2/Cultural Ecology

People everywhere must come to grips with the physical environments within which they live in order to survive and reproduce offspring who carry on their traditions. The physical environment, however, contains not only lands, forests, resources, and foods, it contains many other things as well. Perhaps one of the most compelling ingredients in the environment is other people: from the vantage of members of a particular community—a village, for example—the world beyond has both a physical and a sociopolitical dimension, and one must come to grips with both. Anthropologists usually discuss this process as cultural adaptation: the social, technical, and ideological means by which people adjust to the world that impinges on them. Much of that world is ontologically 'real' in the sense that an outsider from a different culture can 'see' and document it in a fashion that can be verified by other observers. But much of it lies hidden in the minds of the observed natives, whose cultural traditions, meanings, and assumptions infuse it with spirits, project into it meanings, and view it in a way that the outsider can only discover by learning the language and, through language, the intellectual dimensions of culture. This chapter explores Yąnomamö adaptations to the natural dimensions of the environment and how people 'make a living' in that environment. More important, it explores the relationship between ecology, culture, and village dispersion over the landscape, describing how the Yąnomamö settlements fission and relocate in new areas. This process clearly must have been of enormous significance in our own culture's history when agriculture was developed and led to the rapid growth of populations, an event that we now call the "agricultural revolution." What we can learn from studying the Yąnomamö settlement pattern process can shed light on our own population's early history, a history we know now only through archaeology.

The next chapter will consider the 'intellectual' dimensions of how the Yąnomamö cope with their world through myths and ideology.

The Physical Environment

Kąobawä's village is located at the confluence of the Mavaca and Orinoco Rivers, the Mavaca being a relatively large tributary of the latter. His village lies at an elevation of about 450 feet above sea level on a generally flat, jungle-covered plain that is interrupted occasionally by low hills. None of the hills qualify as mountains, but in some areas the terrain is very rugged and hilly and difficult to traverse on foot. Most of the rivers and streams begin in the hills as

tiny trickles that are dry at some times of the year but dangerous torrents other times. A sudden heavy rain can have a dramatic effect on even larg streams, and the Yąnomamö therefore avoid larger streams when they sel garden and village sites. The Yąnomamö are 'foot' Indians as distinct fr 'river' Indians, a basic cultural division in the Amazon Basin.

While the hills do not qualify as mountains, they do reach heights of 30 feet in some places. Almost all of them are covered with jungle, but to the e of Kąobawä's village, in the Parima 'mountains', relatively large natu savannas occur at higher elevations, and one finds Yąnomamö villages there well. Much of the lowland area is inundated during the wet season, making either impossible to travel there or unwise to locate a village and garden the

The jungle is relatively dense and contains a large variety of palm a hardwood trees. The canopy keeps the sunlight from reaching the ground, a on overcast days it can be very dark and gloomy in the jungle. Scrub brush a vines grow in most areas, making travel by foot difficult. Along the rivers a streams where the sunlight can penetrate to the ground, luxuriant vegetati grows, a haven for many kinds of birds and animals.

Trails and Travel Yąnomamö villages are scattered irregularly, but usua thinly, over this vast tropical landscape. Distances between the villages can as short as a few hours' walk to as much as a week or 10 days' walk, dependi on the political relationships between the groups. Warfare between villag generally keeps them widely separated, while alliances of various sorts (s below) and descent from common ancestors tend to reduce the distance, b there are exceptions.

All villages have trails leading out into the jungle and to various villag beyond. Many trails simply go to the gardens that surround the village a terminate there. A Yąnomamö trail is not an easy thing to see, let alone follo particularly a trail that is used only sporadically. Most of them wind throu brush, swamps, rivers, and hills, but tend to be quite direct. Annoyingly so times, as when they go straight up a steep hill to the peak, and then straig down the other side—instead of following more convenient terrain that t anthropologist might have chosen.

It takes experience to recognize a Yąnomamö trail. The most certain spor are the numerous broken twigs at about knee height, for the Yąnomam constantly snap off twigs with their fingers as they walk along. Anoth frequent sign is a footworn log across a stream or ravine, usually so slippe that at first I had to shimmy across them on hands and knees while r traveling companions roared with laughter. Most Yąnomamö trails cr streams and rivers, often going for several hundred feet in the river itself. It easy to get lost on these trails, for it is never obvious when the trail leaves t stream and continues across land.

Friendly neighbors visit regularly, and the most commonly used trail fr Kąobawä's village went south, to the two friendly Shamatari villages: Re boböwei-teri and Mǫmariböwei-teri. Hardly a week went by during the d season without someone, usually small groups of young men, going from o

of the Shamatari villages to Bisaasi-teri or vice versa. Young men can make the trip easily in one day, for they travel swiftly and carry nothing but their bows and arrows. A family might also make it in one day if it kept on the move, but it would be a dawn-to-dusk trip if the women had to carry their babies or items they or their men planned to trade. Should the whole village decide to visit, it might be a two- or three-day trip, depending on how anxious they were to reach the village. On one occasion, Kąobawä invited me to accompany his entire village on a trip to Mǫ̈mariböwei-teri. I packed my supplies carefully and left with them. We walked about 20 minutes inland, to the south, and stopped to let the women and children rest. Much to my surprise and chagrin, that is where we made our first night's camp! We were barely outside their garden! It would have taken them at least a week to reach their destination at that pace, so I simply went on with a young man to guide me, spent a day and a night visiting, and returned home before the Bisaasi-teri even reached the village.

On this trail, and many others like it, there are numerous temporary 'camping places' along the route, a collection of dilapidated pole huts in various stages of decay where earlier visitors spent a night. These huts can be put back into repair in a few minutes by simply replacing the dry, leaky roof leaves, but the whole structure can be built from scratch in about 15 minutes.

Walking entails certain kinds of risks. The Yąnomamö have no shoes or clothing, so thorns are always a problem. A party of 10 men can rarely go more than an hour without someone stopping suddenly, cursing, and sitting down to dig a thorn out of his foot with the tip of his arrow point. While their feet are hardened and thickly calloused, walking in streams and through muddy terrain softens the callouses and then the thorns can get deeply imbedded.

Snakebite is another hazard. A surprisingly large number of Yąnomamö die from snakebites, and almost everyone, if he lives long enough, eventually gets bitten by a snake.[1] Most bites are not fatal, although all are painful. I treated several nonfatal bites with antivenom during my work, but no case was very serious. A few bites can be severe enough to cause the loss either of the limb or its use. One of my Yąnomamö friends lost his leg some 15 years prior to my fieldwork—it just rotted away and fell off. He hopped around rather effectively on his remaining leg. Snakebites are almost as frequent in the garden or near the village as they are on the remote trails, and one must always be careful when picking up firewood from the pile or wandering around in the garden. The Yąnomamö try to keep the garden and paths weeded with this in mind.

In Kąobawä's area, most travel between villages is done from September through April, the dry season. During the wet season, substantial portions of the trail are under water and small 'lakes' replace the swampy lowlands. Communication between villages nearly ceases at the peak of the rainy season and most villages are isolated from most outside visits at that time. Streams that were mere trickles in March become raging torrents in May and June. If the group must travel in the wet season, it will make simple pole-and-vine

[1] I eventually compiled statistics on causes of death of adult Yąnomamö (see Chagnon, 1974:160, for statistics).

Fig. 2–1. Clay pots were common when I began my fieldwork, but these have been almo completely replaced by aluminum ware that is traded from village to village.

bridges over the smaller streams, but will have to avoid large strear altogether and make wide detours around them. These bridges are essential a series of "X" frames linked together with long poles (where the legs of the cross) and vine railings. Generally a gap of 10 to 15 feet separates each X un the stream is bridged. Bridges are usually washed out within a few weeks, b occasionally a few of the poles will last into the dry season. In any case, the are not expected to last very long.

Technology Much of Yąnomamö technology is like the pole-and-vir bridge just described: crude, easy to fashion from immediately availab materials, effective enough to solve the current problem but not destined t last forever. Perhaps the only durable artifact that an archaeologist woul readily find in ancient, abandoned sites is the crude, poorly fired clay p traditionally used by the Yąnomamö (Fig. 2–1). It is nearly an inch thick at th bottom and tapers to almost nothing at the rim. It is undecorated, very fragil and pointed at the bottom. Women, who are considered clumsy by the me are rarely allowed to use them. The pots are often used to prepare food for feast—and men do all the food preparation for that. The pot is made by th 'coil' technique and fired by simply stacking brush and wood around it. Whe

It breaks, usually relatively soon after being manufactured, the pieces are used by the men as a grinding surface for preparing their hallucinogenic snuff powder. Clay pots were relatively common when I first began my field research, but have almost completely disappeared now. As we shall see below, only the members of a few villages made the pots and traded them to their neighbors.

Yąnomamö technology is very direct. No tool or technique is so complex that it requires specialized knowledge or raw materials, and each village, therefore, can produce every item of material culture it requires from the immediately available resources the jungle provides. Nevertheless, some 'specialization' in manufacturing and trade does occur, but the establishment of political alliances has more to do with this, as we shall see, than the actual distribution of resources: people create 'shortages' in order to have to trade with distant neighbors. Yąnomamö technology could almost be classified as that which would be more characteristic of hunters and gatherers, but the Yąnomamö are in fact horticultural.

Bowstaves, some 5 to 6 feet long, are always made from palm wood. One species grows wild, and the other, and preferred kind, is cultivated for its fruits. The wood of both is very dense, brittle, and hard. One cannot, for example, drive a nail into it. Bowstrings are made from the fibers of the inner bark of a tree. The bark is twisted into thick cords by rolling the fibers vigorously between the thigh muscle and the palm of the hand; the cords are so strong that one can use them, in a pinch, as hammock ropes. The bowstave is painstakingly shaped by shaving the stock with the teeth of a wild pig: the lower projecting teeth of this pig are worn razor sharp from eating, and the entire mandible is kept as a wood plane for making bows. The completed bow is oval or round in cross-section and is very powerful—comparable in strength to our own hunting bows. With age and use, they become brittle and often shatter when drawn too hard.

A pencil-shaped splinter of palm wood is also used for one type of arrow point: the curare-poisoned *husu namo* point. The splinter is weakened at about 1-inch intervals along its length by cutting partially through the wood; this causes it to break off inside the target, allowing the curare to dissolve in the bloodstream. While it is primarily used to hunt monkeys, it is also used in warfare. A monkey can pull an ordinary arrow out, but it cannot pull out a point that is broken off deep in its body. The curare gradually relaxes the monkey, and it falls to the ground instead of dying high in the tree, clinging to a branch. The Yąnomamö carry several extra curare points in their bamboo quivers, for they break off when they strike anything, and usually must be replaced after every shot. These arrow points are manufactured in large bundles—50 or 60—in several villages near Kąobawä's, and are prized trade items (Fig. 2–2). The poison comes from a vine that is leached in hot water; other vegetable ingredients are added to make it 'sticky' so it adheres to the wood. Men often wrap a leaf around the poisoned point to keep the rain from dissolving the poison as they travel. In some areas, other vegetable poisons are used, one of them being an hallucinogen. In a pinch, the men can scrape the poison off and get high by snuffing it deeply into their nostrils.

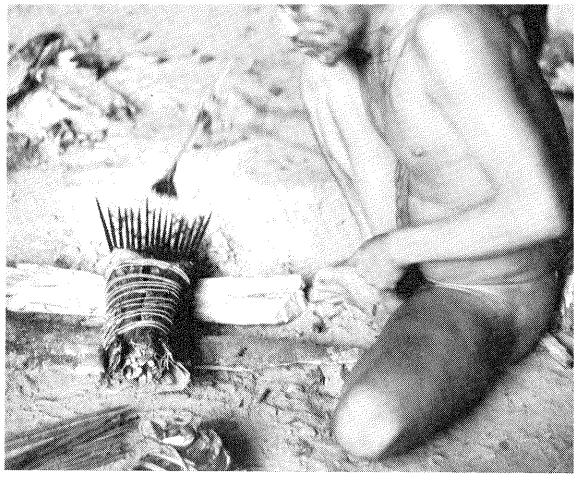


Fig. 2–2. Man painting curare poison on palm-wood arrow points. The poison is leached with hot water and painted on in many coats over glowing embers. The water is evaporated, leaving a sticky poison coating.

The arrow-point quivers—*tora*—which all men have dangling in the middle of their backs, are made from a section of bamboo, usually about 2 inches in diameter and about 15 to 18 inches long. A natural joint in the bamboo serves as the bottom; the open top is covered with the skin of some animal, usually a snake, monkey, or jaguar. The bamboo grows wild in large stands and some villages are known to 'specialize' in trading bamboo quivers. The quiver usually contains several arrow points, fibers, resin, and strings for repairing arrows and, occasionally, a magical charm. A piece of old bowstring is used to hang the quiver around the neck, whence it dangles in the middle of the back. A pair of *tomö nakö* (agouti-tooth) 'knives', used to trim the lanceolate-shaped, broad, bamboo arrow point—*rahaka*—is attached to the outside of the quiver, as is, occasionally, a fire drill made from the wood of the cocoa tree. One piece of cocoa wood, about 10 inches long and lanceolate shaped, contains several holes along the edges worn into the wood by the friction of the longer circular piece of wood that is rapidly spun between the palms of the hands. The lower piece is held secure by the foot, the other spun into it until the friction produces the glowing dust that is quickly fed tinder until a fire starts. Men sometimes work in pairs to generate fire with the drill, taking turns: as one finishes his downward spinning with his palms, the other starts at the top, and so on. The drill is wrapped in leaves to keep it dry. Today, matches in enormous quantities are provided as trade goods in those villages that have contact with outsiders, and these are traded far inland. Like the clay pot, fire drills are rapidly disappearing, even in the most remote villages.

Arrows are made from 6-foot-long shafts of cultivated cane. They are often assumed to be "spears" by people who see them in photographs.

Two long black feathers from the wing of the *paruri* (wild turkeylike bird) are attached as fletching in such a way as to cause the arrow to spin when shot. A thin fiber from a cultivated plant is used to attach the fletching, but white cotton thread traded in from missionaries is now commonly used in some villages. A nock is carved from a piece of hardwood, using the small agouti-

tooth 'knife'. The nock looks like a golf tee when completed, except that it has a notch in it for the bowstring. It is stuck into the shaft behind the fletching and fastened with pitch and fine fibers wrapped tightly around the arrow shaft.

Three arrow points are commonly used and are interchangeable; 'spares' are often carried in the arrow-point quiver. The most effective point for killing large game such as tapir is a lanceolate-shaped point made from a section of bamboo. These are often painted with red, black, or purple pigments and some of them acquire a reputation and history if they have been used to take many animals or have killed men. These histories are recited in some detail when the point is traded to another owner, and much raising of eyebrows, clicking of tongues, and expressions of amazement accompany the transaction as the new owner praises his trading partner's generosity in divesting himself of a property so valuable and lucky. Bamboo points are fastened to the arrow shaft by simply pushing one of the sharp ends into the pith of the arrow cane as far as it will go, usually about one-fourth of the length of the point itself. The arrow shaft is prevented from splitting during this procedure by binding it tightly for about an inch or so with fine cord. The second most useful and effective arrow point is the curare-smeared, pencil-like palm-wood point (Fig. 2–2). These are weakened by cutting nearly through them every few inches or so along the axis, causing them to break off inside the animal, thus enabling the curare to dissolve and eventually kill the animal. The third kind of point is barbed and is used primarily for bird hunting. The barb is made from a sliver of bone, often a monkey bone. The barb prevents the arrow from coming out of the bird, and the weight of the shaft plus its unwieldiness keep the bird from flying away. A fourth kind of arrow point is made from a twig with many branching stems. It is usually fashioned on the spot in a few seconds and discarded after one or two uses. Small birds, often sought only for their decorative feathers, are shot with such points.

