world. TRI Endowed Fellowships are designed to support Masters and Doctoral students who conduct independent research in tropical countries. This year 36 students received TRI Fellowships for summer research. The 2009 recipients and the countries in which they plan to conduct research are:

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Bidisha Banerjee, India
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Hui Cheng, Taiwan
Jeffrey Chow, Bangladesh
Will Collier, Kenya
Kristofer Covey, Bhutan
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Heather McCarthy, Brazil and India
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Nashaat Mazrui, Kenya
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