

# Territoriality among Human Foragers: Ecological Models and an Application to Four Bushman Groups<sup>1</sup>

by *Elizabeth Cashdan*

DISCUSSIONS OF HUMAN TERRITORIALITY have become more sophisticated in recent years; we see fewer arguments for or against the adaptiveness of territoriality for mankind in general and more attempts to probe the ecological factors that make territoriality adaptive in particular circumstances. Current theory from evolutionary ecology, particularly that dealing with the costs and benefits of territorial defense, appears to be particularly promising in explaining the variation that exists in hunter-gatherer territoriality. This body of theory, which holds that territoriality should be found only where its benefits exceed its costs, has led to the general expectation that dense and predictable resources, being less costly to defend, will be associated with a greater degree of territoriality. These arguments have been explicitly applied to human territoriality by Dyson-Hudson and Smith (1978) and are implicit in other recent discussions (e.g., Bishop 1970, Acheson 1975).

Among the Bushmen of the Kalahari, however, the patterning is the opposite of what these arguments might lead us to expect;

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the most territorial Bushman groups are found where resources are sparsest and least predictable. In explaining these findings, I argue that the cognitive and cultural capacities of our species alter the ways in which territories can be defended, which in turn may affect the expected relationships between environmental variables and territoriality. In this paper, then, I wish not only to extend the animal models of territoriality to human foragers, but also to consider how aspects of behavior unique to humans affect territorial costs and benefits and hence how the animal models might be modified to develop a general theory of human territoriality.

I will begin with a selective review of the ecological theory of territoriality, focusing on cost-benefit approaches. Following this, I will discuss territoriality among human foragers in general and consider some of the ways in which human memory and culture affect the mechanisms, and hence the costs, of territorial exclusion and defense. In the biological models of territoriality, resource abundance and predictability affect territorial costs primarily through their effects on territory size. I will argue that, for human foragers, territory size above a given threshold will be associated with a qualitatively different type of territorial defense and that above this threshold territory size is relatively unimportant in determining defense costs. Finally, I will look in detail at territoriality among four Bushman groups in light of these arguments. The four groups, !Kung, Nharo, G/wi, and !Ko, are in environments that differ in both density and predictability of resources. I will attempt to relate these environmental differences to differences in the degree and nature of territoriality that the groups exhibit.

## BACKGROUND: THE ECOLOGICAL THEORY

There is no consensus in the literature of animal ecology concerning the definition of territory. Some definitions are fairly narrow, emphasizing both exclusive occupancy by the territory holder and a means of defense by which the territory is maintained (e.g., Wilson 1975, Brown 1975), while others are quite broad, recognizing territoriality solely on the basis of "spacing out" or dispersion (e.g., Davies 1978). Following Carpenter and MacMillan (1976:639) I recognize territoriality as "the maintenance of an area 'within which the resident controls or restricts use of one or more environmental resources.'" With this definition, which I feel is particularly well suited to human

foragers, territoriality can be viewed as a type of resource management that depends on controlling and limiting access to resources. Exclusive use of a territory may follow from it but is not a necessary part of it.

Most recent studies of territoriality in ecology have assumed that territoriality confers an advantage in fitness upon the territory holder and have attempted to determine the selective contexts that favor it. This approach began with Brown (1964), who argued that, while competition for limited resources is a prerequisite, territoriality will be found only where these resources are also "economically defensible," i.e., where the benefits to fitness gained from territoriality exceed the costs. The benefits derive principally from the increased availability of resources, while the costs include the time, energy, and risks involved in territorial defense. Another possible benefit of territoriality, although one that has not been included in cost-benefit models thus far, is increased foraging efficiency. Since it should be easier for an individual to monitor resources when use by others is limited or controlled, territoriality may increase foraging efficiency by improving information concerning the abundance and location of resources within the territory.

Both costs and benefits (hence economic defensibility) can be expected to vary with territory size. As the area that must be patrolled increases, so do the costs of territorial defense. Benefits, such as increased resources, also increase with territory size, although the benefits may level off as the territory contains more of the resource than the animal needs. It should be possible, therefore, to find an optimum territory size at which the net benefit is greatest (Davies 1978, but see Ebersole 1980).

Although there have been some attempts to measure the costs and benefits of territoriality in terms of calories expended and gained (e.g., Gill and Wolf 1975, Carpenter and MacMillan 1976), most studies have taken the easier but less direct approach of seeing how territorial behavior changes with ecological conditions. One environmental variable that has clear effects on territorial costs and benefits is the density of resources. As resources become sparser, the animal must have a larger territory to satisfy its needs, and therefore defense costs increase and may come to outweigh the benefits conferred by territoriality. At the other extreme, resources may be so abundant in relation to the animal's needs that competition is at a minimum and there is nothing to be gained from defending a territory. We may therefore expect to find territoriality between these two thresholds of resource abundance.

There is empirical support for the effects of resource density on territoriality. Many studies have shown an inverse relationship between territory size and resource density (Cody and Cody 1972, Simon 1975, Gill and Wolf 1975, Kodric-Brown and Brown 1978), and the same pattern appears to hold for at least some human foragers (e.g., Rogers [1969:45] for the Cree-Ojibwa Indians of eastern subarctic Canada and Peterson [1972:24] for sizes of clan estates in Australia). Studies have also been done on nectar-feeding birds that show an upper and a lower threshold for economic defensibility and territoriality at two levels of flower abundance (Carpenter and MacMillan 1976) and at levels of flower abundance that depend also on territory size (Kodric-Brown and Brown 1978).

In the theory just summarized, no benefits accrue from territoriality without competition for resources, and competition is expected to increase as resources become scarcer. Clearly, however, competition results not simply from scarcity of resources in any absolute sense, but from scarcity relative to population density. This should be kept in mind, although population density has not been explicitly considered in the ecological literature on territoriality, and I will not do so here.

Predictability is another important environmental variable that has been associated with territoriality, since resources that are unpredictable, transient, or highly mobile should be less economical to defend (Brown 1964). There is also considerable evidence to support this relationship. Among primates, for

example, "the fruit-eating arboreal species, which exploit a temporally and spatially unpredictable food supply in an environment with poor visibility, are non-territorial, whereas the leaf and bud-eating monkeys, which exploit more abundant and predictable food supplies, are strongly territorial" (Brown and Orians 1970:252). Individuals may also respond flexibly to changes in resources; for example, Davies (1976) has shown that pied wagtails change foraging strategies as the distribution of resources changes, defending individual territories when food is dense and predictable and foraging in flocks when food supplies are patchy and transient. Similar patterns have been described for spotted hyenas (Kruuk 1972) and other animals (see Davies 1978).

Many studies have cited or documented in a qualitative manner the relation of resource predictability to territoriality, but none of these, to my knowledge, has actually measured predictability or even suggested a means of doing so. Measures have been proposed elsewhere in the ecological literature, however. Roughgarden (1979:chap. 20) identifies the predictability of a sequence of events with the autocorrelation function of the variable being predicted, i.e., the correlation coefficient between observations in a sequence as a function of the interval between them. It is not clear, however, that the notion of predictability embodied in the ecological arguments concerning territoriality is the same as that implied by Roughgarden's measure. Predictability, as the term is used in the literature concerning territoriality, seems to refer to the confidence that can be placed in predictions of the abundance of resources at some time or times in the future. It is worthwhile to defend a territory only if there is some basis for confidence that resources will still be present when they are wanted. Thus, any reasonable measure of predictability should be inversely related to the magnitude of the average difference between actual and predicted values. One such measure is the inverse of the residual variance of actual values about predicted values. Clearly, any such measure will depend on the way in which predictions are made as well as on the statistical properties of the environment. Thus, predictability is an attribute not merely of the environment, but also of the pattern of response to environmental variation.

Although patchiness of resources has received little attention in this literature, there is reason to believe that it may encourage territorial behavior. Since patchy resources are aggregated, they are easy to defend; and, since territories will be of uneven quality in a coarse-grained patchy environment, competition for prime territories will be keen. (The limiting case here would be the situation in which inhabitants of one territory hold a monopoly on a resource that occurs only in that territory.) Patchiness, therefore, should reduce the costs and increase the benefits associated with territorial defense.

In their application of the cost-benefit theory to human populations, Dyson-Hudson and Smith (1978) argue that territoriality is most likely when resources are abundant and predictable. Citing the territorial behavior of the Basin-Plateau Indians, the northern Ojibwa, and the Karimojong, they show that the populations in question are territorial only when resources are dense and predictable, hence economically defensible.

## TERRITORIALITY AMONG HUMAN FORAGERS

How useful is the ecological theory just discussed in explaining territoriality among *human* foragers? In applying the theory, it is important to remember that the costs and benefits of territoriality depend not only on the nature of the environment, but also on the characteristics of the species concerned. In the case of humans, we can expect that our long-term memory, sophisticated means of information exchange, and culture will affect the mechanisms—and hence the costs—of territorial

defense. I will argue that human foragers have available two very different mechanisms for controlling access to territorial resources: (a) overt competition through "perimeter defense" of territorial space and (b) reciprocal altruism through controlled access to the social group. The groups studied by Dyson-Hudson and Smith (1978) employ the former strategy, and for these groups the theory can be applied fairly directly. The Bushmen, however, like many other foragers, employ the latter strategy, and for these foragers the expected relationships between resource density and predictability and territoriality no longer apply.

Territory size is an important intermediate variable linking environmental characteristics to the economic defensibility of a territory. When resources are scarce, animals need a larger territory to obtain the same quantity of resources. Territory size will also be influenced by spatial structure in the distribution of resources. Harpending and Davis (1977) argue that range or territory size needs to be large where there is a great deal of variation from place to place in the availability of resources and where the various resources needed tend not to co-occur. When, in addition, locations of resource abundance are unpredictable from year to year, it seems likely that optimal territory size will be additionally increased.

Defense costs for nonhuman animals, which consist chiefly of display or advertisement of the territory, time and energy spent monitoring the territory for intruders, and the cost of repelling intruders, are assumed to increase with territory size, as the animal must patrol a larger area. Humans monitor and defend territories in ways not found in other species, however, and the costs of these human means of territorial defense may be quite unrelated to the size of the territory. To the extent that this is true, the relationship of resource density and predictability to territoriality will no longer hold.

