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1 Flux among the Mbuti Pygmies of the Ituri Forest: An Ecological Interpretation¹

WILLIAM S. ABRUZZI

Introduction

Several years ago, Colin Turnbull (1968) presented an essay on "The Importance of Flux in Two Hunting Societies." Since publication, the comments made by Turnbull in that paper have largely stood unquestioned. In addition, his article has become adopted into the anthropological literature as a "cautionary tale" against too readily accepting ecological explanations of human social behaviors, even as they relate directly to subsistence activities.

The major criticism here is that Turnbull has made categorical statements claiming that ecological factors are of little, if any, importance in understanding significant regularities associated with Mbuti Pygmy subsistence activities,² while at the same time demonstrating a lack of familiarity with ecological concepts and methods. Consequently, he fails to present the necessary data that would substantiate such an unequivocal position, and disregards important information that suggests the operation of ecological processes in Mbuti subsistence activities.

While detailed information on the ecology of the Ituri Forest and on the subsistence activities of the Mbuti is, unfortunately, not available, that which is obtainable suggests conclusions that are distinctly contrary to those pro-

¹ I wish to express my appreciation to Colin Turnbull, Robert Netting, Richard Lee, and Eric Ross for their editorial comments on an earlier draft of this chapter. Acknowledgment is also made to Ruth Blackwell-Rogers for producing the maps.

² In Turnbull (1968), he discusses the incidence of flux among both the Mbuti and the Ik. This chapter, however, will concentrate only on the comments made by Turnbull for the Mbuti and will not be concerned with his argument as it relates to the Ik.

posed by Turnbull. The specific regularities in Mbuti subsistence behavior to which Turnbull refers may indeed be viewed as effective adaptations of this hunting and gathering population to the material demands of its environment. The argument that follows will show that, contrary to Turnbull, the subsistence behaviors of the Mbuti which were discussed by him are understandable only by a consideration of the specific adaptive requirements imposed upon this population by the material facts of its environment.

Turnbull's Thesis

As the title of his article implies, Turnbull is concerned with the cause of flux among the Mbuti bands. By flux he means "the constant changeover of personnel between local groups, and the frequent shifts of campsites through the seasons [Turnbull 1968:132]." Turnbull is inquiring, therefore, into the reason for the flexibility characteristic of Pygmy bands. Before developing his argument, Turnbull (1968:132) summarizes his conclusion concerning the existence of flux among the Mbuti (and the Ik): "Because neither is under the rigid control a truly marginal economy might impose, each is able to maintain a fluid band composition, a loose form of social structure, and to utilize flux as a highly effective social mechanism."

Turnbull begins his analysis by differentiating the Mbuti into two distinct economic divisions. The first of these is the net-hunters, whose camps are generally large, consisting of between 7 and 30 families, though usually not less than 10 (Turnbull 1965a:99), and whose size is based upon the demands of communal or cooperative hunting. A net hunt, which involves the beating of the underbrush by the women in order to drive small game into the nets attended by the men, "demands cooperation between a minimum of six or seven nuclear families, and allows a maximum of thirty [Turnbull 1968:135]."

The other economic division among the Mbuti consists of the archers, who live in much smaller groups and "hunt individually with bow and arrow [Turnbull 1968:132]." In contrast to the organizational and cooperative demands of the net hunt, "the ideal number of archers for either tracking or ambushing game is three. Five would already be felt as unwieldy [Turnbull 1968:135]." Thus the archer bands usually consist of only two or three nuclear families during most of the year (Turnbull 1968:135).

After introducing these important economic divisions, which exist among the Mbuti, Turnbull turns his attention to a description of their habitat, the Ituri Forest, which he depicts as monotonously uniform throughout.

Its climate varies scarcely at all throughout the year. . . . Rain falls evenly over the entire area, and is evenly spread throughout the year. Game and vegetable supplies are similarly uniform in distribution, and are abundant throughout the area. There is nothing that makes one part of the forest more or less desirable than any other part at any time of the year [1968:133].

In other words, according to Turnbull, in addition to being spatially uniform, the Ituri Forest is also characterized by a distinct absence of seasonality. This constant uniformity throughout the forest allows the Mbuti to confine their hunting movements, from one year to the next, to within an area of 260 km² (100 square miles) (Turnbull 1968:134). The distribution of food, according to Turnbull (1968:134), makes longer distances of travel unnecessary.

Given his view of an invariable forest, Turnbull is forced to conclude that "there is no environmental reason why half [the Mbuti] should be net-hunters and the other half archers [1968:134]". He adds that the net-hunters and archers regard each other as "quaint," and wonder how the other can survive, even though members of each division are knowledgeable of the alternate hunting technique and adopt the appropriate hunting strategy when living among each other (Turnbull 1968:134). Turnbull (1968:135) then reiterates his explanation for the presence of this pervasive economic division among the Mbuti: "The environment is generous enough to allow alternative hunting techniques."

Turnbull then turns to an annual event which recurs among the Mbuti and which he feels sufficiently demonstrates his thesis regarding the role of environmental permissiveness in Mbuti subsistence behavior. This event is the honey season, which lasts for about 2 months in the middle of our calendar year (Turnbull 1965b:286). According to Turnbull, the onset of the honey season is not accompanied by any distinct climate change, but merely represents a period of abundance for this one resource. The seasonal abundance of honey, he feels, does not at all compromise his view of temporal uniformity within the Ituri Forest (Turnbull 1968:136).

It seems, however, that the Mbuti do not concur with Turnbull regarding the stability and uniformity of the forest, but rather recognize distinct seasons associated with periods of scarcity and plenty. But while they view the honey season as a period significantly different from the rest of the year, Turnbull contends that the seasons recognized by the Mbuti are entirely imaginary; "the Mbuti treat their stable environment as though it were unstable, creating imaginary seasons of plenty and scarcity [Turnbull 1968:134]." Furthermore, Turnbull argues that his position on the nonexistence of seasons within the forest is confirmed by the fact that the Mbuti contradict themselves on the matter of seasonality:

And it is strange indeed that in the same environment and with equally adequate technologies, the net-hunters regard the brief honey season as a time of plenty, while the archers see it as a time of scarcity. Each group takes appropriate measures to meet the perceived situation, the net-hunters splitting into smaller units, and the archers congregating into larger ones [Turnbull 1968:134].

Having removed any consideration of an ecological basis for Mbuti actions during this period, Turnbull focuses on sociopolitical factors as the cause of these "strange" behaviors. Turnbull views the flux associated with

the honey season, as well as the beliefs that attend it, as an institutionalized mechanism to facilitate a regular reorganization of the hunting bands, made possible only by the stability and abundance of the Ituri Forest. At the end of the honey season, when the net-hunter bands reform, there is a careful avoidance of "any lines of fracture that remain unhealed [Turnbull 1968:134]." Ten months of active cooperation in the hunt and close personal relations, according to Turnbull, lead inevitably to hostilities that must be alleviated before they destroy the "essential unity of the band and consequently ruin the success of the hunt. Thus the honey season is an important safety-valve, allowing for the reconstruction of face-to-face groups [Turnbull 1968:135]."

The archers must also maintain band unity. Their problem, on the other hand, lies in the fact that individual families are scattered throughout the band territory for most of the year. In order to reassert claim to its territory and thus reduce the incidence of trespassing or poaching, Turnbull claims that it is necessary for each band to "draw together all its scattered segments and to act as a band, within its territory, for at least some part of the annual cycle [1968:135]." Consequently, during the honey season,

the net-hunters spread out into fragmented subbands. . . . At the end of the honey season the band begins to reform. . . . The archers, in exactly the same environment, do precisely the reverse. They hunt in maximal bands *only* during the honey season, and for the rest of the year split up into minor and ultimately minimal segments [1968:135].

