

Resource Stewardship: Rain Forest Use among Three Ethnic Groups of Ecuador

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1. INTRODUCTION

How to incorporate the people who live within a reserve while achieving conservation goals is a challenge with which governments and conservationists are working throughout Latin America and the world (Southgate 1998). This question is particularly pressing in The Mache-Chindul Ecological Reserve in northwestern Ecuador (Figure 1). This area encompasses land considered to be part of one of the global hot spots of biodiversity (Dodson and Gentry, 1991). These western forests have high degrees of endemism, and only about 5% of this kind of forest remains in Ecuador (Neill, 2006). Additionally, since numerous people live in and around this area, the indigenous Chachi, *mestizos*, and Afro-Ecuadorians, successful protection with sustainable resource use by its residents is the aim of both development and conservation organizations (Aguirre *et al.*, 2000).

Conservationists and developers are looking at Non-timber forest products (NTFP) as a possible option for sustainable forest use (Coomes, 2004). However, in looking at alternative forest use, it is imperative that the sustainability of these "alternatives" is addressed. The two plant resources on which this study focuses, a palm and a hemi-epiphyte (a vine-like plant that germinates in the ground, grows up a tree, and then sends down aerial roots), can be harvested in such a way that the plant continues to grow after harvested parts have been removed. Thus, these two plants are potentially sustainable resources.

This study questions the idea that non-indigenous groups are more detrimental to the forest than are indigenous people (Rudel *et al.*, 2002). This qualitative study falls into the body of research in which various authors have questioned the concept that indigenous people are inherently conservationist in nature. Examples include articles which discuss the pre-Colombian indigenous mark on the landscape as a result of opportunistic land use and large populations of indigenous people. Denevan (1992) argues that the landscape may have reflected more effects from humans when only the indigenous people populated the Americas. Mann (2005, 2002), in popular literature has also made a convincing argument that pre-Colombian indigenous people affected the landscape more than previously believed.

In order to look at the reality of indigenous land use, it is helpful to discuss Johnson's (1989) article on the Amazonian group, the Machiguenga. Johnson believes that although the Machiguenga do have a minimal impact on their environment, this is not the result of a conscientious attitude towards nature. Their effect stems from their low population density. Johnson writes that the Machiguenga are living below carrying capacity and that this allows immediate cost-benefit analysis to determine their resource use: "People invest in resource management when they must do so in order to survive at an adequate subsistence level" (Johnson, 1989). Yost, an anthropologist who has lived among the Huaorani came to similar conclusions. He explained that: "Harming the forest is an impossible concept for them. In a world of abundance, the word 'scarcity' has no meaning" (Yost, cited in Davis, 1996, p. 294). Further demonstrating the complexity of ethnicity and immigration in terms of forest stewardship, the Atran *et al.* (1999) study found that although the native Maya practiced the most sustainable practices in Guatemala, Spanish-speaking immigrants were more akin to the latter group's practices, than immigrant indigenous groups.

This paper looks at the concept that resource use does not fall along previously conceived notions in relation to ethnicity, and also addresses the line of thought that little difference exists in resource use between groups (Byg *et al.*, 2006). As *mestizos* and Afro-Ecuadorians continue to occupy forested reserves, it is increasingly important to better understand how both indigenous and non-indigenous groups utilize the land and resources on which they settle. Also, when analyzing the data for sustainable and unsustainable practices, it is necessary to include external factors that can influence behavior. Thus, this paper briefly addresses some of these aspects: 1) Non Governmental Organization (NGO) and government participation ; 2) the amount of land to which each group has access; 3) the prominent use of a different plant by a local indigenous group, the Chachi (in addition to the two plants on which this study focuses). When looking at all of these factors, especially that in certain areas indigenous people receive different kinds of assistance from NGOs and the government than other groups, important new ways of looking at how assistance is allotted can be explored.

2. STUDY AREA AND ETHNOHISTORY

The Mache-Chindul Ecological Reserve in northwest Ecuador covers the southwestern part of the Esmeraldas province and the northern part of the Manabí province (Figure 1). According to the Holdridge (1967) scheme of ecosystem classification, the forest type for most of this area is considered lowland moist to wet forest, characterized by tall, dense, and evergreen vegetation. Between 2,000 and 3,000 mm of precipitation fall in the region each year; topographical relief ranges from 0 to 800 m (Neill, 2003).