The Yąnomamö do not rely extensively on fish, but during certain times of the year fish are abundant and easily taken. One method is to simply wait for the rainy season to end. Then, areas of the jungle that have been flooded by the overflowing rivers begin to dry out, leaving pools of fish stranded. As the pools get shallow, it is a simple matter to wade into them and catch dozens of fish by hand.

Fish poisons made of wild lianas are used to poison small streams (Lizot, 1972). The men put the poison into the water upstream from where a small, mud dam has been made, and wait for the fish to become stupefied. They float or swim clumsily to the surface, stunned by the poison, where the women and girls scoop them up by hand or with large circular baskets (Fig. 2–3), biting the larger ones behind the head to kill them. Sometimes the women get shocked by eels while fishing, and the eel must be found and killed before the work continues.

The Yąnomamö use a splinter of a kind of reed—*sunama*— to shave their heads bald on the top and to trim their 'pudding bowl' bangs. A sliver of this reed is wrapped around the finger and scraped on the scalp, neatly cutting the hair off with no more discomfort than what would be associated with shaving

Fig. 2–3. Women collecting stunned fish with baskets in a small stream that has been dammed with brush and mud. The men put barbasco poison in the water upstream to stun the fish and the women catch them.

with a dullish razor blade. Men with large deep scars on their heads acquired from club fights present a somewhat grotesque image, especially when they rub red pigment on their scarred bald scalps. This enhances and exaggerates the scar and draws attention to it.

The size of the tonsure varies markedly from area to area. The Shamatari, for example, sport relatively small tonsures, about 3 inches in diameter. The Yąnomamö north and east of Kąobawä's village shave so much of their head that they look like they have just a narrow fringe of hair, like a black strap, wrapped around their heads just above the temples. Women wear the same hair style as men. If head lice become extremely noisome, they shave their heads completely, for it takes a considerable amount of time to 'groom' (delouse) someone. While grooming someone is also an expression of affection and friendship, it can become a tedious job. Children, in particular, are often shaved when lice become too much of a problem for parents to handle (Fig. 2–4). Amusingly, the Yąnomamö get 'revenge' on the lice by either eating them, or biting them to kill them. I recall the time when I was in elementary school that the county nurse had to come to school to delouse all the students, whether or not all of us needed it. Head lice are not all that far behind in our own culture's sanitation problems.

Hallucinogenic Drugs The jungle provides several highly prized plant products that are used in the manufacture of hallucinogenic snuff powders. The most widely distributed source of drugs is the *yakowana* tree, whose soft moist inner bark is dried and ground into a powder. To this are added snowy white ashes made from the bark of another tree. The mixture is moistened with saliva and kneaded by hand into a somewhat gummy substance, which is then placed on a piece of heated pot sherd (or, now, in some villages, the top from a gasoline drum) and ground into a fine green powder. But the more desirable hallucinogen is from the *hisiomö* tree, whose tiny, lentil-sized seeds are painstakingly skinned and packed into 10- or 15-inch-long cylinder-shaped

wads and traded over a wide area. The tree has a spotty distribution, and villages located near natural groves tend to specialize in trading *hisiomö*. It is more desirable than *yakowana*, and more powerful. Like *yakowana*, it is kneaded with ashes and saliva and then pulverized into a green powder on a piece of heated pot sherd. A smooth stone, often a stone ax, is used to grind it into a powder. Several other plants are used to make hallucinogens: the Yąnomamö cultivate a variety of small bushes of the genus *justicia* and snuff these, but they are less potent and less desirable than the other two. All the drugs are referred to by a generic name when they are in powdered form: *ebene* (Chagnon, LeQuesne, and Cook, 1971).

The men usually make a batch of *ebene* every day; sometimes several different groups of men in a village each make their own batch. It takes quite a bit of kneading and grinding to produce a half cupful, enough for several men, depending on appetites and whether it is *hisiomö* or *yakowana*. The men paint themselves elaborately with red pigment, put on their fine feathers, and then gather around the front of the house of the host. A long hollow tube is used to blow the powder into the nostrils. A small amount, about a teaspoonful, is pushed by finger into one end of the tube to load it. The other end, to which a large, hollowed seed has been fashioned as a nostril piece, is put into a companion's nose. The green powder is then blown into the nasal cavity with a powerful, long burst of breath that starts slowly and terminates with a vigorous blast (Fig. 2–5). The recipient grimaces, chokes, groans, coughs, gasps, and usually rubs his head excitedly with both hands, or holds the sides of his head as he duck-waddles off to some convenient post where he leans against it waiting for the drug to take effect. He usually takes a blast of *ebene* in each

Fig. 2–4. Children delousing each other during a break from playing. Sometimes head lice become so numerous that it is simply easier to shave the children's heads bald.

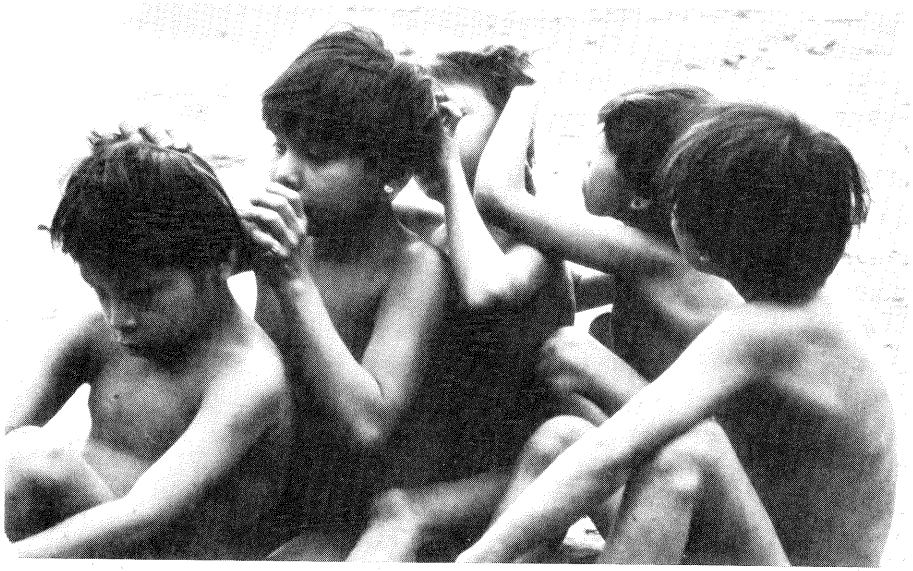


Fig. 2–5. Blowing ebene *powder into another man's nostrils. The initial pain is severe, but the effects are eventually pleasant.*

nostril, sometimes two in each, and 'freshens' it with more blasts later. The recipient immediately gets watery eyes and a profusely runny nose—long strands of green mucus begin to drip from each nostril. Dry heaves are also very common, as is out-and-out vomiting. Within a few minutes, one has difficulty focusing and begins to see spots and blips of light. Knees get rubbery. Profuse sweating is common, and pupils get large. Soon the *hekura* spirits can be seen dancing out of the sky and from the mountain tops, rhythmically prancing down their trails to enter the chest of their human beckoner, who by now is singing melodically to lure them into his body where he can control them—send them to harm enemies or help cure sick kinsmen. (See the film *Magical Death*, listed in Appendix A, for a dramatic documentary of drugtaking and shamanism.)

Trade in *hisiomö* seeds was unexpectedly interrupted by changing warfare patterns while I was conducting field research in Kąobawä's village. The response to this by some individuals was fascinating, for it illustrated the kind of ingenuity that must lie behind the whole process of plant domestication. Rerebawä, who had grown very fond of the drug, took it upon himself to make sure that the source could not be interrupted by wars. He made several trips to an area far to the northeast where the tree abounded, and brought many seedlings back with him. Some of them he transplanted in his own village, and others he transplanted in Kąobawä's village. Yet others he traded inland, to

men in the Shamatari villages. While many of the seedlings did not survive, some did—and later produced quantities of seeds. Whether or not they will manage to survive a long time in this microclimate remains to be seen, but the fact remains that he did attempt to domesticate a wild species and appears to have had some success at it. The Yąnomamö quickly disperse novel or more desirable varieties of other cultigens through trade, and when they discover such plants in distant villages, they generally try to get seedlings, cuttings, or seeds to bring home to their own gardens. For a while, the new variety or plant tends to be remembered as having come from a particular village, but over time people forget where it came from and tend to adopt the position that they have always had it. It should be recalled that the Yąnomamö are highly dependent on cultivated plantains, a domesticant that was introduced to the Americas after Columbus—yet they believe that they have always cultivated it, and have origin myths about it. Prior to plantains, the Yąnomamö were probably much more highly dependent on several other of their native Amazonian domestic foodstuffs (see below).

Shelter All house construction materials are collected from the jungle: poles, vines, and leaves. The Yąnomamö make a sharp distinction, as do many humans, between 'domestic' and 'natural', that is, between Culture and Nature. The focal point of this distinction is the village and its surrounding garden. Things found here are *yahi tä rimö*: of the village, Culture. All else is *urihi tä rimö*: of the forest, Nature.

The village may be constructed of 'natural' things, but it becomes 'cultural' through the intervention of human effort and the transformation such effort entails. The permanent house and its central plaza is called the *shabono* and is probably one of the most labor-intensive products in the entire culture. A high degree of planning and cooperation is necessary to build a village, not to mention many days of work. Unfortunately, the *shabono* only lasts a year or two because the leaves begin to leak or the roofing becomes so infested with roaches, spiders, and other insects that it must be burned to the ground to get rid of them. The roaches can become so numerous that a constant buzzing noise can be heard, increasing in intensity when someone's head passes close to the roofing and alarms the bugs, or when someone places something—bows and arrows—into the roof thatch. Kąobawä's village was so infested at one point that every time someone would move, dozens of roaches would fall from the roof and scurry away. The roaches can get as large as small birds or be so tiny that they can manage to get between the elements in your camera lenses. For some reason, they just loved my Sony shortwave radio.

The *shabono* looks like a large round communal house to the untrained eye, but in fact it is a coordinated series of individual houses (Fig. 2–6). Each family builds its own section of the common roof. The men usually do the heavy work of fetching the poles for the frame, placing them into the ground or overhead, and weaving the thousands of leaves that go into the thatch. Women and older children also help in the thatching, as well as in gathering the necessary leaves and vines that constitute the major items in building the structure. If it is palisaded, the men do this heavy work.

Fig. 2–6. A small Yąnomamö village from the air, located near the edge of the plantain garden and the Demini River.

The first step in building a new *shabono* is selecting the proper site. If the *shabono* is simply being reconstructed after burning the old one, the location might be either on that same spot, or a few yards away—as long as it is not in a depression and likely to be flooded in the rainy season. If it is a new location entirely, the primary consideration is the location of enemies and allies, and then, secondarily, the suitability of the land for gardens.

The four main posts of each house are sunk into the ground by digging holes with a stick and scooping the dirt out by hand. Two short poles, about 5 feet high at the back of the house, are set and then two long poles, about 10 feet high, are placed at the front. Front and back poles are about 8 to 10 feet apart to accommodate hammocks, which also determine how far apart the two front and two back posts are from each other.[2] Cross poles are then lashed to these, horizontal to the ground, near the tops of the upright posts. Long slender saplings are then placed diagonal to these, about a foot to 18 inches apart, and lashed to them with vines. These saplings are 20 to 30 feet long, and run from near ground level at the rear of the house, arching up, bending under their

[2]See my 1974 publication, which gives exact dimensions of a large Yąnomamö *shabono* (Chagnon, 1974:257).

own weight into a gentle arc, and are 15 to 20 feet off the ground at their tips. Vines are then strung between the long saplings, perpendicular to them, about every 12 inches. These hold the long-stemmed leaves most often used in roofing—*bisaasi kä hena*, whence comes the name of Kąobawä's village, Bisaasi-teri: roofing-leaf people. Thatching work begins at the bottom of the roof. A long-stemmed leaf is slid under the second vine and bent over until it reaches down and rests on the first vine (Fig. 2–7). Another is placed a few inches away, bent over, then another, and so on. When one row that runs the entire length of the individual house is finished, a second, higher row is started. As the roof progresses, scaffolding made of poles and vines is erected to facilitate the work. The weight of the leaves bends the saplings even more, and support poles are added to hold up the overhang when the roofing is nearly completed. When club fights break out in the village, these support poles are often ripped out and used as clubs—and the roof often sags and breaks when this happens.

When each house is finished, the effect is a circle of individual houses, each separated from the next one by a few feet of open space. These spaces are then thatched over, and the village looks like one continuous circular roof surrounding the open plaza. Occasionally there will be an unroofed gap of a few feet to a few yards, and sometimes there will be a section of the village that is not connected to neighboring houses at either end. This makes the village appear to be composed of discrete sections, as it is, but the sections usually are not separated by open space in Kąobawä's area of the tribe. Elsewhere, to the north and east, Yąnomamö villages are seldom unified structures such as the kind just described. There, the individual sections of the village might even be double-gabled, that is, have double-pitched roofs on each house. This feature could possibly be introduced from the outside, since the Yąnomamö on the north and northeast periphery of the tribe have had much more contact with either the Ye'kwana (Carib-speaking Indians who have had long-term contact with European culture) or missionaries among the Ye'kwana.

The physical size of a village is a function of two important variables, at least in Kąobawä's area. First, and most obvious, the village is a function of how many people there are in the group. Because warfare is more common in this area of the tribe, villages tend to grow to a fairly large size before they can fission. They must contain at least 80 to 100 people in order to be able to fission, but they will sometimes grow much larger, as we will see in the next chapter. Obviously, a village with 400 people has to be larger than a village with 40 people. The second determinant of the physical size of a village is politics—the extent to which members of a village must enter into alliances and regular visiting with neighboring groups as part of their political strategy. This is a necessity in Kąobawä's area, and alliance obligations require that you invite all the members of your ally's village to visit you. To accommodate them, your village has to be physically larger than the space requirements of the permanent residents. Thus, the physical dimensions are such that accommodating an extra 100 or so visitors is not an impossibility. In a word, where alliances between villages are an inherent part of the political strategies of the

Fig. 2–7. Thatching the shabono *roof with leaves from the* bisaasi kä *hena plant.*

Yąnomamö, a village that housed 80 people would be physically larger than a village that housed 80 Yąnomamö in a part of the tribe where alliances of this sort were less important.

Elevation, and therefore temperature, also affect village construction. I visited Yąnomamö villages in the Parima highlands for several weeks in 1967, some of which were located at about 2500 feet elevation. I was puzzled by the fact that the *shabono* had large masses of banana leaves hanging down—almost to the ground—from the high point of the roof. I discovered why they did this on the first night I slept in such a village. The air temperature dropped to about 60 degrees Fahrenheit, and with the high humidity it felt like it was 40 degrees! The banana leaves kept the rising heat from the hearths from escaping too rapidly, but, unfortunately, also prevented the smoke from escaping. I felt like a smoked monkey each morning. But when you do not have clothing or blankets, you can learn to tolerate a good deal of smoke if it means keeping warm.

