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GAME WARS? ECOLOGY AND CONFLICT IN AMAZONIA

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This paper suggests a resolution of the long-standing controversy concerning game scarcity and warfare in Amazonia. The "protein hypothesis" is evaluated against extensive, mostly recent, literature on relationships between individuals, society, and nature. The findings indicate that those who say game scarcity does explain war and those who say it does not are both correct, but in different senses of "explanation." Game is found to be a nutritional necessity for many interriverine peoples, a necessity that in some circumstances can be quickly depleted by hunting. Increasing game scarcity does lead to increasing interpersonal hostility and social conflict. However, the connection between these hostilities and war is qualified and tenuous. Most game scarcity leads to movement rather than war, and most warfare does not seem attributable to game scarcity. The protein hypothesis, then, is largely correct in identifying a dynamic that can lead from game scarcity to war, but it is inadequate as a general explanation for Amazonian warfare.

FOR ABOUT FIFTEEN YEARS, researchers have argued whether game scarcity causes warfare in interriverine Amazonia. There are probably hundreds of published references to this debate and no less than seven overviews of the subject. Virtually every anthropologist knows about the issue, it appears in many, perhaps most, introductory courses, and it regularly picks up "media attention." Despite all this interest, the debate is far from resolved. Rather than moving toward resolution, it seems to have settled into stalemate. The whole issue could easily be left hanging as attention moves on to less trodden topics.

This paper presents an alternative.[1] By breaking the general controversy down into more specific propositions, I shall develop an argument which may be potentially acceptable both to those who say game scarcity causes war and to those who say it does not. Briefly, proponents of the protein hypothesis are supported in their contentions (1) that game often is a nutritional necessity, which is quickly depleted by hunting, and (2) that diminishing game availability leads to increasing interpersonal hostility and social conflict. However—and here the opponents take heart—the pathway from game scarcity to war is hedged by so many qualifications and restrictions that it becomes a most tentative connection. So, both sides can justly claim verification. This does, however, leave most of actual Amazonian warfare unexplained. A distance remains to be travelled, but the way is more clear.

As several overviews of the protein controversy are already available (Chagnon 1983:81–89; Chagnon and Hames 1980a; Gross 1982; Hames and Vickers 1983:12–18; Harris 1984a, 1984b; Sponsel 1983), only an outline of its development is needed here. The present debate over the significance of ecological factors in Amazonian warfare began with Vayda's (1969:202–3, 209) suggestion in 1961 that Amazonian peoples might fight over access to garden sites in secondary growth forest land. Although it is widely accepted that the more densely settled chiefdoms of the Brazilian coasts and alluvial rivers did fight for land (see below), Vayda's suggestion did not fit the warfare observed in the interior. Interriverine peoples seemed to have more than enough good garden land, with the decisive case being the Yanomamo groups described by Chagnon (1967, 1972, 1973, 1974, 1977).

In these works Chagnon argues that Yanomamo warfare is an adaptation to a hostile and "socially circumscribed" political environment, rather than to the natural environment.[2] While that view is compatible with some understandings of what constitutes an ecological perspective on war (e.g., Vayda 1967:87–88), other ecologists took the exclusion of natural environmental factors as a direct challenge (e.g., Gross 1973:125). Some took up the goal of finding "at least one infrastructural variable that would account for warfare among low-density Amazonian societies" (Harris 1984b:130).

That variable would be game animal availability. Manioc, the staple of interriverine diets, is rich in calories but very deficient in protein and fats (Roosevelt 1980:126–28, 137–38). Many Amazon specialists, most notably Carneiro, had concluded (1) that people who live away from good fishing waters depend primarily on hunted game for these nutrients, (2) that game is limited and easily reduced by hunting, and (3) that this sets limits on the size and permanence of settlements (Carneiro 1985:77; Denevan 1985:103–9; Lathrap 1970:128–29, 1973:85; Meggers 1971:99).

Two papers written about the same time make the connection between game limitations and warfare (see also Divale 1970:182 n.21). Discussing the Sharanahua, Siskind (1973b) posits an "economy of sex." Through various patterned interactions, women exchange meat for sex. Declining availability of game leads to tensions between men and women and then to competition among men and even raiding for women. Relocations prompted by this fighting over women lower hunting pressure on game. Bennett Ross (1971) accepts Siskind's model and marshals evidence indicating that protein is a limiting factor for many Amazonian peoples. She applies this perspective to Yanomamo fighting, arguing that it may be part of an evolved functional complex which regulates a balance between population and game resources. The protein hypothesis regarding Yanomamo warfare was brought to a larger audience in several publications by Harris (1974, 1975, 1977, 1979b; Tavris 1975; see also Divale and Harris 1976; Harris and Ross 1987:51–62). Harris also expanded the posited population-regulation functions of war, emphasizing the significance of female infanticide. Contrary to Chagnon's (1983:86) assertion that "some protein advocates . . . dismiss the suggestion that people will fight over sexual matters," in all these formulations the model holds that interpersonal conflicts, often involving male competition for women, are the trigger for fighting. But in the protein hypothesis, those conflicts themselves are understood to be a function of increasing resource scarcities.

Altogether, the protein hypothesis consists of three distinct arguments which deal with (1) game as a limiting factor, (2) game scarcity as a cause of war, and (3) the adaptive consequences of war. The first two of these topics are examined in this paper. The third will not be examined here, for the posited adaptive consequences of war (also see Durham 1976:403–8) involve distinct empirical questions and dense theoretical issues concerning functionalism and sociocultural evolution which would only be distractions (see Ferguson 1984:25–37).[3]

GAME AS A LIMITING FACTOR

Natural Conditions

Several authors review natural science findings which show why game animals are relatively few in interriverine Amazonia (Fitkau and Klinge 1973; Gross 1975, 1982; Lathrap 1970:Chapter 2; Meggers 1971:Chapter 1; Roosevelt 1980:Chapter 3; Ross 1978; Sponsel 1986). Briefly, the ancient soils typical of Amazonia are heavily leached and nutrient poor. In the forest, plant nutrients are locked in a tight cycle between leaf canopy and rapidly decaying debris on the ground. Comestible plants for larger ground-dwelling herbivores are relatively limited. A high percentage of animal biomass is distributed in hard-to-hunt canopy animals and detritivore insects. The larger ground animals tend to be solitary and mobile. Limited soil nutrients also result in relatively little life in many forest streams.

