

- . 1993b. Ethnic fluidity and open ecological spaces in native Guiana. Paper presented in the session "Land Reform, Territoriality, and Ecology in Latin America," 92nd Annual Meeting of the American Anthropological Association, Washington, D.C., 17–21 November.
- . In press. Donde no hay médico: Las consecuencias culturales y demográficas de la distribución desigual de los servicios médicos modernos entre los Piaroa. *Antropológica*.
- Zucchi, Alberta, Kay Tarble, and J. Eduardo Vaz. 1984. The ceramic sequence and new TL and C-14 dates for the Agüerito site of the Middle Orinoco, Venezuela. *Journal of Field Archaeology* 11:155–180.

CHAPTER 13

Whatever Happened to the Stone Age? Steel Tools and Yanomami Historical Ecology

R. BRIAN FERGUSON

Ecology and History

In a time when ecological projections run from gloomy to disastrous (Ferguson 1995b), we need to learn better how to get along with the earth. The contributors to this volume seek a new understanding of the dynamics of human interaction with the physical world. Anthropologists have long investigated this interaction and now realize that it is not, as we once imagined, a case of people adapting to a natural environment as if it were a static, external object. The environment changes, in the short term and the long, and such change is an integral part of the processes of human ecology. As William Balée puts it, human communities, their cultures, and their landscapes must be seen as integrated historical totalities.

Balée's own research (1989, 1993) on anthropogenic Amazonian forests shows how even "minimal impact" subsistence systems can, over millennia, transform vast environments. Amazonian "garden hunting"—taking game animals that are attracted by recently overgrown gardens (Linares 1976; Ross 1978:10)—illustrates ecological modification at the other end of the timescale. Many other examples will be encountered by readers of this book (also see Crumley 1994). However, this should not be taken to invalidate the basic perspective of earlier anthropological ecology, that the nonhuman environment plays a major role in shaping the contours of culture. Environmental mutability itself has limits, and for any people at any point in time, the environment is a reality that constrains in multiple and often highly specific ways what people do. Again as Balée puts it, there is a dialectic at work between nature and culture, an evolving relationship in which the present adapts to the results of past interactions.

Papers in this volume show that different kinds of societies can have different kinds of ecological interactions, with very different degrees of impact on the

The Historical Ecology Series
William Balée and Carole L. Crumley, Editors

This series explores complex links between people and the landscapes that both mold individuals and societies and are fashioned by them. Drawing on scientific and humanistic scholarship, books in the series focus on cognition and on temporal and spatial change. The series offers examples, explores issues, and develops concepts that preserve experience and derive lessons from other places and times.

ADVANCES IN HISTORICAL ECOLOGY

William Balée,
EDITOR

1998


COLUMBIA UNIVERSITY PRESS / NEW YORK

physical world. Modern states can bring about massive and rapid environmental transformations. The impact of tribal peoples is more limited: their actions also may bring about major change, but usually as a gradual process. Where sudden, dramatic shifts occur in tribal ecologies, it is usually because of contact between previously isolated biotic communities. Of course, the biggest set of cases in this category comes from the expansion of Europe over the past five hundred years, with its massive ecological transfers (Cronon 1983; Crosby 1986), epidemic-driven demographic restructurings (Dobyns 1983; Ramenofsky 1987), and pervasive reorientations of extractive labor (Wolf 1982).

From the perspective of an evolved nature/culture interaction in any given locality, the impact of European contact may seem unpredictable, a historical contingency. But one analyst's contingency is part of another's pattern: from a global system perspective, the encounter will appear highly regular, with expectable local variations. Thus, as Neil Whitehead suggests (chapter 2), developing a generalizing historical ecology may be dependent on developing a generally better historical anthropology, one that situates all peoples in an interconnected world.

On the other hand, the big fault of world systems perspectives in the past has been failure to grasp how "the local" reacts to and shapes "the larger." Close attention to ecological relationships provides a solid grounding for understanding how local systems interact with exogenous introductions, a grounding that can be followed out through social and symbolic organization to frame the arenas of agency in historical change. Teasing apart these connections—showing the history in ecology and the ecology in history—is the proper task of historical ecology.

In the conference that preceded this volume, we debated what "historical ecology" is, or should be. One issue was identifying the object of study. Several participants saw it as the process of landscape or biosphere transformation by human action, which is the primary focus of Crumley's (1994) edited volume, *Historical Ecology*. Of Balée's four postulates of historical ecology, three concern human impact on the environment. But Whitehead, in particular, questioned whether such transformative processes should be called "history." Along the same lines, my view of historical ecology is a concern with human interaction with the physical world in a specific time and place, with the process of interaction understood as conditioned by prior history and frequently changing as history. There is no reason for these different interests to be seen as contradictory: one can and should inform the other.¹

Some of the stickiest points in the conference discussions appear to me more semantic than substantive. A matter of particular dispute was the meaning of "evolution" in relation to "history." Clearly, participants understood many different things by these terms. Some thought the two were incompatible as ways of seeing process. I do not. I see "cultural evolution" as regularity in social change, and its study as an "effort to determine similar form and process in parallel developments" (Steward 1976:15). Within all the particularities of any specific historical sequence are commonalities that can be discovered by comparing situations from different times, places, and cultures. Sometimes these regularities involve the development of more centralized and hierarchical polities—what is often meant by "political evolution"—

but that is just one possible trajectory. From this perspective, understanding evolution requires better histories, but making sense of history requires a sense of evolution (see Fried 1967).

The search for underlying regularities within history raises questions of causality and determinism. In my view, a good place to start that search is the "infrastructure"—the mutually constraining system of ecological relations, demographic patterns, work techniques, and technology (Ferguson 1995a). This chapter focuses on technology—not in order to claim that it is some sort of prime mover, or to advocate any form of technological reductionism, but to redress a long history of neglect. In particular, what has been neglected by anthropology is the cultural and ecological significance of steel tools.

The Cutting Edge

The culture of professional anthropology is as peculiar as any other, and, as with any culture, we take our peculiarities for granted. One big peculiarity is highlighted by Lauriston Sharp's article, "Steel axes for Stone Age Australians" (1993 [orig. 1952]). The introduction of steel axes to Arnhem Land in northern Australia, and the way in which they were traded, led to changes that were nothing short of revolutionary. The Yir Yiront social order based on age, gender, and kinship was subverted; relationships between trade partners changed drastically; even the logic of the totemic system was eaten away. Happily, it turned out that Sharp was wrong in predicting their cultural destruction, for the Yir Yiront creatively adjusted their understanding of totemism and "the old ways" to give meaning to their new and radically different way of life (Taylor 1988). But in retrospect, Sharp's broader point, that the introduction of steel axes set in motion massive social change, is completely confirmed.

There is no reason to consider this an unusual case. Thus it is curious that although Sharp's article is one of most reprinted in anthropology, there has been little follow-up regarding its implications for our conception of the ethnographic universe (R. F. Salisbury's *From Stone to Steel* [1962] being the most visible exception). Although by our best estimates forest clearing is three to ten times more efficient in time and effort with steel axes than with stone (Carneiro 1979a,b; Coles 1979; Harding and Young 1979; Hill and Kaplan 1989; Saraydar and Shimada 1971; Townsend 1969), and although, across cultures and history, it is frequently reported that indigenous people make great efforts to obtain metal tools, the implications of this technological revolution have been ignored.

Curious. Anthropology divides the history of humankind into ages of stone and metal, but the discipline appears simply uninterested in the fact that countless cultural groups have gone from stone to steel sometime before the anthropologists began to study them. (As Carneiro [1979b:21] observes, the "felling of a tree with a stone ax . . . is an event that has rarely been witnessed by ethnologists.") In a recent introduction to Sharp's article (1993:24), the editor notes the "startling impact of

this seemingly minor innovation."² I think it *appears* startling only because so little has been done to investigate a change that—far from being minor—may be second only to the introduction of new epidemic diseases in its expectable impact.

The disregard of steel is part of a much broader disinterest in the impact of Western contact. For most of this century, anthropology has been in thrall to "the ethnographic present," the imagined period between initial contact by Western observers and the beginning of culture change. That was the proper object of anthropological discourse. Acculturation studies were out of the theoretical mainstream, even stigmatized. (Lauriston Sharp's article originally appeared in the applied anthropology journal *Human Organization*.) That is changing, but most studies of culture contact still focus on loftier topics than steel tools, such as cosmology and values (Turner 1993).

Among tree-felling horticulturists, including most known peoples of Amazonia, it seems likely that the impact of steel would have been even greater than for the foraging Yir Yiront. Indeed, soon after Sharp, Alfred Métraux (1959) pulled together some of the copious evidence that indigenous peoples of the Amazon endured war, disease, missionization, and subjugation—all to get their hands on these tools. He argued that their introduction created nothing less than a "revolution." Yet Métraux's article is rarely cited, and ecological studies of Amazonia have taken little notice of metal tools (cf. Harner 1963). As a result, what we have taken to be "indigenous subsistence practices" may in fact be strongly conditioned by exogenous factors.³

Portrayals of the Yanomami provide a good illustration of the general disregard for the difference between stone- and steel-based economies, despite the existence, for the Yanomami, of unusually good research on precisely that topic. Recent articles in the *New York Times* by a reporter with extensive anthropological contacts regularly refer to the Yanomami as a "Stone Age" people (e.g., Brooke 1991)—but no Yanomami today uses stone tools, few if any have used them in recent decades, and those who have, found their stone axes in ancient gardens of extinct peoples (Barandiaran 1967:29–31; Chagnon 1977:24; Cocco 1972:193; Wilbert 1972:30–31). There is no indication that Yanomami ever made stone tools themselves.