A new *shabono* is a pleasant place to be. It is clean, smells like fresh-cut leaves, and has a generally cozy, tidy appearance. It is like being in a new wicker hamper.

The wind, however, can be a destructive problem: it blows the leaves off and, if very gusty, will literally rip the roof off and blow the whole thing into the jungle. To remedy this chronic problem, the Yąnomamö throw heavy branches and poles on the outside surface to help hold the leaves down, but the most common defense is magical. The shamans rush forth and chant incantations at *Wadoriwä*, *hekura* (spirit) of the wind, pleading and enjoining him to stop blowing. He only cooperates occasionally.

When the Yąnomamö travel to another village or go on extended collecting trips in the jungle, they make a simpler house as mentioned above. It is essentially triangular in shape: two back poles and one front pole. They can

erect one of these huts in a few minutes, and a whole group—all members of a village—can create a very homey camp of such huts in about half an hour. The roofing is usually made from the long broad leaf of the 'wild banana', *kediba*, a few of which suffice to make a waterproof roof that will last several days. Travelers run into such huts and simply string their hammocks up in them when it is time to camp, hoping that the roof will not leak. The roof always leaks, and if it rains, people spend most of the night in futile attempts to adjust and readjust the decayed leaves to keep the water out.

Permanent *shabonos* are often surrounded by 10-foot-high palisades if the residents have reason to believe they will be attacked by enemies. The palisade is made of logs, usually palm trees, and is erected a few feet behind the lower part of the roof. The logs are sunk into the ground a few inches and lashed together with vines. It is kept in good repair only if the threat of a raid is high; otherwise, people begin to pilfer the wood to cook with. Both the village entrances and the entrances through the palisade are covered with dry brush at night, the slightest movement of which makes enough noise to wake the dogs, and hence, the residents. Villages without palisades are more vulnerable, but people stack up their firewood under the low end of the roof in such a way that a nocturnal assassin could not easily take a shot at them from that vantage. In the darkness, all people look alike: the Yąnomamö made me stack my pack and any other containers, such as camera cases, against the back of the roof to add some personal safety, explicitly to thwart would-be raiders.

Hunting, Gathering, and Gardening

Wild Foods The jungle provides numerous varieties of plant and animal food, some seasonal and others available at most times of the year, but access is often limited by rainfall. Groups of Yąnomamö could live entirely off the wild foods in their environment, but such groups would have to be relatively small and chronically migratory. Indeed, most of the villages in Kąobawä's area periodically go 'camping' for extended periods of time, usually breaking up into groups of about 30 or 40 people. During these times they subsist very heavily on wild foods, especially palm fruits and game, and time their camping trips to coincide with the ripening of wild fruits. They remain relatively sedentary at their temporary camps, but they usually 'hedge' their subsistence bets by bringing modest quantities of plantains with them from their gardens. Such camping trips are times of fun and relaxation for the Yąnomamö, for they can take a respite from gardening and delight in varying their diets by living off many kinds of wild produce when it is in season.

Generally, the most commonly taken game animals in Kąobawä's area are two varieties of large game birds that resemble our pheasant and turkey respectively (*mąrashi* and *paruri*), two species of wild pig, several varieties of monkeys, tapir, armadillos, anteaters, alligators (*caiman*), deer, rodents, and a host of small birds. Many varieties of insects, fish, larvae, and freshwater crabs are eaten with gusto and highly prized. In some areas, large snakes are also eaten, but are not considered to be very desirable—anacondas and boa constrictors in particular. Large toads and frogs are also eaten in some regions. Certain species of caterpillars are prized foods, as are the the fat white grubs of the insect that lays its eggs in the pith of palm trees, or the grubs that live in the seeds of many palm fruits. In the Parima area, some groups eat the flesh of jaguars, a habit that Kąobawä and his people consider to be peculiar. On the other hand, Kąobawä's people very rarely eat the flesh of the capybara, the world's largest rodent, which abounds in the lowlands and reaches 250 or 300 pounds: they look like giant beavers, but with no tails. Fish, as mentioned above, are taken in considerable abundance in certain seasons and, as introduced fishhooks and fishline become more common, are becoming increasingly important in the diet of those Yąnomamö who have access to fishing tackle.[3]

The Yąnomamö, in short, exploit a wide variety of animal protein resources and enjoy a high standard of living by world health standards (Neel et al., 1971). As more foreigners come into their area and and take up permanent residence, this situation will change quickly—and already has along the major river ways where permanent missions have been established, whose personnel hunt with guns, lights, and canoes both day and night and seine fish from the rivers with nets. The meat is often frozen in kerosene freezers and dispensed generously to the many visitors who are beginning to flock to the missions to 'see Indians'.

Vegetable Foods Vegetable foods most commonly exploited by the Yąnomamö consist of the fruits of several species of palm, fruits of several hardwoods, brazil nuts, tubers, seed pods of the feral banana, and a host of lesser items, including some very delicious mushrooms. Palm hearts can be eaten almost endlessly, and I have joined the Yąnomamö in orgies of palm heart eating in which 40 or 50 pounds among a dozen or so people was not uncommon.

Two of the most commonly eaten palm fruit are called *kareshi* and *yei*. The latter is about the size of a hen's egg, the former about half as large. Both fruits have a leathery skin on the exterior and a very large, hard seed on the inside. Between the skin and the seed is a thin layer of slimy, sticky, stringy flesh, somewhat sweet to the taste, that is sucked and chewed off the seed. The overall flavor of both, however, strongly resembles that of a grade of inexpensive soap, and my throat would often burn when I ate these fruits.

[3]The introduction of canoes and flashlights makes night hunting possible in those villages with chronic contact with missionaries, and the recent introduction of shotguns (after 1965) in these villages makes both night hunting and day hunting very efficient. Alligators (*caiman*), the *amota* (a rodent about the size of a small beaver), and tapir are relatively easily taken at night if canoes, flashlights, and shotguns are available. No shotguns were in the hands of any Yąnomamö in the Mavaca area when I began my field research in 1964. By 1975, members of at least 8 or 10 villages in that area experienced increased contact with missionaries and other outsiders to the point that some 40 shotguns could be found in these same villages. The situation in Brazil is even more dramatic, for used shotguns are so inexpensive in Brazil that they can be used extensively as trade goods, costing about as much as I had to pay in Venezuela for a steel ax head—about $5.00 or $6.00. Needless to say, the introduction of shotguns in some Yąnomamö villages has changed not only hunting patterns, but the warfare patterns as well, as we shall see below.

A third palm fruit, *ediweshi*, abounds in swampy areas. It is a tangerine color, about the size of a large hen's egg, and covered with hundreds of small scales not unlike fish scales. *Ediweshi* fruits look like tiny red hand-grenades. When the dry fruit first falls from the tree, it is very leathery and difficult to peel. The Yąnomamö usually throw the fruits into a pond of water, where most of them usually fall in the first place, and wait for them to be softened by soaking. Then the scaly skin can be scraped off with the fingernails. Underneath is a thin layer of yellowish, soft, sometimes slimy flesh that has a pleasant resemblance to the taste of cheese. It was great fun to go 'hunting' for *ediweshi* fruits with the Yąnomamö. We would probe around the knee-deep muddy water to find the fruit. When we accumulated a half-bushel or so, we would then gather around the pile and eat them and gossip. My general reaction to all the palm fruits just described is that it takes a tremendous number of them to get filled, and the effort required is enormous.

Wild honey is one of the most highly prized foods of all, and the Yąnomamö will go to great extremes to get it. Should someone spot a bee's nest, all other plans are dropped and honey becomes the priority of the day. One can usually assume that when someone returns to the village later than expected, he has been detained because he ran into a cache of honey.

Most honey—and there are many kinds—is harvested by ripping the combs out of the nest, often a hollow tree, and soaking wads of leaves in the liquid that remains in the nest. The honey-soaked leaves are rinsed in water. If nobody has a container with him, a shallow pit is dug in the ground, lined with broad leaves, and filled with water. They dip the combs into the watery pit and eat them, larvae and all. The watery liquid usually has large numbers of larvae and a few stunned bees floating on top, as well as much other debris. They dip the liquid out using cups fashioned from leaves, or, if they have a cooking pot, they pass it around, blowing the debris aside before drinking. Should the nest contain a large amount, they squeeze the honey-soaked leaves onto a pile of broad leaves and wrap it up to take home. Leaf-lined pits filled with water are also used to make other beverages, using palm fruits as the base. The fruits are skinned and kneaded by hand in the water until it is sweet enough, and the beverage is consumed by dipping cupfuls out of the pit.

One of the most ingenious gathering techniques is the process of collecting the large, fat palm-pith grubs. The Yąnomamö fell a large palm and eat the heart. Many days later, they return to the decaying tree and begin chopping it apart to get at the soft spongy pith inside. By then, a species of insect has laid its eggs in the pith and the eggs have developed into large grubs, some the size of mice! In fact, the grub looks like a housefly maggot, but a very large one. As they dig the pith out with sticks they run into the fat grubs, perhaps 50 or 60 of them in a good-sized tree. Each squirming grub is bitten behind its head and held tightly between the teeth. A strong pull leaves the head and entrails dangling from the teeth. These are spit out, and the remainder is tossed, still squirming, into a leaf bundle. Grubs damaged by the digging sticks are eaten on the spot, raw. Leaf bundles containing grubs are tossed onto the coals of the fire and roasted, rendering down into liquid fat and a shriveled white corpse. The corpse is eaten in a single gulp, the fat enthusiastically licked from the leaves and fingers. I ate a number of different kinds of insects with the Yąnomamö, some of them quite tasty, but I simply could not bring myself to eat the palm-pith grubs. An experienced missionary who tried them said they tasted to him like very fat bacon, but I suppose anything fat that is cooked in a smoky fire would taste that way. The fascinating thing about palm-grub collecting is that it comes very close to being an incipient form of animal domestication, for the Yąnomamö clearly fell the tree with the intention of providing fodder for the insect eggs, and with the intention of harvesting the grubs after they mature to a desirable size.

Another interesting hunting technique has to do with taking armadillos. Armadillos live in burrows several feet underground, burrows that can run for many yards and have several entries. When the Yąnomamö find an active burrow, determined by the presence of a cloud of insects around the entry, an insect that is found only there, they set about smoking out the armadillo. The most desirable fuel for smoking out armadillos is the crusty material in old termite nests, which burns very slowly, producing an intense heat and enormous amounts of heavy smoke. A pile of this is ignited at the entry of the burrow and the smoke is fanned into the burrow. Other entries are soon detected as smoke begins to rise from them, and are sealed off with dirt. The men then spread out on hands and knees, holding their ears to the ground to listen for armadillo digging or movement in the burrow. When they hear it, they dig down into the ground until they hit the burrow and, hopefully, the animal. They might have to make several attempts, which is hard work—they have to dig two or more feet down before hitting it. On one occasion they had dug several holes, all unsuccessful—they even missed the burrow. One of the men then ripped down a large vine, tied a knot in the end of it, and put the knotted end into the armadillo entrance. He twirled the vine between his hands, gradually pushing it into the hole. When it would go no further, he broke it off at the burrow entrance, pulled it out, and then laid it along the ground along the axis of the burrow. They dug down where the knot was and found the armadillo on the first attempt, asphyxiated from the smoke.

Gardening Although the Yąnomamö may spend as much time "hunting" as they do gardening, the bulk of their food comes from cultivated plants. The Yąnomamö were persistently described by early visitors to the region as "hunters and gatherers," but that was a characterization based on misinformation or on the romantic assumption that a tribe so unknown and so remote simply had to exist in the "most primitive" conditions imaginable, and therefore *had to be* hunters and gatherers.[4] Approximately 80 to 90% of the

[4]Even more highly informed field researchers have erroneously perpetrated this misconception and have attempted to portray the Yąnomamö as hunters and gatherers to emphasize their 'primitiveness' or their 'pristine' quality, in spite of what their eyes could see. Thus, the Yąnomamö are occasionally referred to by some anthropologists, especially German or German-trained anthropologists, as "wildbeuter" or "hunters and gatherers" (e.g., Zerries, 1954; Wilbert, 1972; Becher, 1960).

[illegible] Yąnomamö is from their gardens (Lizot, 1971c; Chagnon, 1968a [first edition of this book]), and their political, economic, and military activities reflect this fact in an overwhelming manner. Of their domesticated foods, plantains are far and away the most important item in their diet. To be sure, this horticultural emphasis must certainly be a post-Columbian phenomenon, but it would be reasonable to assume that prior to plantains they relied heavily on manioc, maize, and several indigenous varieties of cultivated tubers (see below).

The Yąnomamö are constantly aware of the potentials and suitability of the regions they hunt as future village and garden sites, for their warfare patterns dictate that they must eventually move their villages to such new areas. When I hunted with them, evening conversations around the campfire would eventually revolve around the merits of this particular area as a potential new garden site. Hunters are the ones who usually discover the regions that will be the future sites of their villages when a long move is required.

Land for a new site should not be heavily covered with low, thorny brush, since it is difficult to clear and burn. The larger trees should not predominate in an area, for too much labor would be required to fell them. Ideally, the new site should have very light tree cover, should be well drained and not be inundated in the wet season. It should be near a reliable source of convenient drinking water. One conception they have about potential new garden sites is implied in their word for savanna: *börösö*. Savanna to them is not merely a stretch of land that is treeless, but a jungle that has widely spaced trees that would be relatively easy to clear for gardening. They occasionally also refer to a potentially useful tract of jungle by the very name they use for a cleared garden itself: *hikari täkä*, a 'hole' in the jungle where a garden exists.

The first operation in making a new garden is to cut the smaller trees and ow brush. The larger trees, *kayaba hii*, are left standing until the undergrowth s cleared. Then most of the larger trees are felled with steel axes and left lying n the ground for several weeks so the branches and leaves can dry out. Especially large trees are felled by chopping them down from scaffolds, which re built 10 or more feet above the ground: there the stump is not so thick and ess chopping is required to fell the tree.

