

February 2019

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### Recommended Citation

Shenton, Jeffrey T.. "Going to School in the Forest: Changing Evaluations of Animal-Plant Interactions in the Kichwa Amazon." *Journal of Ecological Anthropology* 20, no. 1 (2018): .

Available at: <https://digitalcommons.usf.edu/jea/vol20/iss1/4>

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### Cover Page Footnote

Funding for this research was provided by an International Institute of Education Graduate Fellowship for International Study (awarded for 2011-2012), and a Vanderbilt University College of Arts & Science Summer Research Award (awarded for summer 2010). The author would like to thank Norbert Ross, Douglas Medin, Beth Conklin, Ted Fischer, Jamie Shenton, and the community of Sacha Loma for their support and inspiration. Thank you also to the co-editors of the Journal of Ecological Anthropology and to two anonymous reviewers for their suggestions in making substantial revisions to this manuscript. The research was carried out with approval from the Vanderbilt University Institutional Review Board. The author declares no conflicts of interest.

## DATA NOTES

## Going to School in the Forest: Changing Evaluations of Animal-Plant Interactions in the Kichwa Amazon



JEFFREY T. SHENTON

### ABSTRACT

*For rural indigenous communities, the ways structural modernization, exposure to Western-scientific epistemologies, and formal schooling affect environmental reasoning remain unclear. For one Kichwa community in the Napo region of Ecuador, daily routines have re-oriented toward formal schooling while environmental learning opportunities remain intact. Here, although a Species Interaction Task elicited consensus across ages on inferred ecological interactions, younger people reasoned differently than did older people: for youth, animal interactions with flora were considered damaging, not neutral. Aspirational practices like schooling can thus reorient environmental reasoning, even in contexts in which young people share cultural understandings of local ecological relationships with adults.*

### INTRODUCTION

We used to have collective work parties between neighbors. We would blow a horn [to call to one-another], we would kill animals from the forest, we'd plant rice, cacao, coffee—but moreso plantains and sweet manioc—and peach palm. Also pastureland for cows, but only for ourselves, not to sell the milk or meat. But not anymore—now we've stopped working, we're more used to village life, the farms are all abandoned, now we've sold all our cows. Now we just have coffee and cacao because of the kids. They're easier to raise if you don't go to the farm much.

The young woman who recounted this to me—Maximiliana,<sup>1</sup> a twenty-year-old Kichwa mother of a three-year old daughter—was speaking about

a transition that occurred in her own youth. By 2012, she and three generations of her family lived in a community of 18 nuclear families that formed an extended-family household cluster (in Kichwa, **ayllu llakta**) carved out of dense, hilly rain forest on the south bank of the Napo River in Eastern Ecuador. In 1992, with the blessing of the Ecuadorian government and funding from the United Nations International Children's Emergency Fund (UNICEF), an American-run non-governmental organization had shown up to make the community, Sacha Loma—the administrative hub of a network of 26 public schools along the Napo River corridor. When she was just a small child, her parents Pepe and Micaela made the decision to move from their farm—about one kilometer inland from the river—to the riverbank to send their children to school to avoid what

they described as the “treacherous” hour-long walk.

Previous work documenting intergenerational changes in ecological reasoning shows links between ecological knowledge and ecological reasoning. Ross (2002), for example, shows that of the two adult generations of Lacondon Maya in the community of Mensäbäk, Chiapas, Mexico, younger adults both *learn less* about their biotic environment, and also *learn differently*. These adult generations were different along many lines: while the older generation of adults came of age in a sparsely-populated forest context close to their agricultural fields and with full access to other ecological learning opportunities, the younger generation chose to live in a densely-settled community setting with running water and electricity. Their agricultural fields, if still maintained, were located far away and rarely visited.

Ross (2002:126) claims that younger adults have begun to give less credence to a traditional framework based upon “right behavior” guided by **hächäkyum**, the Lacandon Maya creator god, and were concomitantly ramping up the credence given to scientific epistemologies and local environmental non-governmental organizations. While Ross (2002:136) very reasonably attributes intergenerational ecological knowledge-reasoning linkages to disruptions in the ecological learning opportunities available to younger adults, in this manuscript I explore the possibility that ecological knowledge is subject to an ideological dynamism that is largely independent of its content. On this account, the ecological knowledge base is highly susceptible to changes in how knowledge *comes to be made sense of* for young people with new kinds of habitual routines that, while not wholly restructuring ecological “learning opportunities,” do implicate the value of local ecology in new ways. While people in Sacha Loma have changed their settlement patterns, they have not changed the fact that they still live *within* the rain forest. Maximiliana’s quote above, then, might be considered just as ideological as

it is factual: her comment reflects not the lack of opportunities to come into close contact with the local biotic world, but rather the reorientation of community-level habitual practice away from what she refers to as “work” (e.g., hunting and agricultural labor) in favor of “village life.”