This chapter will demonstrate how different the Yanomami appear when seen in relation to historical changes in their basic technology. A number of established debates about the Yanomami will be considered—including whether or not they were exclusively hunters and gatherers in the recent past; the role of protein scarcity as a limiting factor; and the reasons for their warfare. Beyond that, I hope to show that several widely accepted characterizations of the Yanomami are highly questionable when seen through a "lens of steel," and to suggest how these foreign items contributed to a broad transformation of their sociocultural organization.

Some important qualifications are needed before proceeding. While the technological advantages of steel tools⁴ are clearly established, how much of an advantage they represent may be exaggerated by the artificial nature of some experiments (e.g., Carneiro 1979b). Even with the limited observations available, it is clear that tree hardness and diameter strongly affect relative efficiency (Carneiro 1979a;

Townsend 1969). Obviously, the significance of cutting tools would vary by the total amount of cutting that a people might do. Thus the advantage of steel blades will expectably vary by ecology and culture, and the practical significance of their introduction merits further investigation by experiment, and via archaeology and ethnohistory.

The demand for steel tools—how many are needed—is also affected by a combination of factors besides efficiency, and these are difficult to assess. Among the Yanomami specifically, demand is affected by the requirements of different types of men's and women's labor, the possibility that one tool (a machete) can be made into several usable edges, the durability of metal tools,⁵ and of course, the number of "consumers" and the exchange relationships between them (Ferguson 1995c:24). No doubt other concerns could be added.

Tools are only one of the Western trade goods sought. As basic tools become more abundant, interest shifts to other goods (see Salisbury 1962; Wike 1951). Those being drawn into the lower levels of national societies may acquire a spectrum of mass-consumption items. Yanomami today need medicines, clothes, shotguns, radios, outboard motors, and much more (Ferguson 1990:244). Even from the start of contact, nonutilitarian items, such as beads and red cloth, are coveted. That is no surprise: we know of the importance of prestige items in indigenous trade systems (Bishop 1983; Friedman and Rowlands 1977)—why not with Western contact? As Whitehead (pers. comm.) notes, tokens of connections to powerful intruders may be especially important political symbols.

Finally, trade is only one aspect of contact situations, which often include hugely negative consequences for indigenous peoples. For that reason, it is quite expectable that some peoples, familiar with the horrid details, will avoid or flee from contact (Ferguson 1990:246). But important though these exceptions and counter-currents are for understanding the role of indigenous agency, they remain exceptional. The general pattern is that those without steel—Yanomami, and nearly everybody else around the world—make great efforts to get it. Neither these complicating factors, nor the current anthropological fashion of exoticizing others and spotlighting cultural difference, should blind us to basic human commonalities: given a choice, people will not choose to work three to ten times as hard to accomplish the same tasks.

The Hunter-Gatherer Debate

Through the late 1950s, when precious little was known about the Yanomami, they were considered to be "essentially hunting, fishing, and gathering nomads" (Steward and Faron 1959:434). Fieldworkers among the Yanomami in the 1950s and early 1960s adopted the position that Yanomami began gardening only recently (Peña Vargas 1981:25; Wilbert 1963:187–188; 1972:14; Zerries 1955:73). Their "marginal" position on the fringes of the tropical forest culture pattern was explained in two ways: as survivors of ancient hunters and gatherers, or as devolved

horticulturalists pushed from the rivers into less-productive zones (Steward and Faron 1959:374–378; and see Albert 1985:33–35).

Napoleon Chagnon (1966:46–49) first challenged the idea of a recent shift to agriculture, pointing out the existence of gardens in early reports, and the fragile evidentiary basis of the assumption of hunter-gatherer status. Jacques Lizot (1977:498–499; 1980:3–7; 1988:506) has argued repeatedly and heatedly for the antiquity of agriculture. Both assert that the reliance on agriculture they observed around the juncture of the Orinoco and Mavaca Rivers (hereafter the Orinoco-Mavaca area) in the 1960s, where groups of 130 or even more people lived in one location for years with only limited use of wild foods other than game, represented Yanomami subsistence as it had been practiced for hundreds of years. And so the question: Did the Yanomami only recently “discover” agriculture, or have they been settled cultivators for centuries? Steel may provide part of the answer, but the question itself is not that simple.

Historical sources provide limited and inconclusive evidence. Five reports from 1767 to 1911 include some information on Yanomami subsistence practices. In 1767, the missionary de Jerez reported that the Yanomami “nation maintain[ed] itself” with wild cacao, which they preserved for consumption later in the year—something no twentieth-century Yanomami is reported to do (Cocco 1972:45). Around 1804 the priest Ramón Bueno (1965:135, 145) came to rather fantastic conclusions—that Yanomami wore skins, slept in trees, and subsisted entirely on gathered roots. But we can give more weight to his lament on how difficult it was to capture Yanomami because, he said, they never stayed in one place.

The botanical explorer Robert Schomburgk (1841:221), in 1838, found a northern Yanomami group along the Uraricoera River to have had a small garden with manioc (of what type is not indicated) that they visited between treks. Their location along a very active trade route would have put these Yanomami in direct contact with many horticulturalists, but that was highly unusual for Yanomami of that time. Also in the 1830s, Agustín Codazzi (1940, 2:48) produced the first ethnographic census of the Upper Orinoco region, in which the Yanomami are noted as living off fishing and hunting, without any reference to cultivation.

Theodor Koch-Grünberg (1979, 3:250, 257–258), traveling the Uraricoera route in 1911–1912, again found Yanomami with manioc gardens, but was told by them that this was a practice recently learned from their neighbors, from whom they had also obtained steel tools. In the past, they said, they had not had gardens, and even then other Yanomami in the highlands lived by hunting, fishing, and gathering. But Koch-Grünberg himself notes Schomburgk’s observation of gardens in this area more than seventy years earlier.

These passages clearly indicate that Yanomami from the eighteenth century to the start of the twentieth were much more mobile and reliant on forest products than the Orinoco-Mavaca people later observed by Chagnon and Lizot. Koch-Grünberg’s report indicates *some* pure foraging, but *some* Yanomami had gardens in 1838 and 1911. There is no reason to believe that the practice of gardening was restricted to them alone. Whether Yanomami who were not exposed to other horticulturalists

had small gardens, or lived by hunting and gathering alone, will not be answered by historical sources.

Another kind of evidence concerns recent Yanomami subsistence patterns. Yanomami are skillful gardeners, with a highly diverse range of crops for this region (Harris 1971:478–482; Lizot 1980), suggesting a knowledge of horticulture well antedating this century. Beyond that, their primary crops offer clues, although no hard answers, about past agriculture.

The Yanomami are unusual among Amazonian slash-and-burn farmers in that the banana, not bitter manioc, is their staple crop (although settled groups exposed to outsiders take up manioc quickly [Barandiaran 1967:37; Colchester 1984:300–302; Montgomery 1970:105; Ramos 1995:25]). If, as is commonly believed, bananas are a post-Columbian introduction to South America, that fact alone would strongly support the idea that Yanomami became gardeners sometime after 1492. But while the banana is not native to the New World (Holway 1956; Simmonds 1962), the possibility of pre-Columbian banana cultivation is real (Patiño 1958).⁶ And as Daniel de Barandiaran (1967:35) points out, a banana soup is an integral part of the mortuary rituals of all Yanomami, including divisions that appear to have separated centuries before Columbus. Thus, while there is reason to suspect that the ancient Yanomami were gardenless foragers, it is not definite that they actually were.⁷

The Yanomami’s recent agricultural organization indicates a past—whenever that past began—in which agriculture was integrated with a great deal of mobile foraging. Bitter manioc requires a cumbersome technology—grater boards, basket presses, and griddles (see Ferguson 1988:144)—for processing the toxic tubers into food, and this burden is inconsistent with high mobility. Preparing bananas, of course, requires no such tools, and reliance on them is consistent with a pattern of trekking between scattered gardens. So is Yanomami reliance on the protein-rich peach palm, a cultivated tree that bears fruit for thirty years or so (Barandiaran 1967:43–47; Lizot 1980:34). Among some twentieth-century groups—most notably those who held the captive Helena Valero (Valero 1984)—seasons of peach palm ripening are times of visiting and trekking between old gardens.⁸

But could they live as pure hunter-gatherers? The Yanomami are superb at living off nature, and frequently opt to do so for weeks or even months at a time (Biocca 1971; Good 1983, 1989, 1991; Valero 1984). The antiquity of their trekking seems beyond question. Yet in those few reported instances when Yanomami were compelled to live for extended periods with no, or unusually small, gardens, they suffered from hunger, even in areas of comparatively rich resources (Biocca 1971:34, 39, 43; Lizot 1974:7; Valero 1984:170). Moreover, the pre-twentieth-century restriction of Yanomami to high country (see Ferguson 1995c)—which, besides having poor soil and a tendency to drought (Huber et al. 1984:108–109), is characterized by wild resources that are scarce and unreliable (Colchester 1984:294; Chagnon 1992:83)—would have exacerbated the difficulties of exclusive foraging.