This general image must be qualified, however. Game scarcity should not be thought of as a universal condition in Amazonia and never has been suggested as such, Chagnon (1983:86) notwithstanding. Protein was suggested as one of many possible limiting factors, albeit a very important one (Bennett Ross 1980:38–39; Gross 1982:129–30; Harris 1984b:130). Ecologists have always recognized that the huge expanse of Amazonia encompasses great ecological variation, and this variation expectably will shape the kinds of societies found in an area and the kinds of warfare they wage. The following discussion identifies some of the major variations.

Several major rivers, along with some seacoasts and seasonally flooded plains, offer fish, game, and agricultural resources far more abundant than those of the interriverine zones. This abundance is the basis of the riverine-interriverine distinction (Lathrap 1973). At contact these areas supported large settled villages, organized into chiefdoms, which practiced a type of warfare very different from the known wars of the interior. Forces often numbered in the hundreds of men drawn from multiple, confederated villages. They travelled by canoe in campaigns requiring extensive material preparations. In combat, coordinated formations executed sophisticated tactics. The wars often had overtly territorial objectives, and there were large buffer zones between powerful enemies. The protein hypothesis was never intended to apply to these conditions, and war by ancient river and coastal peoples will receive only passing attention in this paper.

In the interriverine areas which are the concern of the protein hypothesis and this essay, other variations are important. The attention recently devoted to the Yanomamo may have obscured the fact that there are interriverine Amazonian groups living in different environments, with different kinds of societies and different kinds of warfare. Two patterns stand out in the existing literature, but quite possibly the list could be expanded.

The piedmont region (*montana*) where the Andes descend to the tropical lowlands has a more limited fauna than lower altitudes, with fewer large game animals and fewer and smaller fish in the rapid streams (Bennett Ross 1984:85; Denevan 1982:19, 1985:104–9; Harner 1973:60; Paolisso and Sackett 1982:15). Ross (1978:12) suggests that contemporary Achuara Jivaro maintain an adequate protein intake through a "behavioral pattern involving sorcery and homicide, which disperse population." Their dispersed small settlements, emphasis on small game hunting, and seeming obsession with individualistic feuding (see Bennett Ross 1984:96–105; Descola 1981; Harner 1973:180–82; Karsten 1967) are contrasted by Ross (1978:8) to the better-known lowland pattern of larger villages, big game hunting, and intervillage warfare. The distinction between small and large villages will receive more attention below.

Another environmentally distinctive region is the central Brazilian *cerrado*, savanna interrupted by forest thickets along watercourses. The Ge-speaking peoples and the Bororo who inhabit the cerrado live in communities which are larger than those of the tropical forest—several hundred to over a thousand people—but which break up for much of the year into long-distance trekking groups (Gross 1979; Lévi-Strauss 1967; Maybury-Lewis 1974, 1979). Only limited information is available on the ecology of the region (Flowers 1983; Flowers et al. 1982; Gross 1983; Gross et al. 1979; Werner 1983). This is matched by a lack of studies on central Brazilian war patterns, with the notable exception of Maybury-Lewis (1974). So it is impossible at present to ascertain the relationship between ecology and war. However, competition for environmental resources does seem to be involved in war between different communities, often from different "tribes." In one collection of Ge folklore, eleven of twenty-six tales of battles begin with a group set upon by enemies whom they encounter while out hunting or gathering (Wilbert and Simoneau 1984:270–368). Information in Maybury-Lewis (1974:23–28, 53–56, 210) is consistent with the interpretation that overlapping resource territory fosters hostility (although Maybury-Lewis does not draw this conclusion). Elsewhere I suggest that this territorial jostling may be attributable to circumstances of contact (Ferguson n.d.b).

So regional ecological variations can have direct and indirect consequences for warfare. Local variations also can have such effects. In many situations resources other than or in addition to game may be limiting factors. Vayda's (1969:205) suggestion of competition over garden land could well be true in some cases. Despite the general availability of land, suitable garden spots can be quite restricted in specific areas (Balee 1987:14, n.d.; Fock 1963:4; Gillin 1936:154; Gross 1983:447–48; Leeds 1961:19–20; Moran 1983; Smith 1980:563; Vickers 1978:14, 1983:456, 468). Further, since Carneiro's (1979a, 1979b) experiments in tree felling imply that the advantages of establishing gardens in secondary growth forest rise dramatically when stone, rather than steel, axes are used, there may well have been competition over this limited resource in earlier times. So, to repeat, protein scarcity should not be thought of as a universal condition in Amazonia.

The idea that game is often an effective limiting factor is challenged by Beckerman (1979), who argues that there is an "abundance" of protein in Amazonia. His article stands as the most formidable general attack on game as a limiting factor (also see Descola 1981; Smith 1976). The following discussion considers his argument and evidence.

Many of the protein sources identified by Beckerman are associated with rivers and so are irrelevant for the question of protein scarcity in interriverine areas. For the interriverine areas, Beckerman stresses the availability of gathered and cultivated vegetable sources of protein. He singles out Brazil nuts as rich in protein (Beckerman 1979:547–48). They are, but they are also so loaded with carbohydrates that a person relying on them for protein would be able to consume little else (Werner 1983:234). Beckerman (1979:548) also mentions the fruit of the cultivated piqui tree. Piqui fruit is an important food source in the Upper Xingu and the subject of great attention there, but it is available only for a brief season (Basso 1973:34–35; R. Murphy and Quain 1955:27).

Beckerman (1979:540–47) gives the most attention to edible palm products, but he admits that there is little detailed information on their distribution, seasonality, and nutritional content (see Balee 1988a). One widely used palm product is the fruit of the peach palm, but this too is only seasonally available (Chagnon 1977:20; Ross 1978:30). Like piqui fruit, it is accorded great importance by the people who use it (Bennett Ross 1971:34; Chagnon 1977:29–33, 36; Lathrap 1970:57–58; Morey and Metzger 1974:39; Smole 1976:159–61)—even to the point of fighting over it (Chagnon 1977:77).[4] Peanuts also merit special attention from Beckerman (1979:551–52). Peanuts, however, are most suited to drier conditions, such as those in parts of the Brazilian highlands (Lathrap 1970:58). Even where they are a viable crop, other problems limit their utility as a primary source of protein (Roosevelt 1980:150–52). Nevertheless, among the protein poor Tapirape, the peanut is prized above all other crops (Wagley 1983:57–58). What all these examples indicate is that plants which are good sources of protein are avidly sought, but they do not provide an adequate, year-round supply of protein.

Beckerman (1979:536–39) does *not* claim that large animals can be hunted indefinitely without depletion, but he calls attention to insects as a resilient faunal protein source. Insects certainly are abundant, and most ethnographies report their consumption is an important element in diets. But in observed Amazonian societies, insects provide only a minor percentage of dietary protein (Clastres 1972:160, 166–67; Denevan 1985:104–6; Gross 1982:136; Henley 1982:48; Lizot 1977:509; Milton 1984:14; see Roosevelt 1980:182 n.2 for additional citations).