## REORIENTING TO VILLAGE LIFE

To what is Maximiliana referring as village life? In 2012, Sacha Loma was not served directly by any roads and did not have access to Ecuador’s national electricity grid. All significant travel was by motorized canoe, and all electricity was produced with three diesel-powered generators. However, because young people attended school and adults had occupations that kept them within the community, for most residents an average day did not include travel into the forest. There were only three community households in which at least one of the parental adults did not have something other than forest work as their main occupation. These occupations included school janitor (three people), clinic intake nurse (one person), canoe driver (four people), schoolteacher (two people), store owner (three people), and eco-lodge cook (two people). Most adult women were charged with taking care of young children and performing housework. Though every family had farmland and both subsistence and cash crops, only one couple made farm work a daily, full-time occupation. The gravitational pull of the school’s “promise” has fundamentally restructured habitual environmental practice for all members of the community.

Though this community reorientation was far-reaching, it still took place in a context in which young people had consistent access to local biota. School standards, though, indexed a clear division between town activities and forest activities. Students traveling to school went to great lengths to stay meticulously free of the omnipresent rain forest mud, wearing a uniform that included a white polo shirt, dark blue dress pants for boys or skirt for girls, and black dress shoes. People going to their farms,

on the other hand, were readily apparent from their knee-high rubber boots and machete. Students' routines, however, still involved travel to farms and agricultural work during weekends and school breaks. Local plants and animals were also an unavoidable presence in the community and surrounding forest—sloths, large constrictor snakes, howler monkeys, pygmy marmosets, agoutis, giant earthworms, river dolphins, ocelots, otters, and all manner of birds and bats were just some animal kinds that I, as a semi-casual observer, witnessed in or around the community during my time there.

What Sacha Loma presents to the researcher interested in cultural formations of ecological understandings is a window onto the subtle reorienting effects that changes in habitual practice have on young learners making the transition to compulsory State-mediated schooling. This study examines one particular way in which students who are making this transition reinterpret their ecological context in a manner consonant with the new motivations and aspirations linked to school attendance. Foundational ethnographic work on the ways in which formal schooling functions as a State-mediated conduit to transmit a habitus particular to its vision of modernity has been conducted in the Ecuadorian Amazon (Rival 2002), and indicates that for the Huaorani, this habitus has come to convey prestige. On the flip-side, anthropological studies of environmental learning in children are few and far between (Zarger 2010), and studies that examine the intersection of environmental learning and culture change are even rarer. Reviewing this literature, Zent (2013:227) claims that the impact of formal schooling on environmental learning is inconsistent, with studies variously showing either knowledge loss or even enhancements in environmental knowledge. Zarger (2010:360) appreciates that schooling functions to radically restructure environmental learning opportunities for young indigenous people and—by linking the structure of such learning opportunities to processes of globalization—speculates that such reorientations in attention and learning should impact

what young people know about their local ecologies.

Here, I investigate the intersection of ecological knowledge, valuation of that knowledge, and the practice of schooling with a version of the Species Interaction Task (see, for example, Atran et al. 2002), which elicits patterns of ecological reasoning by asking participants to make causal inferences about hypothetical interactions between pairs of local species. While trivial to administer and for participants to understand, it is designed such that—because of the huge number of potential species interactions—it prompts respondents to generate an *ad hoc* inference of how the species *might* interact. The resultant patterns of reasoning, if consistent across sub-groups, should reveal broader cultural frameworks regarding the nature of ecological relationships.

## CONDUCTING THE STUDY

Stimuli consisted of ten animals and ten plants (100 pairings). The species chosen for the task were generated from a plant and animal free listing pilot task (see Table 1 for species list). The salience of the items in the task was ensured by including items that appeared on multiple free lists and asking about the participant's familiarity with each species before administering the task. Human being was also added to the animal list to interrogate understandings of human environmental influence on plant species. For each interaction, a three-part response was elicited in Spanish.<sup>2</sup> The animal-plant pair was presented to the participant, who was then asked whether the animal affects or doesn't affect (Spanish, *afecta o no afecta*) the plant. If the subject responded yes, the subject was next asked to indicate if the animal helps, hurts, or affects but neither helps nor hurts (Spanish, *ayuda, daña, o afecta pero ni ayuda ni daña*) the plant. These response options represent four qualitatively distinct types of effect that an animal might have: helping (i.e., helps), damaging (i.e., hurts), neutral (i.e., affects but neither helps nor hurts), or doesn't interact (i.e., doesn't affect).