Yes, Yanomami are able to survive as pure hunter-gatherers, but with difficulty. (As argued below, minimal gardening in the past may have been associated with long-term population decline.) No instance has been reported where they have

freely chosen to live without gardens. Probably they would find the notion ridiculous. My conclusion: If any Yanomami had the opportunity to establish gardens in the past, they had the motivation and the knowledge to do so. But what determined their ability to develop gardens? That question brings us back to stone and steel.

It may be possible to make a garden using clearings from natural tree falls (Laura Rival, pers. comm.), or just by girdling and burning trees that are left standing (Tristram Kidder, pers. comm.). But even in such cases, ground clearing, not to mention tree girdling, would be most difficult without some cutting tool. Despite exceptions, the general rule is: to create a garden, you have to fell some trees.

As noted earlier, for tree felling a steel axe is three to ten times more efficient than one of stone. Significantly, the high measure is from Robert Carneiro's (1979a,b) experiment among the Yanomami. Carneiro concludes that garden clearing with stone alone would require more work, and would rely more on burning and domino-effect tree falls. One account also indicates that Yanomami possessing little steel use liana ropes to pull down weakened trees (Valero 1984:183).

Marcus Colchester (1984) considers Yanomami gardening at the reduced efficiency of stone axes, and concludes that its higher costs and lower productivity would tip the scales toward greater reliance on hunting and gathering than among any recently observed Yanomami. That conclusion is supported by Raymond Hames (1989:73) and Stanford Zent (1992), and is consistent with the historical ecology reconstructed above.

But it is not clear that all Yanomami had stone axes. I found no indication anywhere that any Yanomami ever knew how to make a stone axe. On the contrary, those who remember them being used recall that they were found in the surface remains of extinct peoples (Barandiaran 1967:29-31; Chagnon 1977:24; Cocco 1972:193; Steinvoth de Goetz 1969:30; Wilbert 1972:30-31)—not an unusual situation in Amazonia (Balée, pers. comm.). But these remains and axes are not found all over. They are abundant along the far Upper Orinoco (Anduze 1960:96, 210; Grellet 1957:129-130, 139, 144), where there may have been an axe-manufacturing center, probably among people wiped out in the terrible slave-trade wars of the mid-eighteenth century (Ferguson 1995c:79-82). To the north in Sanema country, stone axes are rare (Barandiaran 1967), and Yanomami encountered by Koch-Grünberg along the Uraricoera in 1911 were completely unfamiliar with one he showed to them. Thus the availability of found stone axes for the Yanomami was variable.

Also variable was the availability of steel axes. There is no way of knowing whether Yanomami received any steel through indigenous trade networks prior to the mid-eighteenth century. Comparative studies of Western contact make that seem likely, although it was probably in extremely limited amounts. By the late 1760s, however, Spanish soldiers on the Upper Orinoco were visiting Yanomami directly (Cocco 1972:45), and Portuguese did the same along the Rio Negro by the late 1770s, if not earlier (Hemming 1987:30-32). These Europeans wanted to "reduce" the Yanomami and other Indians—i.e., entice them to come down to settle in villages where they could be used and controlled; standard *reducción* procedure

was to offer gifts, but how much steel was introduced in this way is completely unknown. By 1800, Upper Orinoco Yanomami were engaged in routine trade at the Spaniards' farthest outpost, La Esmeralda (Humboldt 1889:460-463). From then until today, some steel has come to some Yanomami—in trickles or in torrents, in frequently shifting geographic patterns, and with varying amounts of associated risk.

Considering the point of the availability of axes in light of this discussion, three basic subsistence patterns appear possible: (1) no axes—hunting and gathering with no, or only very limited, gardening; (2) stone axes—extensive hunting and gathering between short visits to small gardens; (3) steel axes—regular trekking between longer stays at larger gardens. But still one more historical factor must be considered.

Garden clearing requires burning, more so with stone axes. Burning creates smoke. In the times when Yanomami were sought to feed captive labor markets—which occurred in many periods and places, from the mid-eighteenth century or earlier, and probably up to the early twentieth century—raiders located targets by climbing trees and looking for smoke (Gilij 1965, 3:96-97). Garden makers would be sending up a beacon for knowledgeable indigenous scouts who knew when and where to look. A strong presence of these social predators would greatly encourage maximum mobility among their intended victims.

The question that began this section, whether the Yanomami of the eighteenth and nineteenth centuries were hunter-gatherers *or* agriculturalists, may propose a false dichotomy. Taking into account all considerations—early historical reports, the implications of different aspects of Yanomami subsistence, reconstructions of subsistence options in the absence of steel, and variations in the availability of stone and steel axes and the danger of raiders—one answer seems to fit all: that protohistoric Yanomami subsistence was not one pattern, but a range of patterns, including all three options noted above. This postulated range went from exclusive reliance on hunting and gathering all the way to manioc gardening, with the position along this range strongly conditioned by the availability of different kinds of axes and the danger of raiders.

But if greater reliance on foraging in the past was a more efficient use of time and effort, it did not necessarily guarantee a secure existence, especially in the relatively resource-poor Parima highlands. Elsewhere I have suggested that some areas of Amazonia may operate as "population sinks," places of long-term demographic decline, and that the Yanomami's highland homes were such locations (Ferguson 1989a:255; 1995c:74). At any rate, those Yanomami did not increase at anything like the rate of the past hundred years or so, during which Yanomami settlement area expanded dramatically, and single villages gave rise to whole clusters of local groups (see figure 13.1). Marvin Harris (1977:50-51) hypothesized that this growth and expansion resulted from the introduction of bananas and steel tools—a view that has since gained important support (Albert 1989:637; Colchester 1984: 292-293; cf. Lizot 1988:496-497).

To recast this hypothesis in terms of previous discussion, population growth followed a historical shift to pattern (3), regular trekking between longer stays at



Fig. 13.1 Main Movement of Western Yanomamo Population Blocs. (From Ferguson 1995c: map 4.)

larger gardens. The rubber boom of the late 1900s brought major quantities of steel into the region, some of which went to Yanomami. Although some local rubber barons were terribly brutal, there is no indication of major captive raids deep into Yanomami highlands (which is not to say that none at all occurred). With more steel, and less danger, the Yanomami could develop the semisettled villages observed (beyond or before the missions) in the twentieth century, of the kind discussed in the next section.

In examining evidence related to ancient subsistence technology and patterns, facts were noted that compel a reevaluation of the widely accepted image that the Yanomami were isolated from and unaffected by the outside world until the mid-twentieth century. This brief review has noted relations of violence and exchange that directly and indirectly linked Yanomami to Europeans from the mid-eighteenth century at least, and that had major consequences for the Yanomami way of life. The rest of this chapter will follow the thread of steel through other changes that radically affected twentieth-century Yanomami, both before and during the time that anthropologists arrived on the scene.

Twentieth-Century Yanomami Ecology

Yanomami adaptation to their environment has given rise to one of the most contentious issues in recent anthropology, the "Great Protein Debate" (discussed in Ferguson 1989a,b). This debate developed on the basis of portrayals by Chagnon, and to a lesser extent on those by Lizot. As noted previously, both assert that the fairly large and relatively sedentary groups they studied are typical of Yanomami subsistence for centuries. The originators of the protein theory of Yanomami warfare—Jane Bennett Ross (1971), William Divale (1970), and Marvin Harris (Divale and Harris 1976; Harris 1984)—all accepted that this was a long-established pattern (although Harris, as noted, gave it only a century).

Previously, many ethnographers had observed the lack of protein in Amazonian cultigens, and had suggested that for people who relied on hunting to flesh out their diets, game availability set a limit on the size and duration of settlements: relatively large and settled villages would run through the fauna. Chagnon (1977:33), initially at least, indicated game scarcity in the Orinoco-Mavaca area. There seemed good reason to expect that the Yanomami—inland hunters, even though they had recently moved to large rivers—might have problems with protein. The warfare theory flowed from this reasoning. War was argued to be an evolved adaptive complex, maintaining diet by dispersing settlements and reducing population growth.

But we have already seen that the pronounced sedentism of Orinoco-Mavaca people ca. 1964—Chagnon's "Fierce People"—was not characteristic of Yanomami in the nineteenth century and earlier. If that sedentism is a recent development, how and why did it come about? Environmental changes cannot explain the shift. To understand this and earlier changes in subsistence orientation that affect the

applicability of the protein hypothesis, we must turn to Upper Orinoco history (Ferguson 1992; 1995: chs. 10–13).