FIGURE 1
ECUADOR AND LOCATION OF MACHE-CHINDUL ECOLOGICAL RESERVE

Three groups of people live in and around the reserve, Afro-Ecuadorians, *mestizos*, and the indigenous group, the Chachi. Approximately 7,600 Chachi live in the Esmeraldas province who originally came from the highlands on the western slopes of the Andean

Cordilleras, near to Ibarra (Medina, 1997). The Chachi eventually migrated to the lowlands, where they settled into three distinct sites, one of which falls in the Mache-Chindul Reserve region (Alarcón, 2000). In the late 1940s a group of Afro-Ecuadorians migrated inland, arriving at what is now the Mache-Chindul Ecological Reserve. The *mestizos* were the last group to arrive in the area, beginning in the 1950s. Their numbers continue to grow as more *mestizos* colonize the area. Most *mestizos* are migrating from the provinces of Loja and Manabí (INEFAN, 1999).

3. METHODS

The purpose of the research is to provide a better understanding of the ways in which different ethnic groups utilize their natural resources, particularly in reference to sustainability. I conducted interviews with 26 families: 11 *mestizo*, nine Afro-Ecuadorian, and seven Chachi. There are 31 communities, 760 families, and about 6,000 people in the 111,000 ha reserve. Three of these communities are Chachi, three Afro-Ecuadorian, and 25 *mestizo*. The interviews took place over a one-year period, from December 2000 to December 2001. The *mestizo* communities included Cuadrado, Perrera, Tigrillo, and San Pedro. The Afro-Ecuadorian informants were from the community of Chiva, and the Chachi are from the community of Río Bravo (Figure 2).

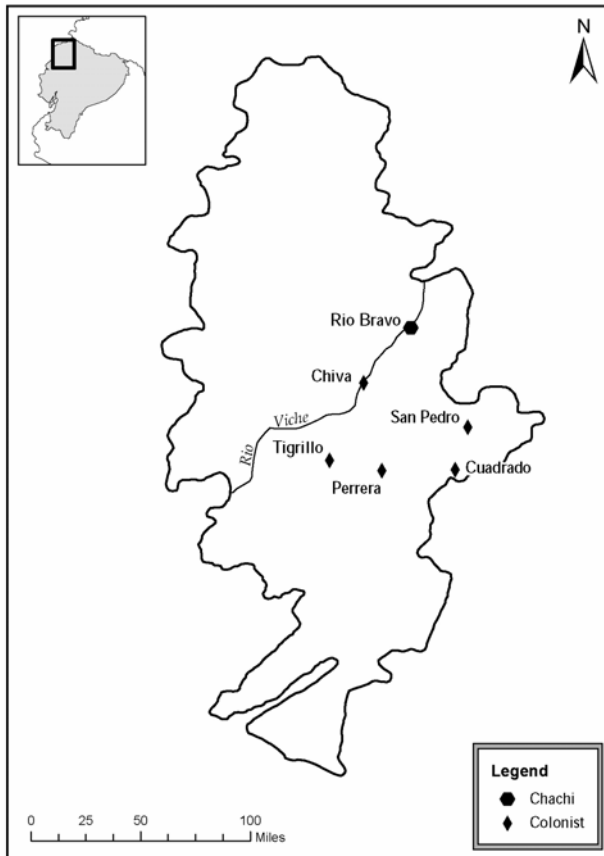


FIGURE 2
STUDY COMMUNITIES, MACHE-CHINDUL ECOLOGICAL RESERVE

The two study plants are used primarily for weaving, thus, criteria for choosing communities included locations where recognized weavers lived. I attended community meetings in order to introduce the project. Selection of families was purposefully nonrandom. I chose households where one skilled weaver lived. All interviews were conducted with informed consent, either in Spanish (spoken by researcher) or with an interpreter for the indigenous language of Chapala'achi. To protect the privacy of the participants, the names of individuals and communities have been changed. Each discussion began with outlining the objectives and procedures of the interview (Fraser *et al.*, 2006). Topics covered included what forest resources were most important, how the communities use, collect and prepare these materials, and the current and historical sense of resource availability. Additionally, I helped with weaving and processing of material, and accompanied the informants on collecting trips, engaging in aspects of participant observation (Bernard, 2002).