As a general observation, Beckerman's estimates are very optimistic and have not received support from subsequent empirical research (Gross 1982:136–37; see also Ross 1978:29–30). This preeminent effort to challenge the protein hypothesis has failed to establish that interriverine environments contain an abundance of protein sources to supplement game in diets.

The Organization of Work and Settlement Size

It is a mistake, and one that has engendered much futile disputation, to try to understand effective protein scarcity in terms of absolute protein availability in the environment, a point emphasized by Ross (1978:15). One cannot simply count potential protein sources and reach any conclusion about their effective availability for human consumption. In the cultural materialist research strategy which informs my approach, ecological conditions are significant only in interaction with other components of the infrastructure.[5] The next section illustrates aspects of this interaction.

A common theme in many disparate studies of the past decade is that no single type of work can be understood in isolation. Work constitutes a system. Different work activities are mutually constraining, and they also interact with other social behaviors and systems. How much and what kind of animal protein is brought home depends on how people set out to get it, and that is influenced by all the other work they do.

Several specific interactions have been noted between agriculture and hunting/fishing. Requirements of gardening can limit long-distance hunting and fishing (Dufour 1983:353; Hames 1980:53) and vice versa (Maybury-Lewis 1974:48). Patterns of long-distance trekking to hunt and gather are associated with reliance on crops that mature more quickly and need less processing than does bitter manioc (Balee 1985:489–90). Abandoned gardens attract game and so are visited by hunters (Balee 1985:495–99, 1988b:38; Linares 1976; Ross 1978:10). Frequent village movement to maintain game supplies may prohibit development of detailed knowledge of local soils and thus restrict the crops which can be grown (Moran 1983:129–31). Finally, gardening practices can lead to long-term modifications of forest cover (Balee n.d.), and this would affect faunal populations (Ross 1978:10).

Excluding consideration of agriculture, different hunting and fishing activities condition each other, as would be expected according to optimal foraging theory. Ross (1978:5–15) argues that where fishing is productive, little effort will go into hunting (see also Beckerman 1980a:91, 99, 104) and that within the sphere of hunting alone, the mix of available species shapes hunting strategy. Ross's (1978:16–33) accompanying discussion of emic preferences and prohibitions on certain fauna as food is the key statement in a debate on food taboos.

In some parts of Amazonia, different faunal procurement strategies seem to result in niche specialization, accompanied by local disdain for the food and lifeways of neighbors in a different niche (Golob 1982:213–14; Nimuendaju 1946:149; Oberg 1953:25–29; Wagley 1983:29–30; see also Nietschmann 1972). But the pattern seems variable. In other areas people make deliberate efforts to visit and exploit different ecological zones or to maintain a symbiotic exchange between groups in different niches (Bennett Ross 1980:40–41; Jackson 1983:150–55; Milton 1984:9–10; Morales and Arvelo Jimenez 1981:613; Morey and Metzger 1974:54).

All of these activities and relationships can be affected by Western contact. Increased sedentization can aggravate problems of depletions and so push people into commodity networks (Gross et al. 1979). Production of commodities enters in as an important element in the total system of work (Aspelin 1975; Henley 1982:212–21; Johnson 1977). Technological innovations change hunting efficiencies (Hames 1979:245; Yost and Kelly 1983; cf. Ross 1978:213) and make swidden agriculture easier, or even possible (Carneiro 1979a, 1979b; Holmberg 1969:265; Morey and Metzger 1974:15–20; Silverwood-Cope in Milton 1984:19). New domesticates, especially introduced pigs (Ross 1978:14) or cattle (Taylor 1981), can trigger major changes in work and diet.

In sum, efforts devoted to procurement of any one resource will be strongly conditioned by all other productive effort. The salience of any particular natural condition is shaped by the totality of interactions between people and their environment. What a man tries to hunt, where, when, and how frequently are affected by all the other work he must do.

Another organizational consideration affecting the effective availability of game is settlement size. This point was raised by Ross (1978:5–8, 31) but has not received adequate attention in subsequent debates. As argued by Ross, the same environment can allow different hunting patterns, and this difference is linked to the size of residential groups. Smaller animals are more numerous and reproduce faster than larger animals. Large game, he argues, is quickly depleted near any settlement. But hunters from small settlements (fewer than roughly 80 people) may prey on small game for relatively long periods without causing depletions. While the actual impact of hunting will depend on many circumstances besides sheer size, smaller settlements may be able to remain in place years longer than larger settlements, at least in regard to game availability.

Because small game is relatively abundant and resilient—still according to Ross—an area characterized by small settlements and small game hunting can support a relatively large human population. In contrast, the more intensive hunting associated with larger settlements tends to deplete both large and small game in the neighborhood. Larger villages maintain an adequate game intake through collective long-distance hunting expeditions which focus on the larger game animals encountered in less frequently hunted, deep forest areas. This is a less efficient hunting pattern in terms of making use of existing game. Villages will move more frequently, and an area will support fewer people.

Following this line of reasoning, settlement size enters in as a crucial variable affecting the significance of game availability. What determines settlement size? Again, many factors can be identified. Conditions related to Western contact—epidemic diseases and access to Western manufactures—play a big role. Structural arrangements having to do with kinship and political organization also are significant (see Chagnon 1979; Riviere 1984:73–74), although I argue elsewhere (Ferguson 1988) that these operate within limits set by material-historical circumstances (see also Arhem 1981:297–303). Focusing on ecological circumstances, Ross (1978:6–7) suggests that, for the Achuara, a long-term process of areal depletion of large game animals leaves little alternative to small settlements. But the Achuara would be atypical in this. More commonly, a range of sizes is ecologically possible. People who rely on fishing and/or small game hunting can accomplish most daily production tasks with quite small residential groups, sometimes even nuclear families (although these invariably have cooperative relations with other families in the immediate vicinity—see below). But people can also live in larger villages which engage in daily, cooperative hunting and pooling of resources (also see Ferguson 1988 and below).