Yanomami around the Upper Orinoco received many steel tools during the rubber boom of the late nineteenth and early twentieth centuries. They also faced the danger of a brutal local governor, Tomás Funes, who killed hundreds of Indians who were not sufficiently productive. His death (in 1921), following the collapse of rubber prices, led to wholesale Creole abandonment of the area. From then on, local Yanomami were not in any danger from outside raiders. They still had steel tools obtained during the rubber boom, although wear brought these to extreme scarcity during the period of maximum Western retraction, in the 1920s and 1930s. From the mid-1930s onward, woodsmen slowly reentered Yanomami lands, offering a new and relatively nonthreatening source of steel, which the Yanomami obtained through work, theft, and assault. How did they subsist in this time of some steel and no raiders?

Fortunately, we have an excellent source for much of this period: Helena Valero, a Brazilian girl captured by Yanomami in 1932 or 1933, who lived with them in the Orinoco-Mavaca area until 1956. Two independent tapings of her life story (Biocca 1971; Valero 1984), and especially the more complete Spanish-language version, show a subsistence pattern of leaving main gardens for extended hunting and gathering expeditions, often combined with visits to old and new gardens, or to the villages (and gardens) of allies. The average time in different modes cannot be estimated, but a typical pattern would be to spend one to three months at one garden, and then several weeks in the forest, before arriving back home or at another garden.

Missionaries who established stations among the Yanomami in the 1950s and 1960s report that at first the surrounding groups would periodically abandon the mission to spend time in the forest (Jank 1977:85–86, 177; Vareschi 1959:169). Recently Kenneth Good (1989; 1991), who has spent years among a Yanomami group that has relatively abundant steel but is not linked to any Western settlement, has provided detailed evidence on subsistence mobility. On the basis of his and other reports, we can estimate that Yanomami with steel tools but not exposed to the danger of raiders spend up to 40 percent of the year on trek, and also spend time at other gardens, so that less than half of the year is spent at their primary garden. This is more time in one place than indicated for earlier periods, but much less than that reported for the center of the Orinoco-Mavaca contact zone, where villages are never left empty and forest products are much less important (see Ferguson 1992:205).

The question of why these Yanomami are not *more* sedentary raises old issues of adaptation, bringing ecology into history. Plainly, the mobile pattern is more conducive to maintaining adequate game intake than the sedentary one. But as Good has shown, game scarcity is only one reason for trekking: cultigen conditions may be just as important. The exhaustion of ripe bananas at one garden, or the ripening of forest fruits and peach palms at old gardens, are incentives to trek, as are a variety of other considerations.

Whatever triggers the movement, this mobility pattern spreads hunting across a much wider area of forest. Thus the significance of game depletion for explaining

war seems less relevant to these trekking Yanomami, and the whole debate would have proceeded very differently if this subsistence pattern had been better known earlier. But the protein controversy as it did develop concerned wars involving the more settled peoples described by Chagnon and Lizot, which brings us back to the question, How do we explain that unusually sedentary pattern of the Orinoco-Mavaca area in the mid-1960s?

To understand the sedentary character of those villages, we again must consider steel—not its utility, but rather the problems of getting and protecting access to sources of it and other Western goods. A pervasive theme in twentieth-century Yanomami history is that of exploration, trade expeditions, and garden relocation to, and then down, streams that led to Western settlements—or to other indigenous people such as the Yecuana who had a source of steel tools (see figure 13.1). Equally pervasive is the observation that those who settle alongside a Westerner, or get one to stop among them, zealously attempt to monopolize the intruder and his goods (Albert 1988:102–103; Chagnon 1974:7–15, 163–171; 1977:79, 152–153; 1983:18; Peña Vargas 1981:30; Shapiro 1972:33, 43). In these and many other reports, machetes and axes are specifically noted as the objects of greatest desire.

Since the 1940s especially, the lure of steel has pulled Yanomami out of highland forest into new locations. Within the highlands, they have gone into resource-poor savannas where outsiders have built their airstrips (see Huber et al. 1984; Jank 1977; Smole 1976), but little is reported about ecological adjustments there. Somewhat better reported is what happens when Yanomami move down to Western outposts along major rivers, such as the Orinoco.

This is not a move that the Yanomami would undertake for subsistence purposes. There is little or no fertile flood plain along the Upper Orinoco (Lizot 1980:47), and flooding is a problem for lower gardens (Cocco 1972:176, 419); thus, getting better agricultural land is not an incentive here. The rivers are rich in fish, but the Yanomami who moved toward them were equipped to exploit only small streams (Biocca 1971; Valero 1984). Mosquitoes and other insects are a severe problem along the rivers (Chagnon 1977:161; Smole 1976:47), and the rivers themselves were an obstacle for canoeless Yanomami (Chagnon 1992:83; Valero 1984:503, 505, 514). At the same time, Yanomami have long understood that coming near to Westerners increases the possibility of disease (see Albert 1988; Saffirio and Hames 1983:5), along with other, less lethal aggravations.

What prompted Yanomami to move down to main rivers—investigators from all over Yanomami-land agree—was their desire for steel tools and other Western goods (Albert 1988:98; Cocco 1972:18, 32, 114; Colchester 1985:10–11; Peters 1973:62–63; Saffirio 1985:24, 91–93; Shapiro 1972:25–29; Smole 1976:51–52). But if they came out to get access to these products, why not continue their mobile, trekking pattern from riverine bases, as they were initially reported to have done?

The answer is that obtaining Western goods involves, not merely being near to a Westerner once in a while, but also controlling access to the source. As I will explain shortly, there is competition both to get these favored positions, and to prevent

others from gaining direct access to them. Thus Yanomami not only came to live close to Westerners, but stayed at home once they were there. (Missionaries actively discouraged trekking [Jank 1977:85–86, 177; Lizot 1976:12; Vareschi 1959:169], but their exhortations seem much less significant than the Yanomami's own trade interests.) Furthermore, individuals and families were allowed by mission Yanomami to move in with them, thereby adding to the size of those villages (Cocco 1972:212–213; Early and Peters 1990:66; Eguillor García 1984:54–56; Ramos 1972:41). Thus the relatively large and sedentary groups of the Orinoco-Mavaca area of the mid-1960s, formerly portrayed as typical of long-term Yanomami adaptation, are better understood as the result of recent efforts to establish and control access to sources of steel tools and other Western goods (Ferguson 1995c: chs. 11–13).

This new pattern of large and sedentary villages, well stocked with Western goods but also exposed to all the hazards of Western contact, set in motion fundamental and far-reaching changes in these groups' interaction with the natural environment (see Ferguson 1992:203–208). For one thing, women, whose gathering was critical while on trek and starting new gardens in the forest, were reduced to being little more than bearers of water and firewood—one of several changes that underwrote the low status of women in the Orinoco-Mavaca area (Ferguson 1995c:357–358). Sedentism also puts more pressure on game resources, which brings us to the protein debate, as seen in the context of all the subsistence changes entailed by moving into contact with Western providers of steel.

Despite all the argumentation, data about game availability and intake in the Orinoco-Mavaca area are limited and most arguable, especially through the middle 1960s—which encompasses the wars described by Chagnon and Lizot. Those authors vigorously dispute the existence of game scarcity until after shotguns became widespread in the later 1960s, although both agree that the entire region suffered drastic game depletion by 1975 (Chagnon 1977:148; Lizot 1976:13). Nevertheless, evidence from many other Amazonian peoples (Ferguson 1989b), from other Yanomami, and anecdotal information from the Orinoco-Mavaca area itself (Chagnon 1977:148; Colchester and Semba 1985:17; Comité 1983:27; Saffirio and Hames 1983:37–38; Saffirio and Scaglione 1982; Salazar 1967:92; Smole 1976: 163–167, 175–176) all suggest that local hunting was substantially less productive by the mid-1960s.

I have challenged (Ferguson 1989b) the game-depletion explanation of Yanomami warfare. Although several of its main postulates are supported, it is theoretically inadequate to explain war, and unnecessary because another, stronger explanation is available (below). But, following Good (1989:135–140), I also argue (Ferguson 1992:206) that the declining amount of game in the Orinoco-Mavaca contact zone was accompanied by a decrease to the point of elimination of the village-wide sharing of meat. This along with other contact-related factors led to a breakdown in reciprocity and social ties, paving the way for greater individualization of production and consumption.

The nutritional challenge posed by a declining availability of game could be offset by an increased reliance on fish and other river resources. Local Yanomami quickly took to canoes, and one mission post gave out almost a million fishhooks between 1957 and 1978 (Peña Vargas 1981:37). Missions also provided food; the quantities are entirely unknown, although missionaries claim that their food distributions prevented starvation in the crisis following drought, flood, and a malaria epidemic in 1964, just before Napoleon Chagnon arrived (Cocco 1972:176). Individual Yanomami also produced food for trade or sale in Creole towns downriver, and some developed extensive banana fields for this purpose (Chagnon 1977:144). By the beginning of the 1980s, some Yanomami near the juncture of the Mavaca and Orinoco were starting to look like peasants, selling crafts and buying food at a local cooperative and even living in single-family homes (Chagnon 1992:221–222).

Put in historical context, the large sedentary village pattern observed by Chagnon and Lizot in the middle 1960s may be seen as one phase in a long subsistence transformation, into which the Yanomami were drawn by the glittering prize of steel. Ironically, since Harris (1984:112) states that the Divale-Harris model is not intended to apply to peoples strongly affected by Western contact, one could say that the theory is not applicable to the main case upon which it was developed.