#### PERIMETER DEFENSE

The two types of territoriality just mentioned are associated with different means of excluding outsiders from territorial resources. In the case of overt competition, foragers typically mark the perimeter of their territory boundary and control access to the territory space itself ("perimeter defense"). With reciprocal altruism, they control access not to the territory space itself, but to the social group having rights to the territory ("social boundary defense").

Among foragers using the former strategy I would include the Vedda, Owens Valley Paiute, Guayaki, many native California groups such as the Maidu and Cahuilla, and possibly also the Ainu. Foragers of this group "look" territorial because their means of controlling access to resources is similar to that found in nonhuman species. Territory boundaries are advertised and marked, social units correspond to territory units, and there is usually little movement of individuals across territory boundaries. These foragers have small territories (on the order of 300 mi.<sup>2</sup> or less), and most are favored with dense and reliable resources, as the small territory sizes would suggest.

The Vedda are a case in point. According to Seligmann and Seligmann (1911:106-17), each Vedda band occupied and defended a territory, and this territory was subdivided for individual band members, who could pass their property on to their children or give it to sons-in-law at their daughter's marriage. Territory boundaries not clearly defined by natural features were marked by pictures, cut into tree trunks, of a man with a drawn bow. Trespass was strongly resented, and intruders might be shot, although the borders were so well known that quarrels over trespass were rare. Territories were so jealously guarded that a visitor passing through the area reported that he was stopped by an archer, interrogated, and made to wait at a band's territory boundary until word arrived from an "elder," whereupon he was escorted through the

territory to the boundary on the other side. Here he was again made to wait for permission to pass and then handed over to a member of the neighboring district to be similarly escorted through that band's territory. As would be expected, Vedda territories were small, about a two- or three-hour walk from one boundary to another.

Because territoriality among these groups is not unlike that found in other species, the ecological arguments developed for these other species should also be applicable. Even among these groups, of course, we can expect some differences in the means, and hence the costs, of territorial defense. For example, human memory and communication should lessen the frequency with which intruders need be repulsed, since each individual need not learn for himself the consequences of territorial trespass. This and other factors may lessen defense costs overall but should not affect the relationship between such costs and territory size. Because residents are controlling entry into the territorial space itself, we should still expect to find that defense costs, especially the costs of monitoring the territory for intruders, increase with territory size. The arguments relating environmental variables to economic defensibility, therefore, should still be applicable.

The dense and predictable resources that give rise to perimeter defense also make an area desirable for nonforaging peoples. It is not surprising, therefore, that many of the areas characterized by perimeter defense among hunter-gatherers are also areas that were subject to early encroachment by nonforaging peoples. Any association of perimeter defense with "acculturated" foragers, therefore, is probably due to the fact that both are effects of the same environmental variables; there is no reason to assume that perimeter defense itself is a result of such contact. (The effects of contact on hunter-gatherer territoriality are no doubt complex and will not be considered here.)

#### SOCIAL BOUNDARY DEFENSE

As resources become sparse or unpredictable and ranges become larger, making perimeter defense uneconomical, humans have another option available. Rather than give up territorial defense entirely, they can control access to resources by controlling access to the social group inhabiting the area (social boundary defense). This type of territoriality has been described by Peterson (1975:60), who argues that because of the large size of Australian territories (clan estates), which range from a low of about 400 mi.<sup>2</sup> in the rich woodlands of Arnhem Land to four times that size in the desert areas (Peterson 1972), defense of local group boundaries would be "not only unrewarding but impossible in face of the need to collect food. An alternative strategy for defending the land is to make acceptance into the local land using group a preliminary requirement for using the resources in its territory; that is, by defending the boundaries of the social group rather than the perimeter of the territory itself."

In Australia, rites of entry into social groups take the form of elaborate greeting ceremonies. According to Peterson (1975:62), the failure to engage in these greeting ceremonies "is taken as a prelude to an act of hostility and provokes the likelihood of aggression from the territory occupiers. Once a person or party has been through a rite of entry, however, they have equal access with the hosts to the everyday resources of the territory. Greeting ceremonies are thus functionally analogous to boundary defense, in that they prevent unregulated movement between territories and control access to food resources."

Among foragers with this type of territoriality, I would include, in addition to the Australians, the Bushmen, at least some Eskimo groups, and possibly the Athabascans and

Algonkians of the boreal forest. Among these foragers, social groups are associated with particular areas, but territory boundaries are not marked and are recognized only by natural features of the environment. Because reciprocal access involves the movement of individuals across territory boundaries and between social groups, furthermore, social units do not clearly correspond to territorial units, particularly over the short term. This latter feature, a response to the unpredictable environments in which these foragers are found, tends to make these groups "look" nonterritorial, if one is accustomed to animal models of territoriality. The impression is enhanced by the lack of clearly marked and advertised territory boundaries.

In what sense, then, can this strategy be viewed as territoriality? I have defined a territory as "an area within which the resident controls or restricts use of one or more environmental resources." In these foraging groups there are social means of gaining access rights to resources in an area (e.g., through inheritance, fictive kin ties, trading partnerships), and the *lack* of these rights can be, and often is, used as a means of excluding nonmembers. This process clearly provides a means of controlling and limiting access to resources and is therefore a form of territoriality.

In considering the costs of this type of territorial defense, we must include the time and energy spent in such things as greeting rituals, the costs (ranging from outright aggression to more subtle means of exclusion) of repelling strangers, and, most importantly, the energy devoted to social and political relationships that enable individuals to claim and manipulate social membership and rights of access. For our purposes, the important thing about these costs is that they are quite unrelated to the size of the territory. For groups that defend territorial resources through social boundary defense, then, we should not expect defense costs to increase with territory size; nor, therefore, should such costs increase as resources become increasingly sparse and unpredictable.

The admittance of outsiders to the social group typically involves the expectation that access will be reciprocated when circumstances permit, and it may therefore be viewed as an example of reciprocal altruism. The conditions under which such reciprocity will be mutually advantageous have been analyzed by Axelrod and Hamilton (1981:1393) using a form of the "prisoner's dilemma" game; they found that it is "evolutionarily stable if and only if the interactions between individuals have a sufficiently large probability of continuing." Because foragers normally restrict interterritorial visits to kin and others with whom they have already established close ties, this condition should be easily met in most cases. Much effort, in fact, may be spent in strengthening these ties to ensure that the hospitality is indeed reciprocated (see Wiessner 1977). The conditions that favor reciprocal altruism also depend on the "payoff matrix," which in the case of territoriality will depend in part on the environment. We can expect that the advantages of reciprocal territorial access will be higher in coarse-grained patchy environments or environments in which resource abundance varies unpredictably in space and time.

This type of territoriality describes many foragers quite well, but it is worth considering how it can work. If one is "defending the boundaries of the social group rather than the perimeter of the territory itself," as Peterson puts it, why should potential intruders ask to be included in the social group in the first place? Why trouble to cultivate rights of access if one can take resources without asking? Is this simply territoriality by the honor system?

One reason is the importance of information exchange in these environments. Where territories are large and resources unpredictable, outsiders can minimize their foraging costs considerably if they obtain information from the residents concerning the location of resources. They therefore have an incentive to seek access to the social group, since it is through the social interactions of these rituals that information ex-

change takes place. To the extent that this is true, furthermore, we can expect that the costs of *not* cooperating in asking permission will rise with territory size, since the more unpredictable the resources and the larger the territory, the more difficult it will be for outsiders to exploit the area unaided.

The granting of permission, furthermore, often involves the allocation of particular foraging areas to be used by the visitors. This ensures that both residents and visitors make optimum use of the area's resources. For example, foraging efficiency should be enhanced for both if the visitors restrict their foraging to a small area with the assurance that they will not be competing with the residents for these resources.

The use of territoriality as a means of information exchange and resource allocation appears to be widespread among human foragers in areas of sparse and unpredictable resources. For example, a //Gana resident of the Central Kalahari told me that, while permission to use the resources of another area is never refused, the owners may tell the newcomers "which side to use and which side not to use." Tanner (1973:112) reports a similar finding for the Mistassini Cree: "the definition of a territory boundary is not as often used in keeping outsiders off one's land, as it is in making sure in advance that the hunting and trapping activities of the group do not overlap with those of another. A hunting territory is a unit of management." Similarly, among the Eskimo of northwestern Alaska, "the summer movements of the members of different societies into and out of one another's territories were so precisely articulated that almost no conflict resulted from them." If such moves were not undertaken after a territory had been vacated by its owners or under the truce conditions that existed at certain times of the year, they would lead to bloodshed (Burch 1980:276).

Allocating resources in this fashion can be viewed as territorial behavior even where it does not involve the expulsion of outsiders from the territory as a whole. It differs from such expulsion, however, in that it may be beneficial to both the territory holder and the "intruder." It can therefore be advantageous for both to play by the rules in seeking access to the social group.

Another reason for the feasibility of territoriality by social boundary defense lies in the effects of territory size on the costs of detecting intruders. Although we can ordinarily expect that the costs of monitoring a territory for intruders will increase with territory size, there is a counterforce operating. With the large territories that one finds with this type of territoriality (often over 1,000 mi.<sup>2</sup>), the transport costs of trespass into another territory will be so high that it will be economical only if the intruders remain in the territory for some time. The longer they remain, however, the greater will be the chances of detection. This may make trespassing an unproductive strategy even if the residents are not engaging in systematic perimeter defense.

The type of resource will be an important variable in determining these transport costs and the chances of detection. Even with large territories, for example, it may pay to go into another territory for a day or two for a resource that is valuable and compact (perhaps salt or game), and such an intrusion may well go undetected. The critical resource in the Central Kalahari, on the other hand, is water or, where it is absent, vegetable foods (melons, roots) that provide a source of moisture. For resources such as these, it would clearly be impractical to trek many miles into another territory unless one could remain in the area to use them. Such a long-term intrusion would almost certainly become known to the residents, simply in the course of their normal foraging and visiting activity. In a small territory, conversely, where it takes only a few hours to walk from one border to another, the costs of a trip into a neighboring area for such a resource would be no more than that of a typical Kalahari gathering trip, and such an intrusion would easily be economical if borders were not patrolled.