The explanation offered by the net-hunters for their behavior during the honey season is that it is a time of plenty, reducing the need for cooperation in the hunt, while the archers insist that this same period is a time of scarcity, requiring increased cooperation among its members. This glaring discrepancy of views among the Mbuti themselves leads Turnbull to conclude that "it all seems to be a rather topsy-turvy world for [the Mbuti] where the things that happen are those that could least reasonably be expected [Turnbull 1968:136]." He then repeats his concluding theme that since the Mbuti work within their permissive environment, rather than attempting to change it,

they are unencumbered by the rigid imperatives that would be imposed by a truly harsh environment. Thus they are able to maintain a fluid band composition and a loose social structure; and are able to utilize this flux as a highly effective social mechanism, providing scope for action in all aspects of social life [Turnbull 1968:136-137].

Turnbull's concluding statements consist of functional arguments regarding the mechanisms through which the Mbuti are able to maintain fluid bands, as, for example, through the creation of cross-cutting ties between age mates of different bands in the place of lineage affiliation. He closes by stressing the

religious implications of the flux; "by deemphasizing stability in interpersonal relations, the process throws people into closer recognition of the one constant in their lives, the environment and its life-giving qualities [Turnbull 1968:137]."

By characterizing the Ituri Forest as uniform throughout, spatially and temporally, and thus incapable of producing either the pervasive economic division that exists among the Mbuti or the apparently contradictory activities associated with the honey season, Turnbull has attempted to eliminate any basis for proposing ecological arguments to explain these behaviors. Rather, he argues that the flux that occurs during the honey season—including the population movement and the associated changes in subsistence strategy and social organization—must be understood in "sociopolitical" terms. More precisely, he argues that these behaviors must be viewed in terms of the functional role they play in maintaining the "essential unity" of the Mbuti bands, and that the environment is merely a passive agent, permitting a wide latitude of subsistence activities.

Anthropologists for the most part have accepted without question the thesis presented by Turnbull and outlined in the foregoing pages.¹ Bicchieri (1969), for example, completely adheres to Turnbull's central argument; he accepts the thesis of the "permissive environment" and views the distinction between net-hunters and archers in precisely the same terms as does Turnbull, "as the concomitant of a permissive environment that allows for variation in exploitative devices to coexist in the same ecological niche, the Ituri tropical forest [Bicchieri 1969:67]." Bicchieri also accepts Turnbull's account for the existence of flux during the honey season, including their "diametrically opposed socioorganizational response to essentially identical environmental conditions [Bicchieri 1969:68]," concluding that the honey season "allows the net-hunters to relieve the tensions of living together by separating; conversely, the archers are given the opportunity to strengthen ties of friendship and lines of communication [Bicchieri 1969:68]."

In a modular publication, widely employed for pedagogical purposes, Netting (1971:7-8) has also displayed an unquestioning acceptance of the Turnbull thesis, maintaining that the Mbuti provide an example of a population for whom the relaxation of environmental and technological constraints upon work-group composition has permitted the dominance of "social considerations" in band organization. During one of the discussion sections included in the symposium on "Man the Hunter," at which Turnbull's paper on flux was presented, Birdsell appears to have accepted the Turnbull thesis as well. Regarding the constraints imposed upon population growth among hunting and gathering populations he states that "it may well be that we are

¹ Richard Lee is an exception in this regard. Lee (1972) rejects on principle Turnbull's claim that no variation exists within the Ituri Forest, and suggests that Turnbull did not investigate the matter sufficiently.

facing the problem raised by Turnbull's Pygmy examples, where density controls are invisible and social, rather than economic [Lee and DeVore 1968: 245]."

Such blanket acceptance of Turnbull's thesis by several anthropologists is particularly disconcerting as his position is in contradiction to basic ecological assumptions.

No Variation within the Forest

Turnbull's depiction of the Ituri Forest as uniform throughout, a view upon which his thesis of the supremacy of social over ecological considerations is constructed, must be examined first. At least two other authors disagree with Turnbull's position regarding the absence of seasonality within the Ituri Forest. Schebesta (1933) and Putnam (1948) both recognize periods of greater and lesser rainfall within the forest. Putnam, who spent over 20 years living among the Mbuti, clearly distinguishes a "dry season," which he claimed occurs around January and February. Schebesta, on the other hand, described this same period as a wet season. While the two authors do not agree on the timing of climatic variations within the forest, they do agree that they occur. Although no rainfall data are available for the Ituri Forest itself, sufficient information exists for enough locations within geographical proximity to the forest to reconstruct the annual variation in precipitation which occurs there as well. The information available confirms Putnam's position that the months of January and February comprise relatively dry months compared to the rest of the year.

First of all, the continent of Africa experiences alternating wet and dry seasons owing to the vacillating movements of two great air masses, the Tropical Continental and the Equatorial. The former, which produces the dry, dusty conditions so common in the great savanna lands of Africa, is at its furthest southern extension during the months of January and February (Grove 1970:12). This southern penetration of the Tropical Continental air mass is accompanied by the retreat of the moist Equatorial air mass, which provides most of the rain on the continent. In March and April, however, the Equatorial air mass proceeds northward, with the Tropical Continental retreating before it. During June and July when these air masses reach their northernmost location (Grove 1970:12), the African savannas experience their seasonal rains.

Rainfall data from as far west as Bangassou in the Central African Republic-Zaire border area eastward to Arua in the West Nile District of Uganda display identical patterns of annual precipitation (see Figure 1.1). The months of May through October in Bangassou average over 200 mm of rain per month, while those of December through February receive less than 50

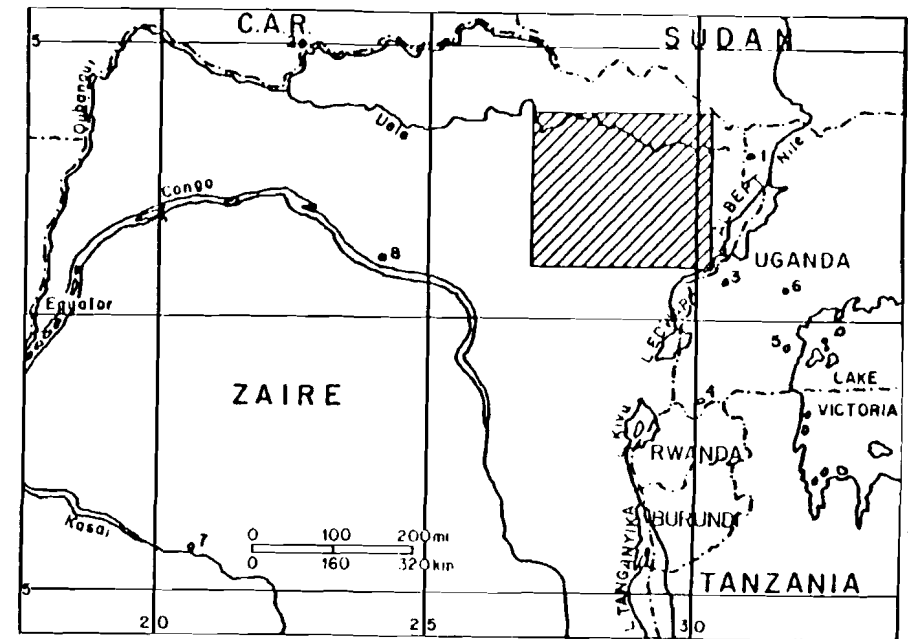


FIGURE 1.1 Central and Eastern Africa. Towns: (1) Arua (Uganda), (2) Bangassou (Central African Republic), (3) Fort Portal (Uganda), (4) Kabale (Uganda), (5) Masaka (Uganda), (6) Mubende (Uganda), (7) Port Franqui (Zaire), (8) Yangambi (Zaire). Shaded area: approximate location of the Ituri forest.

the same pattern in Arua; December thru March are dry months, while April thru November are wet (Parsons 1960c:Fig. 1).⁴

DeSchlippe (1956:152-178) demonstrates that the same rainfall pattern occurs among the Azande in the green belt area near the Sudan-Zaire border. The Azande of the green belt are of particular importance here since they exist in direct proximity to the Mbuti (Turnbull 1965a:19, see Map 2) and should, therefore, display the same climatic fluctuations which affect the Mbuti themselves. DeSchlippe's rainfall data, collected for the entire year of 1950 and for the first 2 months of 1951, clearly demonstrate the existence of distinct wet and dry seasons, which markedly affect the life and diet of the Azande. In accord with the data presented for Bangassou and Arua, no precipitation was recorded from the middle of December to the end of February for either year, yet DeSchlippe registered over 100 mm of rain for each of the months of May through September, with some months receiving as much as 250-300 mm of rain (DeSchlippe 1956:152-178).