The Social Ramifications of Steel

Up to this point, I have kept my focus on Yanomami ecology, arguing that to understand their modes of interaction with the environment, one has to consider both the efficiency and the availability of cutting tools. In this section I shall discuss some of the sociocultural ramifications of the introduction of steel tools, and the other new consumer demands that follow in their wake.

The Orinoco-Mavaca area up to the mid-1960s offers the following picture (Ferguson 1992): Greater access to Western goods brought exposure to new and deadly diseases. High rates of mortality were associated with contact, and these deaths tore at the fabric of kinship. This, along with the decline of meat sharing, led to the atomization of society, and fostered the instrumental use of force in interpersonal relationships. At the same time, the anchoring effect of controlling access to Westerners diminished the traditional option for individuals or groups in conflict situations—i.e., to move away from the problem (see Ferguson 1989b:195–196). These and other changes combined to lower the threshold for violence, to make the people seem fierce.

On top of that, entirely new antagonisms were created through competition for Western goods. The principal argument of *Yanomami Warfare* (Ferguson 1995c) is that the actual occurrence of reported wars among the Yanomami can be explained as the result of antagonisms created by competitive interests in steel tools and other Western manufactures. With the introduction of these goods from a few limited sources, intervillage trade was reoriented toward missions or other sources of

Western goods. As noted, those close to such a source made every effort to monopolize access to the provider. Mission groups with exceptional supplies of steel and other items ceased making local labor-intensive manufactures, and instead obtained them through trade with other groups (Cocco 1972:205, 376–378; Colchester 1984:298; Eguillor García 1984:126; Peters 1973:167–168). The limited information available suggests that this new trade pattern was accompanied by a shift from balanced to exploitative exchange, with realized labor time flowing toward the outpost villages. (This is something that could be measured.)

Bringing steel and other Western goods into the picture at this point allows the correction of another widespread misunderstanding about the Yanomami: that their trading is a social bond without any material basis. In a frequently cited passage, Chagnon (1977:100–101) asserts that Yanomami pretend to forget how to manufacture some item they could easily produce, in order to create a pretext for trading that might lead to a broader alliance without seeming to ask for help. The supposed “forgetting” described by Chagnon takes on an entirely different cast when one learns that it was the mission Yanomami who stopped making everything, and who were supplied with local manufactures by trade partners dependent upon them for Western goods.

The introduction of Western goods brings a parallel transformation in marriage patterns. There is a sharp increase in village exogamy, as primary interests shift from one’s coresidents to those who can supply the coveted steel. This new intermarriage is unequal: as men cede wives to gain access to outpost largesse, there is a pronounced flow of women into the mission villages (Albert 1988:102–103; Chagnon 1966:57–58; 1977:80; Cocco 1972:210–213; Peters 1973:127–129; Shapiro 1972:210–213; Smole 1976:72). Bride-service patterns are similarly skewed—heavy for in-marrying males, light or nonexistent for those who can provide a wife’s family with Western goods (Cocco 1972:211; Chagnon 1977:79; Early and Peters 1990:67; Peters 1973:122–129). All together, groups that can monopolize a Westerner or otherwise act as middlemen in the Western trade can receive great material and social benefits for doing so—hence the great interest in monopolization.

In this regard too I would offer an adjustment to a widespread perception about the Yanomami. Everyone knows that some Yanomami men contend over the marital disposition of women (although this is far more unusual than is generally imagined). But few realize that the most pronounced pattern in exogamic unions of all types is that women are given to men who can reciprocate with steel and other Western manufactures. In my perspective, if conflict over women does trigger war, it is because the contested women are elements within a total exchange and alliance relationship that has gone bad. Whether alliances are happy or strained is to a large degree determined by the distribution of Western goods. That brings me to political relations and war itself.

My hypothesis, stated briefly, is that Yanomami go to war to protect or enhance their access to Western goods. Sometimes this is done very straightforwardly, by plundering small but well-equipped parties or settlements (Arvelo-Jiménez 1971:42,

93; Barandiaran and Walalam 1983:98, 102–103, 191; Cocco 1972:53–54, 64–65, 67, 70, 74, 374, 376; Colchester 1985:47; Peters 1973:155). These raids, though telling much about the motivational significance of steel, constitute only a small part of the Yanomami war record. My argument is *not* that Yanomami warfare, generally, is aimed at plunder, but rather that the goal of improving access to Western goods can be discerned in the patterning of other wars. Antagonisms based on the distribution of these goods historically structure political relationships, relationships that can turn into wars ostensibly fought over revenge, sorcery, women, or prestige.

This logic, my book seeks to show, is substantiated by the spatial and temporal patterning of all reported Yanomami wars—who attacks whom and when. With some simplification, military antagonists occupy different positions in the existing Western trade, and the aggressors would benefit in that trade by driving their enemy away. Political relations go from peace to war after a major change in the Western presence. Similarly, alliances incorporate the trade partnerships and marriage relationships structured by and structuring the flow of Western goods. The use of force within alliances also affects the direction, rate, and (hypothetically) terms of trade of those items.

There is more to it than that, of course. Along with the availability of Western goods, political relations are partly determined by the ability to apply force, something that is also affected by ties to Westerners. And political relations are not talked about in the material-interest terms argued here; rather, aggressors invoke moral principles in entirely personalistic terms, so that their adversaries in war—sometimes close kin—always “have it coming.” The particular logics of Yanomami culture will thus enter into decisions, as with any people anywhere, but in my view these logics are brought into accord with the practicalities of material circumstances.⁹

That, in brief, is my explanation of Yanomami politics and war, an explanation that begins with the critical significance of steel tools for Yanomami. Two other studies illuminate other aspects of the influence of steel.

John Fred Peters’s thesis (1973) describes “the effect of Western material goods upon the social structure of the family” among an eastern Yanomami mission group. Along with changes in marriage patterns as already indicated, Peters describes broader transformations. The possession of Western goods became a key to both individual and village status. As with the Yir Yiront, the traditional social order ascribed by sex and age was upset in favor of one oriented to achievement, as measured in new merchandise. The most Western goods went to those younger men, and sometimes women, who were quickest to grasp what outsiders wanted. One young man with exceptional ties to the missions and Brazilians was recognized as politically precocious, already telling people what to do. New inequalities developed, with different members of one village earning from \$2 to \$80 worth of goods in one year.

Bruce Albert’s article “La fumée du métal” (1988) demonstrates how steel tools come to occupy a central place in Yanomami symbolism. In his reconstruction of the changing interactions of Yanomami with outsiders over the past 150 years, a key

element in their own understanding of the process is the idea that metal objects give off a smoke, which causes epidemics. This is just one point in a much more extensive and sophisticated analysis, an analysis that shows the need for more research on the Yanomami's own conceptualization of Western contact (also see Hill 1988). For now, it is enough to conclude that every aspect of Yanomami culture, from subsistence to worldview, is strongly affected by the introduction of steel tools.

Summary and Discussion

Following the thread of steel has led us through many corners of Yanomami ethnography. In regard to the hunter-gatherer issue, consideration of the efficiency and availability of stone and steel axes, along with other factors, provides a way to understand the mixed evidence on ancient subsistence practices, suggesting the existence of a variable range of subsistence orientations. Along the way, that discussion highlighted the illusory character of the Yanomami's presumed isolation from the outside world.

From the late nineteenth century, the chosen pattern for most Yanomami who possessed steel has been to spend most of their time at different gardens, interspersed with extended trekking. The relatively large and very sedentary villages that became the ethnographic basis for the protein-and-warfare debate are more recent innovations. In those cases, Yanomami were drawn to new environments and encouraged to stay in place in an effort to obtain and control a flow of steel tools and other Western goods. This new existence led to a major overhaul of subsistence orientations, with important social consequences. The Orinoco-Mavaca pattern of the mid-1960s was a stage in a process of transformation that may ultimately lead to their becoming "peasants" (Chagnon 1992:221-222). Seen this way, there is no reason to expect that warfare in the Orinoco-Mavaca area in the mid-1960s should or even could be an evolved complex adapting people to local ecology.

In regard to more general social ramifications, the allure of steel and other Western goods drew some Yanomami into direct and prolonged contact with Westerners—an exposure that in some cases produced social atomization and anomie, adding to an image of "fierceness." I argue that actual warfare arises out of antagonistic interests involving differential access to sources of Western goods. That argument draws on consideration of economic, marital, and political relations that are shaped by access to steel, and suggests correctives to widespread misunderstandings about intervillage trade and marriage. Other research shows additional social and symbolic transformations brought on by the introduction of Western goods (along with other things).

These are the principal findings that come out of greater attention to steel tools among the Yanomami. As with the Australian Yir Yiront, there is no reason to presume that the Yanomami are unusual. This suggests broad new avenues for research in historical ecology. Zent (1992; and chapter 12, this volume), for instance, provides a wide-ranging exploration the impact of steel tools on the subsistence, settle-

ment, and society of the nearby Piaroa. Whitehead and I (Ferguson and Whitehead 1992) demonstrate the huge comparative base that exists for studying these and other contact-related transformations.