Defending the boundaries of the social group is a territorial defense strategy that works only if potential intruders play the game and seek access to the group, rather than attempt to cross into the territory undetected. To summarize, the conditions under which the benefits of such cooperation exceed the benefits of trespassing unannounced include (a) the likelihood that interactions between visitors and residents will continue (see Axelrod and Hamilton 1981), (b) the value of information exchange to potential intruders, (c) the probability that trespassers will be detected, and (d) the value of reciprocal access itself. The latter three factors are determined in part by territory size and the characteristics of the environment. Reciprocal access is advantageous only in patchy environments or environments in which areas of relative abundance vary from year to year. The value of seeking information about these resources should also be greatest in large territories with unpredictable resources, since such environments will be more difficult to exploit unaided. And, finally, the chance that trespassers will be accidentally discovered may be high when territories are so large that intruders must remain in the territory an appreciable length of time to exploit the resource. Each of these conditions makes it more advantageous for a potential intruder to seek social rights of access than to trespass unannounced.

#### A COMPARISON OF FOUR BUSHMAN GROUPS

Southern African Bushmen provide a good "test case" for the ecological arguments concerning territoriality, because Bushman groups can be found in a wide range of environments, and ethnographic sources indicate appreciable differences in territoriality among them. The mechanisms of exclusion are the same among the different groups (all control access to resources through social boundary defense), but the degree to which these mechanisms are put into practice differs considerably. This can be seen both in the attitudes and behavior toward outsiders and in the extent of the network of reciprocal access rights. An examination of the territorial behavior of four Bushman groups (Nharo, !Kung, G/wi, and !Ko) in relation to the abundance and predictability of resources in the regions they inhabit shows that the most territorial groups (those that are the least tolerant of outsiders) are found where resources are both sparse and highly variable. Although this is contrary to what one might expect from the traditional ecological arguments, it is consistent with the general theory of costs and benefits when the factors discussed in the preceding section are taken into account.

Because the four Bushman groups were studied by different researchers and few comparable hard data are available, the existing literature will not permit a really reliable test of the ecological arguments. The difficulty is compounded by the fact that, in some cases, the picture presented by earlier researchers differs markedly from that given by more recent ones (e.g., compare Fourie 1928 with Yellen 1976). In order to obviate this problem somewhat, I am limiting myself to ethnographic reports based on fieldwork undertaken no earlier than the 1950s. In my view, the differences reported by modern researchers are marked enough to give some confidence that the ethnographers are reporting real differences, rather than differing interpretations of the same reality, but the ambiguities inherent in comparing the work of different researchers should be kept in mind.

#### ENVIRONMENT

The abundance, predictability, and distribution of food resources are determined to a significant extent by rainfall, particularly in a desert region such as the Kalahari where water is a limiting resource. In comparing the environments of

the four Bushman groups, therefore, it will be helpful to begin by considering rainfall as a proxy variable for food resources. In arid climates, primary production (the rate at which plants assimilate solar energy) is very strongly correlated with precipitation; a plot of annual rainfall by primary production in the Namibian desert shows an almost perfect linear relationship (Pianka 1978:13-14). Productivity primarily determines the growth of vegetation and secondarily influences the abundance of animals and should, therefore, be a good measure of human food resources.

Approximate values for mean annual rainfall for the four Bushman groups can be determined from Pike's (1971) isohyetal map of Botswana. Because some of the groups have a fairly wide distribution, it is worth considering not only the range in mean annual rainfall for the group as a whole, but also the rainfall for the particular locations in which the ethnographers did their research. Figure 1 gives rainfall data for four locations that represent, as nearly as I can determine, the areas in which the researchers in question centered their field studies. Figure 2 shows where these places are. Dobe (the !Kung location) and Ghanzi (the Nharo location) get the most rainfall, both having about 400 mm yearly. ≠Kade (the G/wi location) is somewhat drier, getting about 345 mm per year, and Lone Tree (the !Ko location) gets the least rain, about 325 mm per year. In general, the rainfall for each region as a whole parallels this pattern, although the range for the Nharo region is considerable, rainfall in its drier southwestern part being the same as for the G/wi and the !Ko.

Just as mean annual rainfall provides a good estimate of average productivity in desert regions, so variation and unpredictability in rainfall should cause variation and unpredictability in productivity and food availability. The literature on territoriality refers chiefly to predictability, but it is intuitively reasonable that the variance is itself important in determining the economic defensibility of a territory. For example, if resources vary only slightly, it should make little difference to the territory holder, no matter how unpredictable this slight variation may be. It was suggested earlier that predictability might be usefully measured by the inverse of the

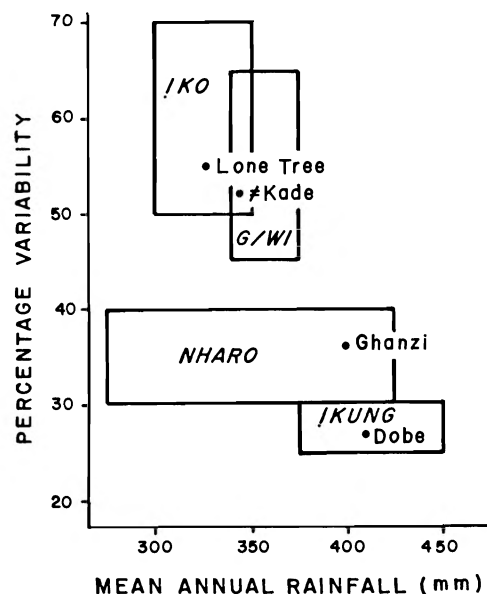


FIG. 1. Magnitude and variation of rainfall at four Kalahari locations. Rectangles indicate rainfall patterns for the group as a whole; dots indicate ethnographic study sites within these areas. The data, from Pike (1971), are based on a 30-year adjusted seasonal mean and may differ from those of the Botswana Weather Bureau (p. 73).

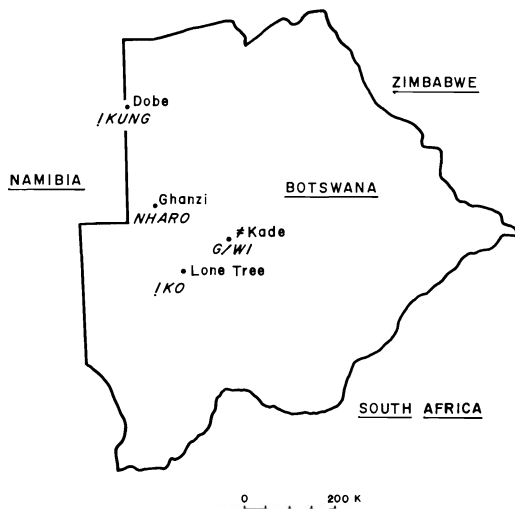


FIG. 2. Approximate locations and study sites for four Bushman groups.

residual variance of actual values about predicted values. If there is no temporal autocorrelation in a resource (i.e., if it is completely unpredictable according to Roughgarden's definition), then the best estimate of the amount of the resource at some point in the future would be the long-term mean. In this limiting case, the measure of predictability suggested here would be equivalent to the inverse of the total variance.

I have no data on the autocorrelation of rainfall or other resources for the Bushman groups discussed here, but patterns of rainfall in the Kalahari appear highly unpredictable in spatial as well as temporal dimensions. More to the point, I am unaware of any ability of the Bushmen to predict this year's rainfall on the basis of rainfall in past years. If this is true, then we can use the inverse of the variance in mean annual rainfall as a measure of their ability to predict rainfall in future years.

Fluctuations in annual rainfall are marked in arid regions generally and in the Kalahari in particular and are most severe in areas with the lowest average rainfall. We can compare the variation in rainfall for the four Bushman groups by referring to Pike's (1971) map of percentage variability (coefficient of variation) in mean annual rainfall across Botswana. These data, summarized in figure 1, show that the !Kung are in the least variable environment, the coefficient of variation in mean annual rainfall being only 25–30%. Rainfall in the Nharo region is more variable, about 30–40%, while that in the G/wi region is about 45–65%. The !Ko, in the most arid region, also have the greatest percentage variability, about 50–70%. The central research locations within each region show the same pattern, Dobe being the least variable, followed in order by Ghanzi, ≠Kade, and Lone Tree.<sup>2</sup>

While rainfall patterns are the only quantitative data available for comparing the abundance and variability of food resources in the four regions, ethnographic descriptions do corroborate the findings based on rainfall.

The !Ko, who have both the lowest and the most variable mean annual rainfall of the four groups, live in an area that Barnard (1979:137) describes as "poorer than that of the other major Bushman peoples. There is no staple food plant, and the

<sup>2</sup> Standard deviations vary similarly, although, as would be expected, the pattern is less marked than that shown by the coefficient of variation. It is not obvious which is the most appropriate measure; foragers have to adjust to changes in actual rainfall, which would suggest that the standard deviation would be more appropriate, but because a deficit of a given amount would be more severe in groups that are in more severely arid areas the percentage variability may be of more relevance.

availability of edible plants and animals, and of water, fluctuates considerably." Heinz (1972:414–15), the chief ethnographer of the !Ko, notes that "the territory of the !Kung has a longer rainy season and more game than the land of the !Ko." He notes that the !Kung area also has a greater abundance of wild plant foods and adds, "I have seen for myself that the !Kung which live in the area of Lee's studies are indeed fortunate with regard to their food resources."

The G/wi, who have slightly more abundant and less variable rainfall than the !Ko, have also been compared with the more well-favored !Kung. Tanaka (1976:99) says, "≠Kade pan . . . is located in a much drier zone [than Dobe]; plant foods are not nearly as abundant or of as high quality as they are in the Dobe area, and standing water is extremely scarce." Evidence for the greater abundance of food resources in the !Kung area is supported by the fact that the G/wi spend more time on foraging activities than do the !Kung, working 32.5 hours per week (Tanaka 1980:76–77) as compared with only 17.1 hours per week for the !Kung (Lee 1979:chap. 9; 1968).

The rainfall characteristics of the Nharo area, especially around Ghanzi, suggest that food resources should be better than those of the !Ko and G/wi but not as good as those of the !Kung. Barnard (1979:38) describes the Nharo area as being well favored with food and water resources but nonetheless states that "Zhu/twasi [!Kung] country has a greater abundance of resources than any other part of the Kalahari."