To fully appreciate the issue of seasonality within the Ituri Forest, the

⁴ Unfortunately, Parsons does not provide specific data on rainfall for Arua, or for Mubende and Kabale referred to later, but rather only graphs the occurrence of seasonality in these three towns on a monthly basis.

problem must be examined within the context of seasonal variation throughout central and eastern Africa. As the Equatorial air system moves north and south, it crosses the equator twice annually. Locations on or near the equator, then, such as Yangambi in Zaire (Phillips 1960:86), and Fort Portal (Parsons 1960c:Map 18) and Mubende (Parsons 1960c:Fig. 1) in Uganda, experience four, not two, alternating wet and dry seasons. Peak periods of precipitation occur in each of these towns around March and April as well as September through November, with dry seasons taking place in January and February and from June through August. The weather pattern for locations south of the equator, naturally, is the reverse of that which occurs in the northern latitudes; peak rains occur in the southern latitudes usually between December and February, while June and July constitute the middle of the dry season. This pattern has been reported for the Lega (Biebuyck 1973:15) and the Lele (Douglas 1963:22) in southern Zaire, as well as for the towns of Masaka (Parsons 1960a:2) and Kabale (Parsons 1960c:Fig. 1) in Uganda. Rainfall data collected for Port Franqui in southwestern Zaire from 1930-1939, for example, show an average of 17 and 14 mm of rain for the months of June and July, respectively, which is in marked contrast to the 236 mm of rain recorded for December (Douglas 1963:22).

As one moves north and south from the equator, the wet and dry seasons merge into distinct annual rather than semiannual occurrences, and the length of the dry season increases with distance from the equator. In southern Uganda two harvests are possible, whereas the concentration of rainfall into a single season allows only one crop in the north (O'Connor 1971:19)—the location of the West Nile District—where the dry season lasts for 4 months (O'Connor 1971:234). Distances from the equator of only 2° or 3° latitude are sufficient to produce distinct annual wet and dry seasons. Since the Ituri Forest lies approximately between 1° north and 4° north latitude, if the seasonal pattern north of the equator is comparable to that in the south³—as the data suggests that it is—then the dry season in the Ituri Forest is likely to last from close to 2 months in the south to perhaps 80 days or more in the north. This is sufficient time to include the months of January and February as suggested by Putnam.

Given the latitude, then, at which the Ituri Forest is situated, in conjunction with the rainfall patterns demonstrated for numerous other localities, both on the periphery of the forest and throughout the region as a whole, the southern extension of the Equatorial and Tropical Continental air masses must certainly produce a period of reduced rainfall in the forest during the months of January and February that warrant the term "dry season." Turn-

bull's failure to provide any data* that would substantiate his claim of temporal uniformity within the forest demands that the evidence to the contrary be accepted as a serious challenge to that claim.

In addition to denying any temporal variation within the Ituri Forest, Turnbull claims that the forest is spatially uniform as well. He asserts that "there is nothing that makes one part of the forest more or less desirable than any other part at any time of the year [Turnbull 1968:133]." Again, Putnam contradicts Turnbull's position, maintaining that the forest varies considerably, at least with regard to vegetation. "In some spots there is no underbrush at all, and nothing but leaf molds between boles of the trees; in others there is a wild tangle of bushes, reeds and lianes [Putnam 1948:322]." While Putnam does not indicate just how extensive these distinct areas may be, he does demonstrate that significant variation in the density of vegetation may exist. In fact, Turnbull himself has made the same observation when traveling "above the Lelo River, where the forest was clear of all undergrowth [Turnbull 1961:176]." Neither Putnam nor Turnbull indicate, however, the degree to which the clearing of the undergrowth is natural or man-made.

The most damaging evidence against Turnbull's contention of a spatially uniform forest from the perspective of the Mbuti hunters is his own description of one section of the forest. Turnbull (1965b) states that

the game supply of the archers is further reduced by the fact that most of them live in areas that have been open to mission and administrative settlements, to economic exploitation by mining, commercial plantations, and tourist centers such as Beni and Mount Hoyo; and finally, to consequent road building. In particular the southeast corner of the forest . . . has been subject to such disturbances, all of which affect both the movement of game and the movement of hunters. Hunting bands in parts of this area are still able to subsist on the forest, but only with great difficulty. Among the archer bands the village is regarded as an absolutely essential source of food, and consequently there is a need for a more stable relationship than that between the net-hunters and the villagers [p. 299].

The southeast corner of the forest is also the area most affected by the activities of agricultural villages which have entered this area from the east.

It seems incredible that Turnbull can acknowledge the existence of such significant disturbances in one general portion of the forest and still claim spatial uniformity for the same forest as regards the subsistence needs of the

³ Douglas (1963:22) indicates that the length of the dry season in the Kasai River area decreases from about 100 days at 6° south latitude to 80 days at 4° south. An equal decrease of 20 additional days at 2° south latitude would still allow for approximately a 60-day dry season in this area.

* Turnbull does not provide any rainfall data. In order to support his claim for temporal uniformity within the Ituri Forest, Turnbull (1968:133) only states that temperature varies less than 5°F. throughout the year. However, in a tropical environment, annual variations in temperature are not likely to be a significant limiting factor. Rainfall is usually the most significant variable to consider. Douglas (1963:21), for example, shows that while rainfall varies from less than 20 mm per month in parts of the dry season to over 200 mm per month for several months during the wet season among the Lele of southwestern Zaire, temperature averages between these two seasons vary less than 1°C.

Mbuti. Turnbull's own description of the forest (see also Turnbull 1961: 29; 1965a:95-96) casts serious doubt upon his claim that there is nothing that makes one part of the forest more desirable for hunters and gatherers than any other.

Net-Hunters and Archers

Since the existence of significant variation within the forest is almost certain to have important implications for the adaptive strategies employed by the Mbuti, the presence of such evidence necessitates a consideration of Turnbull's second contention, that there is no environmental reason for the existence of two distinct subsistence strategies employed by the Mbuti. Rather than constituting the fortuitous result of a "permissive environment," a clear ecological basis appears to exist for the division of Mbuti into net-hunters and archers.

Were the net-hunting and archer bands to display a near random distribution throughout the forest, there might be some methodological support for Turnbull's contention that "environmental permissiveness" is operating. But, on the contrary, there appears to be a clear spatial dimension associated with the distribution of these two subsistence strategies (see Figure 1.2). While the net-hunters are found throughout the western half of the forest, the archers are concentrated in its southeast corner (Turnbull 1965b:289) and confined to the eastern third of the forest generally (Turnbull 1965a:317, Map 2). The southeast corner of the forest is precisely the area which Turnbull describes as being modified by the activities of non-Mbuti populations, and the eastern edge of the forest, as will be discussed later, is the area most affected by the encroachment of agricultural populations practicing shifting cultivation. Rather than proposing a "permissive environment" as the cause of this significant division among the Mbuti—which violates the evidence for the operation of nonrandom forces—a more productive explanation is likely to derive from an investigation of the impact that the disturbed conditions have had upon the subsistence activities of the Mbuti.

Turnbull has remarked several times (Turnbull 1965b:290, 301; 1968:299) that the members of the archer bands are in greater sustained contact with the neighboring agricultural villages than are the members of net-hunting bands. Furthermore, the archers rely more for their subsistence upon the productivity of the agriculturalists' gardens than they do upon the forest (Putnam 1948:333; Turnbull 1965b:301), and subsist solely upon the forest only during the brief honey season (Turnbull 1965b:301; 1968:135). "For most of the year each archer band maintains almost daily contact with the villagers, and the archers' daily diet includes plantains and cassava. Only during the *begbe* [during the honey season], which is a time of plenty, may these Mbuti rely entirely upon the forest [Turnbull, 1965b:301]."