TABLE 1. Animal and Plant lists for the Species Interaction Task.

Animal Kinds			
Main Elicited Name	Alternate Elicited Name(s)	Latin Name(s)	English or common name
abeja negra	putan	<i>Trigona fuscipennis</i>	black bee
boa	N/A	In Napo, "boa" refers variously to either the common boa ( <i>Boa constrictor</i> ), or the green anaconda ( <i>Eunectes murinus</i> )	boa constrictor; green anaconda
mono araña	chambira, chichiko	<i>Ateles belzebuth</i>	white-bellied spider monkey
perezozo	indi llama	<i>Bradypus variegatus</i>	brown-throated sloth
ser humano	hombre, runa	<i>Homo Sapiens</i>	human being
tigre	jaguar, puma	<i>Panthera onca</i>	jaguar
tucan	dumbike, sikuanka	several species of the family <i>Ramphastidae</i>	toucan
guanta	lumucha	<i>Cuniculus paca</i>	paca
guatusa	siku	<i>Dasyprocta fuliginosa</i>	black agouti
zorro	chaja	<i>Didelphis marsupialis</i>	common opossum
Plant Kinds			
Main Elicited Name	Alternate Elicited Name(s):	Latin Name:	English or common name:
avio	cauje	<i>Pouteria caimito</i>	abiu
cedro	N/A	<i>Cedrela odorata</i>	Spanish cedar
ceibo	zamona, ochu puto	<i>Ceiba pentandra</i>	ceiba, kapok
chonta, chontaduro	chunda	<i>Bactris gasipaes</i>	peach-palm
eguiron	ila	<i>Virola multinervia</i>	N/A
guava	pacay	<i>Inga feuillei</i>	ice-cream bean tree
hungurawa	shiwa muyu	<i>Oenocarpus bataua</i>	patawa
piton	membrilla	<i>Grias neuberthii</i>	N/A
uva	uvilla	<i>Pourouma cecropiifolia</i>	Amazon grape, Amazon tree-grape
yucca	lumu	<i>Manihot esculenta</i>	cassava

To ascertain whether all of the participants in the task shared a single model of understandings about animal-plant interactions in the local forest, I used the Cultural Consensus Model (CCM) (Romney, Weller, and Batchelder 1986). Formal CCM is a factor-analytic technique to explore distributions of cultural knowledge, consisting of a principal-component analysis conducted over an

inter-informant agreement matrix. Consensus is assumed if: 1. the ratio of the 1<sup>st</sup>/2<sup>nd</sup> eigenvalue is 3:1 or greater, 2. the first eigenvalue accounts for a large fraction of the variance, and 3. all individuals' first factor scores are positive and relatively high (Ross 2004). As constituted here, the task meets the conditions for use of Cultural Consensus Theory (CCT) (Weller 2007): responses were provided

individually, questions were uniformly salient, and responses were consistent. The CCM analysis was performed *only* on the responses of all participants to the dichotomous question “Does animal X affect plant Y? (Yes/No).”

Participants included 48 Sacha Loma residents between the ages of 12 years and 64 years (mean  $27.3 \pm 13.3$  years) who self-identified as Kichwa. To distinguish residents who have come of age in different learning environments, respondents were broken into two *a priori* groups: those aged 12-29 (the younger group), who have had consistent access to formal schooling ( $n=31$ , mean  $18.9 \pm 4.7$  years); and those aged 30-64 (the older group), who lived on family farms before the advent of state-sponsored local schooling ( $n=17$ , mean  $42.6 \pm 9.7$  years).

## RESULTS

The analysis indicated a good fit for the CCM, establishing that residents of Sacha Loma share a common model of animal-plant interactions. CCM factor scores were then correlated with participant age; this analysis was not significant. Together, these analyses indicate that while there is robustly-shared inferential consensus in Sacha Loma for the animal-plant pairings that both interact and do not interact, the strength of agreement with this consensus is not based upon the age of the participant. While the analysis does not address the question of whether the overall *nuance* of the ecological model is eroding over time (because highly salient species were used), it does argue that the ecological poverty of the learning environment has *not* reached the point that an

overwhelming “cohort effect” (Hanazaki, et al. 2013) limits the possibilities for local ecological knowledge learning. Please see Table 2 for numerical results of the analyses conducted in this paragraph.