Most interviews were semi-structured, with my asking each informant similar questions in a conversation format that did not involve a structured set of questions (Bernard, 2002). The benefit of this method is that discussion could follow the lines of thinking introduced by the informant and some of my questions were then influenced according to the interest and expertise of the person being interviewed (Fraser *et al.*, 2006). Therefore, although the general topic was introduced by the researcher, the detailed research categories came from the informants (Telfer and Garde, 2006). This qualitative method cannot be analyzed with statistics, because not all informants received the exact same questions. However, although not making concrete generalizations, through the repeated in-depth interviews carried out over a lengthy period of time, collective views can emerge from which patterns and results can be understood (O' Brien, 2006).

4. RESULTS

All three groups identified a palm and a hemi-epiphyte as the most important forest plants. The first study plant, *mocora* (*Astrocaryum standleyanum*) is a palm with a solitary, stout, subcanopy stem 8-15 m tall and 16-22 cm diameter. Flattened spines that may reach 20 cm in length protect the trunk and the leaflets. It grows most commonly in lowland rainforests, usually below 200 m elevation but can be found up to 500 m (Henderson *et al.*, 1995). The distribution ranges from Panama to Ecuador. The most important use for the *mocora* is mat weaving. The locals collect the innermost leaves and weave these into mats on which almost all *mestizo* and Afro-Ecuadorians, and some Chachi, sleep. Although this is the first study of the *mocora* in the Mache Chindul Ecological Reserve, the palm is also important for *mestizo* use in the coastal plains of Northwest Ecuador (Pedersen, 1994) and for basketry for the Wounaan and Emberá in Panama (Velasquez-Runk, 2001). People also consume the fruits.

The second study plant, *piquigua* (*Heteropsis ecuadorensis* Sodiro) is a secondary hemi-epiphyte (Mori *et al.*, 2002), with oblong-lanceolate, alternate simple leaves arranged in flat rows along both sides of the stem (Ray, 1992). *Heteropsis ecuadorensis* Sodiro is endemic to Ecuador, growing in the Pacific Coastal and Amazonian rainforests (Valencia *et al.*, 2000). *Piquigua*, is part of the genus *Heteropsis*, which is found throughout Latin America, and numerous groups find it useful (*e.g.*, Goncalves, 2005). The most common and widespread items made from *piquigua* in the Mache-Chindul region are baskets. People also make brooms, bottle holders, and hats, and use the root as twine for lashing (Alarcón, 2000; Barrett, 1994; Fadiman 2007). There is also a commercial market for *piquigua*. Middlemen will buy the roots, who will then sell them to furniture makers. *Mestizos* and Afro-Ecuadorians participated in this economic activity to a limited extent, while the Chachi rarely, if ever, collected *piquigua* to sell (Fadiman, 2007).

These two plants form the basis of the study, since the majority of the residents interviewed in the Mache-Chindul Ecological Reserve identified them as the most utilized forest plants. The indigenous group, the Chachi, also speak of the plants' importance. However, among those interviewed, these plants play a lesser role for the Chachi than for the *mestizos* and Afro-Ecuadorians. This is mostly because, although the Chachi do use *mocora*

and *piquigua* they also use another fiber plant not specifically explored in this study, *rampira* (*Carludovica palmata* [Cyclanthaceae]) that the other groups do not utilize. How this specifically factors into the sustainability aspect, will be discussed later in the paper.

4.1 PLANT COLLECTING AND MANAGEMENT

One of the most important aspects that emerge in terms of sustainability has to do with how people collect the material. Weavers collect *mocora* using two distinct methods. For the *mestizos* and Afro-Ecuadorians, when the palm is still considered short, not having reached a height more than approximately three meters, they remove only the desired leaves by pressing a pole with a chisel blade attached at the end against the base of the leaf or fruit raceme. The *mestizos* and Afro-Ecuadorians specifically pointed out that they cut only every other spear leaf, and every other fruit raceme emphasizing that they need to leave enough leaves and fruit so that the palm continues to grow and reproduce. However, when a plant is too tall to use the pole, collectors fell the entire palm. The Chachi discussed that in their collecting practices, they almost always cut down the palms, irrespective of height. They say it is too difficult to avoid the spines in any other way. They also commonly cut down the palms in order to collect fruit.