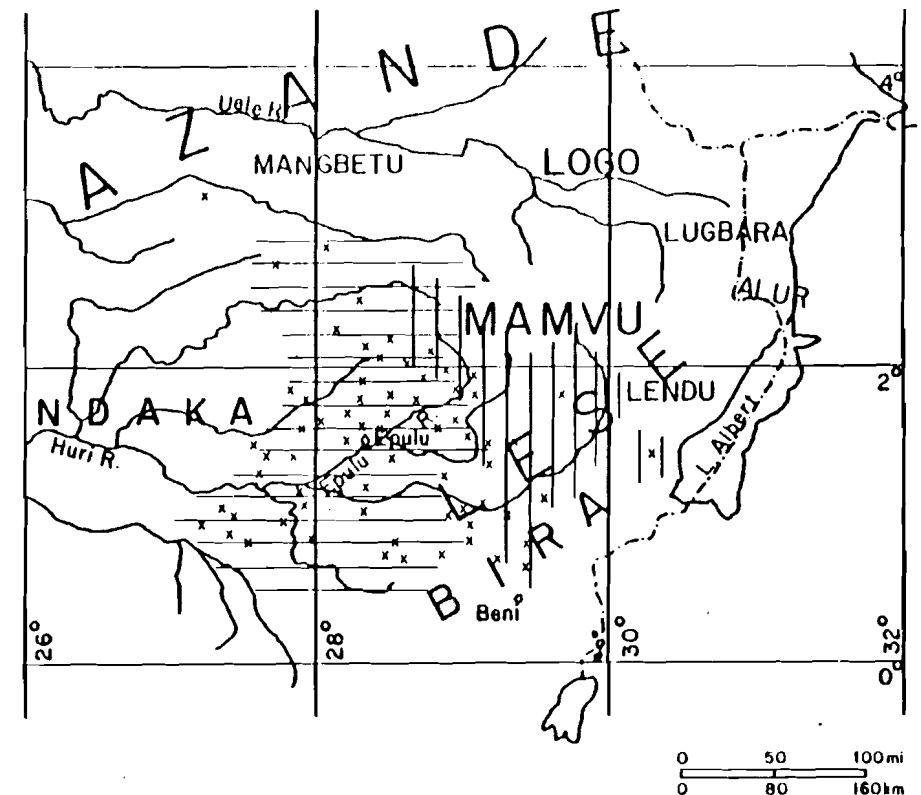


FIGURE 1.2. Distribution of hunters and cultivators in the Ituri Forest: horizontals, net-hunters; verticals, archers; crosses, approximate location of hunting camps visited by Turnbull; Azande, approximate location of the principal groups of shifting cultivators (information on Mbuti adapted from Turnbull, 1965a:317, Map 2).

A significant association appears to exist. In the central and more remote sections of the forest, the Mbuti subsist primarily by cooperative and communal net hunting. In the eastern and southeastern section of the forest, on the other hand—that portion of the forest most affected by the impact of intruding populations, particularly the growth of agricultural villages—the Mbuti have fragmented into smaller, independent units.

The reason for the fragmentation of archer bands into smaller, more independent units in the eastern and southeastern section of the forest seems clear. Both Putnam (1948:323) and Turnbull (1965a; 1965b:294) indicate that the socioeconomic relationship between the Mbuti and their agricultural neighbors is based upon a more or less stable exchange between individual families. The Pygmy client protects his Negro patron's garden, particularly from elephants (Putnam 1948:330), and in turn is supported from the produce of that garden. The dependence of the Mbuti, particularly the archers, upon

the produce of the agricultural gardens is reflected in the heavy incidence of plantains, cassava, and other domesticated foods in their diet (Putnam 1948:333; Turnbull 1965a:34, 168; 1965b:301; May 1965:111). "From the Pygmy point of view, the village is merely another source of food—acquired by another form of hunting as often as not [Turnbull 1965b:287]." The economic dependence of the archers, unlike that of the net-hunters, is not upon each other; instead, their economic ties are primarily with the external agricultural villages, and not as a group, but rather as individual hunters. Consequently, individual archer families have developed strong socioeconomic relationships with the villagers rather than with each other. This is in contrast to the net-hunters who, being dependent upon each other economically, have organized socially to ensure their survival. The adaptive significance of these distinct subsistence strategies is demonstrated by the persistence they display in spite of a high degree of interchange of personnel (flux) between the two groups.

Thus, it is precisely those groups that are the most dependent upon the gardens of the agricultural villages and have entered into individualized exchange relationships to secure a continued supply from this source, which lack the large, cooperative band organization. In contrast, those groups that exist more autonomous of the agricultural villages and subsist primarily on the produce of the forest have organized into cooperative hunting bands. This dual adaptation is hardly unique among human populations; it should not be surprising. It has been described in the literature before, and for reasons that appear to be similar to the conditions present among the Mbuti (cf. Murphy and Steward 1956).

Imaginary Seasons and Opposite Response

Turnbull has further argued that the Mbuti create "imaginary" seasons where none exist and are able to respond to identical conditions with contradictory behaviors, again because of the permissiveness of their environment. While the net-hunters maintain that the honey season is a time of plenty and the archers insist that it is a period of scarcity, Turnbull contends that the forest experiences no significant change from one part of the year to the next, although he does at times concede a greater productivity within the forest during the honey season (Turnbull 1965b:286; 1968:298). The issue here is whether there is any justification for the divergent views among the Mbuti, or whether Turnbull is correct in claiming the whole affair to be a fantasy on the part of the Mbuti. Although the Mbuti disagree among themselves, the available evidence suggests that their perception of the situation—indeed their very disagreement on the issue—is not only justifiable, but is to be expected.

Information has already been presented that strongly suggests that sea-

sonality occurs within the Ituri Forest. The honey season, which occurs during the months of June and July, would fall within the wetter part of the annual cycle. Since the Mbuti, like most hunters and gatherers, acquire the majority of their caloric intake from vegetable rather than animal sources (Turnbull 1965a:168; Lee 1968:46), an increased abundance of flora produced by the greater rainfall, in conjunction with the seasonal availability of honey, could easily be viewed as a period of plenty. The net-hunters' response during the honey season, then, would appear to be justified. However, if the information on seasonality within the forest supports the behavior of the net-hunters, what justification is there for the apparently contradictory activities and beliefs of the archers? A review of some of the information already presented should resolve this issue.

As has already been indicated, the archers subsist primarily upon the produce that they receive from the gardens of their agricultural patrons as "the game supply is less adequate" in their portion of the forest (Turnbull 1965b:289–290). Furthermore, the archers subsist solely upon the forest *only* during the honey season (Turnbull 1965b:301; 1968:135). A complete dependence upon the forest by the archers is indeed a hardship, as has been stressed by Turnbull himself. Owing to the disturbed conditions that prevail in the southeast corner of the forest where the archers are concentrated, "Hunting bands in parts of this area are still able to subsist on the forest but only with great difficulty [Turnbull 1965b:299]."

For the archers, whose habitat has been significantly modified to the point of adversely affecting their ability to subsist solely upon the forest, their attempt to do just that must surely be viewed as a period of hardship for them. Thus, the discordant views of the relative abundance of the honey season among the Mbuti would have some material basis.

But if surviving upon the forest does constitute such a hardship, why do the archers persist upon doing it? Continued year-round subsistence on the gardens of their agricultural patrons would appear to be the more advisable course for them to follow, given the circumstances. Is maintaining band unity that important, or do possibly good material reasons exist for abandoning the agricultural villages at this time? The answer to this question may lie in an understanding of the agricultural cycle in this general area. The Azande farmers of the green belt will serve as the model since they exist in proximity to the Ituri Forest.