On the subject of war, I have shown (Ferguson 1990) how many cases of Amazonian warfare can be clearly linked to interests in Western goods. With the historicization of Amazonian studies (Roosevelt 1994), highland New Guinea has emerged as a crucial locale for formulating and testing theories about indigenous warfare relatively unaffected by Western contact (Ferguson 1995c:408; Knauff 1993:1186). But even there, outside influences have not yet been given sufficient attention. Salisbury (1962:118-119), for instance, records a major intensification of war just as steel axes began filtering into the highlands during World War II. Robert Crittenden and Edward Shieffelin (1991:132-138) have recently described the spread of new tools and diseases up valleys from the coast, starting in the late nineteenth century; their discussion of efforts to monopolize this trade, and of the unusually intensive warfare associated with the situation, has both strong parallels and intriguing contrasts with the Yanomami tribal zone (e.g., in the efflorescence of prestige economies). The political history of highland New Guinea is ripe for reappraisal from a tribal zone perspective. Once that is done, we can be more certain about what is purely local in the warfare that anthropologists have reconstructed, observed, and filmed.

William Denevan (1992) and William Doolittle (1992) take the significance of steel so far as to suggest that shifting agriculture was rare or nonexistent in the pre-Columbian New World, and developed only with the introduction of metal cutting tools. Both argue that ancient cultivators relied primarily on intensive cultivation and repeated field use—evidence of which has been accumulating throughout the Americas.¹⁰ Indeed, the ancient inhabitants of the Upper Orinoco—not Yanomamo—apparently left their mark in what are today square patches of bamboo forest, suggesting intensive and repeated cultivation (Lizot 1980:41).

These topics also frame new areas for archaeological research (see Bamforth 1993; Rogers 1993). Archaeologists, better than anyone, may be able to trace the dissemination of Western tools and other goods, and their possible impact on subsistence. They may be able to reconstruct trade networks and the other forms of integration that typically accompany them, and the war patterns that often do the same. In that, archaeology may make a crucial contribution to our understanding of tribal warfare, and help explain the great disparity observed in the violence of prehistoric and historic peoples (see Ferguson in press).

Another reason to pay more attention to steel and other aspects of Western contact is suggested by Alcida Ramos (1990), who notes that North American anthropologists generally study topics that direct their attention away from the impact of Western contact. By recasting our research orientation to encompass the topics raised here, it would be possible to merge established North American theoretical concerns with the *indigenista* focus on the continuing problems of contact (Turner 1993).

In countless situations around the world, steel tools and the goods that follow them are the principal "means of seduction" whereby indigenous people are drawn

into cooperation with intrusive agents of the state. John Hemming (1978:9) calls this the "fatal fascination" of Amazonian Indians. Anthropologists have devoted much attention to studying "cultures of resistance"—but in situations of resistance, there are many who cooperate with the invaders. Understanding such cooperation would seem a necessary counterpoint to understanding resistance; and in many cases, the introduction of steel tools can provide one starting point.

Notes

1. These two foci—how human activity produces historical change in the environment, and how historical process shapes human interaction with the environment—suggest a third potential area of research for historical ecology: the long-term effect of ecological relations on the broad processes of social history. How different, for example, would France be if its past four hundred years had occurred in a different environment? If the answer is "that would not be France," the point is made.

2. In another collection, the editors James Spradley and David McCurdy (Sharp 1990:410) refer to the "introduction of an apparently insignificant, hatchet-sized steel axe."

3. Roosevelt (1989:30–34) makes this point based on the emerging archaeology of Amazonia. But even she—in her survey of post-Columbian changes—mentions new technologies only in passing, and steel tools not at all.

4. It would be more accurate to say "iron and/or steel," but the distinction is rarely noted in available sources.

5. Thomas Headland (pers. comm.) found laughable my estimate (Ferguson 1995c:389), based on one single report, that tools could last for twenty-five or thirty years. I willingly concede the point, and hope that some fieldworker will provide a better estimate of durability in the future.

6. Patiño (1958) describes debate from the sixteenth century about whether Spaniards introduced bananas from the Canary Islands, or whether the fruit was already here. The main argument for the latter position is the extraordinary distribution of large-scale banana cultivation encountered in the subsequent decades of conquest. Then again, that may be just another demonstration of the rapidity of pre-observer tribal zone transformations.

7. Whatever the situation of the ancestral Yanomami, they were probably connected in important ways to the more advanced riverine polities of the region. Those polities were obliterated during the eighteenth century, if not before (see Whitehead 1988, 1994). Thus any complementarity of subsistence orientation of highland and river people, or any trade in technology (e.g. axes), may be recoverable only archaeologically.

8. The pattern can be so marked that, a year before *The Fierce People* was published, Barandiaran (1967:47) suggested calling the Yanomami the "people of the peach palm." One can only wonder how the debate over Yanomami warfare would have gone if that name had stuck.

9. A long-standing problem in understanding war has been a failure to distinguish emics from etics. Anthropologists who report the participants' stated reasons for war almost always produce a grab bag of motives, some obviously economic, some reflecting particular cultural values. But does this mélange of motivation truly explain the actual occurrence of war? In the perspective argued here (Ferguson 1995c:364–367), the practicalities of daily life structure social relationships, including those of politics and war—but the underlying structure

will rarely be apparent in elicited rationales. Local discussions about war will be framed in terms appropriate to local moral idioms. Explanations provided to outsiders will reflect this, plus all the vagaries of informant personality and memory, and considerations of what might "play well" with powerful outsider interviewers. Beyond that, the intergroup relationships involved in political process are multidimensional, encompassing trade, marriage, alliance, prestige, and more. Any disputed element may stand for the whole in a strained situation, and thus a seemingly trivial slight may lead to violence. For all these reasons, the emics of war will always produce a variety of explanations. One object of anthropological analysis has always been—at least until recently—to discover underlying order beneath surface explanations.

10. Roosevelt (1989) also stresses the existence of intensive cultivation regimes preceding the more mobile patterns that developed after contact. However, she also finds archaeological evidence for an earlier (ca. 3000–2000 B.C.), less intensive, horticulture based on root crops, although it is not apparent how fixed or shifting the garden plots may have been.

References

- Albert, B. 1985. Temps du sang, temps des cendres: Représentation de la maladie, système rituel et espace politique chez les Yanomami du sud-est (Amazonie Brésilienne). Doctoral thesis, Université de Paris X, Nanterre, France.
- . 1988. La fumée du métal: Histoire et représentations du contact chez les Yanomami (Brésil). *L'Homme* 28(2–3): 87–119.
- . 1989. Yanomami "violence": Inclusive fitness or ethnographer's representation? *Current Anthropology* 30:637–640.
- Anduze, Pablo. 1960. *Shailili-Ko: Relato de un naturalista que tambien llegó a las fuentes del río Orinoco*. Caracas: Talleres Gráficos Ilustraciones.
- Arvelo-Jiménez, Nelly. 1971. *Political Relations in a Tribal Society: A Study of Ye'cuana Indians of Venezuela*. Cornell University Latin American Studies Program Dissertation Series, no. 31. Ithaca, N.Y.: Cornell University.
- Balée, William. 1989. The culture of Amazonian forests. Pp. 1–21 in Darrell A. Posey and William Balée (eds.), *Resource Management in Amazonia: Indigenous and Folk Strategies*. Advances in Economic Botany, vol. 7. Bronx: New York Botanical Garden.
- . 1993. Indigenous transformation of Amazonian forests. *L'Homme* 33(2–4): 231–254.
- Bamforth, Douglas. 1993. Stone tools, steel tools: Contact period household technology at Helo. Pp. 49–72 in Rogers and Wilson (eds.), *Ethnohistory and Archaeology*.
- Barandiaran, Daniel de. 1967. Agricultura y recolección entre los Indios Sanema-Yanoama, o el hacha de piedra y la psicología paleolítica de los mismos. *Antropológica* 19:24–50.
- Barandiaran, Daniel de and Aushi Walalam. 1983. *Hijos de la luna: Monografía antropológica sobre los Indios Sanema-Yanoama*. Caracas: Editorial Arte.
- Bennett Ross, Jane. 1971. Aggression as adaptation: The Yanomamo case. Unpublished MS.
- Biocca, Ettore, ed. 1971. *Yanoama: The Narrative of a White Girl Kidnapped by Amazonian Indians*. New York: Dutton.
- Bishop, Charles. 1983. Limiting access to limited goods: The origins of stratification in interior British Columbia. Pp. 148–161 in E. Tooker and M. Fried (eds.), *The Development of Political Organization in Native North America*. Washington, D.C.: American Ethnological Society.