My older informants claimed that they did not have steel axes when they ere younger and had to kill the big trees by cutting a ring of bark off the base f the stump with a crude stone or by piling brush and deadfall wood around ne bases of the large trees. They burned the brush to kill the tree, which ould then drop its leaves and allow enough light to reach the ground to ermit their crops to grow. The dead trees were simply allowed to remain anding. Informants also claimed that making a garden was much more work those days because a large area would have to be scoured in order to cumulate enough wood and brush to kill the larger trees with fire. Today eel axes are becoming so common that even the uncontacted villages enjoy latively new ax heads that get traded into them via the intermediate ąnomamö villages that link theirs to the mission posts whence most steel ols now come. Still, I have contacted remote villages where steel axes were not only rare, but so badly worn from previous use that at least 50% of the blade was gone. The rate at which steel tools and other Western items are now entering the region is nothing short of incredible. One Catholic missionary I knew very well, Padre Luis Cocco, gave the members of his village—some 130 people—over 3000 steel machetes alone in a 14-year period, plus hundreds of axes, aluminum cooking pots, knives, and hundreds of thousands of meters of nylon fishing line and an equivalent number of steel fishhooks. These items were quickly dispersed, through trade, to not only the villages immediately adjacent to his, but far inland to the most remote villages (Chagnon and Asch, 1976). Other mission posts where permanent contact with the Yąnomamö now exists provide large quantities of these same items to the Yąnomamö on both the Venezuelan and Brazilian sides of the border. Before the arrival of missionaries, the Yąnomamö appear to have gotten steel tools from the Carib-speaking Ye'kwana Indians to their north, who have been known to be in contact with Westerners for 200 years. The Ye'kwana, a people who have carried the art of dugout canoe building to a high degree of sophistication, would take trips as far away as Georgetown, Guyana, to trade with the English colonials there—long before Westerners penetrated their area to establish permanent contacts. Whole villages of Yąnomamö would go to the Ye'kwana villages to work for them for several months to earn steel tools and other items, tools that would eventually be traded further and further inland to the remote Yąnomamö villages whose members had never seen the Ye'kwana. A similar relationship between the northern Yąnomamö villages and the Ye'kwana still exists, a relationship that has occasionally and erroneously been called 'slavery' (see Hames, 1978; Arvelo-Jimenez, 1971, for discussions of Ye'kwana/Yąnomamö political relationships).

I draw attention to the trade in exogenous items for a number of reasons. First, to make it clear that the Yąnomamö have had access to some steel tools for as long as 100 years, perhaps in some areas near the Ye'kwana for longer than that. This might possibly be important in understanding the rapid population growth that I have documented among several large clusters of Yąnomamö villages for the past 125 years—a "population explosion" that might be related to both the introduction of an efficient, productive cultigen—plantains—on the one hand, and steel tools that make gardening much more efficient and productive on the other. Second, I want to emphasize that 'uncontacted' as a description of some villages is a relative term: the residents of such villages might never have seen outsiders, but they and their ancestors might have had some benefits derived from exogenous items that were introduced into the New World by Europeans—such as steel tools and certain cultivated plants. Useful items often spread rapidly between cultures, a process that does not require direct contact, and such items often set about changes in the recipient cultures that transform them into new and different kinds of cultures. Classic examples of this process abound in the anthropological literature. For example, the nomadic equestrian buffalo-hunting cultures of the North American Great Plains region came into existence only after the introduction of firearms via the French and English traders in Canada and the

introduction of horses via the Spaniards in Mexico (Secoy, 1953). Prior to this, the cultures of the Great Plains that we emphasize in both our anthropology textbooks and in our theatrical films simply did not exist in any form resembling what we now have fixed in our impressions. Again, many of the dramatic cultural processes and situations that are found in Highland New Guinea and in much of Micronesia and Polynesia owe their form and content to economies based on the cultivation of the sweet potato, a plant that was brought to these areas from the New World *after* the discovery of the Americas in the 16th century. Finally, many traditions and technoeconomic realities affecting Western European culture took form because of borrowed plant crops *from* the Americas. Karl Marx, for example, once mused that the Industrial Revolution could not have succeeded without the white potato, a cheap and efficient food for a large labor force: the potato came to Europe from the Andes. And what would pizza be like without tomato sauce, the tomato being another New World plant introduced to Europe after Columbus? Finally, I emphasize the almost staggering quantity of steel tools being introduced to the Yąnomamö by mission posts to answer a question I often get from sensitive but uninformed students and colleagues who find it morally questionable that I provided some steel tools to the Yąnomamö in order to conduct my field research, questions that often explicitly suggest that I, alone, am responsible for 'changing' or even 'ruining' Yąnomamö culture. The fact remains that the Yąnomamö (and all primitive cultures) will be exposed to acculturation processes in the complete absence of anthropologists, and the anthropologists have no control over this. We enter into the field situation long after the process has begun, and despite conscientious efforts to limit our own participation in it, have little alternative other than to trade exogenous items as part of the cost of being accepted and acceptable to the people we wish to study and understand. It would be almost impossible to enter Yąnomamö culture and not participate in some sort of reciprocity with them, and there is no reciprocal relationship that would not have some influence or impact on them. The only viable alternative to the fear of 'affecting' or 'having an impact on' the culture studied by the anthropologist would be to simply stay home and remain 'pure' while the culture disappears, being able to self-righteously point a finger at those who didn't stay home and who traded machetes for knowledge. But who would provide the ethnographic data that lies at the basis of our discipline if that were to be the proper course? The best that one can do is to simply attempt to minimize one's effects on another culture and try to be as unobtrusive as possible.

Thus, the Yąnomamö clear their trees with steel tools today, often not knowing the provenance of the tools they use or paying much attention to the question in the first place—other than "we got this ax from the Monou-teri" or "that machete came from the Yeisi-teri." They then plant these sites primarily with a crop that was introduced to the New World after Columbus (Reynolds, 1927).

The larger trees are usually felled toward the end of the wet season, although I have seen them do this kind of work at other times of the year, especially when military relationships imposed compelling schedules on them. In general, the clearing of the jungle tends to be a wet season activity and burning of the brush and smaller branches a dry season activity, but Yąnomamö gardening is far less 'systematic' than the slash-and-burn schedules found in many other parts of the world (see Conklin, 1961, for a useful bibliography on swidden farming; and Carneiro, 1960 and 1961, for an excellent analysis of swidden cultivation in the Amazon Basin). An adequate burning of the felled timber can be achieved even during the rainy season, provided that the fallen timber has had two or three days of sunshine in succession to dry it out. Only the smaller branches are burned, along with the brush and scrubby vegetation, and it is therefore not necessary to wait until the large trunks are dry. They are left lying helter-skelter on the ground and serve as 'boundaries' between patches of foodcrops owned by different families and as firewood.

Other Garden Products Many kinds of additional foods and other nonfood cultigens can be found in most Yąnomamö gardens. Among the more important foods not yet discussed are several root crops. Manioc, a starchy root staple widely found throughout the Amazon Basin, is cultivated in small quantities by most Yąnomamö. They usually grow the 'sweet' variety, that is, a variety that contains little or no cyanic acid, a lethal poison that must be leached from the manioc pulp before it can be eaten (see Cock, 1982). When the pulp of the poisonous manioc is exposed to air, as it is when it is uprooted and peeled, the toxin oxydizes into hydrocyanic acid, related to the substance used in those states that use the gas chamber in capital punishment. The Yąnomamö are beginning to use larger and larger amounts of poisonous manioc in the north, where their villages are found near the villages of the Carib-speaking Ye'kwana, who have diffused both the plant and the proper refining techniques into the Yąnomamö area. In Kąobawä's area, the sweet manioc variety is dominant. It is refined into a pulp by rubbing the roots on rough rocks. The moist white pulp is made into thick 'patty cakes' about 10 inches in diameter, and then cooked on both sides by placing the cakes on a hot piece of broken pottery (Fig. 2–8). Ye'kwana cakes are much larger—up to 3 feet in diameter. In general, the Yąnomamö prefer foods that require little or no processing, a kind of 'take it from the vine, throw it on the fire' attitude that applies to both vegetable and animal food alike.

Three other root crops are also widely cultivated and provide relatively large amounts of calories in the Yąnomamö diet. One is called *ohina*, a South American variety of taro (*xanthosoma*). Sweet potatoes (*hukomo*) are also cultivated, as is another potatolike root known in Spanish as *mapuey* and in Yąnomamö as *kabiromö* or a slightly different variety called *ahä akö*. All these are usually roasted in the hot coals of the hearth, peeled by finger after cooking, and eaten with no condiments.[5]

[5]The Yąnomamö make a salty-tasting liquid from the ashes of a particular palm tree on rare occasions, and dip their food into it. It is probably calcium chloride rather than sodium chloride. When the Yąnomamö first taste salt, they detest it and claim that it 'itches' their teeth and gums. They gradually become addicted to it, and beg for it frequently.

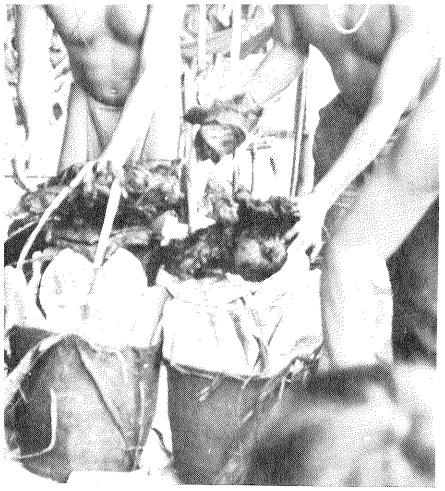


Fig. 2–8. Kąobawä's younger brothers preparing packs of food at the end of a feast. These will be given to the guests to eat on their way home. Each pack contains vegetable food—cassave bread in this case—and smoked meat. Yąnomamö cassave bread is smaller and moister than that made by their Carib neighbors.

Perhaps another dozen food items of less importance are grown by the Yąnomamö, but not all of them are found in every garden. Avocados, papaya trees, and hot peppers are among the more important of these.

Several very important nonedible cultigens are also found in all or most Yąnomamö gardens. Arrow cane is grown for its long, straight shafts, which are dried in the sun and made into hunting or war arrows, exceptionally long by our standards: 6 feet. They are light and springy, but can be shot completely through the body of an animal or man.

Without a doubt, the most significant nonfood cultigen in any Yąnomamö garden is tobacco, to which men, women, and children are all addicted. They 'chew' rather than smoke their tobacco, but the chewing is perhaps better described as 'sucking'. Each family cultivates its own tobacco patch and jealously guards it from the potential theft of neighbors—a common problem when someone in the village runs out of tobacco, either by giving too much away to visitors in trade or having his crop fail. It is the only crop I saw in a Yąnomamö garden that is sometimes fenced off to remind avaricious neighbors that the owner is overtly and conspicuously protecting his crop from theft. The fence, a flimsy 'corral' of thin sticks stuck into the ground and laced together with vines, would not prevent theft: it is merely a proclamation that the owner is prepared to defend his tobacco plants with more than the usual vigor. I have even seen some Yąnomamö bury 'booby traps' in their tobacco patches to cause any poacher severe discomfort: very sharp, long splinters of bone were buried, and an unsuspecting intruder would have a painful sliver in his foot for a long time. Addiction to tobacco is so complete that even relatively young children—10 years old or so—are hooked. As a cigarette smoker myself, I can understand their plight when the tobacco runs out. They often 'bummed' cigarettes from me when this happened, but instead of smoking them they wrapped fine string around them to hold them together and stuck them between their lower teeth and gums and sucked contentedly on them, remarking how strong and *nakri* (powerful) my tobacco was. They prepare their own tobacco in a somewhat complex way. It is first harvested, selecting the individual leaves at the peak of maturity. The leaves are then tied together by the stems, 15 or 20 at a time, and hung over the hearth to cure in both the heat and the smoke of the campfire. Once dried, they are stored by making large balls, wrapped in other leaves to keep insects and moisture out. These balls of tobacco are traded to visitors. As needed, several leaves of the cured tobacco are removed from the ball, dipped in a calabash of water to moisten them, and then kneaded in the ashes of the campfire until the entire leaf is covered with a muddy layer of wood ashes. The leaf is then rolled into a short, fat, cigarlike wad, which is often bound with fine fibers to keep it in that general shape. The large wad is then, with conspicuous pleasure, placed between the lower lip and teeth, and the preparer reclines in his or her hammock with a blissful sigh and sucks on the gritty, greenish, and very large wad. They are also very sociable about tobacco: when someone removes his wad and lays it down for a second, another might promptly snatch it up and suck on it until its owner wants it back. The borrower may be a child, a buddy, a wife, a stranger, or, if willing, the anthropologist. Although I occasionally ran out of cigarettes during my fieldwork, I could never bring myself to suck either on a new or a used wad. It should be clear that tobacco usage among the Yąnomamö lends itself very effectively to the rapid spread of viruses and infectious diseases at both the village and regional level.

Cotton is also an important cultigen, for its fibers are used for hammock manufacturing as well as for 'clothing' (Fig. 2–9). One must have a fairly generous interpretation of the last word, since Yąnomamö 'clothing' is largely 'symbolic' and decorative. Indeed, some well-dressed men sport nothing more than a string around their waists to which they tie the stretched-out foreskins of their penises. As a young boy begins growing and maturing, he starts to act masculine by tying his penis to his waist string. The Yąnomamö use this cultural/ontogenic phase to quite accurately describe the age of young boys—"My son is now tying his penis up." A certain amount of teasing takes place at this time, since it is difficult to control the penis when you are young and inexperienced. It takes time to stretch the foreskin to the length required to tie it adequately and securely, and until that happens, it keeps slipping out of the string, much to the embarrassment of its owner and much to the mirth of the older boys and men around. Sometimes older boys and men accidentally get 'untied', causing great embarrassment—for it is like being *completely* naked.[6] A penis string is not comfortable. Take my word for it. Wherever

[6]So circumspect are the men about this that in the passion of a serious fight or duel they will cease hostilities momentarily should one of the contestants come untied. There is an amusing scene in our film *Yanomama: A Multidisciplinary Study* (see Appendix A) in which two men are pounding each other violently in a chest-pounding duel. The penis string of one of them comes untied and both, without any discussion, temporarily cease the duel until he gets his penis tied up again, at which point they resume slugging it out. Women, too, are very careful and modest despite the fact that they are dressed no more adequately than the men. Thus, a girl or woman will be very careful when rising from a sitting position, crossing her legs to conceal as well as she can her otherwise naked pubis.

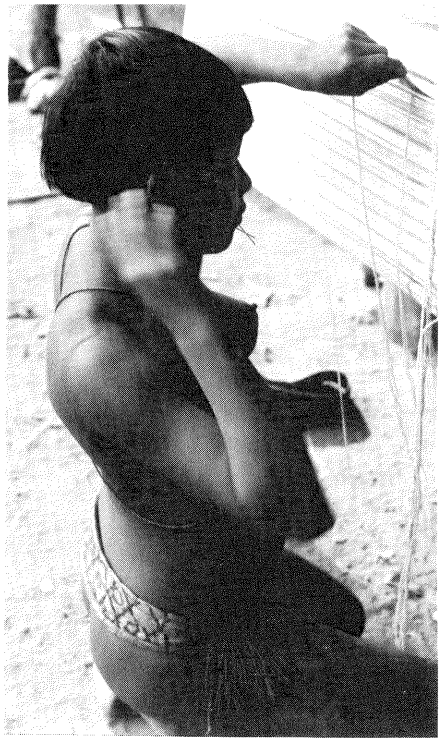


Fig. 2–9. Cotton hammocks are made from a continuous strand of yarn wrapped between two upright posts. Cross 'woofs' are plaited in every few inches.

possible, as at mission posts, the men become rapidly accustomed to wearing short pants or loincloths and these become popular trade items very quickly. Men who wear pants stop tying their penises. It should not be assumed that *all* customs are enjoyed or liked by the practitioners, a topic of anthropological research that deserves far more attention than it has thus far received.