One factor which can explain why people would live in larger settlements, despite the hunting problems this entails, is warfare. Ross (1978:8) asserts that settlement size determines war patterns, not the reverse. That may be true if smallness of settlement is determined by narrow tolerances of local ecology, as he indicates for the Achuara Jivaro. However, taking a broader view encompassing less circumscribed Amazonian peoples, Bennett Ross (1980:54–55) observes that the presence of warfare "will set a threshold on settlement size below which communities may be especially vulnerable to attack," with protein availability setting the upper size limit. Several other ethnographers have noted that the threat of a raid by a sizable war party makes people cluster together to maintain an adequate military force (Arhem 1981:54; Carneiro 1987:110; Chagnon 1973:199; Clastres 1972:164; Good 1978:21; Hames 1983:398, 423–24; Oberg 1973:199; Shapiro 1972:38–39; Steward 1949:704).[6] In this light, it seems very significant that the Amazonian region where the smallest of settlements are found, the Guianas (see Riviere 1984:4), is also notable for the relative absence of warfare (see below).

All this has very important implications for the protein hypothesis. First, it means that the game depletion explanation of warfare is most generally applicable to interriverine populations living in larger villages. Second, since large villages are the result of warfare, it suggests that the protein hypothesis is most applicable within a context of ongoing warfare, rather than as an explanation for the initiation of warfare. Third, it means that if war does result from diminishing game supplies, war, in turn, by forcing nucleation, reduces access to and so availability of game, thus *creating* scarcities. This is one of several reasons for questioning the "adaptive" character of warfare.[7]

The preceding discussions show that the relationship between absolute environmental supplies of comestible protein or any other nutrient (or resource) and effective availabilities for human consumers is a complex relationship indeed. It is strongly affected by the organization of work and village size, and no doubt by other factors besides. The key issue is not absolute supplies, but whether in practice interriverine peoples find game to be limiting. To answer this, we must focus on the results of production efforts. When that is done, the proposition that game is a limiting factor receives ample support.

Protein Procurement

There has been an unfortunate dispute over what the protein hypothesis actually predicts (Chagnon 1980:118; Chagnon and Hames 1979, 1980a, 1980b; Hames 1983:421; Harris 1979b, 1984a, 1984b; Nietschmann 1980:118). At one point Harris (1971:230, 1974:100–102) was portraying the Yanomamo as an "adaptive failure" who had depleted their environment and were consequently "starving for protein." He now acknowledges that to have been a mistake (Harris 1984b:115, 118). Still, it should be noted that the presumed dietary inadequacy was posited as a consequence of a *failure* to adapt.

The basic ecological argument, however, has always been that adaptive responses, such as war, are triggered by diminishing returns for effort in procuring critical resources and that (successful) adaptation consists of maintaining actual resource intake within acceptable levels. That is a general ecological position which antedates this particular debate (Carneiro 1964:214; Harris 1972:18; Vayda 1969:214; see also Harris 1974:66). It was explicitly stated in initial formulations of the protein hypothesis (Bennett Ross 1971:11; Siskind 1973b:231), and it has been clearly repeated numerous times since 1975 (Good 1983:3; Gross 1975:535, 1982:129, 133; Harris 1977:53, 1979b:130, 1984b:120–21; Ross 1978:33, 1979:152). So there should be no confusion. The protein hypothesis does not predict a deficiency of dietary protein. On the contrary, it predicts that a cultural response—war—will arrest the decline in protein intake before it reaches unhealthful levels.

Despite limited environmental protein sources and the undisputed protein-poverty of major interriverine cultigens, Amazonian peoples are typically reported to have adequate protein in their diets (Berlin and Markell 1977; Campos 1977; Chagnon and Hames 1979; K. Hill and Hawkes 1983; Johnson 1977, 1982; Lizot 1977; Vickers 1980; Werner et al. 1979; Yost and Kelly 1983; see Chagnon 1983:87 for additional citations). Again, this is what the protein hypothesis predicts and also seeks to explain. Still, it must be acknowledged that dietary protein *greatly* in excess of minimum needs would cast doubt on the reality of protein as a limiting factor. But critical inspection of the diet studies does not indicate that this is the case.[8]

Some reports of very high protein intake are not relevant because they describe riverine situations. Some make the fundamental error of confusing live weight of game with consumable protein. Estimates of consumable protein in game range from 14 percent to 20 percent of live weight (Clark and Uhl 1987:18; Gross 1982:137; Harris 1979b:131; Paolisso and Sackett 1982; Werner 1983:234). For purposes of later calculations, I use a compromise figure of 17 percent.

Temporal variation can upwardly distort intake level reports in three ways. Measurements taken early in the occupation of a new site will be high, obviously, since game depletion takes time. The period of observation may be weighted toward the more bountiful seasons in an annual cycle that has regular depressions of fish and game availability. Such depressions often accompany the flooding of the rainy season (Berlin and Markell 1977:77–78; Clark and Uhl 1987:17; Dumont 1976:144; Milton 1984:11–14; Smith 1976:458–59; Yost and Kelly 1983:219; cf. K. Hill et al. 1984). And occasional windfalls may boost averages and so conceal more typical lower consumption (see Ferguson 1988). In all forms of temporal variation, periods of high intake cannot provide for other times. Storage of flesh in Amazonia is usually possible for only a few days, or about two weeks in the best conditions (Roosevelt 1980:105–9). Neither can protein be stored in the body; consumed protein in excess of current physiological needs is excreted (Pollock 1978).

Another kind of distortion, based on an often unwarranted assumption of perfect distribution (cf. Dufour 1983), arises from averaging total intake for a group. It has been widely observed that Amazonians have a great appetite for meat, "meat hunger," and when they have meat, they eat all they can (Baksh 1982:7; Descola 1981:623–24; Good 1983:11; Gross 1975:532; Jackson 1983:58; Johnson 1982:415; Lizot 1985:111; Shapiro 1972:57; Wagley 1983:58–60).[9] Despite norms of sharing, people often withhold some meat for themselves or closer relatives (see below). Consequently, much more than a population average minimum intake may be required for all members of a group to receive an adequate protein allotment (see Nietschmann 1972:54).

Finally, it is not easy to say what is a safe minimum level of protein consumption (see Gross 1975:532; Lizot 1977:512). Illness and parasites may create a heightened need for protein (Clark and Uhl 1987:18; Ross 1979:153), as may the metabolism of residual toxins in bitter manioc food (Dufour 1983:351; Spath 1981). Leaving aside these complications, Dufour (1983) demonstrates how difficult it is to apply United Nations' FAO/WHO guidelines on protein in an Amazonian context, and Harris (1985:Chapter 2) emphasizes that game must be considered as a source of other vital nutrients besides protein, such as fats. In some situations game may also be the major source of calories (K. Hill et al. 1984; Milton 1984:17). Mindful of all these uncertainties, it is still worth noting that the figure of 30 grams per day is sometimes invoked as a rough benchmark of minimal dietary adequacy. All things considered, then, interriverine peoples generally have adequate protein in their diets, but within the lower reaches of the acceptable range.