- Brooke, James. 1991. Venezuela befriends tribe, but what's Venezuela? *New York Times*, 11 September, p. A4.
- Bueno, P. Ramón. 1965. *Tratado histórico*. Ed. F. de Lejarza. Caracas: Biblioteca de la Academia Nacional de la Historia.
- Carneiro, Robert. 1979a. Forest clearance among the Yanomamo: Observations and implications. *Antropológica* 52:39-76.
- . 1979b. Tree felling with stone ax: An experiment carried out among the Yanomamo Indians of southern Venezuela. Pp. 21-58 in C. Kramer (ed.), *Ethnoarchaeology*. New York: Columbia University Press.
- Chagnon, Napoleon. 1966. Yanomamo warfare, social organization, and marriage alliances. Ph.D. diss., University of Michigan.
- . 1974. *Studying the Yanomamo*. New York: Holt, Rinehart and Winston.
- . 1977. *Yanomamo: The Fierce People*. 2d ed. New York: Holt, Rinehart and Winston.
- . 1983. *Yanomamo: The Fierce People*. 3d ed. New York: Holt, Rinehart and Winston.
- . 1992. *Yanomamo*. 4th ed. Fort Worth: Harcourt Brace Jovanovich.
- Cocco, P. Luis. 1972. *Iyewi-teri: Quince años entre los Yanomamos*. Caracas: Librería Editorial Salesiana.
- Codazzi, Agustín. 1940. *Resumen de la geografía de Venezuela*. 3 vols. Caracas: Biblioteca Venezolana de Cultura.
- Colchester, Marcus. 1984. Rethinking Stone Age economics: Some speculations concerning the pre-Columbian Yanoama economy. *Human Ecology* 12:291-314.
- , ed. 1985. *The Health and Survival of the Venezuelan Yanoama*. Copenhagen: Anthropology Resource Center/International Work Group for Indigenous Affairs, document no. 53.
- Colchester, Marcus and Richard Semba. 1985. Health and survival among the Yanoama Indians. Pp. 13-30 in Colchester (ed.), *The Health and Survival of the Venezuelan Yanoama*.
- Coles, J. 1979. *Experimental Archaeology*. London: Academic Press.
- Comité para la Creación de la Reserva Indígena Yanomami. 1983. *Los Yanomami Venezolanos*. Vollmer Foundation.
- Crittenden, Robert and Edward Shieffelin. 1991. The back door to the Purari. Pp. 125-146 in E. Schieffelin and R. Crittenden (eds.), *Like People You See in a Dream: First Contact in Six Papuan Societies*. Stanford: Stanford University Press.
- Cronon, William. 1983. *Changes in the Land: Indians, Colonists, and the Ecology of New England*. New York: Hill and Wang.
- Crosby, Alfred. 1986. *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*. Cambridge: Cambridge University Press.
- Crumley, Carole, ed. 1994. *Historical Ecology: Cultural Knowledge and Changing Landscapes*. Santa Fe: School of American Research Press.
- Denevan, William M. 1992. Stone vs. metal axes: The ambiguity of shifting cultivation in prehistoric Amazonia. *Journal of the Steward Anthropological Society* 20:153-165.
- Divale, William. 1970. An explanation of tribal warfare: Population control and the significance of primitive sex ratios. *New Scholar* 2:173-192.
- Divale, William and Marvin Harris. 1976. Population, warfare, and the male supremacist complex. *American Anthropologist* 78:521-538.

- Dobyns, Henry. 1983. *Their Number Become Thinned: Native American Population Dynamics in Eastern North America*. Knoxville: University of Tennessee Press.
- Doolittle, William E. 1992. Agriculture in North America on the eve of contact: A reassessment. *Annals of the Association of American Geographers* 82:386-401.
- Early, John and John Peters. 1990. *The Population Dynamics of the Mucajai Yanomama*. San Diego: Academic Press.
- Eguillor García, María Isabel. 1984. *Yopo, shamanes y hekura: Aspectos fenomenológicos del mundo sagrado Yanomami*. Vicariato Apostólico de Puerto Ayacucho: Librería Editorial Salesiana.
- Ferguson, R. Brian. 1988. War and the sexes in Amazonia. Pp. 136-154 in R. Randolph, D. Schneider, and M. Diaz (eds.), *Dialectics and Gender: Anthropological Approaches*. Boulder, Colo.: Westview Press.
- . 1989a. Ecological consequences of Amazonian warfare. *Ethnology* 28:249-264.
- . 1989b. Game Wars? Ecology and conflict in Amazonia. *Journal of Anthropological Research* 45:179-206.
- . 1990. Blood of the Leviathan: Western contact and warfare in Amazonia. *American Ethnologist* 17:237-257.
- . 1992. A savage encounter: Western contact and the Yanomami war complex. Pp. 199-227 in Ferguson and Whitehead (eds.), *War in the Tribal Zone*.
- . 1995a. Infrastructural determinism. Pp. 21-38 in M. Murphy and M. Margolis (eds.), *Science, Materialism, and the Study of Culture*. Gainesville: University of Florida Press.
- . 1995b. (Mis)understanding resource scarcity and cultural difference. *Anthropology Newsletter*, November, p. 37.
- . 1995c. *Yanomami Warfare: A Political History*. Santa Fe: School of American Research Press.
- . In press. Violence and war in prehistory. In D. Martin and D. Frayer (eds.), *Troubled Times: Violence and Warfare in the Past*. Langhorne, Pa.: Gordon and Breach.
- Ferguson, R. Brian and Neil L. Whitehead, eds. 1992. *War in the Tribal Zone: Expanding States and Indigenous Warfare*. Santa Fe: School of American Research Press.
- Fried, Morton. 1967. *The Evolution of Political Society: An Essay in Political Anthropology*. New York: Random House.
- Friedman, Jonathan and M. J. Rowlands. 1977. Notes towards an epigenetic model of the evolution of "civilization." Pp. 201-276 in J. Friedman and M. J. Rowlands (eds.), *The Evolution of Social Systems*. London: Duckworth.
- Gilij, Felipe Salvador. 1965. [1783]. *Ensayo de historia Americana*. 3 vols. Trans. and preliminary study by A. Tovar. Caracas: Biblioteca de la Academia Nacional de la Historia.
- Good, Kenneth. 1983. Limiting factors in Amazonian ecology. Paper prepared for the symposium "Food Preferences and Aversions," Cedar Key, Fla., October.
- . 1989. Yanomami hunting patterns: Trekking and garden relocation as an adaptation to game availability in Amazonia, Venezuela. Ph.D. diss., University of Florida.
- . 1991. (With David Chanoff.) *Into the Heart: One Man's Pursuit of Love and Knowledge Among the Yanomama*. New York: Simon and Schuster.
- Grellier, Joseph. 1957. *To the Source of the Orinoco*. Trans. H. Schumckler. London: Herbert Jenkins.
- Hames, Raymond. 1989. Time, efficiency, and fitness in the Amazonian protein quest. *Research in Economic Anthropology* 11:43-85.

- Harding, A. and R. Young. 1979. Reconstruction of the hafting methods and functions of stone implements. Pp. 102–105 in T. Clough and W. Cummins (eds.), *Stone Axe Studies*. Council for British Archaeology Research Council, Report no. 23.
- Harner, Michael. 1963. Machetes, shotguns, and society: An inquiry into the social impact of technological change among the Jivaro Indians. Ph.D. diss., University of California, Berkeley.
- Harris, David. 1971. The ecology of swidden cultivation in the Upper Orinoco rain forest, Venezuela. *Geographical Review* 51:475–495.
- Harris, Marvin. 1977. *Cannibals and Kings: The Origins of Culture*. New York: Random House.
- . 1984. A cultural materialist theory of band and village warfare: The Yanomamo test. Pp. 11–140 in R. B. Ferguson (ed.), *Warfare, Culture, and Environment*. Orlando: Academic Press.
- Hemming, John. 1978. *Red Gold: The Conquest of the Brazilian Indians, 1500–1760*. Cambridge: Harvard University Press.
- . 1987. *Amazon Frontier: The Defeat of the Brazilian Indians*. Cambridge: Harvard University Press.
- Hill, Jonathan, ed. 1988. *Rethinking History and Myth: Indigenous South American Perspectives on the Past*. Urbana: University of Illinois Press.
- Hill, Kim and Hillard Kaplan. 1989. Population and dry-season subsistence strategies of the recently contacted Yora of Peru. *National Geographic Research* 5:317–334.
- Holway, M. 1956. *Bananas*. Washington, D.C.: Pan American Union.
- Huber, Otto, Julian Streyermark, Ghilleen Prance, and Catherine Ales. 1984. The vegetation of the Sierra Parima, Venezuela-Brazil: Some results of recent exploration. *Brittonia* 36(2): 104–139.
- Humboldt, Alexander von. 1889. *Personal Narrative of the Travels to the Equinoctial Regions of America, during the Years 1799–1804*, vol. 2. Trans. and ed. T. Ross. London: George Bell.
- Jank, Margaret. 1977. *Culture Shock*. Chicago: Moody Press.
- Knauff, Bruce. 1993. Review of R. B. Ferguson, *War in the Tribal Zone*. *Science* 260:1184–1186.
- Koch-Grünberg, Theodor. 1979. [1923]. *Del Roraima al Orinoco*. 3 vols. Ed. E. Armitano. Caracas: El Banco Central de Venezuela.
- Linares, O. 1976. "Garden hunting" in the American tropics. *Human Ecology* 4:331–349.
- Lizot, Jacques. 1974. El río de los Periquitos: Breve relato de un viaje entre los Yanomami del alto Siapa. *Antropológica* 37:3–23.
- . 1976. *The Yanomami in the Face of Ethnocide*. Copenhagen: International Work Group for Indigenous Affairs, document no. 22.
- . 1977. Population, resources, and warfare among the Yanomami. *Man* 12:497–571.
- . 1980. La agricultura Yanomami. *Antropológica* 53:3–93.
- . 1988. Los Yanomami. Pp. 479–583 in W. Coppens with B. Escalante (eds.), *Los aborígenes de Venezuela*, vol. 3. Caracas: Fundación La Salle de Ciencias Naturales.
- Métraux, Alfred. 1959. The revolution of the ax. *Diogenes* 25 (Spring): 28–40.
- Montgomery, Evelyn Ina. 1970. *With the Shiriana in Brazil*. Dubuque, Iowa: Kendall/Hunt.
- Patíño, Victor Manuel. 1958. Plátanos y bananos en América equinoccial. *Revista Colombiana de Antropología* 7:295–337.
- Peña Vargas, Camila. 1981. *El P. Luis Cocco: Ejemplo de evangelización Salesiana en Venezuela*. Caracas: Librería Editorial Salesiana.