Most cultivated cotton is used for making hammocks. A continuous strand of spun cotton yarn is wrapped around two upright posts until the proper width of the finished hammock is achieved, and then cross-seams are plaited vertically every few inches to hold the strands in place (Fig. 2–9). When this is done, the posts are removed from the ground and the ends of the hammock are tied with stronger cotton yarn, giving a finished hammock about 5 to 6 feet long. Everyone wants to have a permanent cotton hammock, but since they are often given in trade, many people make do with a flimsier, less comfortable hammock made of vines. Women also use cotton yarn to make a small waistband that is quite pretty but covers nothing. Cotton yarn is also used to make armbands and a loose, multistring, halterlike garment that is worn by women crossed between the breasts and in the middle of the back. The women make, for men, a fat cotton belt that looks like a giant sausage; the men tie their penises to this. Men, women, and children wear single strands of cotton string around their wrists, ankles, knees, or chests. Apart from this, there is no other 'clothing'.

Finally, in some villages a variety of magical plants are cultivated, especially by the women. Most are associated with casting spells on others, spells that are often nonmalevolent as in the case of 'female charms' called *suwä härö*. Tiny packets of dusty powder, wrapped in leaves, are used by men to 'seduce' young women. The charm is forced against the woman's nose and mouth. When she breathes the charm, she swoons and has an unsatiable desire for sex—so say both the men and the women. The women also cultivate magical plants in some villages that allegedly cause the men to become tranquil and sedate. It is thrown on the men especially when they are fighting, the intended effect being to make the men less violent.

In villages to the north of Kąobawä's, people allegedly cultivate an especially malevolent plant that can be 'blown' on enemies at a great distance, or sprinkled on unwary male visitors while they sleep. A particularly feared class of these is called *oka* and is said to be blown through tubes at enemies, causing them to sicken and die. Kąobawä's group does not use *oka* but they insist that their enemies do. Their enemies, in turn, disclaim its use but claim that Kąobawä's group uses it. It is one of those harmful practices that you are sure the enemy employs but one that you yourself do not engage in. All Yąnomamö groups are convinced that unaccountable deaths in their own village are the result of the use of harmful magic and charms directed at them by enemy groups.

Slash-and-Burn Farming Each man clears his own land. Adult brothers will usually clear adjacent portions of land and, if their father is still living, his garden will be among theirs. Thus, connections between males that are important for other social relationships to be discussed in a later chapter are also significant in the distribution of garden plots and land usage. The size of a plot is determined, in some measure, by one's family size and kinship obligations, but some men are poor planners and occasionally underestimate how much land they have to clear in order to plant sufficient food to take care of their family's needs. I once overheard a Yąnomamö headman, who was annoyed that one of the inmarried men in his village chronically had to borrow food from others, scold the man viciously as he inspected his garden: "This isn't big enough for your wife and children!" He warned, "You will have to beg plantains from others if you don't make it bigger! See that tree over there? Clear your garden out to there and you will have enough—and you won't have to beg from the rest of us later!" His tone of voice was such as to make it clear that future begging would be greeted with no small amount of reticence. One mistake is allowed, but persistent ones are not.

Headmen tend to make larger gardens than other men, for they assume a considerable responsibility for entertaining periodic groups of visitors that must be fed. They also contribute much more food to a feast when all the members of an allied village arrive to spend several days. Kąobawä's garden is much larger than those of other men. He is helped by younger brothers in some of the heavy work and by his wife's brother, a man who has no wife or dependent children—largely because he is something of a brute and a bit on the stupid and unattractive side. He is, however, an unflinching supporter of Kąobawä and will work indefatigably to help him garden. This man's son also helped Kąobawä in gardening, for he was eligible to marry any of Kąobawä's daughters, putting him into a relationship in which he 'owed' Kąobawä favors

and service. The young man is Bakotawa, the guide who abandoned me in the headwaters of the Mavaca River when I made first contact with Sibarariwä's group.

When the garden is ready to burn, the brush and smaller branches are stacked into piles and ignited. Other brush is added as it is ripped from the fallen trees. A man might have several such fires going in his garden, and each man burns his garden at a time most convenient for him. Sometimes the fires are placed around the large, fallen timbers, which dries them out and makes them easier to split into firewood, the collection of which is almost entirely the woman's task and the quantities of which are staggering. I had not anticipated that firewood could be such a major concern of the Yąnomamö or any Tropical Forest society, but very large quantities of firewood are needed—for cooking, for keeping warm at night, and for cremating the remains of dead people. Women spend a large amount of daily effort collecting firewood, and try to do so with minimal inconvenience and effort. Thus, a fallen timber in the garden plot—especially a species that splits easily—is jealously regarded and becomes a useful resource. Over time, the more useful large trees are gradually split, broken or chopped into firewood by the women and the garden gets 'cleaner' as it matures. A woman should not take firewood from the garden plot of a neighbor unless invited to do so. Firewood is not only valuable and important to the Yąnomamö, but somewhat to my own surprise, is a strategic resource in many other parts of the world as well (*National Academy of Science*, 1980).

Planting the newly-cleared and burned garden proceeds in one of two ways. If the site is at a considerable distance from the village, a great deal of strategic planning is involved as to crop mixture and maturity of the cuttings that will be transplanted. If the new garden is simply an extension of the old one, a different kind of strategy is involved, for the transport of seeds and cuttings is a small problem.

The Cultural Ecology of Settlement Pattern

Micro Movements of Villages and Gardens Let us consider the first and simplest scenario of garden extensions. A Yąnomamö garden lasts about three years from the time of initial planting. As the garden becomes overrun with scrub vegetation and thorny brush and foodcrops nearly depleted, an extension is added to the garden by simply clearing the land around the periphery. At this point, the old garden is referred to as an "old woman"—-unable to produce anymore. The new extension is called the "nose" and is added onto the "old woman" part as the latter is allowed to fall into disuse. The "old woman" part is also called the "anus" of the garden.

Some anthropologists during the 1950s and 1960s, when the theory of "cultural ecology" first began having a major impact on studies of cultural adaptation, argued that slash-and-burn gardens in Tropical Forest regions such as the kind occupied by the Yąnomamö had to be abandoned simply because the crops exhausted the soil nutrients and new, fresh land had to be brought under cultivation because of this problem. As the argument went, local villages in the Tropical Forest could not exceed a certain size limit, and complex cultural developments were impossible because the generally poor quality of the soils demanded chronic movement and relocation. In the 1950s, an anthropologist named Robert L. Carneiro decided to put this argument to an empirical test, using his own meticulous field research among the Kuikuru of the Brazilian Xingu area (Carneiro, 1960, 1961). His work literally overturned the 'poverty of the soil' argument that purported to account for village relocations in this kind of environment. By measuring crop yields in Kuikuru gardens, testing soil samples for declining fertility, and noting several measurable variables such as acreage required to support an average family or an individual, distance from the garden to the village that cultivators were willing to travel, and how long it took an old garden to regenerate new forest after being abandoned, he showed quite convincingly that Tropical Forest villages larger than 500 people were easily feasible, that villages did not have to move because of soil depletion, and that a high level of horticultural productivity could be maintained in the lands immediately surrounding a typical village. In short, he argued that whatever it was that lay behind the village relocations of tribes like the Kuikuru, exhaustion of soil nutrients was not a very persuasive explanation. Moreover, soil exhaustion could not be convincingly given as the explanation for why villages failed to exceed 500 people, or be used as an explanation of cultural inertia due to low productivity. Indeed, he was able to show that the Kuikuru produced more calories per acre than Inca farmers and did so with much less labor effort (Carneiro, 1961). Few people argue today that settlement relocation in the aboriginal societies of the Tropical Forest of Amazonia can be simply reduced to soil poverty—the issue is much more complex than that and many variables are involved in the decisions that lie behind village movements.

The short movements of gardens by the Yąnomamö can be thought of as "micro" movements and entail either the extension of an existing garden or the clearing of a new garden a few hundred or so meters from the existing garden. In either case, the planting of new crops is relatively easily accomplished, for the seeds and cuttings do not have to be carried very far. The reasons given by the Yąnomamö for making new gardens in this way are similar to those found among the Kuikuru studied by Carneiro and are also documented for other Amazonian cultivators: the vegetation that begins to grow up in maturing gardens is dense and usually very thorny, and therefore very unpleasant and tedious to clear and burn. This must be done by people who wear no clothing, and if you ever have to make your way through such vegetation in the buff, you will immediately understand the wisdom of avoiding such brush.

Figure 2–10 schematically illustrates "micro" movements of Yąnomamö gardening and how adjacent new land is brought under cultivation. Since, as I have described above, the *shabono* must be rethatched every two or three years, the movement of a garden a few hundred yards might also be the

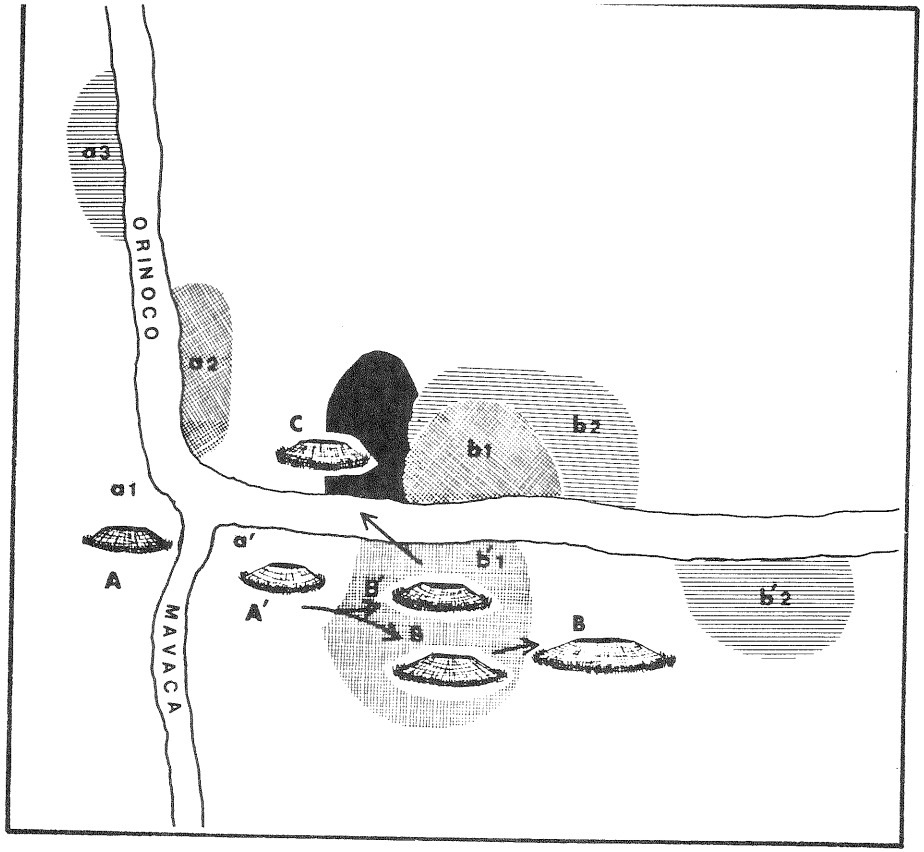


Fig. 2–10. "Micro" movements of Bisassi-teri between 1960 and 1968, showing how new gardens were added as extensions of older ones. When the Bisaasi-teri moved here, there were two shabonos *on opposite sides of the Mavaca River, just a few hundred feet from each other (A and A'). Kąobawä's group (A') decided to make two new* shabonos *(B and B') when they extended their gardens, the first sign of a fission. Eventually one group (B') moved across the Orinoco to begin a separate existence (C). Kąobawä's group remained behind (B) and just a few hundred feet from the two other* shabonos *(from Chagnon, 1968c).*

occasion to move the *shabono* as well—to keep it located conveniently near the food crops.

The Yąnomamö prefer to remain in one *general* area a long time, especially one that has a reliable source of game within a reasonable walk from the village. My research has revealed many cases of the same village remaining in one area for 30 to 50 years, leaving it only when the military pressures on them are overwhelming. A second attraction for remaining in the same general area has to do with the domesticated peach palm trees that produce very large crops of prized fruits every year. They continue to produce long after the garden is abandoned, so the Yąnomamö like to remain reasonably close to old, abandoned gardens to harvest these fruits. This palm is an exception to my earlier generalization that it takes a great many palm fruits to get a full belly. Peach palm fruits (*rasha*) have a relatively small seed (some have no seed at all) and a very large amount of mealy flesh, about the texture of boiled potatoes, rich in oil, and very tasty. Families usually plant one or several of these trees every time a garden is cleared, and the trees produce very large crops of fruits for many years after the gardens have been abandoned (Fig. 2–11). Thus, by remaining in a general area, the peach palm crops can be easily and conveniently harvested, and yield enormous quantities of tasty, nutritious fruit.

Plantains, bananas, and manioc are cultivated by the generative process, that is, cuttings are transplanted: no seeds are sown. As a plantain 'tree' matures, it sends out underground suckers that sprout, each of which in turn can grow into a new productive 'tree'. Each mature plantain tree produces one bunch of fruits, often very large (depending on variety), and when this is cut, the plant is then useless and it, too, is cut to the ground to make room for the growing young suckers. The suckers are the next generation of plantain, for each will produce a new bunch of fruits at maturity. These can be transplanted when they are very small—a few inches high—or when they are very large—several feet high. The larger they are, of course, the heavier they are. But the larger they are, the sooner they yield their fruit. Thus, a man who wants to have a new crop of plantains soon will transplant large suckers, each weighing 10 pounds or more. But one does not want all the plantains to mature at the same time, for most of them will be wasted. Thus, a good garden has plantains in various stages of growth and nearness to maturity to insure that there will be reliable, abundant food all year long. Probably 80% of the calories from cultivated foods comes from plantains, and the gardens reflect that emphasis in terms of the proportion of land that is given to plantain cultivation. It takes about four months for a large sucker to yield a ripe bunch of plantains—perhaps six months for a small sucker to do the same.

Macro Movements of Villages and Gardens The warfare pattern waxes and wanes in all Yąnomamö areas. Years may go by in some regions, particularly in the villages along the periphery of the tribal distribution, where no intervillage conflicts occur. In the interior of the tribal distribution, where all villages are surrounded by neighbors on all sides, as in Kąobawä's area, the periodicity of active wars is different in two ways. First, it is rare for long periods of tranquility between villages to occur: several years might pass without shooting difficulties with some neighboring group, but anything beyond that is not common. Second, once hostilities between villages erupts and someone gets killed, the contestants are locked in mortal relationships for many years and do not have the option of migrating away into a new, totally unoccupied area as do the villages on the periphery of the tribe. This essentially means that villages in Kąobawä's area have no choice but to develop political alliances with some neighbors, for it is impossible to move into distant land and escape from enemies, and it is unwise to 'leapfrog' past distant neighbors, for there are other, less known Yąnomamö beyond them who may be more difficult to deal with than one's immediate neighbors. But the distance between Yąnomamö villages is very large in Kąobawä's area, so relatively long moves can be

Fig. 2–11. Rerebawä climbing a rasha *tree to harvest the fruit. He rests on one "A-frame" and pushes the second one up higher, climbs onto that one, and then pulls the lower one up. In this fashion he painstakingly reaches the top of the 75-foot tree and lowers the fruit bunch with a vine.*

effected—four or five days' walk—in order to escape from enemies and start a new garden elsewhere. I have characterized this situation as *social circumscription* (Chagnon, 1968b) similar in effect to Carneiro's (1961) "geographic circumscription." Carneiro argued that the world's major civilizations—Egypt, Mesopotamia, the Incas, and so on—all developed in regions that were circumscribed by deserts, the sea, or other geographical features that restricted expansion and therefore encouraged increasing intensification of land use within the developing region (Carneiro, 1961). He argued that this leads to increased complexity in social organization. My argument about "social circumscription" is similar, for Yąnomamö villages whose ability to move is restricted by the existence of neighbors on all fronts seem to be somewhat more complex in organization and much larger in population size than those on the tribal periphery where migration to virgin unoccupied lands is not impeded. Carneiro, in turn, adopted the notion of "social circumscription" into his general theory of the origin of the state (1970). The long moves made by the Yąnomamö are not provoked by horticultural techniques or the demands made on gardening from crop type, soils, maturity of gardens, or deterioration of the *shabono*. I call these *macro movements*. They are motivated by politics and warfare and must be understood in this context. The relevant 'ecological' variables here are human neighbors, not technology, economic practices, or inherent features of the physical environment as such. The 'cultural adaptation' in this is not so much to the 'sticks and stones' of the environment, but to one's neighbors.