The relative abundance of water resources is not identical to that of food resources and must be considered separately. Like food resources, water resources are determined to an important extent by rainfall. Equally important, however, is the presence or absence of surface rock that can hold water in permanent pools. The Nharo, who live along a limestone ridge, have always had permanent pans and plentiful water in their region and today have even more abundant water available through the boreholes that have been drilled on the nearby Ghanzi ranches (Barnard 1979). The !Kung are also relatively well supplied with water, although less so than the Nharo; many of the pans in the !Kung region provide only seasonal water, but at least a few hold water year-round, even in a drought year (Lee 1972a, 1979). The Bantu wells that have been dug at many of these locations have presumably increased the amount and reliability of water for the !Kung in recent years, although probably not to the same degree as the mechanized boreholes have for the Nharo.

In contrast to these two groups, neither the G/wi nor the !Ko has traditionally had a permanent source of standing water. Because the pools in these areas do not hold water for more than a few weeks after a rain, both groups must rely for moisture on tsama melons and other succulent plants during part of the year (Silberbauer 1972, 1981; Tanaka 1976, 1980; Heinz and Maguire n.d.). Things have eased somewhat for the G/wi and !Ko in recent years, however, because of the drilling of government boreholes; there is one borehole in the G/wi area that was established recently (after Silberbauer's fieldwork), and there are now others in the !Ko area as well.

This summary of water resources supports Barnard's (1979) conclusion that the Nharo have the most abundant water supply of the four groups, followed in order by the !Kung, G/wi, and !Ko. This ranking for water resources is similar to the ranking for rainfall (hence food resources), the chief difference being that the Nharo have abundant standing water in spite of having less abundant wild food resources than the !Kung.

#### TERRITORIALITY

All four Bushman groups control access through social boundary defense rather than perimeter defense. The following brief summary of the common features of their territorial organization and acquisition and use of land rights is drawn from



Heinz (1972) for the !Ko, Barnard (1979) for the Nharo, Silberbauer (1972, 1981) for the G/wi (Tanaka, the other principal G/wi ethnographer, wrote little about territorial organization), and Lee (1972, 1979), Wiessner (1977), Marshall (1976), and Yellen (1976) for the !Kung. I have also made use of my own familiarity with the territorial organization of the //Gana of the Central Kalahari Game Reserve (Cashdan 1977, 1980) although I have not included this group in the formal comparisons.

Bushmen inherit primary access rights to the resources of a territory through their parents; territorial inheritance is bilateral, the primary affiliation being with the territory in which the individual decides to live. Less commonly, access rights to a territory are acquired through occupation of an empty territory. Territorial boundaries are not marked, but are recognized by natural landmarks such as pans or groves of trees, and gating across a border is usually avoided.

There is considerable movement across territory boundaries and between social groups, so that bands will typically include members having access rights to more than one territory. While much of this movement is purely social, some is a response to the spatial variation of resources in the Kalahari. When resources are scarce in one area, people from that area will customarily move in with relatives living in a temporarily more well-favored location.

Permission to use the resources of another area is always asked but rarely if ever refused. Even among the less territorial !Kung, however, an individual may be met with hostility if he moves into a territory without having sought permission and without access rights or kin ties to residents of the territory (see Marshall 1976:132). Permission is asked of the territory "owners," who are typically elder members of long standing and may be founding members of the band or individuals descended from the founders. The status of "owner" does not confer real ownership of resources, however; decisions concerning visitors and the allocation of resources are made by consensus, and the owner acts as spokesperson for the band.

The process by which individuals gain access rights to the resources of other territories is described by Silberbauer (1981: 141) as follows:

As advance news of movements in the territories of neighboring and allied bands is usually available, new arrivals are seldom a surprise and band consensus has already crystallized during informal discussion of the prospect of the newcomer's arrival. The "owner" then merely voices his approval on behalf of his fellows. . . . Although membership is not closed, it does confer exclusive rights. Permission is never actually withheld and its asking is simply a formality. It is, however, a formality that clearly indicates that the use of territorial resources and residence have to be granted before they are gained. Unwelcome visitors are given permission to remain but are later eased out of the band.

This passage illustrates clearly that defense of territorial resources is effected by controlling access to the social group. There are no formal greeting rituals such as are found in Australia, but the essence of the process is the same. Silberbauer also makes it clear that the process can be effective in excluding outsiders, even without hostility or physical defense of territory boundaries.

The many similarities in the form of territorial organization among the four Bushman groups suggest that similar mechanisms exist among them for excluding outsiders and controlling access to territorial resources. The degree to which such exclusionary mechanisms are brought into play, however, appears to differ.

Among the !Ko, territoriality operates not only at the level of the band, but at the level of the band "nexus," a group of bands related to each other by ties of friendship, kinship, and ritual bonds. According to Heinz (1972:407-8), there is considerable intermarriage between bands within a nexus, and permission to forage in the territory of another band within

the nexus, while it must be sought, is normally granted. Relationships between bands *within* a nexus, therefore, are very much like interband relationships as they have been described for the !Kung. Among the !Ko, however, the band nexus (a level of organization not described for the !Kung) is "a true territorial group." There is a strip of "no-man's-land" between the land of adjacent nexuses in which foraging is avoided, and "members of a band would never hunt on the land of an adjoining nexus" because the absence of kinship ties between them deprives them of such access (Heinz 1972:408). Band nexus boundaries are often dialect boundaries (Eibl-Eibesfeldt 1974a: 6; Barnard 1979:138), and relationships between different nexuses may be characterized by great animosity.

Barnard (1979:137) has concluded that "the !Ko are highly territorial, and have a well-known dislike of strangers," and this is amply documented by Heinz's examples of hostility to intruders and lack of hospitality to strangers (see Heinz 1972: 411-12). Dispute over the location of territory boundaries has also been reported among the !Ko, causing in one instance a fifteen-year estrangement between the members of two neighboring bands (Heinz 1972:411).

The G/wi appear to be somewhat less territorial and exclusionary than the !Ko. Relationships between bands are not delimited by nexus boundaries, but take the form of a network of alliances across the entire G/wi region (Silberbauer 1981: 178). In contrast to the animosity displayed between band nexuses among the !Ko, Silberbauer (1972:303) reports that among the G/wi "there is no enmity between nonallies, who meet quite happily in the territory of a mutual ally." The greater friendliness between band members across the G/wi region is paralleled by what appears to be more extensive interband mobility. Silberbauer (1981:178) reports that "during the period of fieldwork, every band exchanged at least visitors with every other band known to me."

The Nharo, as described by Barnard (1979), are the least territorial and the least "nucleated" of all the Bushman groups. While the Nharo, like the !Ko, recognize the existence of a band "cluster" (apparently equivalent to Heinz's "nexus"), "cluster boundaries do not distinguish separate dialects and, perhaps more today than in the past, are not always clearly defined geographically" (p. 139). Barnard describes a pattern of widespread visiting and social ties across the Nharo region. While the !Ko rarely travel beyond their nexus boundaries, "many Nharo do, and they frequently extend their social networks to individuals in other band clusters" (p. 141). The Nharo have a reputation for hospitality which contrasts markedly with the reputation for hostility to strangers reported for the !Ko (Barnard 1979:139; Heinz 1972:410-12) and which is further evidence of the difference in the degree of territoriality and exclusion found in the two groups.

In sum, Barnard (1979:141) says that "the !Ko appear to be highly territorial and the Nharo (except perhaps in the drier western areas) relatively unconcerned with territoriality." It is of particular interest that Barnard notes the possibility of greater concern with territoriality among the Nharo who live in the drier areas, since this is consistent with the larger trend whereby the !Ko, who are in the most arid and variable environment, are the most territorial of the Bushman groups.

Flexible territorial organization and widespread visiting also characterize the !Kung (see esp. 1972a, 1979; Wiessner 1977; also Marshall 1976, Peterson 1979, Yellen 1976, Yellen and Harpending 1972). The numerous recent reports on !Kung land use and territorial organization have given rise to something of an archetype in the anthropological imagination, characterized by nonexclusive, flexibly organized bands having highly permeable spatial and social boundaries. Because the nature of !Kung territorial organization is so well known, I will not discuss it further.

Barnard (1979) considers the Nharo to have the most "fluid" and least nucleated spatial organization of the four groups, followed in order by the !Kung, G/wi, and !Ko. Although I would find it difficult to decide whether the !Kung or the Nharo are the least nucleated in their spatial organization, I am in general agreement with his conclusions and consider them directly related to the issue of territoriality. Territorial exclusion is brought about in part by *limiting* marital and social ties with people in other bands, since such ties are the vehicle that allows outsiders access to territorial resources. The absence of widespread (internexus) social networks and visiting among the !Ko, then, can be seen as an indication of their greater tendency to exclude outsiders from territorial resources. Their animosity and lack of hospitality to strangers is further evidence of the same thing. To summarize, the four Bushman groups vary both in their attitudes towards outsiders and in the extent of their social and mobility networks, showing the most territoriality (the greatest exclusion of outsiders) where resources are sparse and least predictable.

Are larger territories required where resources are sparse and unpredictable? Because the arguments about economic defensibility are based on the assumption that this is so, it is worth considering whether this relationship holds among the Bushman groups. When interpreting the ethnographic literature on this subject, it is important to distinguish data on "range" from that on "territory." A territory is an area within which the resident controls or restricts access to resources. A range, on the other hand, is the total area that the animal actually uses. An animal's territory is usually smaller than its range, and this is also the case among the Bushmen, who have various cultural means of extending their range into the territories of other bands.

Given the environmental data presented earlier, we would expect to find the smallest territories among the Nharo and !Kung, who have the most abundant resources, followed in order by the G/wi and then the !Ko. The Nharo do appear to have the smallest territories of the four groups. Barnard (1979: 140) reports that "their territories are considerably smaller than those of other Bushman groups, sometimes averaging only about 30 square kilometres in the interior of the ranching area. In the southern area they are often much larger." !Kung territories (*nlores*) appear to be quite a bit larger, varying between about 300 and 600 km<sup>2</sup> (Lee 1979: 334). Silberbauer's data indicate still larger territories for the G/wi, the territories of six G/wi bands averaging 780 km<sup>2</sup> with a range of 457–1036 km<sup>2</sup> (Silberbauer 1981: 198). I have no data on !Ko territory sizes with which to complete this comparison,<sup>3</sup> but for the three Bushman groups about which we have information territories do appear to be smaller where resources (especially water resources) are more abundant and predictable.