In his description of the agricultural cycle of the Azande, DeSchlippe (1956:178–179) distinguishes between the rainy season and the dry season. While he depicts the dry season as a period of general abundance for these farmers, due to the recency of their harvest, he characterizes the rainy season, particularly the period from late April until July, as a period of considerable "nutritional strain." This is a period of planting and preparation for the new agricultural cycle, but it is not yet a time of renewed agricultural productivity.

While increased energy is required for the heavy labor demanded at this time, caloric consumption is at its lowest point in the year, because of the depletion of the supplies gathered during the previous year's harvest.

Assuming that the agricultural cycle in the villages directly contiguous to the Mbuti approximates that of the Azande in the green belt, the honey season, which occurs during June and July, would fall at the very height of the "hungry period." This would be the time when the villages upon which the archers depend would most need sufficient supplies of food, but would be least likely to have them. Providing the Mbuti with food at this time might constitute a considerable additional burden upon their meager resources. June and July may also be a period—after the previous harvest and prior to the growth of the new crops—when the labor of the Pygmies in protection of the gardens is least needed by the villagers, and when the pressure shifts to recruiting them for the heavy agricultural labor, which the Mbuti continually try to avoid (Turnbull 1965a:38-39). Consequently, as the supplies from the gardens begin to dwindle, the archers may be compelled to temporarily switch their dependence to the forest, which is now better able to support them because of the brief honey season. Furthermore, due to the disturbed conditions in their area of the forest and since they hunt communally without the aid of nets, the archers may need to organize into cooperative groups that are larger even than those which are characteristic of net-hunting bands (see, for example, Turnbull 1972:301). With the end of the honey season and the growth of crops in the village gardens, the archers could then return to their dependence upon the villages and resume their role as protectors of the coming year's harvest. Given their different points of origin, the net-hunters and archers could quite reasonably be expected to view the honey season in antithetical terms and respond to it in their characteristic ways.

Further Problems

In addition to the empirical discrepancies just discussed, there are four basic contradictions associated with Turnbull's position. First, as indicated already, Turnbull's claim that flux among the Mbuti, as well as their division into net-hunters and archers, is simply made possible by the existence of a permissive environment is in direct contradiction with his own statements that a significant portion of the forest has been seriously disturbed, and that hunters can subsist in this section of the forest only with great difficulty.

A second inconsistency in Turnbull's argument is his claim that, for the net-hunters, the honey season and all of the "imagined" elements that accompany it serve to facilitate a redistribution of individual Mbuti throughout the forest. The creation of this imaginary season by the Mbuti, according to Turnbull, functions primarily to minimize conflicts that would inevitably destroy the "essential unity of the band and consequently ruin the success of the hunt

[Turnbull 1968:135]." While population redistribution is important among hunters, Turnbull's thesis is in contradiction with the fact that the Mbuti do not maintain more than 40% continuity from one month to the next (Turnbull 1972:300). The high interband mobility that exists among the Mbuti is illustrated by the following passage (Turnbull 1965a):

The composition of the band is fluid, to say the least, and does not follow any clear unilineal or cognatic descent system. Throughout the forest, the bands are in a constant state of fragmentation as well as in a constant process of fission and fusion. Members of any band are quite likely at any moment to leave and join another band, temporarily or permanently, for any one of a number of reasons. In-law visiting is common, and permanent attachments to the band are sometimes accomplished this way. But at the same time, with each successive, monthly change of site, the hunting camp also shows another stage in the over-all process of fission and fusion along recognizable lines of structural cleavage [p. 27].

The existence of such a high degree of flux throughout the remainder of the year calls into question Turnbull's position that the Mbuti create such elaborate measures of self-delusion regularly at one time of the year simply to achieve the same goal. Since population redistribution is taking place anyway, other factors are more likely to be responsible for the behaviors associated with the honey season.

The immediate change in material conditions for both the archers and the net-hunters during the honey season is more likely the cause for the events which occur at this time. In addition, for the net-hunters at least, the dispersal of individuals and the reduced dependence upon hunting that occurs during the honey season may function to randomize hunting pressure upon game; the effect that this has upon their movement redistributes these resources more evenly throughout the forest (cf. Moore 1957). As one member of the Epulu (net-hunting) band emphasized, "The honey season was no time to be bothered with hunting [Turnbull 1961:264]." The redistribution of game is a long-term adaptation that the anthropologist, spending at the most a year or two in the field, is not likely to observe (Lee 1972:143).

A contradiction also exists in Turnbull's claim that by deemphasizing the stability of interpersonal relations, flux "throws the people into a closer recognition of the one constant in their lives, the environment and its life-giving qualities [Turnbull 1968:137]." Two contradictions are present here. First, the Mbuti do *not* recognize their environment as constant; it is Turnbull—not the Mbuti—who attests to the uniformity of the Ituri Forest, and it is this discrepancy that serves as the major theme of his argument. Second, the forest environment is not the primary source of "life-giving qualities" for the archers. Rather, their principal source of survival consists of the gardens of the agricultural villages. When the archers have to depend solely upon the "life-giving qualities" of the forest in their area, they do not like it because they can do so only with great difficulty.

While increased energy is required for the heavy labor demanded at this time, caloric consumption is at its lowest point in the year, because of the depletion of the supplies gathered during the previous year's harvest.

Assuming that the agricultural cycle in the villages directly contiguous to the Mbuti approximates that of the Azande in the green belt, the honey season, which occurs during June and July, would fall at the very height of the "hungry period." This would be the time when the villages upon which the archers depend would most need sufficient supplies of food, but would be least likely to have them. Providing the Mbuti with food at this time might constitute a considerable additional burden upon their meager resources. June and July may also be a period—after the previous harvest and prior to the growth of the new crops—when the labor of the Pygmies in protection of the gardens is least needed by the villagers, and when the pressure shifts to recruiting them for the heavy agricultural labor, which the Mbuti continually try to avoid (Turnbull 1965a:38-39). Consequently, as the supplies from the gardens begin to dwindle, the archers may be compelled to temporarily switch their dependence to the forest, which is now better able to support them because of the brief honey season. Furthermore, due to the disturbed conditions in their area of the forest and since they hunt communally without the aid of nets, the archers may need to organize into cooperative groups that are larger even than those which are characteristic of net-hunting bands (see, for example, Turnbull 1972:301). With the end of the honey season and the growth of crops in the village gardens, the archers could then return to their dependence upon the villages and resume their role as protectors of the coming year's harvest. Given their different points of origin, the net-hunters and archers could quite reasonably be expected to view the honey season in antithetical terms and respond to it in their characteristic ways.

Further Problems

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Turnbull's line of argument leads to still another contradiction. His claim that flux is able to occur among the Mbuti principally because of their "permissive environment" is in opposition to the fact that this same flux has been demonstrated for numerous other populations of hunters and gatherers: Most notably the Bushmen (Lee 1968, 1972a), the Hadza (Woodburn 1968), the Eskimo (Balikei 1968; Damas 1969), the Australian Aborigines (Meggitt 1962), and the Shoshone (Steward 1938, 1955)—none of whom inhabit what Turnbull might label a "permissive environment." His argument, therefore, leads to the inconsistent position that flux occurs among all of these populations because of the "rigor" of their environments, while the very same process occurs among the Mbuti for precisely the opposite reason.

Lee's suggestion that the "worldwide occurrence of this pattern of spatial organization in vastly different kinds of environments indicates the degree to which it was basic to the hunting and gathering adaptation [1972:139]" is considerably more parsimonious. However, flux is perhaps not inherent to a hunting and gathering adaptation, but rather may be typical of such contemporary populations due to the similarities of their present circumstances. Contemporary hunters and gatherers all inhabit a reduced and marginal portion of their former habitats, because of the expansion of competing agricultural and industrial systems. Hunters today, therefore, must all subsist upon a less abundant and stable supply of undomesticated resources.