The protein hypothesis predicts that, in interriverine areas, hunting will reduce the local availability of game animals, resulting in diminishing returns for labor and a decline in protein consumption. As noted earlier, this pattern had been reported by many ethnographers, and recent quantitative research has documented it. Harris (1984b:124–27, 1984a) summarizes four such studies (Baksh 1982; Good 1983; Paolisso and Sackett 1982; Vickers 1980). These do not need discussion here, other than to note that they involve relatively large villages with populations over 100, except for the Yukpa village studied by Paolisso and Sackett (1982:2) with a population of 41. That community also made extensive use of shotguns in hunting.

Three newer studies also show game depletion. Saffirio and Scaglion (1982) compare hunting efficiencies in several Brazilian Yanomamo villages. Very small villages (22.1 average population) newly located in virgin or long-fallow forest enjoy high hunting yields. Residents of a somewhat larger village (about 37 inhabitants) anchored to a highway for five years "have depleted their local resources" (Saffirio and Scaglion 1982:325). The latter keep meat in their diet by more intensive hunting efforts, and the authors question if that will suffice in the future (see also Smole 1976:175–76).

The other two studies focus on local subgroups of hunter-gatherers which have recently settled at missions. Among the Ache of eastern Paraguay, the sedentary residence for two years of over 150 people reduced the efficiency of hunting within a day's walk of the mission to less than half that of more distant areas (K. Hill and Hawkes 1983:165). Among the Maku of the northwestern Amazon, the greatest hunting yield was in a remote forest area. The least amount of animal food was found at a large mission settlement of about 165 people:

> The individuals in residence appeared to have little to eat other than manioc products and, occasionally, termites, grubs, or fish. This was the only Maku settlement in which nocturnal wood rats, freshwater crabs, small armoured catfish, pipefish, and other small aquatic animals were avidly collected for human consumption. (Milton 1984:14)

Vickers (1983:469–70) estimates that hunting by Siona-Secoya annually kills about 5–9 percent of local game. Besides killing animals, hunting also scares animals away, and that may be equally responsible for depletion (Moran 1983:127; Smole 1976:208). All this (see also Hames 1980:56–58) indicates that hunting efficiency typically will begin to show serious declines soon after establishment of a large village.

In contrast, four quantitative studies seem to suggest that hunting does not lead to fairly rapid depletion of game and the consequent need for relocation. First, Hames (1980:32–33) asserts that Amazonian peoples deal with local game depletion through a system of hunting zone rotation and "fallowing," so that "game depletion is not an important cause of village movement." Despite Nietschmann's (1980:134–35) immediate endorsement of this notion, Hames (1980:54–57) is not clear on what is meant by rotation. In one sense he seems to mean that a given village, having depleted the larger game in one zone, will stop hunting there and thus allow game to rebound. Yet his data (Hames 1980:46, 53) show that no such fallowing occurs. The areas where game has been depleted are those around the villages, and these are still actively hunted because of their accessibility. There is no reason to expect a game rebound here.

In another sense rotation seems to mean that one village will use an area once hunted, but long abandoned, by another group. His data show that this happens, and the long-unhunted areas are initially well-supplied with game. However, the previous hunters of these zones have either relocated to river sites or are apparently hunting outside the study area (Hames 1980:56–57).

These replenished zones are accessible to the settled Ye'kwana only because they can reach them in motor launches (Hames 1980:47); nearby Yanomamo without launches are less able to make use of such distant areas (Hames 1979:245). What we see here is not an indigenous system of hunting zone rotation but simply an *expansion* of hunting territory made possible by conditions related to Western contact.[10] In a more recent article, Hames (1983) describes dynamics indistinguishable from the standard game depletion view, with no mention of zone rotation.

Vickers (1988) also challenges the depletion position, arguing that a linear regression analysis of hunting yields for one Siona-Secoya village over a ten-year period shows only a "questionable" relationship to population. The anomalies, Vickers (1988:1521) notes, derive from two years, 1974 and 1981–82. The second year of this community's existence was 1974, and hunting yields were only slightly lower than during the first year. That may confound linear regression, but it is no problem for the depletion argument, which never has asserted that depletion is immediate or linear. A dramatic upturn was registered in 1981–82, after several years of low yields. This would seem to contradict the depletion view. However, Vickers provides no information about his sample. Critically, he gives no indication of how many "man-days" of hunting were involved, so the high yield could be the result of an exceptional windfall, most likely an encounter with a herd of white-lipped peccary (Vickers 1988:1521).

Significantly, Vickers's (1988:1522 n.10) data also show a 23 percent increase in the length of hunting days, comparing 1973–74 to 1979–82, and what he acknowledges to be depletion of other local animals (besides peccary) which make up the more regular kills of Siona-Secoya hunters (Vickers 1988:1522). Vickers's argument that the peripatetic movements of the wide-ranging white-lipped peccary will produce major fluctuations in hunting yields is a point well taken although it was anticipated by Ross (1978:9–10). But his own data still show that the daily task of putting meat in the pot gets more difficult over time.

Yost and Kelly (1983:223) argue that game is not a major limiting factor for the Waoroni, who, they assert, enjoy protein consumption well above minimum nutritional requirements even using traditional technology. But, in fact, their data conform to the expectations of the depletion argument—if clarifications discussed earlier in this paper are taken into account. First, their very rough per capita daily consumption estimate of 190 grams of *meat* (calculated at 70 percent of live weight) prior to the shotgun (Yost and Kelly 1983:206–7, 221), represents 42 grams of protein (at 17 percent of live weight). Further, 26 percent of total animal weight, but only 4.8 percent of animal kills, is accounted for by white-lipped peccary (Yost and Kelly 1983:208, 210). Subtracting these exceptional kills from the total game intake reduces per capita daily protein consumption to 31 grams.

Second, the Waoroni inhabit a transitional environment similar to that of the Achuara Jivaro (Ross 1978:4; Yost and Kelly 1983:192). Waoroni live in small settlements (24–73 people in the sample), and individual families spend much of the year in separate gardens scattered through the forest. Their hunting technology and recorded kills show a reliance on small game (Yost 1981:682–86; Yost and Kelly 1983:194–200, 206, 210–11). In other words, this is the small village pattern discussed earlier, which puts less of a burden on local game supplies.

The same point applies to Balee's (1985) study of the Ka'apor. The small and scattered Ka'apor settlements remain in one place for ten to fifteen years, two or three times longer than most interriverine villages. In this case local game depletion is further slowed because of a ritual injunction which compels hunters to explore and hunt in more distant territories.[11] Nonetheless, calculations from Balee's (1985:493, 496–98) figures indicate that depletion occurs. The larger (72 people) and older of two villages had a per capita game intake 44 percent below that of the smaller (27 people) and younger village. Significantly, in one of the two observation periods for the larger village, my calculation of per capita protein intake from game is only 27 grams.