## DISCUSSION

The theory of territoriality developed by animal ecologists holds that, where competition exists for resources, territoriality is most adaptive where resources are abundant and predictable,

<sup>3</sup> Heinz (1972: 414) has remarked in passing that "journeys of 60 to 100 miles undertaken by an entire !Kung band, as mentioned by Mrs. Marshall (1960: 329), are impossible for the !Ko because no !Ko band has access to resources over such a vast area." However, this statement must be an indication of range, not territory size, since a journey of 60 to 100 miles suggests an area on the order of 13,000 km<sup>2</sup>, much larger than the !Kung territory sizes of 300 to 600 km<sup>2</sup>. The fact that the !Ko do not have "access to resources over such a vast area" is presumably an indication of their more restricted social and mobility networks (i.e., of the greater degree of territorial exclusion found among them) and tells us something about range, but nothing about territory sizes. We might expect to find that range and territory become more nearly isomorphic as a group becomes more territorial.

since such resources require smaller territories and are therefore more economical to defend. These arguments might lead us to expect the least territoriality among the !Ko, who are in a region where both food and water are scarcest and least predictable, and the most territoriality among the !Kung and Nharo, who are in more well-favored areas. Yet the opposite is the case. One relevant factor in accounting for this apparent discrepancy is that Bushmen defend territorial resources by controlling access to the social group rather than by perimeter defense, and the costs of this form of defense are unrelated to territory size. The other important factor that must be considered is the existence of competition; if resources are sufficiently abundant, territoriality may be uneconomical even though the costs of defense are low. Both of these factors are relevant in the Bushman case.

The ecological arguments suggest that territoriality will be economical between two thresholds of resource abundance. As resources become sparser and larger territories are needed, defense costs increase and at some point may come to outweigh the benefits conferred by territoriality. At the other extreme, resources may be so abundant in relation to the animal's needs that competition is minimal and there is little or nothing to be gained from defending a territory. Whether or not a lower threshold of resource abundance exists for *human* foragers, however, depends on their form of territorial defense. Foragers who exploit dense and predictable resources need only small territories, and they typically defend them by defending the boundaries of the territory space itself. The costs of this type of territorial defense can be expected to rise with territory size and, as resources become increasingly sparse, may reach a threshold at which territoriality is no longer economical. For foragers who live in areas of sparse and unpredictable resources, however, this threshold will not exist. These foragers need very large territories, and resources in this case may be more economically defended by controlling and limiting access to the social group. When outsiders are excluded from the social group rather than from the territory space itself, territory size is no longer a relevant factor in determining defense costs. While the territories of these foragers may become larger as resources become sparser, the cost of defending these larger territories does not increase.

This argument applies to the Bushman groups discussed above, all of which control access to resources through reciprocal altruism and social boundary defense. The Bushmen with the least abundant and least reliable water supplies do appear to have larger territories (although the data are incomplete), but because costs are unrelated to territory size there is no lower threshold of resource abundance below which territoriality becomes uneconomical. The costs of territoriality should be about equal for the four groups, in spite of the environmental differences between them.

The *benefits* conferred by territoriality, however, should not be equal for the four groups, because they decrease as resources become increasingly dense and predictable and may reach a point at which they are lower than the costs of territorial defense. This upper threshold of resource abundance should be as applicable to human as to nonhuman foragers and explains the patterning seen in Bushman territoriality. As Brown (1964: 162) has noted, the value of territoriality "should tend to be in proportion to the intensity of competition—defendability allowing." Bushmen in the areas where resources are scarcest and least predictable should be facing the greatest competition and should, therefore, derive the greatest benefits from territorial exclusion. Since their costs are no greater, it is not surprising to find that these groups exhibit the strongest territoriality, that is, the greatest exclusion of outsiders from territorial resources. This general trend, whereby the groups with the most abundant resources exhibit the least territoriality, is echoed by the fact that within all four groups territorial



concern is minimal over very abundant resources. Even among the normally territorial !Ko, "an overabundance of any one of the important resources may cause territoriality to become insignificant during the period of such abundance" (Heinz 1972:410).

Ideally, data on resource abundance should be taken in conjunction with data on population density to determine the degree of competition for resources, but there are no density figures for either the Nharo or the !Ko. Population density of the !Kung (.16 persons/km<sup>2</sup> [Lee 1968]) is higher than that of the G/wi (.05-.07/km<sup>2</sup> [Silberbauer 1981, Tanaka 1980]), but the data showing greater work effort among the G/wi than among the !Kung can be taken as indirect evidence of greater competition in the G/wi region, their lower density notwithstanding.

It will be remembered that the !Ko, unlike the Nharo, do not have marital and social ties with members of other nexuses and rarely travel outside the territory of their own nexus. I have argued that their more restricted social and mobility networks are a means of excluding outsiders from territorial resources and, together with other evidence, suggest a greater degree of territoriality among them. It might be asked why the !Ko should respond to scarcity by closing off ties with outsiders (a territorial response) when such ties, and the interterritorial visiting they facilitate, are themselves often used as a means of coping with scarcity. The answer to this seeming paradox lies in the distinction that must be made between scarcity on the local and scarcity on the regional level. Moving in with relatives in other areas is a good means of coping with the risk of local scarcity (assuming that the chances of scarcity in the different local areas within a region are more or less random), but it presupposes abundant resources in some neighboring territory and can therefore work only in a situation of local scarcity but regional abundance. Interterritorial visiting, in other words, is essentially a distributional mechanism. When there is scarcity on the regional level, this mechanism will no longer work, and we can expect the territorial mechanisms of social exclusion to come into play.

The notion that resources may be so abundant that there is no net gain in defending them is intuitively reasonable. However, it is based on the assumption that the acquisition of resources beyond a certain level does not significantly benefit the territory holder or, at any rate, that benefits fall off more rapidly than costs. Ebersole (1980) has pointed out that this may not always be true for animals, some of which can use "extra" food to increase their fitness through such mechanisms as larger clutch sizes, faster growth, and so on. For some human foragers, such as the Bushmen, it is reasonable to assume that resources in excess of those required for maintenance will yield few or no additional benefits, and the explanation of the relative lack of territoriality among the Nharo and !Kung is based on this assumption. For other human foragers, however, this may not be so. Foragers who store food as a means of protection against years of scarcity can make use of extra resources, and territoriality may consequently confer benefits at higher levels of abundance than would otherwise be the case. Where stored resources are used to increase prestige, as was the case for the Indians of the Northwest Coast, there may be no upper threshold of resource abundance at all, since in such a case there may be no apparent upper limit to the amount of resources desired. In areas such as native California and the Northwest Coast, therefore, where such storage is important, territoriality may continue to confer benefits in even the richest environments.

In this discussion I have pointed to some aspects of human behavior that must be considered in applying the ecological theory of territoriality to human foragers. In determining the costs of territoriality, we must consider the means by which access to resources is controlled, since only then can we ascertain

whether the costs will be related to resource abundance and predictability. In determining benefits, we must consider the degree to which storage of extra resources will confer additional benefits. Finally, in determining benefits where resources are scarce and spatially unpredictable, we must consider whether the scarcity exists on a regional or only on a local level. The variation in territoriality that has been described for the different Bushman groups is consistent with the ecological theory of costs and benefits only when these factors are taken into consideration.

## CONCLUSION

The cost-benefit theory of territoriality developed by animal ecologists has great potential for explaining variation in territoriality among human foragers, but care must be taken when applying hypotheses from this theory to our own species. The theory has led to the general expectation that dense and predictable resources, being less costly to defend, will be associated with a greater degree of territoriality. This relationship has in fact been documented not only for many animal species, but also for some human foragers (see Dyson-Hudson and Smith 1978). Among the four Bushman groups compared here, however, the opposite pattern is found. I argue that this reflects the effect of human culture and cognition on the form (hence costs and benefits) of territorial defense and, consequently, on the relationships between environmental characteristics and the economic defensibility of a territory.

## Comments

by ALAN BARNARD

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Cashdan gives a convincing argument, and I am in agreement with her findings. However, some additional points on the Bushman data are worth noting.

All areas of the Kalahari have two seasons, wet and dry, but the intensity of these seasons, as indicated by differential rainfall, varies from place to place. As Cashdan's discussion shows, differential rainfall, together with the variability of surface water and water-bearing plants, permits or even determines radically differing settlement patterns among Bushman peoples. These in turn affect notions of territoriality. To expand on Cashdan's findings, in my view the principle is best seen through a consideration of logical possibilities.

Given one absolute distinction (wet season versus dry season) and one settlement variable (aggregation versus dispersal), there are four logical possibilities: (1) wet-season aggregation, dry-season dispersal; (2) wet-season dispersal, dry-season aggregation; (3) wet-season aggregation, dry-season aggregation; (4) wet-season dispersal, dry-season dispersal. Interestingly, each of these four possibilities is realized by one of the four Bushman groups Cashdan describes. The first is represented by the G/wi, the second by the !Kung, the third (in a relative sense) by the Nharo, and the fourth (similarly) by the !Ko. What is more, to some extent members of at least three of these groups (G/wi, Nharo, and !Ko) are aware of each other's seasonal cycles. It would be interesting to consider how this knowledge of other groups affects their perceptions of territoriality and the territorial boundaries they maintain. This is one area in which more fieldwork is needed.

To add to the complexity, the Nharo today share much of

their land with Afrikaner cattle ranchers. The Nharo word for "ethnic group" is the same as that for "animal species" (*≠au*—, feminine), and in some southern areas of the ranches the Afrikaners seem to be perceived as separate "species" in the English sense of that word. Specifically, the Nharo there consider the ranchers and their fenced boundaries irrelevant to the "species"-specific, traditional Bushman boundaries which divide Nharo bands and band clusters from each other and from those of other Bushman groups.