Most *mestizos* and Afro-Ecuadorians prefer to collect from palms that they have left growing in their fields and pastures, because the plants are closer to the home. *Mestizos* and Afro-Ecuadorians all agree that they will collect from the forest if there is no available *mocora* material in the fields. The Chachi differ in that they prefer to collect from the forest.

Integral to collecting practices are management activities. The most common form of management for the *mestizos* and Afro-Ecuadorians is to leave palms in the fields. The farmers allow these plants to continue growing when they clear the forest for their farms, because these plants are so useful. As one *mestizo* colonist woman says, "You would be crazy to cut it down." The *mestizos* and Afro-Ecuadorians say that they leave *mocora* so that they will have access to the leaves (Fadiman, 2008). This also is the practice of those in Manabí, who maintain *mocora* for shade in agroforestry systems (Pedersen, 1994). The protection of species, by leaving them standing in otherwise cleared and planted fields, has been part of many agricultural systems, including those in North America (Doolittle, 2000), and specifically leaving palms in fields is common practice in lowland swidden agriculture (Padoch, 1987). The Chachi sometimes leave *mocora* standing when they clear forest for fields, but because of the spines, they will just as often cut them down. From observation, no *mocora* palms were seen in the Chachi fields, while many grew in the *mestizo* and Afro-Ecuadorian fields.

Piquigua roots grow in patches throughout the forest, and all three groups know of specific areas where they can collect. The *mestizos* and Afro-Ecuadorians will sometimes even search out a particular plant. The Chachi know areas as well, but their seeking out of locations was different. They were less specific, especially of individual plants. All groups locate areas where *piquigua* grows while pursuing other activities in the forest. They will then return to those places to collect at a later date.

Most *mestizos* and Afro-Ecuadorians have a few *piquigua* plants on their own land, often at least a half hour walk away. However, because the plants are scarce, people will travel to neighboring lands to collect as well. In theory, neighbors should not take resources from each other's land. However, people understand that this happens, and make allowances for such behavior. In the case of the Chachi, there are communal lands from which weavers can collect. It is common to walk between two and four hours to a collection site. Since they collect on an "as needed" basis, each collecting trip varies from the others. A common complaint among all groups is that they have to walk further today than in times past to obtain the material. A landowner confided that he was waiting for a specific root to mature, only to discover that it was later stolen. Another collector wrote his name on the root to claim it, although it was not even on his property.

The desired part of the hemi-epiphyte, *piquigua*, are the roots that grow from the canopy to the ground. Thus, collecting *piquigua* is quite different than harvesting palm fronds.

To collect *piquigua*, the harvester cuts the root at ground level with a machete, and then pulls. Skilled collectors snap the root in such a way so that the stem does not come down as well.

The *Mestizos* and Afro-Ecuadorians included in this case study were particularly conscious about protecting this resource. They exercise control in harvesting to prevent pulling down the stem. On one occasion, I witnessed a mother scolding her children for pulling too roughly and endangering the stem. On a different collecting trip, I watched a man make a ladder out of surrounding trees, so that he could reach up higher on the root and better control the connection to the stem. *Mestizos* and Afro-Ecuadorians also make a point to leave a sufficient number of roots growing from each stem, so that the plant maintains adequate connection to the ground and will continue to send down future roots.

Another form of management when clearing fields is to leave trees standing that have *piquigua* growing on them. These cultivators say that *piquigua* will only grow for a few years without the surrounding forest, but that it is worth it to save a tree that has *piquigua* growing on it for at least that amount of time. Furthermore, one *mestizo* family in San Pedro cleared an area of forest right up to where a *piquigua* patch grows. These farmers scouted the land beforehand, not wanting to clear where the hemi-epiphyte is present. They organized their forest cutting around the location of *piquigua*. Clearly, managing for the plant itself can involve larger scale conservation-oriented management of an entire section of forest (Fadiman, 2007). The Chachi, although they sometimes discussed the importance of these factors, rarely mentioned conservation issues in regard to *piquigua* and were far more zealous in their collecting. They pulled with little caution and took many more roots at one time. Often plants would tumble out of the tree tops. After a collecting trip, few if any *piquigua* roots would be left in the area from which the Chachi had harvested.