In addition to containing the above inconsistencies, Turnbull's attempt to explain the cause of flux among the Mbuti is simply inadequate. His explanation, based upon the nebulous and pseudo-ecological concept of a "permissive environment," amounts to no explanation at all. A hunting and gathering population—or any population, for that matter—does not respond to such vague and subjective characterizations as "permissiveness" and "harshness" in its environment; rather, a population adapts to the specific demands presented by its material environment. For hunters and gatherers such as the Mbuti this includes, among other considerations: the specific migratory and herding patterns of the game hunted; the seasonal, annual and long-term variations in climate, particularly those that affect resources; extractive requirements associated with vegetation gathered; and, of course, the impact presented by the presence of other populations of the same species. Unlike harshness or permissiveness, these represent objective features of the environment that can be placed within a spatial and temporal framework, and thus can be specifically related to particular behaviors associated with the population in question.

A functional argument for the role of flux in maintaining the "essential unity" of Mbuti bands suffers from all of the methodological problems inherent in such arguments (Collins 1964; Hempel 1965). Specifically, no attempt has been made by Turnbull to examine, through the deductive application of relevant ecological principles, whether or not the variations in subsistence activities of the Mbuti are related to variations which occur

Instead, the purported result of the flux, the maintenance of band unity, is proposed as the cause of that flux among the population.

Lacking the conditional form inherent to a scientific explanation, Turnbull's explanation of flux among the Mbuti is constructed upon a circular and teleological, functional argument, employing concepts such as a "permissive environment" and "essential unity of the band," which lack any empirical referents. Consequently, his explanation fails to account for the existence of flux among the Mbuti; owing to its qualitative and nonquantified construction, Turnbull's argument is impervious to empirical verification within a spatial and temporal framework. A valid explanation of flux among the Mbuti would have to explain the distinction between the net-hunters and archers, as well as the events that accompany the honey season, with a consistent theoretical model, and within a spatial and temporal framework, which avails itself to objective verification. This is precisely the type of explanation that Turnbull has failed to present and that is proposed in the following section of this chapter.

Ecological Adaptation among the Mbuti

THE ECOLOGICAL NICHE AND ITS APPLICATION TO THE Mbuti

Bicchieri (1969:67) has referred to the Ituri Forest as the ecological niche of the Mbuti. However, as Turnbull (1965a:17) has correctly recognized, the Ituri Forest constitutes the *habitat* of the Mbuti, not their *niche*. The ecological niche comprises more than simply the spatial location of an organism or population⁷ under investigation; it is a more comprehensive concept that includes "not only the physical space occupied by an organism [or population], but also its functional role in the community (as, for example, its trophic position) and its position in environmental gradients of temperature, moisture, pH, soil and other conditions of existence [E. Odum 1971:234]." (See Hutchinson 1957; Boughley 1973; Hardesty 1975.) The second, and perhaps most crucial, component of its ecological niche is the role performed by the population in the flow of energy throughout the larger community.⁸ While this functional role is often defined in terms of the trophic position occupied by a population within a community food chain (or web), certain nonconsumptive behaviors of one population may affect the niche exploitation of other populations (E. Odum 1971:211-233). Thus, energy flow throughout multi-

⁷ The concept of an ecological niche is normally associated with individual organisms or with populations (usually species). Since it is the population that is of concern in evolutionary theory, and thus in this chapter, the niche concept applied here will be associated with the population.

⁸ The term *community* in ecology does not necessarily refer to a specific spatial location, but rather denotes one level of analysis (along with the individual organism, the population, and the habitat) in the study of ecological systems. In this chapter, the term *community* refers to the Mbuti population and its interactions with the Ituri Forest environment.

species communities is affected by a complex of interspecific relations, including those defined as competition, predation, parasitism, ammensalism, commensalism, and mutualism. Furthermore, the relationship that exists between two species may be variable, rather than absolute, and depend upon the conditions of interaction. Ecological communities containing human populations may have several such populations occupying separate, discrete niches, and exhibiting the same complex of relations at the subspecies level (Barth 1956, 1964, 1969). The third component of the ecological niche comprises any variation in the environment that is significantly associated with the distribution of a particular population.

Given the above definition of the niche, the Mbuti must be viewed as two populations that occupy separate and distinct niches. Regarding the habitat component of the niche, these two populations occupy different areas with apparently little spatial overlap; the archers are located in the eastern and southeastern portion of the forest, while the net-hunters are distributed throughout the remaining area to the west. In addition, the net-hunters and archers diverge with regard to their functional role in the flow of energy through the community. While the net-hunters subsist primarily upon undomesticated resources, the archers live in greater sustained contact with the nearby agricultural villages and employ different technologies and organizational mechanisms to exploit a different range of resources. The methods employed by the archers to acquire these domesticated resources, moreover, are still distinct from those utilized by the villagers themselves, who consume still another unique range of resources.

The significant environmental gradient among the Mbuti is the distribution of non-Mbuti populations, and the disturbed conditions that they have produced within the forest. The intimate association of the archer population with the distribution of agricultural villages qualifies as a distribution along an environmental gradient.

Thus, the Mbuti appear to inhabit at least two distinct ecological niches, with each population located in distinct areas and employing different technologies and social organizations in order to exploit a unique range of resources. The exchange of personnel between these two groups does not alter the fact that ecologically definable populations exist which stand in distinct relations to the other populations within the community (Mayr 1963; Barth 1956, 1964, 1969). This ecological differentiation between the net-hunters and the archers is central to an understanding of the subsistence behaviors of the Mbuti.

POPULATION PRESSURE AND SUBSISTENCE BEHAVIOR AMONG THE MBUTI

Research has amply demonstrated that increases in the size of a population relative to the area that it exploits demands significant changes in the subsistence behaviors of that population if its continued growth, or even

maintenance, is to be assured (Carniero 1961, 1967, 1970; Boserup 1965; Clark 1967; Rappaport 1968; Harner 1970; H. Odum 1971; Spooner 1972). The continued growth of a human population within a fixed habitat necessitates an increased intensification in the exploitation of a given unit of land within that territory—in conjunction with a greater cooperation in subsistence activities among the constituent segments of the larger population. Both of these developments are inextricable components of the same adaptive process.

A scale of cooperative organization among the Mbuti may be derived from calculations of the minimal and average size of work teams, as well as the level at which local segments of the population are integrated into effective operational units. Any analysis of the level of social organization involved in subsistence and other maintenance activities must be mindful that variations in organization are likely to occur within the same population. Seasonal variations in organization, associated with fluctuations in the availability and distribution of resources, are quite common, particularly among hunting and gathering populations. Such seasonal variations should be explained in precisely the same terms as the more gradual changes associated with long-term adaptations to population growth, since both variations entail responses to changes in the population-resource ratio.

The implications of this framework for the Mbuti seem clear. As already mentioned, work teams are considerably larger (Turnbull 1968:135), and the level at which decision making and behavioral integration occur is greater among the net-hunters than among the archers. Turnbull (1965b:298) states that in their forest context the net-hunter band "is an egalitarian unit, acting by unanimous accord," whereas among the archers "each section is independent of the others, and cooperates only when called upon to do so by the headman for some purpose related to the village [Turnbull 1965b:300]." The position of headman among the archers, furthermore, is nonhereditary and exists primarily to expedite relations between the Mbuti and their village patrons, with the headman lacking any means of enforcing his orders (Turnbull 1965b:300). It is likewise significant that the individual families assume greater independence among the net-hunters as well when these bands are resident in the village (Turnbull 1965a:85; 1965b:298), while the dominance of the band over individual families occurs among the archers when they are away from the villages and dependent primarily upon the forest during the honey season (Turnbull 1965a:107).

The different levels of integration and cooperation, then, are not specific to each division among the Mbuti; rather they appear only to be typical of each group as a function of its particular place of residence and dependence—village or forest. The large, cooperative bands characterize the net-hunters only because they spend most of their time dependent upon the forest, while the archers, characterized by the prevalence of independent nuclear families, depend primarily upon the village. A more precise understanding of the association between residence-dependence and subordination of the nuclear

family would be possible if more quantitative information—instead of qualitative typing—were available on band residence and organization.