The argument for complexity in this issue could be taken still farther if we were to look at hunter-gatherer populations in other parts of the world. Mesolithic foragers in Britain, for example, had one seasonal distinction (summer/winter) and at least two possible variables (aggregation/dispersal and upland/lowland). This set of variables would generate sixteen rather than four logical possibilities of seasonal settlement. Only one of these (winter lowland aggregation, summer upland dispersal) occurs in the traditional "cost-benefit" interpretation of the archaeological record, in spite of recent evidence for some of the others (see, e.g., Bonsall 1980:468–69). In comparison, the Bushman model is relatively simple. Of course, there is no way of finding out about Mesolithic British notions of territoriality, but this sixteen-possibility model illustrates the direction in which one might have to go in order to analyze human forager territoriality in general. Conversely, the complications yielded by the Bushman data may help to extricate some schools of archaeology, as well as perhaps ecology, from strict adherence to cost-benefit theory.

Regarding a related ethnographic point Cashdan raises, I would agree that it is very difficult to assess the relative territoriality of the !Kung and Nharo, but as I see it this entails two problems which are not explicitly dealt with in her paper: (1) "territoriality" is not a clear-cut, monothetic concept, and (2) the precontact Nharo settlement pattern is by no means as easily ascertained as the !Kung one.

On the first problem, the meaning of the word "territorial" depends on its context. If a single criterion were to be isolated as particularly relevant for Bushman territoriality, I would say it is the degree of nucleation (cf. Yellen and Harpending 1972). This is a factor which can easily be compared among Bushman groups, e.g., by recording the migration of individuals from camp to camp. A second criterion would include ideological factors, such as concepts of land or resource ownership. A third would be the means of physical boundary maintenance, e.g., by defense of territory or by avoiding contact with other groups. Probably many other criteria could be listed.

On the second problem, the Nharo settlement pattern has undergone considerable, if slow, change since the arrival of the ranchers in 1898. As Cashdan says, the seasonal cycle before that time was probably similar to the !Kung pattern described, but the tendency in recent years has been towards more permanent aggregation. Partly because of the influence of Herero and Tswana pastoralists, this tendency has also been occurring among the !Kung (Lee 1979:361–64). The difference, though, is that the changes in !Kung settlement have occurred virtually in the presence of their ethnographers, whereas changes in Nharo settlement must be inferred from oral history, travelers' tales, and early ethnography (see Barnard 1980).

Finally, a few bibliographical points may be of interest. Steyn (1971*a, b*, 1980, 1981) has done fieldwork on western Nharo subsistence ecology, economics, and social structure; I was unaware of his study, carried out in 1967–69 and subsequent years, at the time I wrote my comparative paper on Bushman settlement patterns (Barnard 1979). In addition, Heinz (1979) has now provided a more detailed account of !Ko territoriality which bears out Cashdan's generalizations on that people, and I have recently given a fuller account of contemporary Nharo settlement patterns and notions of territoriality, showing particularly how these have been affected by

adaptation to life on the cattle ranches (Barnard 1980). Guenther (1981) has also contributed to the territoriality debate and, in particular, provides a useful review of the Bushmanist literature on the subject.

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Cashdan addresses the question of food gatherers' territoriality very ably. The analytical implications of her research, backed up with straightforward ethnographic comparisons, shed new light on the issue and carry wider significance for anthropological interpretation as a whole.

Cashdan's concern with model construction and the utilization of nonhuman animal behavior analysis in anthropological interpretation deserves some reinforcement. The utility of models rests on the clear understanding that they are not phenomena, but theoretical constructs that should aim to explain and predict the structural and functional nature of related phenomena. Similarly, the use of animal behavior analysis is a heuristic device. It must, however, clearly take into account the fact that human behavior is preponderantly learned rather than instinctive. As Cashdan suggests, behavior in human collectives is generational and adjustive. This significantly affects the population-space-resources relationship; that is, unlike other animals, human foraging populations rely primarily on social strategies for transgenerational stability in relation to space and resources.

I would also propose that predictability is not simply "another important environmental variable," as Cashdan writes, but a primary factor that must be related to the total adaptive strategy. The more appropriate analytical question would be how a culture achieves total operational predictability, followed by how territoriality fits into the wider scheme and, finally, how defense fits into the population-space-resources triad. Given this premise, Cashdan's interpretation is not carried to its ultimate conclusion. Predictable access to resources is the ultimate goal of the group, and unless territoriality and its defense are related to it rather than vice versa we will continue to have conflicting interpretations of the same data.

The term "nexus" deserves elaboration. Cashdan uses it to refer to a network of social relationships, while elsewhere (e.g., Silberbauer 1981), it has been used with reference to resources. I consider it a potentially useful concept in an overall sense, that is, as an essential combination of both social and environmental elements within the total strategy of the group, as well as in the specific ways it has been applied.

The thrust of the article is that varying concentrations of resources will affect the population-space ratio and, consequently, competition for and defense of territory. Territoriality can be viewed as a dependent variable of permissive (abundant/concentrated resources) and restrictive (scarce/dispersed resources) environments (Bicchieri 1969) and the correlated social nexus devised to deal with them. Concentrated resources entail a simple resource nexus easily accessible to intruders and therefore make exclusionary defense efficient, while dispersed resources entail cognition of a complex resource nexus and maximize the efficiency of "reciprocal altruism." It is, thus, the type of resource nexus, rather than the territory itself, with respect to which defense efficiency is developed.

Cashdan's lead in developing a more basic functional language must be pursued in order for ethnographic comparisons to produce valid human generalizations. The overall predictability of a given strategy as it relates to a specific ecosystem must be considered when comparing space use in specific population-resource relationships. The different environmental and social nexuses associated with different ecosystems will make different defense modes efficient.

It is a truism that there is a correspondence between the distribution of resources and the distribution of all living things. However, insofar as humans manage resources through the application of cultural rules or norms, human forms of territoriality can be distinguished from those of other animals. On the basis of this premise, Cashdan distinguishes two forms of forager territoriality—perimeter defense and social boundary defense—and shows how four groups of Bushmen illustrate variations in the latter form. It is said that the costs of territoriality among the four groups are about equal, but the benefits decrease as “resources become increasingly dense and predictable.” Thus, at some point on this hypothetical continuum between a situation characterized by relative abundance and predictability and one where ranges are sufficiently small to permit perimeter defense, there should be no territoriality. I doubt that this possibility is intended, since it is implied (and I agree) that all foragers practice some form of resource management. It does, however, reflect an inconsistency in the model which, I maintain, is due in part to the inadequacy of the data base. As Cashdan admits, the evidence “will not permit a really reliable test of the ecological arguments.” Indeed, she uses too few cultural data, no historical data that might help to explain the development of the different territorial forms, and no demographic data. Further, when she uses the term “resources” it is evident that she means subsistence resources. She doesn’t seem to consider the possibility that forms of territoriality can be based upon nonfood resources and that the distribution of these can alter the spatial distribution of human groups in ways that can lessen subsistence efficiency and/or risks. For example, the quest for trade goods by Subarctic Indians often took precedence over more practical subsistence habits.

Nor does she consider the historical provenience of Bushman territorial variations. Recent forms may be accommodations to conditions generated by pastoralism, which has been practiced in the Kalahari for centuries (Schrire 1980:25–28). Perhaps the wild game biomass was greater prior to competition with domestic animals for pasture and/or overhunting. Silberbauer (1981:289) also mentions a series of epidemics that periodically reduced both human and animal populations from the mid-19th century on. The !Ko data in particular suggest interference. The system described by Heinz operates “in a context of boundaries, roads, boreholes, and farms” (Schrire 1980:14). The !Ko speak a language related to “two remnant languages spoken by a few survivors in the Republic of South Africa” and to the “formerly widespread Cape Bushmen languages (Traill 1973)” (Lee 1976:7). This evidence implies that the !Ko themselves are composed of a number of remnant groups—band clusters or nexuses—which are trying to eke out a living in the context of modern civilization. Indeed, the nuclear family level of territorial organization has a parallel in the postcontact Northern Algonkian family trapping territory system (Bishop 1970, 1978). And, contrary to Cashdan, !Ko band nexuses do appear to protect territorial perimeters through mutual avoidance of a “no man’s land” (Barnard 1979:138). Thus, while clearly there is a relationship between resource densities and territoriality among the !Ko and other Bushman groups, we can’t be certain that it doesn’t reflect adaptations to nonforaging activities until more historical work is done.

Do foragers control access to resources by controlling access to the social group through such rituals as greeting ceremonies? Maybe, but it is necessary to specify what resources are being defended. Peterson, from whom Cashdan gets the idea, argues that in Australia clan totemism “is the main territorial spacing mechanism” (1972:28) and that such landowning ideologies

“code the distribution of resource nexuses” (1979:121). However, these ideologies pertain not to subsistence resources, but to localized cultural symbols, clan designs, and other such emblems (Peterson 1972:28–29). I suggest that these symbols, along with women, are localized in space to permit the senior males to control access to them. As Peterson (1972:28) says: “The only wealth that can be accumulated is ritual knowledge and wives.” Aggressive behavior is associated with defense of these, not subsistence resources, although the localization of sacred sites and the stated preference of individuals to live near these can have ecological consequences. Thus, while greeting ceremonies may define social boundaries, it is doubtful whether the defense of these is intended to be a means of restricting access to food resources, especially since persons often forage beyond clan estate boundaries. The argument requires a high degree of isomorphism between the social group and the territory exploited, one not supported by the data.

Intergroup cooperation involving information exchange and mutual decisions concerning where foraging may occur are, as Cashdan states, simply an attempt to avoid competition, that is, a form of subsistence management. Given seasonal, annual, and regional flexibility in group size among foragers and interlocking kin ties, one may ask: Who would be excluded? Perhaps persons suspected of witchcraft or foul play—but here the reasons for exclusion may have little to do with the gastric needs of the group. Because band societies value leisure, social mechanisms which reduce subsistence efforts and/or risks, such as population regulation, arise before subsistence resource defense becomes necessary. Territorial restrictions on subsistence resources, however, may develop among groups whose habitat has been desecrated, as perhaps was the case among the !Ko. Perimeter defense, I suggest, is a product of resource depletion, geographical circumscription, exchange-dependency relationships, or some combination of these conditions, or it develops when social ranking and trade stimulate population growth to increase the production of exchange goods and foods for feasts. In the latter case, perimeter defense of non-subsistence resources is extended to include certain foods, as on the Northwest Coast. Indeed, the distinction between resource management and perimeter defense is nicely illustrated among the early 19th-century Carrier Indians (Bishop n.d.). Rights to beaver tracts involving perimeter defense were possessed by nobles and transmitted matrilineally. Beaver flesh, however, was not a basic food and was consumed only at occasional feasts hosted by the village nobles. Pelts were traded for luxury items either from Northwest Coast Indian trading partners or from European trading posts. Salmon, the basic food, were caught at strategically located sites, usually near a village. If salmon failed at one location, the villagers simply moved temporarily to another where they had kin ties. Occasionally, intervillage hostility prevented access to a particular site, but this hostility was generated by gambling activities or by competition for women, not by competition for food. The question, then, is whether resource management involving intercommunity cooperation is a form of territoriality in the absence of certain rules of exclusivity. I argue that where foraging populations are adjusted so as to maximize efficiency and/or reduce risks, and where overproduction for ceremonial or exchange purposes is not regular or frequent, the ideal of nonterritoriality suggested in Cashdan’s model can be, and indeed once was, a social reality. I further argue that perimeter defense never existed among pristine egalitarian foragers.