5. DISCUSSION AND CONCLUSIONS

In comparing use and collection between the three ethnic groups, the *mestizos* and Afro-Ecuadorians are more similar to each other than to the indigenous people, the Chachi. In looking at these distinctions in forest resource use, the principal contrast is that the Chachi collect both of these specific resources in a less sustainable way than do the *mestizos* and Afro-Ecuadorians. Furthermore, in terms of management, the Chachi also do not manage either plant to promote growth and permanence. On the other hand the *mestizos* and the Afro-Ecuadorians, do manage by leaving the palms in the fields and saving trees and section of forest in which *piquigua* grows

As noted by Pedersen (1994), and reinforced by my information, *mocora* can be harvested sustainably. When collecting palm resources with the pole and chisel method, both *mestizos* and Afro-Ecuadorians have a clear preservation sentiment. The two groups collect in this way because of the understanding that it will maintain the palms' growth and thus the plant will continue to provide them with material well into the future. However, as mentioned, contradicting this careful resource use, both groups of *mestizos* and Afro-Ecuadorians will cut down the entire palm when it is more convenient. The Chachi differ from the *mestizos* and Afro-Ecuadorians in that they almost always cut down palms, and do not mention preservation strategies. And with *piquigua*, the conscientious efforts *mestizos* and Afro-Ecuadorians make to collect in such a way as to ensure that the plant remains in the tree, and to assure that there are enough roots that continue to keep the plant and the ground connected, are distinct from the indigenous group. The fact that the Chachi do not collect with these same criteria in mind, demonstrates a difference in the long term sustainability of these group's plant use.

5.1 EXTERNAL REASONS FOR COLLECTING DIFFERENCES

When finding results which indicate that one group collects more sustainably than another, it is important to look at the context in which these activities are occurring (Zambrana *et al.*, 2007). Below I outline the reasons why the groups' collecting patterns may differ from each other. In general, these distinctions appear to depend more on the availability and

importance of a resource, rather than on an inherent adherence to, or lack of, stewardship concepts.

Both resources are more available to the indigenous people than to the *mestizos* and Afro-Ecuadorians, simply because the Chachi have more forested land per person than do the non-indigenous groups. Because the Chachi do not have the same need to conserve, it is logical that these people would expend less energy in preserving these plants. They have little reason to collect more sustainably. This holds true to Johnson's statement "It [resource management] is not to be expected where access to abundant resources exist" (Johnson, 1989). This sentiment mirrors findings among the Amazonian Shuar and *mestizos* (Byg and Balslev, 2006).

Further adding to the sense of abundance, the Chachi do not rely on these plants as heavily as do the *mestizos* and Afro-Ecuadorians. One of the most important reasons why the Chachi may collect in a less careful manner is that they rely more heavily on another fiber plant *rampira*, *Carludovica palmata* Ruiz and Pavón (Cyclanthaceae), commonly known as the Panama hat palm. The Chachi use the petioles to weave baskets and mats. The Chachi do say that *mocora* is softer for mats, and that *piquigua* is more durable for baskets, however, this group has traditionally used *rampira*, and are more accustomed to this material, and finds it easier to collect and work. Thus, because the study plants do not play as central a role in Chachi livelihood, this group has fewer reasons to be as concerned about these plants' maintenance.

As with the Chachi's apparent lack of conservation ethic because of a tradition of access to abundant resources, the *mestizos* and Afro-Ecuadorians' preservationist attitude may come from a present need coupled with a history of resource depletion. The *mestizos* and Afro-Ecuadorians have come to the Mache Chindul area because there was not enough land on which to farm in their previous homelands. Because these more recent arrivals have already had to leave an area as a result of resource depletion, the *mestizos* and Afro-Ecuadorians may have a greater consciousness about preserving the forest, or at least these species, than the indigenous people of the region who have never experienced this deficit.

Another contributing factor to the differences in collecting practices is that the NGOs and government programs that work in the area concentrate on Chachi economics, not on environmental issues. Most NGOs for the Chachi begin programs such as chicken houses, traditional cloth belt weaving projects, local banks run by the women, and stores that provide basic foods and fuels. In contrast, the few NGOs that work with the *mestizos* and Afro-Ecuadorians emphasize the environment (INEFAN 1999).