Altogether, quantitative data from five separate cases show diminishing returns for hunting effort in settlements of over 100 people. In three other quantitative studies, villages of fewer than 80 people also experience declining game availability, although the smaller two are affected by extensive use of shotguns and the presence of a highway. Additionally, recent nonquantitative studies report local game depletion (Arhem 1981:206; Butt 1977:8; Descola 1981:620; Henley 1982:51–53; Kracke 1978:56; Whitten 1976:78; also see Meggers 1984). So the proposition that game commonly is a crucial factor limiting size and duration of interriverine settlements seems confirmed beyond question—keeping in mind earlier points that other limitations will accompany and sometimes supersede that of game availability.

Other questions remain. The absence of quantitative data from the very small settlements of the Guianas (see Riviere 1984) leaves open the question of whether they are at all limited by game. From the Central Brazilian cerrado, Werner's (1983) quantitative study of a large (285 people) Mekranoti village shows an unusually high level of protein intake over a one-year period (see also Werner et al. 1979). This must be taken as contrary to game depletion expectations, although the absence of longitudinal data and our limited understanding of cerrado ecology make it difficult to draw any conclusions from this intriguing case. Finally, a notable lacuna is the absence of data for the "fierce" Yanomamo groups of the Mavaca-Orinoco area, made famous by Chagnon. After all these years of debate, to my knowledge no quantitative data have been published on hunting efficiency over time among these people. Since in many ways these particular Yanomamo are the type case for the protein hypothesis, such data would be very useful.

In this section I have argued that the idea of game as a limiting factor in Amazonia is strongly supported by available evidence. Game is a crucial nutritional resource of limited effective availability, which can be quickly depleted by hunting. At the same time, major qualifications of this point have also been stressed. First, game limitations would not apply to people living on and utilizing the resources of the coasts or rivers, and even in interriverine areas, game availability may not be the critical limitation in some situations. Second, game limitations in interriverine areas are most relevant in the case of relatively large settlements in a context of ongoing warfare.

GAME DEPLETION AND WAR

The second part of the protein hypothesis holds that a declining availability of meat leads to tensions between men and women and competition between men over women. This creates animosities which build until a village fissions, and these animosities are continued in raids. Below, I will first present evidence that supports these posited relationships and then introduce qualifications that restrict the explanatory power of the model.

Game Depletion and Social Conflict

It is hardly more than a commonplace in Amazonian ethnography that kin share food. It may be said that the people who share food are considered kin, rather than the reverse (Clastres 1972:170; Good 1984:7; Gregor 1977:266, 282–83; Henley 1982:85–87; Hugh-Jones 1978:47; Jackson 1983:57–60; Kracke 1978:247; Siskind 1973a:22–23, 83–86; see also Nietschmann 1972:553; Sahlins 1972:Chapter 5). Especially important is the sharing of meat.

In an earlier paper I discussed the respective importance of game and fish versus garden produce and how the different characteristics of production of these foods fit into relations within and between the sexes, postmarital residence patterns, and various aspects of warfare. Several points are relevant here. Because of the hit-or-miss quality of hunting, a single family is not a viable production unit. Strict norms, often supernaturally sanctioned, require the sharing of meat between the families of a coresidential group. Meat is *social*, in contrast to the more regularly available manioc, which remains *domestic*. Meat is valorized far above garden products. This difference between male and female products underwrites an ideology of male dominance, and the distribution of meat is a key element in relationships between the sexes (Ferguson 1988:144–45).

It is not surprising, then, that procurement and distribution of meat is a central theme in relationships between individual men and women. Siskind's posited "economy of sex" receives confirmation in data from all over Amazonia. Meat is exchanged for sex, either directly or as a recognized basis of marital ties (Arhem 1981:162; Balee 1985:495; Crocker 1969:246; Gregor 1973:245, 1977:133, 137, 1985:76; Henry 1964:35–36; Holmberg 1969:126, 145–46; Kaplan and Hill 1985:237; Maybury-Lewis 1974:36; Y. Murphy and R. Murphy 1974:187; Riviere 1984:89; Siskind 1973a:69, 90, 96, 105; Wagley 1983:71; Werner 1984:398, 402; see also Reichel-Dolmatoff 1971:219–20; Baksh [1982] actually has quantitative data on this).

The next link in the protein hypothesis also receives widespread empirical support. Men, as individuals and collectively, are scrutinized and are subject to open hostility and ridicule from women and children over their performance as providers of meat (Basso 1973:52; Chagnon 1977:91; Gillin 1936:3; Goldman 1963:54; Harner 1973:89; Henry 1964:26; Holmberg 1969:71; Jackson 1983:56–57; Lizot 1977:512; Y. Murphy and R. Murphy 1974:64; Oberg 1953:90; Siskind 1973a:69, 90, 96, 105; cf. Vickers 1975). Taking these two points together, it is clear that declining game availability provides fertile ground for increasing sexual intrigues and jealousies.

The disruptive effects of dwindling game supplies will not be confined to sexual disputes. In all but the most atomistic of Amazonian societies, the nuclear family exhibits a mixture of economic autonomy and embeddedness in regard to the larger band or village. Economic relations within families are intimately conjoined with the economic organization of the larger group. As noted above, the sharing of meat is the crucial element in this superfamilial cooperation.

But when little meat is available, it often is eaten by individual hunters or shared only among their closest kin, regardless of prescriptions to share with the larger social group (Basso 1973:53; Clastres 1972:171; Dumont 1976:144; Kracke 1978:101; R. Murphy 1960:112; Oberg 1953:89; see also Holmberg 1969:150). Grumblings and even open disputes over the distribution of meat are frequently reported (Biocca 1971:142; Chagnon 1974:189–90; Janet Chernela, personal communication; Good 1983:n.10; Henry 1964:98–101; Holmberg 1969:154–56; Kracke 1978:62–63, 101, 111; Maybury-Lewis 1974:181–82, 202; Siskind 1973a:83–86; Villas Boas and Villas Boas 1973:23; Wagley 1983:61; Wilbert and Simoneau 1984: tales nos. 105–8; see also Arvelo Jimenez 1973:9). Scarcity of meat, or any critical resource, will thus generate a dialectic of intra- and interfamilial strain, disrupting the community of interest, attenuating solidarity, and feeding an increasing level of interpersonal hostility.