While foragers managed their subsistence resources, kin networks and reciprocity prevented territorial exclusivity. Even where groups of radically different origin, such as the Inuit and the Subarctic Indians, shared a frontier, it wasn’t compe-

tion for food, but rather the fear of witchcraft that defined the boundary. Thus, while the distribution of foraging groups in space is unquestionably related to the distribution of food resources, the benefits of territoriality needn't increase as resources become less dense and less predictable given certain demographic and cultural conditions. There is no evidence to suggest that the Australians of the desert zones are any more territorial than those of the grasslands and forests.

There is a growing myth, one founded on the high quality of field research produced by the Harvard Kalahari Research Group, that a detailed knowledge of the Bushmen will answer most of our questions about hunter-gatherers. However, until these studies acquire historical depth, data pertaining to other areas, particularly North America and Australia, will, in some cases, be more relevant.

by VALDA BLUNDELL

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Cashdan's stimulating and insightful article makes it clear that models of animal territoriality cannot be uncritically applied to human foragers. The idea from animal ecology that territoriality will be found where its benefits exceed its (defense) costs leads, according to Cashdan, to the "general expectation that dense and predictable resources, being less costly to defend, will be associated with a greater degree of territoriality." As Cashdan demonstrates, Bushman groups reverse this relationship because, as culture bearers, they practice social boundary defense rather than the perimeter defense of certain human and nonhuman species. They are able to maintain large territories in an environment of relatively scarce resources because the costs of social boundary defense (in contrast to perimeter defense) do not dramatically increase with territory size. Thus we should not be misled to think that Bushmen are not territorial simply because they do not "look" territorial in the context of animal ecological theories.

I agree with Cashdan that we must fully take account of the cultural and cognitive aspects of human territorial behaviour. On the basis of my own fieldwork, I have described Northwest Australian territoriality as a set of ideas held in the minds of these foragers and have proceeded analytically to consider the ways such cognitive models are expressed on the ground, given the nature of environmental, demographic, and other kinds of variability (Blundell 1980, 1982; Blundell and Layton 1978).

Foragers with contrasting forms of territoriality will experience different ecological relationships. Cashdan argues that "because territoriality among [perimeter-defending] groups is not unlike that found in other species, the ecological arguments developed for these other species should also be applicable." However, the fact that such groups "look" territorial should not mislead us. Ecological relations similar to those among non-human species may well obtain, but we should not conclude that they exist because perimeter defense in humans is somehow less cultural than social boundary defense. The recognition by the perimeter-defending Vedda of symbolic territory markers on trees or their interrogation or even shooting of trespassers is no less cultural than the recognition by Australian social boundary defenders that kin links must be asserted in order to gain entry into another group's territory. In both cases we are dealing with cultural systems expressed behaviourally. All foragers, to use Cashdan's phrase, "play the game," and the "game" is a cultural one.

When Cashdan states that social boundary defending foragers "look" nonterritorial to animal ecologists because among such foragers "social units do not clearly correspond to territorial units, particularly over the short term," she seems to mean by "social unit" some observed residential unit. However, observations of residence, like those of the cutting of pictures into tree trunks, relate to behaviours which only in-

completely reflect the cognitively held territorial structure. My own view is that, like units of land in a territorial model, land-using groups such as Australian bands are cultural constructs held in the minds of the foragers. As such, they are only imperfectly expressed on the ground in observable residential behaviour (Blundell 1980; cf. Peterson 1979 for the Bushmen and Tanner 1973 for the Cree).

Cashdan's analysis leads us to ask why foragers culturally construct differing models of territoriality (and, it would seem, a limited number of models). It suggests that when foragers whose resources are sparse and unpredictable have cultural models that link groups to land and encourage reciprocal exchange networks, social boundary defense will be viable. In contrast, when foragers richer in resources have more encapsulating territorial models, perimeter defense will be viable.

Finally, it may be worth looking further at the "costs" of territorial defense among various foragers. Cashdan's argument that territory size will not greatly affect social boundary defense costs is well made. Again, my own work among Northwest Australian social boundary defenders suggests that their costs include the expenditure of ritual energy and symbolic labour (Blundell 1982). This energy is expended not just to maintain the cultural (including territorial) system, but also to deal with breakdowns in the system (resulting from such events as local group extinctions). One avenue of future research might be further consideration of the ways that foragers with different kinds of territorial systems maintain and transmit them.

by JEFFREY EHRENREICH

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It is noteworthy and commendable that Cashdan's work has emphasized the significance of resource scarcity (including variation and fluctuation) in interpreting the vast literature on the San peoples of the Kalahari. This paper makes an important contribution to the body of theory which treats scarcity directly or implicitly as a critical factor in analyzing human adaptation and cultural ecology (e.g., Boserup 1965; Carneiro 1970, 1974; Harner 1970, 1975; Harris 1974, 1977; Piddocke 1965). Specifically, Cashdan correlates the application of sociocultural mechanisms used to control access to resources with the degree of availability of important resources and concludes that greater use of such controls will be made in areas where resources are least. The analysis moves beyond the recent work of Dyson-Hudson and Smith (1978), which promotes the idea, derived from cost-benefit ecological theory, that humans will defend economic resources when they are "sufficiently abundant and predictable in space and time." The strength of Cashdan's approach is its direct acknowledgment of the uniqueness of culture in human ecological adaptation. She suggests that, "like many human foragers, the Bushmen control access to territorial resources in ways not found in other animals" and "that these differences in the means of territorial defense may alter the expected relationships between environmental variables and territorial costs and benefits." I wholly concur with this view.

I believe that Cashdan's paper significantly increases our understanding of the sociocultural methods employed by human societies as they adapt to their environments. I have only one misgiving about the work. It seems regrettable that the analysis is framed in reference to the issue of "territoriality." No matter how carefully or broadly this concept is defined, it conjures up a biological imperative. It serves no useful theoretical purpose that I can perceive to lump together under the heading "territoriality" what might be more accurately distinguished as "control of," "use of," "defense of," and "access to" a given territory, particularly when the distinctions between biology and culture are at risk of being badly muddled. The sociocultural mechanisms used by San and other peoples to con-

trol access to scarce resources are unique in the animal world, as Cashdan herself points out. On this basis, I believe Cashdan's data argue best for an understanding of human adaptation outside the realm of animal models of territoriality. Like the idea of the "naked ape," territoriality is a concept "we could live without" (Pilbeam 1982).

In support of Cashdan's general position, I have collected data recently on the Coaiquer Indians of Ecuador which extend her analysis beyond the range of foragers. The Coaiquer are horticulturalists, heavily dependent on plantains produced by a slash-and-mulch technique in a region continuously too wet for burning. Coaiquer social structure, however, is remarkably close to what is regularly found among hunter-gatherers (Harris 1980, Murphy 1979), with some striking similarities to that of the San peoples (Lee 1972*b*, 1979). Like the !Kung San, the Coaiquer are extremely egalitarian (cf. Roberts and Brintnall 1982: 37-68), living in a highly dispersed settlement pattern of extended-family households, each an independent socioeconomic unit. Sibling groups of brothers and sisters and their spouses are the principal building blocks of these extended families. The Coaiquer practice a period of trial marriage in which residence is bilocal, alternating between the households of their primary kin groups. There is a preference for marrying close kin, particularly parallel and cross-cousins, and a strong tendency toward sibling exchanges (distinguished from brother-sister exchanges) between Coaiquer households. Descent is reckoned bilaterally, with emphasis on the personal kindred (cf. Harner 1972: 97-98). There are no established lineages based on generational descent. Social structure is characterized by a high degree of flexibility.

The population I worked with had migrated to Ecuador three generations ago, principally to secure greater access to land, which had become increasingly scarce in Colombia. Under conditions of land scarcity caused by a growing population and encroachment by an expanding pioneer frontier, the Coaiquer in Colombia strongly emphasized marriages between very close kin, especially parallel-cousin marriages (see Osborn 1968). Such marriage alliances served to facilitate land rights of marriage partners by strengthening their claims to inheritance. The result was effectively to limit and control access to scarce land and to keep it from falling into the hands of those not closely related to the sibling group. In contrast, the Coaiquer I studied in Ecuador had been, for two to three generations, in a relatively open land situation. The tendency for marriage between close kin had fallen off dramatically. While the ideal of marriage between close kin persisted, the degree of pressure to achieve such unions had diminished.

In the last ten years, the Ecuadorian situation has shifted to accelerated pressure on the land from outsiders and a population upswing. The data indicate that, once again, there is an increased pressure for, and an actual rise in, marriages between close kin. What this suggests, then, is that the social structure of marriage, residence patterns, and kinship serve to regulate and control access to land. In times of scarcity, the mechanisms are rigorously applied; when land is available, they are relaxed. The flexibility of such a system has clear-cut adaptive benefits and supports Cashdan's basic ecological premises.

by MATHIAS GUENTHER

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Cashdan's article is a valuable contribution to the ecological study of hunter-gatherers in general and of Bushman (or San) hunter-gatherers specifically. The predominant hunter-gatherer researchers have been anthropologists, virtually all of whom have had occasion to play with the notion of territoriality because of the strong ecological orientation that is built into hunting-gathering research. The concept derives from ethology,

a subfield of zoology of which the majority of anthropologists have inadequate knowledge. As a result, their formulations on territoriality and their analytic application of this concept to hunting-gathering groups have the tendency to be somewhat simplistic, loose, or uninformed. For example, Heinz, in his important article on !Ko territoriality, only once presents a definition of the concept: "intolerance confined to space" (Heinz 1972:406). While catchy and beguiling, this overly general and enigmatic definition is neither explained nor elaborated in any way. Cashdan evidently has an excellent grasp of the zoological literature on the concept (focusing on the cost-benefit models current in ethology and sociobiology), and she brings this expertise to bear on her thorough examination of territoriality in the context of human hunting-gathering societies.