5.2 ETHNIC IMAGES IN RELATION TO RESOURCE USE

The fact that the Chachi harvest these plants more destructively than the *mestizos* and Afro-Ecuadorians should not be used to denigrate indigenous practices. This reality can serve indigenous and non-indigenous people and the forest in two ways. Initially, conservation, development, and government groups can organize their programs more effectively when they understand the motivations and activities of the people with whom they are working. The myth of the ideal, conservation-minded indigenous person is not an advantageous image to the people living in forested regions. Indigenous groups should not be held to different standards of behavior than other people because of their way of life. Nor should help in any way be denied to them, because they do not live up to a mythical ideal of comportment (Posey, 1992). This study helps to portray both the *mestizos* and Afro-Ecuadorians and the Chachi for who they are and how they function. These realities can help conservationists and other interested parties effectively target programs that benefit the real people who live on the land, and the land itself.

Secondly, the realization that in certain instances newer immigrants are actually more environmentally conscious than indigenous people in the same area may reduce some of the criticism that non-indigenous people traditionally receive about their forest practices (Browder 1995). I am not arguing that *mestizos* and Afro-Ecuadorians are more environmentally conscious than indigenous people, nor that *mestizos* and Afro-Ecuadorians use the forest

carefully in every way in Mache-Chindul Ecological Reserve. In fact, they have many destructive practices, such as clearing the land for farming, logging until recently, and having detrimental collecting habits of other forest resources not explored in this work. I am saying that they are at least as important in the reserve as are the indigenous groups who currently receive more benefits than the *mestizos* and Afro-Ecuadorians, however. Perhaps *mestizos* and Afro-Ecuadorians could be more included by local NGOs and governments. Furthermore, perhaps some of the conservation efforts currently geared towards the *mestizos* and Afro-Ecuadorians could extend to the Chachi, giving all groups equal opportunities to gain forest use and preservation knowledge.

In looking at the case study of these three groups' uses of a resource in an ecological reserve, the sustainable collection practices and possibilities, and the realization that ethnic differences do not always break down as expected, we are better able to understand aspects of tropical forest use and misuse. Further research can include *mestizo*, Afro-Ecuadorian, and Chachi use of other commonly utilized plants, in order to see if the trends discovered in this case study hold true for other plants. Furthermore, research in additional places throughout the region can help add to the understanding of these three groups and their forest use.

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7. REFERENCES

- Alarcón, H.P. 2000. *Diseño Final del Subproyecto de Aapacitación y Comercialización de Artesanía Chachi de La Zona Norte de La Provincia de Esmeraldas*. Esmeraldas: FECHE.
- Atran, S., D. Medin, N. Ross, E. Lynch, J. Coley, E. Ucan Ek, and V. Vapnarsky. 1999. Folkecology and commons management in the Maya Lowlands. *Proceedings of the National Academy of Sciences, USA* 96:7598-7603.
- Barrett, S.A. 1994. *Los Indios Cayapas del Ecuador*. Quito: Abya-Yala.
- Bernard, H.R. 2002. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. 3rd ed. Walnut Creek: Altamira press.
- Pedersen, B. 1994. *Mocora* Palm-Fibers: Use and Management of *Astrocaryum standleyanum* (Arecaceae) in Ecuador. *Economic Botany* 48(3):310-325.
- Byg, A., J. Vormisto, and H. Balslev. 2006. Using the useful: characteristics of used palms in south-eastern Ecuador. *Environmental Development and Sustainability* 8:495-506.
- Byg, A., and H. Balslev. 2006. Palms in indigenous and settler communities in southeastern Ecuador: farmers' perceptions and cultivation practices. *Agroforestry systems* 67:147-158.
- Browder, J.O. 1989. Introduction. In: *Fragile Lands of Latin America: Strategies for Sustainable Development*, 1-3. J.O. Browder, ed. Boulder: Westview Press.
- Coomes, O.T. 2004. Rain forest 'conservation-through-use'? Chambira fibre extraction and handicraft production in a land-constrained community, Peruvian Amazon, *Biodiversity and Conservation* 13(2):351-360.
- Davis, W. 1996. *One River*. New York: Simon and Schuster.
- Denevan, W. 1992. The pristine myth: The landscape of the Americas in 1492. *Annals of the Association of American Geographers* 82(3):369-385.
- Dodson C.H., and A.H. Gentry. 1991. Biological extinction in western Ecuador. *Annals of the Missouri Botanical Garden* 78:273-295.
- Fadiman, M. 2007. Exploring conservation: *Piquigua, Heteropsis ecuadorensis*, in Ecuador. *Papers of the Applied Geography Conferences* 30:427-436.