As would be expected, the net-hunters, who for the most part subsist in larger, more cooperative units, dependent upon the forest, employ a hunting technology which both demands and facilitates their integration at this level, while the archers, operating in the village for most of the year as independent families, employ a technology that places a premium on small, autonomous hunting units. Based on this information, current models of the dynamics between population growth and energy expenditure in subsistence (cf. Boserup 1965; H. Odum 1971) would predict that population pressure* is greater among the net-hunters than it is among the archers, and that, consequently, the expenditure of energy in subsistence activities should be greater among the net-hunters as well.

Unfortunately, Turnbull (1961, 1965a, 1965b, 1968, 1972) does not provide any substantial ecological or demographic data from which a conclusive evaluation can be made of the role that variations in population density play in the divergent subsistence strategies employed by the Mbuti. Instead, he only gives a general estimate for the entire Mbuti population at about 40,000 persons inhabiting an area of approximately 50,000 square miles (129,500 km²) (Turnbull 1972:295).

However, the former distribution of Pygmies in Africa, including the Mbuti, was much greater than it is today (Murdock 1959:48-49), due primarily to the invasion and reduction of the forests by populations of shifting cultivators. Turnbull (1965a:19-20; 1965b:283) lists the groups that are directly contiguous to the Mbuti and acknowledges the impact that this encroachment has had upon the mobility of the Mbuti. The principle invaders of the Ituri Forest are the Azande and Mangbetu to the northwest, and the Mamvu-Mangutu to the north, the Bira to the south, and the Lese to the east. The Ndaka and Mbo may be included to the west. The Alur, Lendu, Logo, and Lugbara may also be added to this list of invaders; while not all of these latter groups have been in direct contact with the Mbuti, each represents a significant factor in the general population expansion into Mbuti territory from the contiguous and more densely settled areas of Uganda to the east and the Sudan to the north. Turnbull (1972:295) estimates the groups that he lists to number 60,000 persons; with the latter groups included, this number would be considerably higher, displaying a sizable population of densely settled shifting cultivators enclosing the Mbuti on the north and east. Baxter and Butt (1953:20) state that Pygmies were previously located as far north as the Uele River

near the Zaire-Sudan border, an area presently occupied by Azande, while the Alur claim that before they settled in the territory adjacent to Lake Albert on the Zaire-Uganda border, this area was almost exclusively inhabited by bands of Pygmies (Southall 1956:23). The present distribution of Pygmies in the Ituri Forest, then, represents a considerable reduction in area from their previous dispersion. Furthermore, the Mbuti do not enjoy exclusive occupation of the remaining areas of the forest that they inhabit today.

The major thrust of the population invasion into Mbuti territory has been from the east. The present West Nile District of Uganda, north of Lake Albert and containing a diverse population of cultivators and herders, has served as a major staging area for this westward expansion. The population density of the West Nile District is among the highest in Uganda. While the population concentrations in this district do not equal those in the vicinity of Lake Victoria, or in southern Kigezi (on the Rwanda border) where little uncultivated farmland is still available, the average density according to the 1959 census was 74 persons per square mile (1 mi² = 2.6 km²) (Parsons 1960b:49). Many local densities reported were considerably higher; Okoro County (Alur) was estimated at 123 persons per square mile, while Ayiva County (Lugbara) was reported at 324 persons per square mile (Parsons 1960b:49). Southall (1956:267), meanwhile, estimated the average population density among the Alur at 100 persons per square mile. Even Toro District to the south of Lake Albert registered a population density of 80 persons per square mile (Parsons, 1960a:7). Even granting a large margin for error in calculation, these figures denote relatively high population densities for this area relative to other comparable areas in Africa (cf. Stevenson 1968).

The relatively high population density in the West Nile District, and the subsistence pressures that this produces, has been attributed as the principal reason for the replacement of the cereal endosine by the higher yielding yet less nutritious tuber cassava as the principal food in this area (O'Connor 1971:41-42), and is also likely to be the primary agent making the West Nile District a major source of labor migration into the urban centers of Uganda (O'Connor 1971:42, 261). High population density has also been the major force behind the continuous expansion of peoples from this area into the less densely settled territory of the Mbuti to the West. Climatic factors, combined with the availability of land, made migration westward more attractive than expansion in other directions. This westward expansion has made the eastern portion of Zaire, from Lake Kivu in the south to the Sudan border in the north, one of the most densely settled areas in the country (Trewartha and Zelinsky 1954:70). Population density in northeastern Zaire has been more than double that of the nation as a whole, with local densities reported in 1948 of 75 persons per square mile (Trewartha and Zelinsky 1954:173).

The contemporary picture of population density in northeastern Zaire is in marked contrast to the image presented by the Alur for the period when they first entered the area. Contemporary populations of hunters and

* The claim that population pressure is higher among the net-hunters does not imply that this group has been reduced to near starvation. This statement merely stresses that the ratio of population to exploitable resources is higher among the net-hunters than it is among the archers. Indeed, the thrust of the argument presented here is that the net-hunters, faced with higher population densities, have adopted behaviors which increase the amount of food resources exploited by

gatherers have all experienced a continuous reduction in the size of their habitats as a result of the encroachment of agricultural populations; the Mbuti are no exception. A continual reduction in the size of the Mbuti habitat has occurred as a result of a general population expansion from the east and of Azande expansion and conquest from the north. Recent developments have also had their impact by further reducing the effective size of the Mbuti habitat. Upon returning to Camp Putnam (Epulu) after a 2-year absence, Turnbull (1961:29) describes some of the changes that had taken place during that time. These include the construction of a modern motel, "built by an enterprising Belgian who hoped to attract tourists," the establishment of a "Station de Chasse for the capture of forest animals, particularly okapi, and for the training of forest elephants," as well as the building of mud houses for the workers "with a few tiny African stores and an establishment proudly calling itself Hotel de Biere."

The most recent encroachments upon the Mbuti habitat, including those mentioned previously, must be viewed simply as a continuation—albeit dramatic—of a long-standing trend. Meanwhile, Turnbull (1965a:26) maintains that no evidence exists to suggest that a reduction has taken place in the size of the Mbuti population. If this is the case, then it is difficult to accept the contention that these developments have had little impact upon the subsistence methods of the Mbuti, who have been the chief victims of these transgressions.

However, an apparent contradiction exists; of the two divisions among the Mbuti, the archers, located in the eastern and southeastern portions of the forest, those regions most affected by the intrusion of cultivators (and other disruptions), exhibit the behavior and organization which indicate the least effect of population pressure on resources. Unfortunately, the absence of any information on the size of the net-hunter and archer populations specifically, or on the magnitude of their respective territories, precludes any calculation of the relative density of each population. The closest information provided by Turnbull, which might indicate the relative size of the two divisions among the Mbuti, includes the number of huts present in each of several net-hunter and archer camps plus a map of the location of hunting camps in the Ituri Forest visited by him. The number of huts in 6 net-hunter camps were 28, 18, 16, 13, 11, and 8 for an average of 15.66 huts; 7 archer camps contained 25, 11, 10, 9, 6, and 5 huts for an average of 10.85 huts per camp (Turnbull 1965a:99). Turnbull's (1965a:317, Map 2) map indicates that of the total hunting camps visited by him, approximately 50 were net-hunter camps while only about 15 were camps belonging to archers. Although how representative these figures are, unfortunately, cannot be determined, they do at least suggest both a greater size and density of the net-hunter population in the forest relative to that of the archers.

While the density of archers is likely to be less than that for the net-

non-Mbuti populations in this portion of the forest. However, another factor assumes significance, which may account for the absence of behavioral indications of population pressure among the archers relative to the net-hunters. Although neither the archers nor the net-hunters are likely to have maintained the same diet that was common to the Mbuti prior to the invasion of their habitat by agricultural populations—population encroachment, for example, is quite likely to have effected a gradual reduction in the general availability of meat within the forest and in the Mbuti diet—the archers have clearly experienced the greatest dietary transformation. While the net-hunters still subsist mainly upon the forest, the archer diet consists primarily of domesticated foods, particularly cassava and plantains. The archers, then, have experienced more than merely a shift in the relative frequencies of different wild foodstuffs; they have undergone a fundamental change in their trophic position within the forest community, subsisting primarily upon abundant, domesticated resources.