However, it is also true that younger residents *evaluate* this common knowledge base in a strikingly different manner than do older residents. Across all potential interactions, older people were significantly more likely than were younger people to infer that an interaction was neutral; in contrast, younger people showed a trend to infer that an interaction was damaging. When only the youngest residents (aged 12-18, those who began school in the nucleated community) were considered relative to the older group, this difference became highly significant.

The groups showed another striking difference in their reasoning patterns. Overall, both groups reported that the majority of interactions between animals and plants came by way of the animal consuming the plant (its fruit, seeds, leaves, bark, or roots; for younger residents this represented 67.2 percent and for older residents 77 percent of all reported interactions). For this response type, younger people were significantly more likely to see them as damaging, while older people were significantly more likely to see them as neutral. Together this indicates that younger people tend to reason, to a greater degree than their older counterparts, that animal effects on plants are damaging, while older residents reason that *these same interaction types* are neutral.

Humans were inferred by all respondents to be the species that most affected plants; 82.7 percent of

**TABLE 2. Cultural Consensus Model Results.**

Ratio 1st/2nd eigenvalue	variance explained by the first factor	mean first factor score	
10.51	43%	0.64	
correlation of first factor score with participant age			
r-value	t-value	df	p
0.25	1.75	46	>0.05



all human-plant pairings were reported to interact (75.3 percent older vs. 86.8 percent younger). This is compared with only 28.9 percent of all other animal-plant pairings being reported to interact (27.1 percent older vs. 29.9 percent younger). Here there was a clear double-dissociation between age groups regarding the inferential framework invoked. Using as the dependent variable difference scores of the rates at which each group responded to human effects on each plant kind, younger people inferred to a greater degree that humans' effects on plants were damaging, while older people inferred to a greater degree that humans' effects were either neutral or that humans have no effect *on the very same plant kinds*. In all, both older and younger residents acknowledge that humans interact to a greater degree with plant species than other animals, and that those human interactions can damage plant kinds. However, younger people infer to a greater extent than older people that these interactions are damaging, rather than neutral. Please see Table 3 for numerical results of the analyses conducted in the above three paragraphs.

## CONCLUSION

Research has shown that for rural, indigenous communities structural change associated with modernization may be insufficient to account for environmental knowledge change (Zarger and Stepp 2004), and also that discursive/practice-based change

toward global-scale, scientific epistemological modes may be insufficient to induce shifts in environmental valuation (Cepek 2011). The findings here suggest that conditions exist in some rural indigenous communities that represent a hybrid-type, reflecting the subtlety with which aspirational practices can reorient reasoning. While children in Sacha Loma do still learn their environment—at least insofar as they share cultural understandings of local ecological relationships with their adult counterparts for the salient species used in the task—there is simultaneously a shift in the *evaluation* of this common inferential base: that is, children in Sacha Loma do not seem to learn less but instead seem to evaluate differently. Further, the confluence between the disjuncture in evaluations by younger versus older people and the generational disjuncture in formative routines implicating the forest that I have outlined suggest that this pattern may represent a continuum wherein the values attached to biotic interactions may be shifting generationally.

Community changes in routine practice, as pointed to in the opening epigraph and ethnographic description, may thus have measurable effects on default patterns of *ad hoc* evaluations of ecological inference. Indeed, schooling and the aspirations related to it for jobs within the local service economy have far-reaching effects on the way young people index desire—including in moments when they are interacting directly with the forest. One day

**TABLE 3. Comparisons of inference patterns on shared knowledge base, by age group.**

Interaction Type	Older Residents	Younger Residents (Residents 12-18 years)	t-value	df	p-value
All Interactions (damaging)	17.6%	23% (26.5%)	1.66 (2.80)	46 (31)	0.10 (0.009)
All Interactions (neutral)	10.0%	2.4%	3.12	46	0.003
Consuming Interactions (damaging)	50.9%	76.0%	2.7	46	0.01
Consuming Interactions (neutral)	34.1%	10.0%	2.83	46	0.007
Human/Animal Interactions (damaging)	46.5%	60.3%	2.2	9	0.05
Human/Animal Interactions (neutral)	16.5%	5.5%	4.56	9	0.001
Human/Animal Interactions (no effect)	24.7%	13.2%	4.01	9	0.003