- Fadiman, M. 2008. Use of *Mocora*, *Astrocaryum standleyanum* (Arecaceae), by three ethnic groups in Ecuador: differences, similarities and market potential. *Journal of Ethnobiology* (in press).
- Fraser, D., T. Coon, M.R. Prince, R. Dion, and L. Bernatchez. 2006. Integrating traditional and evolutionary knowledge in biodiversity conservation: A population level case study. *Ecology and Society*. 11(2):4. [http://www.ecologyandsociety.org/vol11/iss2/art4/].
- Goncalves, E. 2005. Araceae from central Brazil: Comments on their diversity and biogeography. *Annals of the Missouri Botanical Garden* 91(3):457-463.
- Henderson, A., G. Galeano, and R. Bernal. (1995). *Field Guide to the Palms of the Americas*. Princeton: Princeton University Press.
- Holdridge, L. 1967. *Life Zone Ecology*. San Jose: Tropical Science Center.
- Instituto Ecuatoriano Forestal y de Areas Naturales (INEFAN). 1999. *Estudio de Alternativas de Manejo para Las Montañas de Mache, Provincia de Esmeraldas, Ecuador*. Quito: INEFAN.
- Johnson, A. 1989. How the Machiguenga manage resources: Conservation or exploitation of nature? *Advances in Economic Botany* 7:213-222.
- Mann, C.C. 2005. *1491: New Revelations of the Americas before Columbus*. New York: Knopf Publishing.
- Mann, C.C. 2002. 1491. *Atlantic Monthly* 289(3):41-53.
- Medina, H.V. 1992. *Los Chachi: Supervivencia y Ley Tradicional*. Quito: Abya-Yala.
- Mori, S., E. Hecklaur, and T. Kirchgessner. 2002. Life form, habitat and nutritional mode of the flowering plants of central French Guiana. *Journal of the Torrey Botanical Society* 129(4): 331-345.
- Neill, D. 2006. Missouri Botanical Garden Ecuador Vegetation Page. [Http://www.mobot.org/MOBOT/research/ecuador/vegetation.shtml](http://www.mobot.org/MOBOT/research/ecuador/vegetation.shtml). Last Accessed 26 May 2006.
- O'Brien, E. 2006. A questions of value: what do trees and forests mean to people in Vermont? *Landscape Research* 31(3):257-275.
- Posey, D. 1992. Interpreting the "reality" of indigenous concepts. In: *Conservation of Neotropical forests*, 21-34. K. Redford and C. Padoch, eds. New York: Colombia University Press.
- Ray, T.S. 1992. Foraging behavior in tropical herbaceous climbers (Araceae). *Journal of Ecology* 80:189-203.
- Rudel, T., D. Bates, and R. Machinguishi. 2002. Ecologically noble Amerindians? Cattle ranching and cash cropping among Shuar and *Mestizos* and Afro-Ecuadorians in Ecuador. *Latin American Research Review* 37(1):144-159.
- Southgate, D. 1998. *Tropical Forest Conservation: an Economic Assessment of the Alternatives in Latin America*. New York: Oxford University Press.
- Telfer, W.R., and M.J. Garde. 2006. Indigenous knowledge of rock kangaroo ecology in western Arnhem Land, Australia. *Human Ecology* 34(3):379-406.
- Valencia, R., N. Pitman, S. León-Yáñez, and P. Jørgensen. 2000. *Libro Rojo de las Plantas Endémicas del Ecuador*. Quito: Hojas y Signos.
- Velasquez-Runk, J. 2001. Wounaan and Emberá use and management of the fiber palm *Astrocaryum standleyanum* (Arecaceae) for basketry in eastern Panama. *Economic Botany* 55(1):72-82.
- Zambrana, N., B. Byg, J. Svenning, M. Moraes, C. Grandez, and H. Baslev. 2007. *Biodiversity and Conservation* 16:2771-2787.