Figure 2–12 gives a graphic illustration of how a macro move is effected when a group of Yąnomamö must abandon its currently producing garden and begin a new one at a long distance away. It will become increasingly clear why 'alliances' with neighbors is a kind of cultural adaptation that permits the Yąnomamö to have some flexibility in dealing with—adapting to—intervillage warfare and conflict. Chapter 6 describes this pattern in considerable detail, in the context of a specific war and settlement relocation.

The first phase in some macro moves is the recognition that continued residence in the village or area will lead to violent fighting in which someone near and dear to you (or you yourself) will be badly injured or killed—with clubs, machetes, axes, or arrows. All the members of a village might be united and act collectively in a move, the threat or danger being the presence of hostile enemies in other villages, enemies who begin raiding your group chronically and take a small toll per raid, but over time a toll that is significant. The constant fear and worry that raiders might be lurking outside is sufficient to increase the level of anxiety and tension in a village and disrupt the normal patterns of movement and social existence. When raiders are feared, nobody leaves the village alone. Even the women, who must collect firewood and water daily, have to be escorted the few yards to the garden or stream by armed men, who nervously keep their eyes peeled for telltale sounds and movements in the jungle, or the disturbance of birds in the distance, fidgeting with their nocked war arrows as the women collect the wood or water. During these times, people are even afraid to leave the village to defecate, and they are forced to do so on leaves, which are then thrown over the palisade. Several weeks or months of this is exhausting, and life could be more relaxed if one lived elsewhere, a greater distance from the known enemy. In other cases, there might be factions within the village, becoming increasingly hostile to each other, and increasingly violent in their arguments and duels, usually over sexual trysts and infidelity, but once started, easily provoked by snide comments, thinly veiled insults, or any one of a host of trivialities that ruffles someone's feathers the wrong way. As villages grow larger, internal order and cooperation become difficult, and eventually factions develop: certain kin take sides with each other, and social life becomes strained. There appears to be an upper limit to the size of a group that can be cooperatively organized by the principles of kinship, descent, and marriage, the 'integrating' mechanisms characteristically at the disposal of primitive peoples, a fascinating question to which we will return later. Suffice it to say here, kinship-organized groups can only get so large before they begin falling apart—fissioning into smaller groups. This size limit appears to be as much a function of the inherent properties of kinship and marriage alliance as it is a function of 'strategic resources'—the material things that sustain people and permit them to live in large social groups that are sedentary and fixed. One might, in this vein, view the long history of both our hunting and gathering ancestral past, as well as our more recent shorter history as cultivators, as a struggle to overcome the

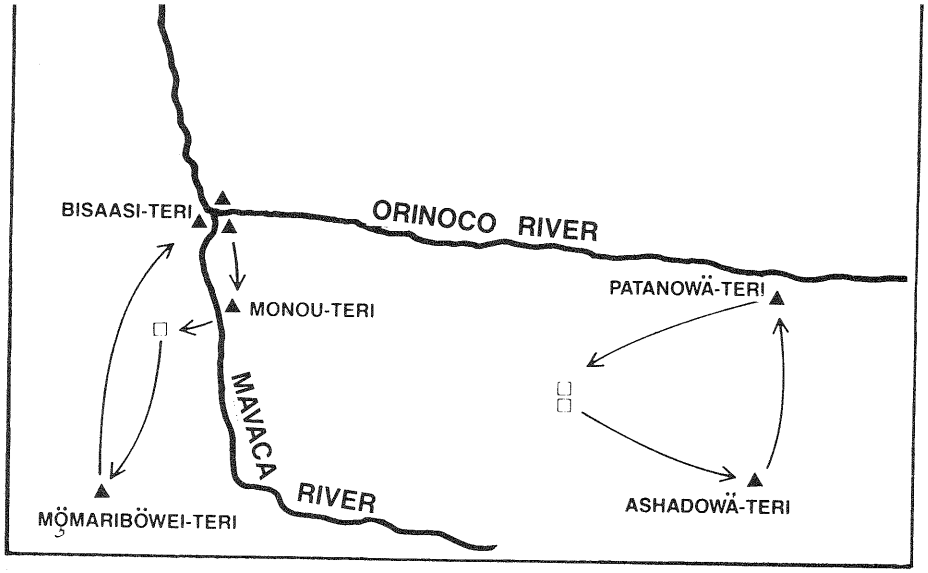


Fig. 2–12. How a new garden and village are established at a long distance (short-term "macro" movements) from the old garden and village (from Chagnon, 1968c).

limitations on group size imposed by the traditional principles of organization that mark most of our history: transcending kinship and adding new kinds of organizational principles. Many general discussions of our social past as hunters and early cultivators allude to the 'magic' numbers of 50 to 200 as the general community size within which our recent cultural and biosocial evolution occurred (see Lee & Devore, 1968), a maximal community size that was only transcended in the very recent past—within the last several thousand years.[7]

Thus, large villages eventually break up and subdivide into smaller villages, usually a bifurcation of the large group into two similar-sized smaller villages, occasionally into three. One of the groups retains possession of the existing, productive garden—or that portion of it that belongs to them—and the other faction must move away to clear, burn, plant, and begin life elsewhere in a new garden.

The distances between the recently fissioned groups can be small or large, depending on the precise nature of the confrontation that causes the fission. Thus, they may simply build two separate *shabonos* located only a few yards away from each other. This solution occurs when it would be hazardous for the larger group to fission and create two small, distantly located villages that would be easy prey to hostile neighbors who might otherwise avoid attacking the larger village or one of the two closely situated splinter villages. Such a solution or alternative is not possible, however, if the final confrontation that

[7]See Briggs (1983) for a summary of the remarkable rate at which large cities have emerged. Carneiro (1970) draws attention to the tremendous significance of the first development of supra local political organization of a nonkinship sort.

determines the split leads to the death of someone. Then, despite the number and determination of other enemies, the group *must* fission into two parts and one of the new groups must move far away and begin a new, separate garden.

Making a new garden from scratch and keeping well fed can be a problem if you must abandon your existing productive garden without warning. If, for example, 100 people from a village of 200 must suddenly pull up roots and immediately leave the group after a fight that led to the death of someone, they have only two choices. Either they can flee to a neighboring village that has been 'friendly' to them in past dealings and 'mooch' off them for several months, or they can tough it out by a combination of living extensively off wild foods and periodic visits to friendly villages where they rest, gorge themselves on their host's cultivated foods, and eventually depart, bringing as much cultivated food with them as they can carry or their hosts are willing to give them. Meanwhile, they are busy clearing a new garden and attempting to get crops producing as soon as possible. Here is where a 'cost/benefit' decision par excellence has to be made, for one must carry by hand all the cuttings and seeds that will be transplanted in the new garden. The issue is essentially a question of an early return of desirable foods, in which case you carry few but large plantain cuttings (Fig. 2–13), or a longer-term security of enduring desirable foodstuffs, in which case you carry larger numbers of smaller, lighter cuttings—but have to wait longer for them to begin producing. A compromise

Fig. 2–13. Plantains are transplanted by cutting 'suckers' from a larger plant. These produce within a few months if they are large, but the larger they are, the heavier. Transporting them a long distance is difficult and energetically expensive.

[illegible] with maize—less desirable than plantains, but its seeds are light, easily transported in large quantities, and the maturity time is short—two to three months. Thus, one can quickly get an abundant, early, low-effort crop into the ground in a hurry, have a surfeit of food for a spell, and wait for the plantains to start maturing. I have visited Yąnomamö gardens that had been established under these circumstances, and they are totally different from 'standard' gardens in the sense that the overwhelming fraction of the new garden is given over to maize cultivation. In time, plantains are gradually transplanted in large quantities and the garden shifts from mostly maize to mostly plantains.

The other important variable in such a move, also a function of the Yąnomamö dependence on garden produce, is the direction and precise location of the new site. Neighbors who are friendly are usually willing to provide plantain suckers for transplanting, and if it is impossible to return to the old garden to get such cuttings, the new garden must necessarily be located somewhere within a reasonable distance from a friendly neighbor who will provide the cuttings.

But the combination of variables can be quite mixed and complex. For example, the increase in village tensions might provoke some members of the group to begin clearing a new garden at a long distance away, anticipating the eruption of a fight that will inevitably cause a fission. One can, in short, predict the disaster and plan for it under some circumstances, and get a new garden under production prior to the final confrontation. If it never comes, the new garden is a convenient haven in which to 'camp out', and may serve, ultimately, just that purpose. A more common combination of variables entails a pattern, of the sort schematically represented in Figure 2–12, in which a newly formed fission group can sequentially exploit several human and natural resources: they can periodically return to their original productive garden to rest up, eat voraciously from their ripe crops, and leave, taking both food and cuttings with them, and camp out in their new garden where they work at felling or burning trees or planting crops, living off a combination of transported foods from their old garden and seasonally available wild foods and game. They might even send young men back to the old garden periodically to fetch more food, or to the village of a friendly neighbor, where supplies are begged. The entire group will follow a cyclical pattern of working in the garden, moving en masse to the village of an ally for a fortnight or so, thence to their producing garden, and back to the new garden.

But this pattern involves several kinds of risks. The first one is the risk of being attacked at the old garden or getting into a fight with the members of the group from which yours is now separating. If there were no such risk, the group would not have to move in the first place. The second risk is the dependency that one enters into with the allies who provide food, refuge, or both. The Yąnomamö are quick to take advantage of those who are vulnerable, and the 'cost' of getting food or accepting refuge from allies is usually the expected sexual license with which your wives, sisters, and daughters are treated: disadvantaged groups have to expect that the tendered friendship and support of an ally will invite some sexual advances from men of the allied village. This can be resisted only up to a point, and then one either is no longer welcome in the village or one must be prepared to overlook the chronic attempts of the hosts to seduce the women of the guests. The best solution is to visit allies for as short a time as possible, extract the maximum amount of economic and political aid in the available time, and then repair to either another ally or to one of the gardens, as shown in Figure 2–12.

Once a new garden is established and is yielding crops in a chronic, reliable manner, labor follows a more regular pattern. There is no peak harvest period, for plantains, if planted in the proper fashion, are ripening all year long. Peach palm fruits do, however, ripen all at once and large quantities of them are eaten at this time—February and March. Some trees produce a smaller crop in June and July.

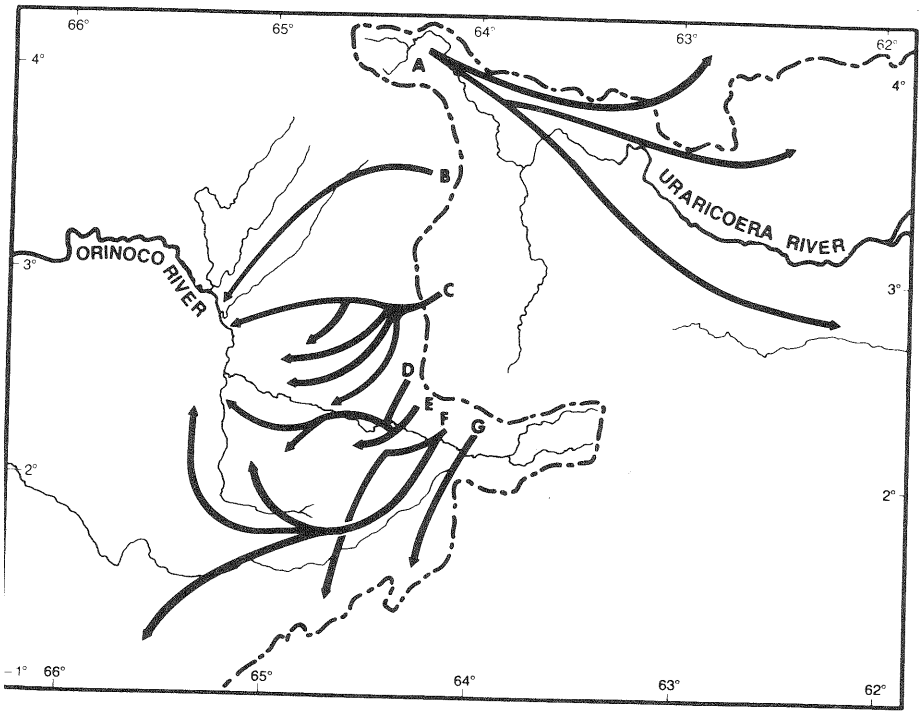
The dry season (September through March) is the time for feasting, visiting other villages, trading, and for many groups, the time for raiding enemies. Garden activities are at a minimum at this time of year, but ambitious families will spend an hour or two each day weeding their gardens, transplanting plantain suckers, and burning small piles of brush and debris. In general, the Yąnomamö—and many other tribal peoples who rely on either hunting and gathering or on swidden agriculture— achieve an adequate, if not abundant, subsistence level with very few hours of work per day (Lee, 1968). So notable is this aspect of primitive economies that one distinguished anthropologist referred to hunters and gatherers as the 'original affluent society' (Sahlins, 1968a, b), stressing the fact that the difference between what they "need" and the "means" for achieving it is very small. In terms of absolute labor given to work this is equally true, for hunters and gatherers like the Bushmen of the Kalahari Desert 'make a living' on only a few hours per day (Lee, 1979) and Yąnomamö productive efforts are about the same (Lizot, 1971b; Hames, in prep.). By comparison, those of us in industrial society are condemned to a life of hard labor and overtime by the forces of the market!

Population and Village Dispersal over Time The micro and macro movements of Yąnomamö villages distribute the population and the villages thinly over the landscape. Immediate concerns for warfare and alliances with neighbors fix the villages with respect to each other at any given point in time as their respective members attempt to 'optimize' their garden and village locations. They want to be as far from active enemies as possible, but as close to current allies as they can be. With each village move, they also try to remain close to their ancient, abandoned gardens so they can continue to exploit their peach palm trees. And they do not want to make moves that entail severe deprivation caused by excessive labor (transporting cuttings a great distance) or catastrophic flight that leads to intense dependence on some erstwhile ally. Finally, some of the choices, as well as the timing of movements, are a function of the demographic properties of the village—especially the number of active, healthy adult males who will live in the new garden and village. These will be discussed in the next chapter.

The longer-term patterns that result from the immediate decisions can be determined only by interviewing scores of old people who can recall all the gardens they lived in during their lifetimes and the major events that transpired there. Two of the most important events are the enemy/ally patterns that obtained at that site and the fissioning of larger groups into smaller ones. This information, when added to the genealogical information that links individual to individual by kinship and marriage ties, results in an overall settlement history of many villages, whose members are both historically and genealogically related to each other.