- Peters, John Fred. 1973. The effect of Western material goods upon the social structure of the family among the Shirishana. Ph.D. diss., Western Michigan University.
- Ramenofsky, Ann. 1987. *Vectors of Death: The Archaeology of European Contact*. Albuquerque: University of New Mexico Press.
- Ramos, Alcida. 1972. The social system of the Sanuma of northern Brazil. Ph.D. diss., University of Wisconsin.
- . 1990. *Ethnology Brazilian Style*. Série Antropologia, no. 89. Brasília: Universidade de Brasília, Instituto de Ciências Humanas.
- . 1995. *Sanumá Memories: Yanomami Ethnography in Times of Crisis*. Madison: University of Wisconsin Press.
- Rogers, J. Daniel. 1993. The social and material implications of culture contact on the Northern Plains. Pp. 73–88 in J. Daniel Rogers and Samuel M. Wilson (eds.), *Ethnohistory and Archaeology: Approaches to Postcontact Change in the Americas*. New York: Plenum.
- Roosevelt, Anna. 1989. Resource management in Amazonia before the conquest: Beyond ethnographic projection. Pp. 30–62 in Darrell A. Posey and William Balée (eds.), *Resource Management in Amazonia: Indigenous and Folk Strategies*, Advances in Economic Botany, vol. 7. Bronx: New York Botanical Garden.
- , ed. 1994. *Amazonian Indians from Prehistory to the Present: Anthropological Perspectives*. Tucson: University of Arizona Press.
- Ross, Eric. 1978. Food taboos, diet, and hunting strategy: The adaptation to animals in Amazon cultural ecology. *Current Anthropology* 19:1–36.
- Saffirio, Giovanni. 1985. Ideal and actual kinship terminology among the Yanomama Indians of the Catrimani River basin (Brazil). Ph.D. diss., University of Pittsburgh.
- Saffirio, Giovanni and Richard Scaglione. 1982. Hunting efficiencies in acculturated and unacculturated Yanomama villages. *Journal of Anthropological Research* 38:315–327.
- Saffirio, John and Raymond Hames. 1983. The forest and the highway. Pp. 1–52 in *The Impact of Contact: Two Yanomamo Case Studies*. Cambridge, Mass.: Cultural Survival Report no. 11; Bennington, Vt.: Bennington College Working Papers on South American Indians, no. 6.
- Salazar, Fred with Jack Herschlag. 1967. *The Innocent Assassins*. New York: Dutton.
- Salisbury, R. F. 1962. *From Stone to Steel: Economic Consequences of a Technological Change in New Guinea*. London: Cambridge University Press.
- Saraydar, Stephen and Izumi Shimada. 1971. A quantitative comparison of efficiency between a stone axe and a steel axe. *American Antiquity* 36(2): 216–217.
- Schomburgk, Robert. 1841. Report of the third expedition into the interior of Guyana. . . . *Journal of the Royal Geographical Society of London* 10:159–267.
- Shapiro, Judith Rae. 1972. Sex roles and social structure among the Yanomama Indians of northern Brazil. Ph.D. diss., Columbia University.
- Sharp, Lauriston. 1990. Steel axes for Stone Age Australians. Pp. 410–424 in James Spradley and David McCurdy (eds.), *Conformity and Conflict: Readings in Cultural Anthropology*, 7th ed. Glenview, Ill.: Scott, Foresman.
- . 1993. Steel axes for Stone Age Australians. Pp. 24–31 in Arthur Lehmann and James Myers (eds.), *Magic, Witchcraft, and Religion: An Anthropological Study of the Supernatural*, 3d ed. Mountain View, Calif.: Mayfield.
- Simmonds, N. W. 1962. *The Evolution of Bananas*. London: Longmans.
- Smole, William. 1976. *The Yanomama Indians: A Cultural Geography*. Austin: University of Texas Press.

- Steinvorth de Goetz, Inga. 1969. *Uriji Jami! Impresiones de viajes Orinoquenses por aire, agua y tierra*. Caracas: Asociación Cultural Humboldt.
- Steward, Julian. 1976. *Theory of Culture Change: The Methodology of Multilinear Evolution*. Urbana: University of Illinois Press.
- Steward, Julian and Luis Faron. 1959. *Native Peoples of South America*. New York: McGraw-Hill.
- Taylor, John. 1988. Goods and gods: A follow-up of "Steel axes for Stone-Age Australians." Pp. 438-451 in Tony Swain and Deborah Bird Rose (eds.), *Aboriginal Australians and Christian Missionaries*. Bedford Park, South Australia: Association for the Study of Religions.
- Townsend, William. 1969. Stone and steel tool use in a New Guinea society. *Ethnology* 8:199-205.
- Turner, Terence, ed. 1993. *Cosmology, Values, and Inter-Ethnic Contact in South America*. South American Indian Studies, no. 2. Bennington, Vt.: Bennington College.
- Valero, Helena. 1984. *Yo soy Napeyoma: Relato de una mujer raptada por los indígenas Yanomami*. Caracas: Fundación La Salle de Ciencias Naturales, Monografía no. 35.
- Vareschi, Volkmar. 1959. *Orinoco arriba: A través de Venezuela siguiendo a Humboldt*. Caracas: Lectura.
- Whitehead, Neil. 1988. *Lords of the Tiger Spirit: A History of the Caribs in Colonial Venezuela and Guyana, 1498-1820*. Providence, R.I.: Foris.
- . 1994.
- Whitehead, Neil L. 1994. The ancient Amerindian polities of the Amazon, Orinoco, and Atlantic Coast: A preliminary analysis of their passage from antiquity to extinction. Pp. 33-54 in Roosevelt (ed.), *Amazonian Indians from Prehistory to the Present*.
- Wike, Joyce. 1951. The effect of the maritime fur trade on Northwest Coast Indian society. Ph.D. diss., Columbia University.
- Wilbert, Johannes. 1963. *Indios de la región Orinoco-Ventuari*. Caracas: Fundación La Salle de Ciencias Naturales.
- . 1972. *Survivors of Eldorado: Four Indian Cultures of South America*. New York: Praeger.
- Wilmsen, Edwin N. and James R. Denbow. 1990. Paradigmatic history of San-speaking peoples and current attempts at revision. *Current Anthropology* 31:489-524.
- Wolf, Eric. 1982. *Europe and the People Without History*. Berkeley: University of California Press.
- Zent, Stanford. 1992. Historical and ethnographic ecology of the upper Cuao River Wothiha: Clues for an interpretation of native Guianese social organization. Ph.D. diss., Columbia University.
- Zerries, Otto. 1955. Some aspects of Waica culture. *Proceedings of the 31st International Congress of Americanists*, pp. 73-88. São Paulo.

CHAPTER 14

Missionary Activity and Indian Labor in the Upper Rio Negro of Brazil, 1680-1980: A Historical-Ecological Approach

JANET M. CHERNELA

The role of missions in postcolonial Brazil remains a significant gap in contemporary models of Latin American social and economic history. The prevailing view among historians holds that the mission village system, which flourished in Brazil between 1680 and 1750, was succeeded by an irreversible shift toward secularization (MacLachlan 1973; Boxer 1962), severing permanently the practical and ideological ties between church and state in Brazil. Taking as its case the mission village enterprises of the Upper Rio Negro in Brazil (see figure 14.1), this chapter shows the persistence of the mission village system in the north-central Amazon into the last quarter of the twentieth century. I discuss the environmental, economic, and political factors that together have contributed to a "history apart" for the native American populations inhabiting the northern frontiers of Brazil, and the role of the mission village as economic and political agent in the region through a number of significantly different governmental regimes.

The mission villages of the northern Amazon received the attention of modern reformers in 1980 when an international tribunal on human rights found the Order of Salesians of the Upper Rio Negro in violation of laws and agreements on ethnocide and racial discrimination against the 20,000 Indians of the Rio Negro watershed. The allegations against the mission, charged by both urban reformers and indigenous witnesses, focused on its active participation in the supply of indigenous labor to urban centers. The case raised a number of questions regarding the continued role of the frontier ecclesiastical mission in modern Brazilian society.

Rather than treat the events of 1980 as isolated from the parameters of political and economic contexts, I emphasize the historic embeddedness of the role of the frontier mission as mediator in the organization, distribution, and control of Indian