during my time in Sacha Loma, I joined some of Maximiliana's family members—her mother Micaela and her teenage sibling Moreina—for a day harvesting coffee beans on their inland farm. The day was hot, and while we worked with a long hook to pull down the overgrown branches covered in coffee berries to fill large plastic mesh bags, Moreina histrionically indexed disgust at becoming “dirty, hot and sweaty” from the work. The coffee bushes were covered in ant colonies that, if one held the coffee branch for too long, swarmed and bit. Moreina complained bitterly about these bugs and used them as an excuse not to pick berries from certain bushes. Later, traveling back to the community, Micaela stopped to show me a path frequented by agouti on which she had placed a trap, a noose of rope with a thin bent-over branch for a trigger. The trap had been tripped but there was no animal caught in it, and she proceeded demonstrate to me how to reset it. Moreina sat in the path apathetically, saying nothing and looking bored, declining even to acknowledge the process. While Micaela and I were several yards into the forest, Moreina stalked back to the community alone.

I believe that there is an important connection to be made among: 1) the movement in ecological inference frame from neutral to damaging to which I point here, 2) changes to the way Sacha Lomans implicate the forest in their routine practice, and 3) the kind of hostile indifference to farm work and the forest that Moreina indexed. Routines centered on formal education provide a practice-based and discursive logic for new aspirational horizons within the regional service and tourist industry. Because the overall structure of forest learning opportunities—and the overall content of biotic knowledge—has not shifted dramatically, removal from the biotic environment might more clearly be conceived of as ideological, rather than literal. Because the interactions elicited in this task were *ad hoc*, that is, generated on the spot from sometimes novel animal-plant pairings, the answers respondents gave were of the quick, gut-reaction type (cf. Medin et al. 2006). That measurable differences in the evaluation of

species' interactions can be seen on this level may be evidence that this ideological change is deep, motivating, and cognitively durable.

But why this *particular* conceptual change in ecological inference frame, from neutral to damaging? I would suggest that young people in Sacha Loma—given their participation in routinized forms of practice that hinge on the aspiration to future participation in wage-work in the local eco-tourism and service economy—are applying a reasoning frame about local forest species styled on a basic assumption imported from Western-style environmentalism: that non-human environments are fundamentally fragile and in need of protection (Argyrou 2005). On this account, the aspirations that young people have for their future livelihoods reinforce, and are reinforced by, their evaluations of how local species—including humans themselves—interact with their biotic context.

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## ACKNOWLEDGEMENTS

Funding for this research was provided by an International Institute of Education Graduate Fellowship for International Study (awarded for 2011-2012), and a Vanderbilt University College of Arts & Science Summer Research Award (awarded for summer 2010). The author would like to thank Norbert Ross, Douglas Medin, Beth Conklin, Ted Fischer, Jamie Shenton, and the community of Sacha Loma for their support and inspiration. Thank you also to two anonymous reviewers for their suggestions in making substantial revisions to this manuscript. The research was carried out with approval from the Vanderbilt University Institutional Review Board. The author declares no conflicts of interest.

## NOTES

<sup>1</sup>All personal and place names have been replaced with pseudonyms.

<sup>2</sup>I detail the complicated relationship between residents of Sacha Loma and language use (Kichwa versus Spanish) elsewhere (cf. Shenton 2014). In brief, while Kichwa is still regionally dominant and actively used among indigenous residents, parents in Sacha Loma have made decisions that foreground Spanish as the dominant language within Sacha Loma itself. This is particularly true for young people, many of whom only understand Kichwa passively and do not attempt to speak it, especially in public. Many of these parental decisions are in keeping with the conclusions of this article regarding community aspiration to participate in practices perceived as linked to wage work in the service industry, and also reflect the historical fact that Sacha Loma is the regional hub for State-mediated schooling. For example, parents reported that though they were given the choice to make the local school bilingual when it was established, they chose not to do so. Indigenous parents also cite the fact that the school is not really “for” indigenous students at all—there is a large majority-culture population in the area that also sends their children to the Sacha Loma school. The result is that Spanish has become the dominant language for almost all public discourse in Sacha Loma. While I make no strong claim as to the status of “language shift” ongoing in the community given the complexity of documenting such processes (e.g., Fishman 1991), patterns of linguistic practice in Sacha Loma are consistent with pressures that Fishman calls “social dislocation” (1991:59-62), wherein members of a minority language group reflect a desire to succeed economically within the parameters defined by their majority-culture counterparts in their everyday choices regarding language use.

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