Figure 2–14 graphically represents the historical movements of several 'blocs' of Yąnomamö, based on approximately 125 garden relocations over a period of about 150 years. This is only a fraction of the information on garden relocation in my data files to date, but it is sufficient to illustrate the point that there is a dynamic relationship between population growth in local villages and the dispersal of both populations and the villages into which they subdivide. Figure 2–14 thus summarizes this in schematic terms, showing that it is possible to identify discrete 'population blocs' and describe the long-term migration pattern each follows. Figure 2–14 in fact identifies seven such population blocs (A through G). It is possible that as many as 30 or 40 such

Fig. 2–14. Long-term effects of "macro" movements of seven groups of Yąnomamö over a 125-year period. Populations grow and fission and move into new areas. In time, a given region will have as many as a dozen interrelated villages that derived from the same 'mother' village many years back. Kąobawä's population bloc is labeled "D"; his Shamatari neighbors are "F" (from Chagnon, 1968c).

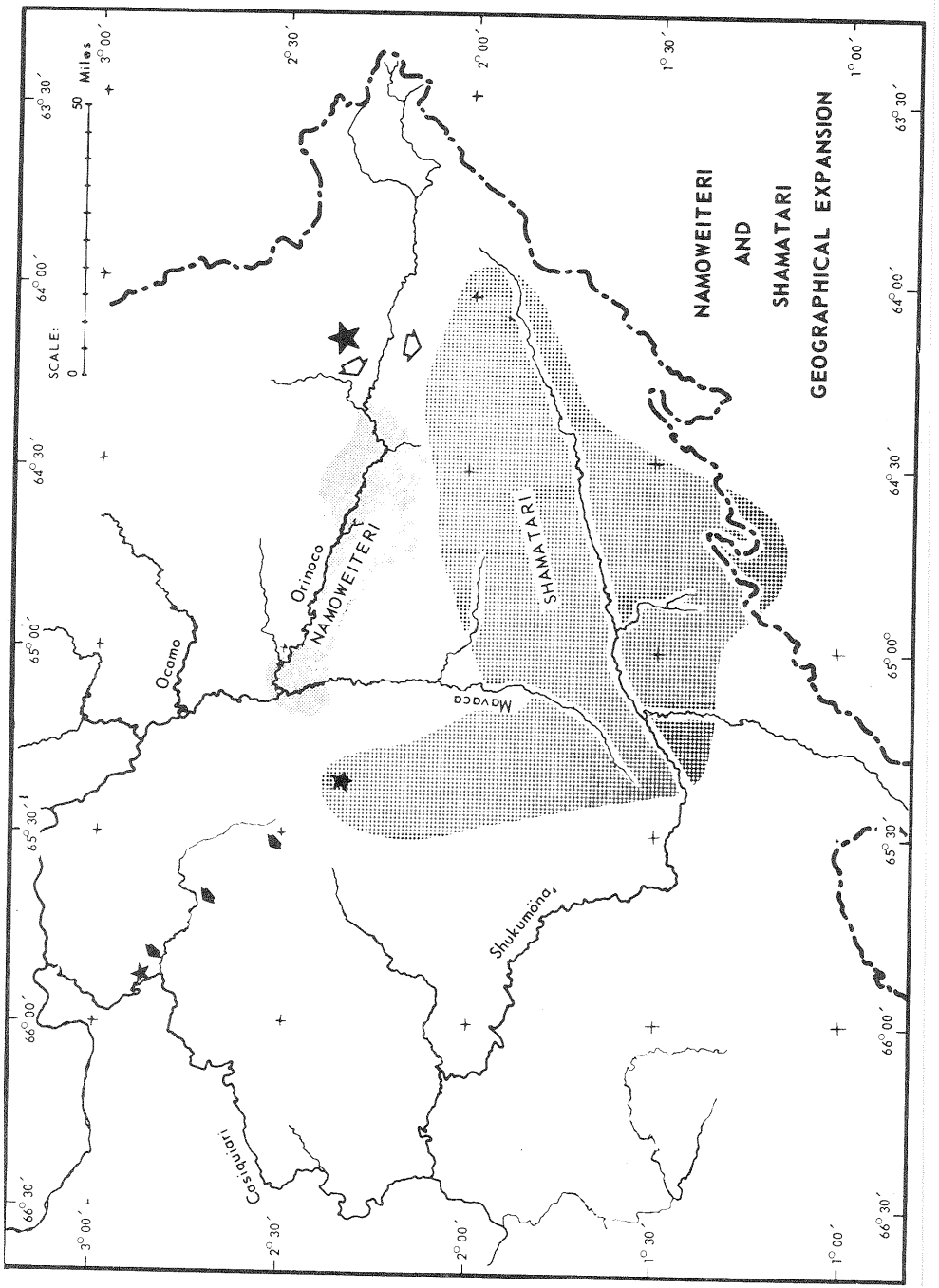


blocs could be identified among the Yąnomamö if the field research were conducted along the lines described here and elsewhere (Chagnon, 1974).

Only two of the seven population blocs shown in the above figure have been discussed above—the bloc to which Kąobawä's group belongs and the bloc that I have called Shamatari. I have designated Kąobawä's bloc as "Namowei-teri," the name of an ancient site where the ancestors of his group and the villages related to his lived nearly 100 years ago (Chagnon, 1974).

The current distribution of most of the villages in these two population blocs is summarized in Figure 2–15, which describes the geographical range of the villages in the two blocs. It is clear that the Shamatari bloc covers a much larger area. Yet the number of villages for each bloc is about the same (seven or eight each). But there are some major differences between them. Shamatari villages tend to be much larger than Namowei-teri villages. They average about 150 people per village, whereas Namowei-teri villages average closer to 80 or 90. Both figures are dependent on the year in which the census is taken, for fissions of large villages drastically alter average size in each population block (cf. Chagnon, 1974; 1975b; 1979a). The general pattern, however, is that Shamatari villages tend to be larger whatever the census year. Shamatari villages are also located much farther apart from each other. This seems to be due to two factors. First, the Shamatari have few neighbors to their south and therefore have more area into which they can pioneer. Second, warfare among the Shamatari seems to be somewhat more intense if mortality due to warfare can be used as a measure of intensity: approximately 30% of adult male deaths are directly attributable to warfare and mortal duels. In the Namowei-teri bloc this figure is about 25% (Chagnon, 1974). Finally, the maximum size to which the Shamatari villages grow is also different. Some of their villages have reached a population of close to 400 people before fissioning, whereas the Namowei-teri villages rarely reach a size of 200. The reasons for these differences appear to have something to do with the marriage and kinship patterns that occur in the two population blocs, patterns that I will discuss in more detail in Chapter 4. For the moment, I will simply suggest here that the differences in village size in the two population blocs is *in part* a function of the difference in warfare intensity, that is, the Shamatari villages grow larger before fissioning due to the slightly higher pressures of intervillage warfare.

The genealogical and settlement pattern information can be summarized in another fashion. Figure 2–16 schematically shows how both population blocs have come into existence through population growth and fissioning of larger villages into smaller ones. The genealogical and historical connections between the existing villages, both determined through field research using Yąnomamö informants, describe how the villages are related to each other. Note that in both population blocs there are 'questions' about other villages. For example, I know that there are other Shamatari villages beyond those I have personally contacted. These are still not known through firsthand visits to them. Still, I have rather complete genealogical data on some of them, at least for some of the older people who are known to live there. How large these



villages are and what the current kinship, family, and marriage patterns are can only be discovered by going there. For the moment, I simply know the villages exist, and where they fit in the political/historical/genealogical diagram given in Figure 2–16.

It should be clear now why a single Yąnomamö village cannot be considered in isolation from its neighbors. It fits into a historical matrix of kinship, descent, and political process. Some neighbors are well-known kin from whom you and your own covillagers separated at some recent point in time. Other neighbors are known to be "shomi"—different. Contact and alliance with these people leads to knowledge and familiarity with them and with their past, and highly advised men such as Kąobawä know a great deal about the history and fissions of the Shamatari villages. They have to, for the past relationships are good clues to what future relationships with them might be. Similarly, highly advised men among the Shamatari know a good deal about the history of Kąobawä's village. As is the case among all population blocs, there have been periods of war and periods of alliance between villages of the two blocs. Ironically, some of the consequences of war—abduction of each other's women— can be turned to advantage when a new alliance with an old enemy becomes a possibility. Men who are the sons of the abducted women use the kinship connection to her relatives in the enemy village as an entree to that village, and are called forth to make the initial visits. Thus, a man who has never seen any of his mother's kin during his lifetime will begin speaking with admiration and affection about his mother's brothers and how desperately he would like to visit these important kin. Through his visit a new period of alliance and peace might begin.

The Great Protein Debate: Yąnomamö Data and Anthropological Theory

The publication of the first edition of this case study in 1968 coincided with the rapidly developing emphasis in anthropology on what is generally known as cultural ecology theory. That theory explores the relationships between culture and environment in the broadest sense, attempting to demonstrate that the environment imposes limitations on the patterns that cultures can evolve and maintain and, in addition, seeks to identify the specific ways that cultures and human populations 'adapt' to their physical environments. The general theory has two components or dimensions. The first has to do with how the various parts of culture—kinship rules, descent rules, residence rules, economic practices, and so on—articulated with each other and 'functioned' to maintain the whole cultural system and how they influenced each other as the system changed over time. The second is borrowed from the field of general biology and has to do with the relationships of animal populations to their

Fig. 2–15. The geographical areas utilized by Namowei-teri villages and Shamatari villages. Much larger distances separate the Shamatari villages from each other and population density is expectedly lower there. Yet the warfare pattern appears to be higher among the Shamatari (from Chagnon, 1974).

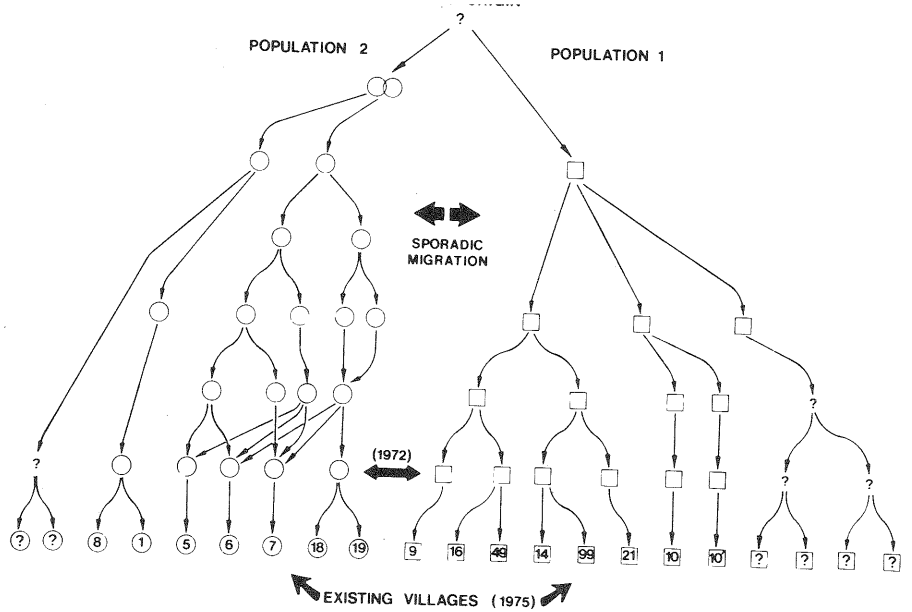


Fig. 2–16. Schematic diagram showing how Namowei-teri villages (Population 2) and Shamatari villages (Population 1) are related to each other historically (from Chagnon, 1979a).

resources and how certain critically important resources limited the growth and dispersal of populations and the densities that they might achieve given the fact that the resources might vary in abundance, predictability, desirability, and reliability. The addition of 'culture' to evolutionary ecology—that is, combining anthropological insights and understanding with general ecological principles—thus amounts to a kind of partial synthesis of anthropology and ecology and to an attempt to combine the best arguments of both.

The major emphasis in anthropology by those who are intrigued by this emerging synthesis is on the limitations or possible limitations that food and other critical resources impose on human population clusterings, the size to which they can grow, the densities they achieve, and the extent to which social and cultural institutions reflect the material (food/resources) substrate that all populations rest on. Most anthropologists would accept the general arguments, logic, and desirability of the cultural ecological approach and most of my own work is built on this general approach.

But the synthesis is proceeding faster and with greater enthusiasm than the facts warrant, and some of the logic is not carefully worked out. In addition, the portions of the argument that are borrowed from biology were borrowed at a time when biology itself was undergoing a major intellectual revolution that dramatically affected the whole field of ecology. One fundamental change in biology was the shift away from the argument that *whole populations* or species 'adapted' to their food and resource base to the argument that *individuals* within the population were the units of adaptation, and that the proper and theoretically most appropriate vantage in ecological studies was the individual and how the behavioral strategies (mating, foraging, social interactions) they adopted affected their personal chances of surviving and reproducing (Williams, 1966; Chagnon and Irons, 1979). In this view, the attributes of the population are the sum of the attributes of the individuals. There is, in short, a fundamental difference between a herd of fleet deer and a fleet herd of deer (Williams, 1966). The *group* is in a fundamental sense a sum of its *individual* parts. This is contrary to much of anthropological, if not philosophical, thinking. The *assumption* that human proclivities and behavior are the product of group selection can no longer be justified in any of the social sciences and this issue must now be reexamined in light of the important new discoveries in theoretical biology (see Williams, 1971, for a readable and comprehensive summary of these issues).

The argument over the 'group' versus the 'individual' perspective in the study of adaptation is now raging vigorously in the field of cultural ecology. Biologists have, however, generally concluded that the 'individual' perspective is the proper one. Whether that will be the ultimate conclusion in cultural ecology remains to be seen and these are very exciting theoretical times in anthropology as this issue is debated and the whole notion of culture is being critically reexamined. If man is 'group selected' it would appear that he is the only living organism for which that claim can be plausibly made. This is an astonishing and staggering claim, and brings us back to the intellectual milieu in which Darwin, in 1858, made the audacious argument that species were not immutable. It is nothing short of a challenge to reassess Man's place in Nature. But Man is the only living organism with culture, and that is the issue on which the debate will probably be resolved, for culture provides man with capacities and capabilities more complex and sophisticated than what other organisms are capable of.

One issue in the theoretical debate has to do with the extent to which 'protein' is the limiting resource par excellence in human cultural adaptations and human social behavior. My work on the Yąnomamö has been caught up in this debate, since some of the variables the protein 'argument' purports to explain are things such as warfare, infanticide, aggression, and population parameters, on all of which I have published extensively. Some of the most useful data needed to resolve the issue is Yąnomamö data, and therefore, the protein advocates have worked especially hard to make the Yąnomamö 'fit' the theory. I have, unfortunately, been less enthusiastic than they about the goodness of fit, since I collected the data and do not believe that it fits. I have also been skeptical about the assumptions and logic of the protein hypothesis because of the monocausal demands it makes, the failure of the data to fit the protein argument, and the devastating contradictions it contains in terms of the recent refinements in *biological theory*. The 'theory' of materialistic cultural ecology will now change radically to conform to its intellectual fount, biology, and Yąnomamö data will be one of the major reasons for this change.