Good (1983:12–13) makes a relevant observation regarding the Yanomamo. In smaller villages, the villagewide distribution of game meat is a central means of achieving social integration. As villages surpass about 100 people, it becomes more difficult to give shares to everyone, even from successful hunts. (Obviously, the problem would be aggravated as hunting becomes less productive.) Some people get left out of distributions, feel slighted, and return the insult by pointed omissions when *they* have meat to distribute. Cracks appear in village solidarity, and these grow along "lineage" lines. They harden into cleavages as fence sitters must decide which subgroup to associate with, particularly as men begin to go out separately on extended hunts (see also Kracke 1978:61, 247; Whitten 1976:78, 125).

In support of the protein hypothesis, then, it seems well established that decreasing availability of game will lead to intensifying interpersonal hostility and growing divisions within the local community.[12] This essentially describes the process that leads to village fissioning. But does this account for war?

From Conflict to War?

Here we arrive at a crucial point for the protein hypothesis, the relation between the interpersonal hostilities and social conflict which can be attributed to game depletion and the actual fact of war. Although this would seem to be *the* question, the connection has received little attention, far less than the issue of game depletions. This is surprising because some ambiguity about the connection clearly exists.

Good (1978:21, 1983:13–14), who provides an insightful analysis of the role of limited game in village fissioning, does not say that this leads to war. Gross (1982:128–29) says that war may be a means of prompting relocations in situations of depletions but that no necessary relationship is involved. Harris (1979b:130), in his most precise formulation of the protein hypothesis, stipulates only that "some kind of compensatory activity" will occur as availability declines. In his subsequent discussion, however, Harris (1979b:131–32) stresses war as the behavior that grows out of game depletion and which prompts relocations. And of course, this is the general idea of the protein hypothesis. But just how does game depletion lead to war?

Three density-related triggers for war are suggested in various statements of the protein hypothesis. One is that decreasing game prompts hunters to travel further—sometimes egged on by the women—thus encroaching on a neighbor's territory and provoking a clash (Harris 1979b:132; Ross 1978:7). This proposed trigger suffers from contradicting one of the postulated adaptive effects of warfare, the creation of no-man's-lands between hostile groups (see Ferguson n.d.a; cf. Harris and Ross 1987:61). Good (1984:4) provides a case illustration showing that hostility between groups is reflected in deliberate avoidance of each other's hunting territory (see also Lizot 1977:507). Looking at ethnographers' descriptions of war in interriverine areas, it appears that the fear of retaliation outweighs the lure of better hunting, for I found a general absence of reports of such incursions preceding violent clashes. There are two exceptions to this generalization: the conflicts in the shrinking native territory of the cerrado region, noted earlier, and one deliberately provocative incursion by the (possibly suicidal) Yanomamo headman Fusiwe (Biocca 1971:200–204; see also Anduze, cited in Smole 1976:230).

A second explanation is that war is simply an outgrowth of the intensifying personal disputes and suspicions of witchcraft that lead to village fissioning (Bennett Ross 1971:46–47; Harris 1979b:132). A generalization that bad feelings and interpersonal conflicts lead to war would be applicable to many Amazonian war reports. However, it is of limited value as an explanation, even if linked to the causal factor of game depletion, because it does not explain why animosities reach intense levels in one case but not another, or why intense bad feelings sometimes lead to war but other times do not. This problem is well illustrated by the Yanomamo, the case for which we have the most extensive information on political conflict. Among the Yanomamo, village segments that fission with a high level of animosity may begin to raid each other, as may unrelated villages which have developed a similar antagonism; but more commonly, fissioned village segments remain at peace (Chagnon 1967:135–36, 1977:41, 66, 118; Good 1978:20, 1983:13–14; Hames 1983:409, 421–22).

A third suggested route to war is through escalation of conflicts over women, as men raid other villages to obtain wives (Bennett Ross 1971:49; Harris 1979a:132; Siskind 1973b:236–37). Although this could be considered a subtype of general bad feelings, conflict over women is, in itself, the main thread of the protein hypothesis and consequently merits special attention.

Conflict over women sometimes is a prominent theme in local politics (Chagnon 1967:132, 1977:40–41; Dumont 1976:41; Harner 1973:95–96; Holmberg 1969:154–56; Siskind 1973b:235–39). In other situations, sexual jealousies and rivalries remain personal matters and do not become overtly political issues (Arhem 1981:174; Dole 1966:73; Fock 1963:232; Lapointe 1970:104–5, 131; Oberg 1953:47)—although, even as personal grudges, these can aggravate intensifying social conflict. This variation in the political significance of conflict over women is linked to social organization and other factors with little or no relation to game depletion (Ferguson 1988).

Even where local conflict over women is most intense, however, it seems insufficient grounds for war. The Yanomamo would seem to be the prime example of this kind of conflict. Yet Chagnon, for all his emphasis on male competition for women, tells us that "the desire to abduct women does not lead to the initiation of hostilities between groups that have no history of mutual raiding in the past. . . . Once raiding has begun between two villages, however, the raiders all hope to acquire women. . . ." (Chagnon 1977:123).

Furthermore, much raiding for women in Amazonia is not between neighboring groups which could be competing for local resources. Rather, it involves longer distance expeditions against unrelated or weakly related groups. Often this raiding for women is done by riverine groups which are not expected to be limited by game (Arhem 1981:part 3; Chernela 1987:13; DeBoer 1986; Farabee 1922:2, 108; Oberg 1953:44; Whitten 1976:130). Again, the importance of raiding for women is strongly conditioned by social organization and other factors, and much interriverine warfare does not involve the capture of women at all (Ferguson 1988).

In sum, the postulated dynamic leading from game depletion to intense competition over women to warfare is (1) strongly conditioned by other factors with little relation to game depletion, (2) insufficient, in itself, to start a war, and (3) inapplicable to most warfare, even that involving the capture of women.

The three proposed game-dependent triggers of war are each plausible and do seem applicable to some situations. But they are so qualified and restricted that their general connection to war is tenuous.[13] In my estimate, the main reason for this weakness in the connection between the conflicts associated with game scarcity and war is the existence of a theoretically neglected, less costly alternative to war—movement.