The greater population density made possible by the increased production of edible foodstuffs from the agricultural gardens would provide for a reduction in the pressures of population upon resources among the archers. This is true particularly since the population providing this increased productivity was considerably larger than the archer population and thus could absorb them with little additional stress. The archers appear to have been readily assimilated as daily consumers of the new resources, while at the same time more or less retaining their traditional mode of subsistence; they have not had to become involved in the heavy agricultural labor upon which this new level of productivity is based (Turnbull 1961:172-173; 1965a:39). Rather, the archers operate an important work gate (see H. Odum 1971:43-47.) in the energetics of the agricultural system; by protecting the gardens from destruction by animals, the archers remove a limiting factor that would inhibit the growth and production of crops in those gardens.

Because of their importance in the agricultural system throughout most of the year, the archers may have been able to increase their caloric consumption relative to the labor expended in obtaining those calories. Given the continued encroachment of agricultural populations on at least three sides of the forest, and the reduction that this must have caused in both the size and the natural productivity of the Mbuti habitat, the input-output ratio of energy expended to that received is likely to have proceeded in the reverse direction among the net-hunters, who still subsist primarily upon the undomesticated resources of the forest.

The explanation given here, then, for the distinction between net-hunters and archers may be summarized. As a consequence of a steady intrusion into the forest of populations practicing agriculture—primarily from the east but also from the north—the effective size and natural productivity of the Mbuti habitat suffered a decline relative to the size of the population. The higher population density among the Mbuti, which resulted from this encroachment

organization among those groups that still subsist primarily upon the forest if a continued maintenance of the population is to be assured.¹⁰ At the same time, this intrusion of agriculturalists into the forest has created a new niche for some indigenous hunters where the input-output ratio is lower than that which is obtained from traditional subsistence on the forest. This reduced ratio would indeed make the new niche desirable, particularly for hunters living in the most disturbed sections of the forest.

The same considerations can be applied to the temporal variations in subsistence behaviors among the Mbuti as well. The honey season is a period of general abundance in the forest (Turnbull 1965b:286; 1968:298) that follows the resumption of the rains after the brief dry season in January and February. The increased natural productivity of the forest at this time provides a greater variety and amount of food sources for the net-hunters, temporarily reducing the population-resource ratio among them, and facilitating commensurate adjustments in work loads, degree of cooperation, and band organization. The net hunter's beliefs and activities during the honey season are entirely consistent with the predictions for a population experiencing a reduction of population pressure on resources, and the reduced input-output ratio of energy expended to energy received that this affords.

From the same theoretical perspective, the behavior of the archers during the honey season is predictable as well. If the rhythmic productivity of the agricultural cycle produces a period of "nutritional strain" at this time of the year and the archers are unable to rely as usual upon the produce from the gardens of their patrons, then they must band together in order to maintain a subsistence solely upon the most disturbed section of the forest. By doing this, they might also be avoiding pressure to become involved in the heavy agricultural labor required at this time. Because their area of the forest is the most affected by the encroachment of non-Mbuti populations, their subsistence solely upon undomesticated resources represents a shift from a low population-resource ratio for most of the year to a brief period of relatively high population density. Subsistence solely on the natural productivity of the forest in this area demands an appropriate increase in cooperation and work load among the archers. Thus, the *begbe* hunt of the archers during the honey season

is like the net-hunt in technique, only without the nets, and it similarly demands the cooperation of men, women and children in much larger numbers than could be

supplied by any one section of the band. All sections, therefore, gather together at this time and build a single camp [Turnbull 1965b:300].

The behavior of the archers during the honey season, while apparently contradictory to the actions of the net-hunters, is precisely the response expected of a population suddenly forced to depend upon a forest that is unable to provide them with the caloric consumption relative to energy expenditure comparable to that which they receive from the domesticated gardens during the remainder of the year. Given the sudden increase in the population-resource ratio at this time of the year, the response of the archers is quite predictable—increased cooperation and organization and increased per capita expenditure of labor in subsistence activities (archers claim this happens). The greater disruption of the areas of the forest inhabited by the archers would partly account for their formation into larger cooperative bands during this period than those which characterize the net-hunters for the remainder of the year.

Conclusions

This discussion strongly suggests that the Mbuti, like most other populations, respond to spatial and temporal variations in the abundance and distribution of resources within their habitat through ecologically intelligible behavior. As would be expected, the categorical claim that ecological considerations are irrelevant to an explanation of variations in Mbuti subsistence behavior appears to lack foundation; rather than being "strange" (Turnbull 1968:134) or "curious" (Turnbull 1965b:299), the variations that occur in these behaviors are precisely those that would most reasonably be expected (in contrast to Turnbull 1968:136), given the aggregate material context of the Mbuti hunters within the Ituri forest.

The theoretical model employed here suggests that divergent evolution has been occurring among the Mbuti, most likely since the advent of agricultural encroachment upon the forest several centuries ago. The circumscription and invasion of the forest by populations of shifting cultivators has apparently caused the two distinct hunting adaptations. By reducing the total size and natural productivity of the forest, the encroachment of agriculturalists has demanded an increased intensification of subsistence activities among those groups (net-hunters) that still subsist primarily upon the natural productivity of the forest. At the same time, the presence of agricultural villages in the forest has created a new niche for hunters (through their protection of and subsistence upon the village gardens) that has afforded a reduction in the ratio of population to resources compared to that offered by continued subsistence upon the forest. Since these hunters (archers) enjoy a reduced input-output ratio of energy expended to energy received in subsistence, they have sustained a reduction in the intensity of social cooperation and organization

¹⁰ Turnbull (1961:94-108) describes the "crime of Cephu," which he refers to as "one of the most heinous crimes in Pygmy eyes, and one that rarely occurs [Turnbull 1961:109]." Cephu was a member of the Epulu net-hunting band who was discovered secretly placing his net ahead of the nets of the other members of the band, thus violating the strict rule of cooperation in the hunt, which is central to the net-hunting band. The seriousness of Cephu's crime in the eyes of the Pygmies, symbolized by the permission given even to children since that event to act disrespectfully towards him, underscores the likelihood that reduction of their habitat has placed pressure upon

among themselves, and have developed greater, individualized socioeconomic ties with the village communities upon which they rely. A seasonal variation in the abundance and distribution of resources within the forest temporarily reverses the relative population-resource ratio among the net-hunters and archers, producing a reversal in the levels of social cooperation, band organization, and work loads associated with these groups.

This explanation for the distinction between net-hunters and archers, as well as for the apparently paradoxical events that accompany the honey season, recognizes the centrality of ecological considerations in subsistence behavior. The ecological explanation of flux among the Mbuti proposed here is not only more consistent with the expectations derived from research on other human populations; it is also more consistent with the aggregate, albeit limited, information available on the spatiotemporal context of the Mbuti hunters than is the opposing claim by Turnbull that environmental considerations are irrelevant to an understanding of variations in Mbuti subsistence behavior.

Unfortunately, the conclusions offered here can only remain suggestive; sufficient data for demonstrating the precise operation of ecological processes among the Mbuti are not available.¹¹ The absence of the necessary supporting data to confirm the explanation proposed is symptomatic of the problems inherent in Turnbull's contention that ecological considerations are irrelevant. While arguing for the primacy of social over ecological considerations in Mbuti subsistence behavior, Turnbull fails to appreciate significant ecological concepts and the kinds of quantitative data they require for their proper evaluation. The lack of a clear ecological or materialist paradigm, with the integral application of a deductive research method to ensure sufficient data collection, precludes any adequate appraisal by Turnbull of the operation of ecological processes among the Mbuti, and makes his claim for the irrelevance of environmental considerations scientifically groundless.

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¹¹ Additional data on Mbuti ecology became available to the author too late to be incorporated into this chapter. These new data include important quantitative information on Mbuti subsistence and, thus, are of relevance to the thesis proposed here. These data have been discussed in a subsequent article (Abruzzi 1979), and the interested reader is encouraged to consult this later publication.

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