The most prominent champion of the protein theory is an anthropologist named Marvin Harris, formerly of Columbia University, now at the University of Florida. We disagree a good deal and have 'debated' the protein issue publicly on a number of campuses. My data will not change. He refuses to change his protein 'theory'—at least not in one dramatic step. That is called "eating Crow," a high-protein diet eschewed by any concerned scholar. If his protein theory cannot explain the Yąnomamö, one tribe on which precisely the right kind of data exists that is germane to the theory, his theory is in serious difficulty. The Yąnomamö seem to be a critically important test case and thus they play an important role in the modifications that will occur in ecological theory. Although case studies are not usually the forum for explaining theoretical issues in anthropology, the issues are widely known to the public at large through several popular books written by Harris that, in my estimation, carefully edit Yąnomamö data to make the fit look better than it is. For this reason, I am discussing the 'protein' hypothesis in this case study. Students are often better judges of evidence and theory than the passionate advocates who produce both or either.

The argument began when I cautioned the protein advocates that the Yąnomamö did not suffer from a protein shortage and that their warfare (and warfare in any group) was too complex to reduce to a single variable such as protein scarcity (Chagnon, 1974). Professor Harris argued that the Yąnomamö probably were suffering from a per capita shortage of animal protein (Harris, 1974; Divale and Harris, 1976), as did several of his students (Gross, 1975; Ross, 1978). Harris seemed to take issue with my caution, for it challenged the more general proposition that many of the practices anthropologists documented in their field research among tribesmen and other kinds of societies were most likely responses to a scarcity of protein and should be interpreted as "adaptations." These included such things as the practice of female infanticide to regulate population size and thereby avoid overexploiting the game animals, or conducting warfare to keep people out of your hunting areas or adjacent lands that would be 'reserves' for future protein exploitation—or even why Hindus love cows but Jews and Arabs abhor pork (Divale and Harris, 1976; Harris, 1974). It seemed like a neat idea and Harris, as well as several of his students, pushed it as if it were the only or the most 'scientific' theory able to explain many cultural adaptations and the general evolution of culture from time immemorial (Harris, 1974; 1977). The theory began emerging as some of my first publications on the Yąnomamö appeared, and some of my observations were selectively perused to find 'evidence' of a protein shortage among the Yąnomamö. My several cautions were not only not taken seriously, but I soon found that I was some sort of villain for refusing to be 'scientific', to go along with the Columbia crowd and assert that it was all a question of protein shortage. Instead, I persisted in my insistence that this theory—any theory—had to be based on evidence, and none of my evidence on the Yąnomamö suggested that they were suffering from a shortage of protein. My demographic research had clearly demonstrated in a meticulous way that the Yąnomamö population was growing at a moderately high rate, which can hardly be taken as evidence that they had bumped up against the 'carrying capacity' of their environment. Indeed, that is the best evidence that the Yąnomamö have *not* yet reached the carrying capacity (Chagnon & Hames, 1979; 1980).

For most of my early research on the Yanomamö, I collaborated with a large team of very competent and distinguished medical researchers whose thousands of biomedical, epidemiological, and serological observations on several thousands of Yąnomamö led them to conclude that the Yąnomamö were one of the best nourished populations thus far described in the anthropological/biomedical literature (Neel, 1970). This does not easily lend itself to the interpretation that their diet is marginal or deficient, and such a finding would cause some caution among scholars who might propose a dietary deficiency as the major driving force behind Yąnomamö warfare and infanticide.

As the Yąnomamö gradually came to be a popular 'textbook' culture and cited widely to exemplify specific aspects of tribal practices in general, the protein advocates found it more and more necessary to explain them away. Remarkably, their 'theory' began with the flimsiest of evidence. "Evidence" in the 1960s and 1970s was, unfortunately, rather loosely defined by the would-be "scientists" of the protein school. It often amounted to careful sifting of detailed ethnographic accounts to find suggestive statements about hunger, starvation, deprivation, or bad hunting luck that could, when stacked up in a pile, be used to make a circumstantial case for a 'theoretical' argument. Very often the original ethnographer did not provide statistical facts to accompany his/her statement, but even more remarkably, those who used the statements for 'scientific' arguments themselves never collected such information either. An enormous amount of 'science' was built on a nonempirical, anecdotal base. As one observer described their methods, it was "preemptive" theorizing (Neitschman, 1980). As far as Yąnomamö data goes, the protein advocates insisted that the onus of proof was on *me* to show that the Yąnomamö were *not* suffering from a protein shortage. The argument was that I had not actually weighed and measured the protein intake of the Yąnomamö, and until I had done so, they would refuse to accept my arguments to the contrary. Had they advocated Yak fat, trace elements, heavy metals, salt peter, or the absence of molebdenum in the diet as the cause of Yąnomamö warfare, it would presumably have been up to me to prove them wrong. That is what "preemptive" theorizing means.

To do my part to lay these concerns to rest forever, I agreed to meet with Professor Harris and his several supporters at Columbia University on the eve of my departure to the Yąnomamö in 1974 to continue my research. This expedition would collect, with the aid of several of my advanced graduate students accompanying me that year, the data that Harris and his supporters thought would empirically settle the issue. We discussed the matter at length and agreed that if the Yąnomamö consumed the equivalent of one Big Mac per day, a suggestion made by Harris himself, Harris would 'eat his hat'. A Big Mac contains about 30 grams of animal protein.

left for the field the next day. The three students initiated their field research, one component of which was the determination of per capita protein intake per day. I will not go into some of the darker, ethical, and astonishing events that eventually transpired around this issue—at least not in this book—but simply report some of the results that we obtained. Table 2–1 summarizes the per capita protein consumption of the Yąnomamö, several other South American Indian groups, and selected industrialized nations—the latter data taken from tables in one of Harris' own textbooks. What it indicates is that the Yąnomamö are consuming large quantities of protein by comparison to even citizens in very affluent industrialized nations. Indeed, if a correlation between protein consumption and frequency, intensity, or seriousness of warfare exists at all, it is that protein *abundance*, not protein *scarcity*, correlates with fighting and warfare. One might even argue too much protein, not too little, causes war.

I have, in many publications, as I do again in this one, drawn attention to the fact that much of Yąnomamö fighting and conflict arises over sex, infidelity, suspicion of infidelity, failure to deliver a promised wife to a suitor—in a word, women. I explained Harris' theory of their warfare to the Yąnomamö: "He says you are fighting over game animals and meat, and insists that you are not fighting over women." They laughed at first, and then dismissed Harris' view in the following way: "Yahi yamakö buhii makuwi, suwa käbä yamakö buhii barowö!" ("Even though we do like meat, we like women a whole lot more!") Some protein advocates dismiss the suggestion that people will fight over sexual matters as 'labidinal speculation'. That is an ad hominem way of asserting that most of the theory of evolution by natural selection is, simply, labidinal speculation. And that, I submit, is not science. It is not only 'vulgar Marxism', it is also blind Marxism.

The assumptions behind the general ecological argument that all organisms, including humans, must eat to survive and how they satisfy nutritional needs sheds important light on their social activities and interactions are acceptable to most anthropologists, particularly those of us who advocate a 'scientific' view of human behavior and maintain that it can be explained in cause-and-effect terms. The extremes to which the protein advocates have carried the argument, however, are less acceptable. First, they simply dismiss or repudiate the significance of reproductive striving as a meaningful element in human social behavior—while simultaneously arguing that they are proposing an *evolutionary* view of human life. The basic fact is that evolutionary theory is not simply a theory about survival, it is a theory about survival *and* reproductive success. They are leaving out a major component by restricting it to survival alone. Second, even in the 'survival' component, they focus only on one item among a host of possible items: protein intake. Protein is treated almost as a mystical force, the inherent biological drive for which is alleged to produce all manner of adaptations and behaviors in humans that explain most everything that they do. In a peculiar sense, the argument seems to say you are what you eat, and the most important thing in your diet is red juicy meat. People seem to be seen, historically, as behaving almost as if they were inimically

TABLE 2–1 Comparative data on animal protein consumption per capita for some Amazonian tribes. In general, the only quantitative data that exists for Amazonian tribes clearly indicates that they are consuming more than adequate quantities of animal protein. These should be taken as very conservative estimates, since vegetable protein is not counted nor is the protein that is inevitably consumed by the hunters while they are on hunting trips. Data in parentheses indicates that either per capita or per adult consumption figure was missing in original source and was estimated by standard conversion factors from the original statistics, (revised from Chagnon and Hames, 1979). Figures reported by Harris (1975:430) indicated that the highest per capita animal protein consumption among developed countries is about 70 gm per day in Australia and New Zealand. The next highest level is for the United States and Canada at about 66 gm per day. Amazonian Indians do better than the U.S.S.R., the United Kingdom, Germany, Portugal, and Japan among developed countries, all of whose per capita consumption of animal protein falls below the figure 64.6 given in the table below.

Society	*Per Capita*	*Per Adult*	*Source*
Jivaro	79.3	(103.0)	Berlin & Markell, 1977
Jivaro	84.4	(116.2)	Ross, 1978
Yąnomamö	29.7	36	Lizot, 1977
Yąnomamö	51.9	77	Lizot, 1977
Yąnomamö	52	75	Chagnon & Hames, 1979
Wayana	(77.7)	108	Hurault, 1972
Boni	(82)	114	Hurault, 1972
Maimande	26.3	(36.2)	Aspelin, 1975
Bari	86.8	(119.5)	Beckerman, 1978
Ye'kwana	77.3	95.5	Hames, in prep
Siona-Secoya	64.3	96.7	Vickers, 1978
AVERAGES	64.6	88.8	

responding to a gigantic Paleo Mac Attack, and much of what they did was to satiate this urge. Evidence for the Paleo Mac Attack, unfortunately, usually amounted to preemptive anecdotalism. Any comment in an ethnographic monograph that alluded to meat being in less abundance than what the natives desired tended to be converted into evidence for widespread meat famine and starvation. One could as persuasively argue that a millionaire who complains about a 20% drop in his annual interest income is evidence of widespread poverty. What the protein intake actually was among the people who allegedly had extreme shortages of it *was never actually determined prior to theorizing*. It simply sounded so good to the ear, as 'mouthtalk' (Service, 1969) usually does, that its advocates apparently expected the anthropological community to accept it as if it were a hardnosed, rigorous idea or argument—detractors of which were cynically dismissed as 'softheads' who were non- or antiscientific.

But Harris and I do agree on one issue, the broader one. We agree that human behavior and cultural institutions can be explained scientifically and that the most satisfactory explanation will ultimately be an evolutionary one. I depart from him when the weight of evidence clearly shows that protein is *not* the central issue or single variable that magically explains everything—for no single variable can.

protein poverty has been substituted for 'soil poverty', discussed above, and, like the 'soil poverty' argument, is withering when empirical studies of protein consumption have been brought to bear on the issue. Neither the research by Carneiro nor the research done on protein consumption argues that Amazon soils are rich or the forest a cornucopia of protein on the hoof or wing; both do effectively expose the weakness of grand arguments that are expressed as monocausality.

The Amazonian jungle evokes many kinds of reactions from people who try to portray it in a catchy phrase or in a few words. Casual visitors are impressed with its vastness, and with the serene beauty of the lush vegetation. For some of them it looks like a 'tropical paradise' and is portrayed as teeming with inexhaustable supplies of game, minerals, valuable undiscovered botanical and pharmacological treasures, and perhaps a hidden civilization or two. Others emphasize the dangers of its wildlife, such as jaguars, *caimans*, piranha fish, and both poisonous and constricting snakes, which are real enough and occasionally take a toll on the natives who dwell there. But Amazonia is far wide of the "green hell" that is usually given as the shorthand reference. Still others, often academically oriented, and perhaps motivated by a sense of duty to correct the 'tropical paradise' or 'green hell' image of novels and Hollywood films, go to some extreme to portray it as a desert, having little or no potential, a tough place in which to make a living. In recent years, national planners and optimistic businessmen, especially in Brazil, have promoted unrealistic conceptions of immense wealth in natural resources or potential grazing land for cattle and have set out on devastating enterprises to clear the jungle and turn it into pasture—pasture that feeds the herds for a year or two, and then is overrun by inedible vegetation and bakes hard from the relentless sun into a near desert, usless to humans and livestock alike, and forever taken from the native flora and fauna.

The fact of the matter is that Amazonia is a complex place and not a great deal of ecological research has been done there. That which has been done has also been ignored by planners and developers who, often wild-eyed, rush forth with designs to 'open it up' and harvest its putatively endless wealth.

Historically, the Amazon Basin was colonized by natives relatively late, long after agriculture had appeared and was flourishing in the Americas. The archaeological evidence is currently very spotty and of variable quality, but it does indicate that native cultures spread throughout the Amazon forest long after native civilizations appeared in Mexico, Guatemala, and Peru. Population density appeared to remain relatively low all during the time periods documented archaeologically and ethnographically, save for those areas immediately adjacent to the larger rivers such as the Amazon. Very little is known about the peoples who lived deep in the jungle between the major rivers—the interfluvial 'foot' Indians of which the Yąnomamö are one example—but what little evidence we do have suggests that the adaptations, found both before and after Columbus, entailed the use of some cultivated foods. That is, true hunter/gatherers were rare in the deep forest. Perhaps this reflects a more correct view of the Amazon Basin, at least that portion of it away from the larger rivers: to prevail there requires at least some agricultural knowledge and skill. But with agriculture, relatively large native communities can develop and can remain sedentary, and can do so with little dependence on the abundant fish resources found in the local waterways. The Yąnomamö are one such example. Their diet is rich and highly varied, and they exploit a large number of animal species that assure both an abundant and a reliable fount of protein. Among most Amazon Basin Indians some forms of protein are more prized than others: tapirs are more enthusiastically sought and eaten than snakes. Some game is less predictable than other game in hunting. Hunting everywhere, given native technology, is always a function of luck as well as a function of animal population density and biomass. I have hunted with the Yąnomamö on many occasions. On some, we had bad luck and brought home little or nothing, but on others we got so much we couldn't carry it all, had to terminate the hunt before we expected to, and brought enough meat home to feed the whole village. These kinds of trips are designed to take the most 'prized' kind of meat, for the Yąnomamö classify meat into a number of categories, one of which is specifically reserved for the kind of meat you are expected to give to visitors at ceremonial feasts. This includes tapir, spider monkeys, armadillos, *caimans*, paruri (turkey), alligator, and wild pigs. All else, in this context, is 'nonmeat', for it cannot be given at feasts, any more than we would invite guests for Thanksgiving dińner and serve them hamburgers or scrambled eggs. It is clear that the Yąnomamö are not suffering from a deficiency of protein in their diet, at least under aboriginal, noncontacted, nonacculturated conditions, and one should treat with extreme skepticism any argument that purports to explain either the broad features of their culture or the minute details as a mechanistic response to protein scarcity. That argument seems to rest largely on an assumption that is simply advocated with passion and has little empirical justification. It appeals to many of us in our culture, however, for we tend to think of protein as coming in lean, red, thick, juicy T-bone steaks or plump, corn-fed poultry. But for people who eat termites, grubs, bee larvae, and caterpillars with as much gusto as we eat lobster tails, such a view appears to be highly ethnocentric.