Movement is a very real alternative to war, an alternative which causes problems for the protein hypothesis. Fissioning and/or relocation of settlements commonly occur as a direct response to deteriorating living conditions without any threat of violence (Balee 1985:507; Butt 1977:15; Chagnon 1973:126; Gillin 1936:31–32; Good 1984:4; Gross 1983; Harner 1973:45; Henley 1982:49–50; Johnson 1982:415; Morey and Metzger 1974:30, 53; Riviere 1969:37;

Smole 1976:58–59, 92; Vickers 1978:27, 1983:469–73; Whitten 1976:125). Furthermore, it is widely and repeatedly observed that when people feel in danger of being attacked, they move to a safer location. Flight is preferred to fight (Arvelo Jimenez 1973:14; Basso 1973:129; Beckerman 1980b; Bennett Ross 1980:53; Clastres 1972:143; Gregor 1977:303–5; Hahn 1981:88; Henley 1982:10; Metraux 1963:392; R. Murphy and Quain 1955:10–12; Riviere 1970:249; Wagley 1983:39–40; Yde 1965:4; Yost 1981:682). Both possibilities weaken the connection between game depletion and the actual occurrence of warfare. Both indicate that the former will lead to the latter only if populations are in some way "circumscribed," either hemmed in or anchored down by some restrictive aspect of the local environment (see Carneiro 1970:735, 1985:86–88).

Circumscription by natural conditions is not reported for interriverine environments. Chagnon (1973:136), however, argues that some Yanomamo are "*socially* circumscribed": war is intense in the "center" of Yanomamo territory because the villages there, surrounded by other potentially hostile Yanomamo, cannot avoid war by moving away. Social circumscription is a valuable expansion of the circumscription concept. It seems most applicable, however, within the naturally circumscribed riverine areas, where resident groups typically claim a fixed territory (Basso 1973:43–45; Fejos 1963:82; Goldman 1963:33, 57, 88; Hames 1983:423; J. Hill and Moran 1983:121; Lapointe 1970:12; R. Murphy 1960:69; R. Murphy and Quain 1955:12, 26, 40; Whiffen 1915:111–12). There, encroachment on empty, but claimed, lands may constitute an act of war.

But in interriverine areas, where reports of clearly identified territories are notable by their absence (Hames 1983:420–23; Riviere 1984:12; see also Dyson-Hudson and Smith 1978), it is hard to see any illustration of social circumscription in practice. In fact, the supposedly "central" Yanomamo described by Chagnon are actually at the western periphery of the Yanomamo range, next to a vast area of uninhabited forest (Chagnon 1972:255–60; Lizot 1977:504). I suspect that the reason they do not move is that moving would put them further away from sources of Western manufactured goods (Chagnon 1977:42; Lizot 1985:3–4; see also Arvelo Jimenez 1971:18–27; Saffirio and Scaglion 1982:317; Smole 1976:51–52, 192–93).

Circumscription by access to Western manufactures is quite common throughout Amazonia, and that is one of several ways in which Western contact promotes warfare (Ferguson n.d.b). But this is the only widespread limitation on movement that I can see in interriverine areas. In terms of ecology alone, social conflict related to game depletion will typically stop short of war because it will be handled instead by relocation.

In this section I have argued that game depletion leads to interpersonal hostilities and social conflict. However, only a weak connection exists between this kind of conflict and war. The three postulated game-dependent triggers of war are highly qualified and of restricted applicability because in the typically uncircumscribed environments of interriverine Amazonia, game depletion results in relocation before conflict gives way to major violence.

CONCLUSION

In this paper the protein hypothesis has been strongly supported and strongly restricted. Game is a limiting factor in Amazonia, although the limit exists in human interaction with nature, rather than in nature itself. Game depletion does promote social conflict. But game depletion is likely to contribute to war only in interriverine areas (and not in all of them) characterized by large villages with a substantial degree of circumscription. Even where these conditions are met, the discussion of village size and triggering mechanisms indicates that game scarcity is an important contributing factor, but insufficient, in itself, to explain war.

These conclusions mean that most Amazonian warfare remains to be explained, a challenge I take up elsewhere (Ferguson n.d.b). This does not mean that the great protein debate has been futile. The protein hypothesis has stimulated very productive research into the relationships between humans and the natural environment. This research has taken us away from an earlier, rather crude view of populations approaching a fixed regional carrying capacity and toward a more complex picture of individuals making multiple, mutually constraining decisions shaped by interacting social and environmental conditions. Far from invalidating an ecological perspective, this work has made the necessity of understanding ecological constraints on human social organization even more clear.

Finally, the conclusions presented here suggest a new conceptual category which may be useful in developing a general theory on war. I call this category the "almost-war." An almost-war is a conflict between autonomous groups, characterized by those processes which precede actual wars—sharpening tensions and political polarization—but which does not culminate in lethal violence because of an ability to exit from the conflict situation and/or the expectable costs of launching an attack. The protein hypothesis is a better explanation of almost-war than of war, because almost-wars can happen in uncircumscribed environments.

Any society with regular warfare will of course experience many almost-wars. This is a trivial observation. What strikes me as theoretically interesting is the possibility of social situations which frequently give rise to almost-wars, but which rarely, if ever, break out into actual war. Such situations may once have been quite common. The regular occurrence of almost-wars may have preceded the development of chronic warfare by millions of years in the course of human evolution. Almost-wars may have been the typical form of social conflict in relatively egalitarian societies before they came in contact with expanding states. The concept might even apply to more evolved polities whose military response to past wars had included the development of fortifications which rendered them practically invulnerable to assault by enemies using lithic technology. We tend to think that all societies can be fit into one of two categories: those that have war and those that do not. Perhaps there is room for an intermediate category: societies with a regular pattern of almost-wars, but in which collective lethal violence is exceptional.

NOTES

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2. "Natural" as used in this paper means the nonhuman environment, even if that environment has been modified by past human action (see Balee n.d.; cf. Clark and Uhl 1987).

3. The empirical questions are examined in Ferguson n.d.a.

4. Peach palm fruit is still only 2.8 percent protein by weight, but it is rich in fats, 6.7 percent, also needed in the diet (Smole 1976:153).

5. "Infrastructure is not some simple, transparent, single-factor 'prime mover'; rather, it is a vast conjunction of demographic, technological, economic, and environmental variables" (Harris 1979a:74).

6. Lapointe (1970:88, 149) makes a related point, arguing that the tendency for river dwellers to specialize in fishing, noted above, may also be related to nucleation forced by warfare.

7. These qualifications are to a degree anticipated by Divale and Harris (1976:531).

8. The following discussion draws on Good and Lizot (1984), Gross (1982), Ross (1978, 1979), Ross and Bennett Ross (1980).

9. Hunters and gatherers may also have "manioc hunger" (Silverwood-Cope in Milton 1984:18).

10. For other criticisms, see Gross 1982:134.

11. This may only be possible because the Ka'apor live in a long-pacified area.

12. The process of faction formation and polarization will receive detailed analysis in another work.

13. There are additional complications not dealt with here (see Ferguson 1988).

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