Regarding Bushman ecological studies, the general contribution of this paper is that it clarifies the debate on Bushman territoriality which has recently been reopened, especially in European anthropology. By attributing strong territoriality to all Bushman groups, Eibl-Eibesfeldt and Heinz (both working amongst the !Ko) have strongly polarized the debate, which, hitherto, had presented the Bushmen on the whole as rather nonterritorial (Eibl-Eibesfeldt 1974*b*, 1975, 1978; Heinz 1972, 1975; Schmidbauer 1973; Guenther 1981). Painstakingly identifying the ecological (and resultant cultural) differences between four Botswana Bushman groups—all of them culturally closely similar and relatively close geographically—Cashdan shows that territorial patterns vary quite widely among them. Her paper exposes the hastiness and inaccuracy of generalizing from one Bushman group to all Bushmen, since it shows how even slight ecological variations, experienced by the "same" ethnic entity of hunter-gatherers, may significantly alter their economic and social patterns of behaviour.

I have one slight reservation concerning the ethnographic section of the article. The material presented on the Bushmen leans rather heavily on Barnard's (1979) paper, which examines the modes of territoriality of the same four Bushman groups that Cashdan selects for her analysis (albeit with a totally different theoretical stance; indeed, Barnard's paper is primarily descriptive and low-key in its theoretical examination of the ethnographic material). I think it would have been more meaningful, and an enrichment of the Bushman ethnography, had the author presented the data on territoriality she has gathered herself amongst the //Gana. Perhaps these might have replaced the Nharo data, which are in fact very scant. Virtually all of the Ghanzi Nharo have been sedentary farm labourers and marginal food-producers for some five or six generations. Their patterns of territoriality have not been and cannot be observed with nearly the degree of thoroughness and empirical directness as has been the case with the other three groups, all extant hunter-gatherers whose ecological and social organization has been studied firsthand. The //Gana, too, are such a group, and the presentation of original field data on the topic of spatial organization would, in my opinion, have been more valuable than data that are primarily "memory culture" reconstructions (notwithstanding the contribution of these latter data to the theoretical argument).

by ANNETTE HAMILTON

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Cashdan's paper joins the ranks of those whose paradigm evolved in the heady days of the sixties; two decades later, the debates about hunter-gatherer territoriality continue to inspire a remarkable number of scholars. If one accepts the contemporary necessity for such endeavours, then this is a worthy

addition to the field: neatly organised, precise, original enough, and a useful corrective to mechanistic "cost-benefit" analyses derived from animal studies.

However, it is difficult to feel enthusiastic about these questions today, especially from the perspective of Australia, where the intricacies of human-land relations are emerging in land-claim courts through Aboriginal testimony under cross-examination, in the process demanding some dramatic reconsiderations of all sorts of received anthropological wisdoms. It cannot be denied that the basic premise of evolutionary ecology is that foragers are more like animals than anyone else; otherwise, why are animal models of territoriality so relentlessly applied to them? Yet the application of cost-benefit analyses suggests that the fundamental determinants of forager life—where and with whom one lives—derive from the same parameters used in modern businesses. No doubt the Aboriginal people currently briefing their legal advisers would be amazed and perhaps alarmed to think that their law came down to such an extraordinary conjunction. Cashdan's paper, however, takes it all for granted.

Even accepting the paradigm, however, there remain some troubling questions. Cost-benefit theory must have behind it the notion that certain "strategies" are more advantageous than others. But one must enquire: advantageous to whom? To "the group"? To each separate group, operating on homeostatic principles? To certain families, or even individuals? To the gene pool as a whole? If foragers all lived in enclosed self-sustaining groups or fixed territories, the answer would be obvious. But how many do?

Cashman's demonstration that access to the social group is the prime determinant of territorial access in "Bushman" groups could be extended to Aboriginal groups without difficulty. It would be much harder to find any Aboriginal examples of perimeter defense. Even where "territories" are small and clearly recognised and resources abundant, it is always the social group which determines access to resources—provided, as Myers (1982) has demonstrated, one "always asks." Access to ritual resources is, however, much more clearly controlled and considered much more important. While this too has definite consequences for the people using the land, it hardly fits any of the animal models—and, indeed, why should it?

In the last analysis, to specify the determinants and mechanisms of human territoriality one must have access to the *ideas* people have about rights. The Australian evidence is changing because of the testimony of Aborigines themselves; one wonders how our concepts of territoriality would alter if "Bushmen" and others were able to present their views in a similarly rigorous enquiry.

by HENRY C. HARPENDING

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Anthropologists agree that humans are unique among animals. Unfortunately, many who are attempting to link anthropology with other biological sciences do not confront this uniqueness in any creative way. Both sociobiologists and cultural ecologists too often appropriate models created to explain birds, trees, or fish and use them to generate silly hypotheses to "test." The important strength of Cashdan's work is her incorporation of human cognitive abilities and memory into a new theory of territoriality.

The human pattern seems to me to be derived from our peculiar (among mammals) social organization of groups of pair bonds. Some peoples have weak or transient groups, some have weak and transient pairing, but all peoples have some of each. Everyone, then, has a father and a mother, thus two whole sets of kin. When this is combined with incest avoidance and with a highly developed memory for conspecifics, the result is spatially dispersed social links not clearly present in other

mammals. Birdsell (1968) demonstrated a modal size of about 500 for regional social sets in hunter-gatherers. In my own fieldwork I could detect no discrete linguistic clusters in !Kung Bushmen, but the mean marriage distance incorporated 500 to 600 people, just as Birdsell found in Australia. Cashdan shows how this larger reticulum of social ties can lead to qualitatively new and different spatial organization not anticipated by current models in ecology.

I would criticize Cashdan for posing her problem in terms of what groups do rather than in terms of what individuals do. This focus leads to unnecessary semantic and substantive confusion, as for example in describing "fluid groups" among !Kung and other such peoples. The relevant phenomena, as she points out in the corpus of her theoretical argument, are the manipulation of kinship and reciprocal links by the individual participants. These interactions generate the regularities of spatial organization and territoriality. Finer understanding of regional organization will proceed from respect for the underlying local dynamics.

by NANCY HOWELL

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Cashdan makes two contributions to my understanding of the ways that population density is regulated and maintained in hunter-gatherer societies.

The first contribution is in the area of data use. One is used to seeing the !Kung data used as the end point of a continuum of societies from "least to most" on some criterion; Cashdan breaks this stereotyped use of the !Kung by comparing them with three closely related groups. Her use of the term "Bushmen" for these groups is odd and irritating. I thought that scholars had agreed to substitute "San" for that derogatory term. It also seems odd that she does not draw upon her own direct observations of the //Ganakwe to extend the analysis to one more group. In general, however, her use of the available data on population, resources, density, and social organization strikes me as original and useful. By comparing the oft-cited !Kung with groups closely matched on environment, economic organization, and culture, Cashdan uses the !Kung as a data point, not a metaphor—a practice much to be encouraged. In this comparison, she produces some unexpected observations and nonobvious perspectives, in which the !Kung look rich, not poor, and, like the members of an exclusive club, motivated to find ways to exclude others.

The second contribution is the theoretical or conceptual point on the functional equivalence of territorial defense and group membership defense. Borrowing from Peterson, she develops the idea that there are two variables to be manipulated when the ratio of land (representing resources) to people is a concern. Perimeter defense of a territory is a mechanism that will work when the only means of entering a defined population is by birth, the only way of leaving by death. But when changes in the definition of group membership are possible—marriage, adoption, immigration, and visiting are examples—it is not relevant to defend the borders. That seems to me to be a real insight into the ways in which human population density manipulation is more complicated than that of animals. Combined with the description of the four San groups and their resources, it is a valuable contribution to our understanding of how these groups are different and how their differences develop and are maintained.

It is clear from Cashdan's article that what at first glance seems to be a simple matter of applying models of animal territoriality to humans is not so simple. The number of variables that enter into the description of differences between groups is large, and an additional long list of variables has been implicitly "controlled for" by comparing carefully matched groups. Cashdan's work shows that we cannot be confident of



finding the needed data in the literature to test models on even relatively well-known societies. A satisfying specification of the process of density maintenance seems still far away.

by ERIC ALDEN SMITH

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Cashdan's paper makes some useful contributions to a very worthwhile goal—adapting ecological cost-benefit models to the explanation of the diversity of human systems of spatial organization. I certainly agree that the models and theories of spatial organization currently available in evolutionary ecology (e.g., Davies 1978, Brown and Orians 1970), although instructive, are insufficient to this task and that certain unique qualities of human societies resulting from symbolic communication and cultural transmission must affect the expected patterns of human spatial organization. My main reservations about this paper concern two matters: the advisability of treating social boundary defense as a form of territoriality and the absence of formal models and explicit hypotheses that could be tested with quantitative data in a precise way.

As Cashdan notes, "territoriality" has been defined in a multitude of ways. She favors a fairly broad definition emphasizing control over resource allocation by the resident group. In contrast, I would restrict the term to systems characterized by the *exclusive use of a spatially fixed and clearly bounded area by some means of defense or communication* (cf. Dyson-Hudson and Smith 1978:23). Hence, Cashdan sees the systems of reciprocal access of Bushmen and others as a form of territoriality, distinct from but functionally equivalent to systems of perimeter defense, while by my restrictive definition only the latter is territoriality.

As in any semantic dispute within science, the central issue should be which definitional scheme is most productive in guiding the development of theory that explains empirical patterns. For both Cashdan and myself, the relevant functional issue is the adaptive significance of alternative ways of mapping people onto resources, so we should in principle be able to agree on the most appropriate way to define territoriality. In essence, we should want to classify systems of spatial organization with the same adaptive function(s) under this label, distinguishing them from systems with different adaptive functions. Is social boundary defense with reciprocal access *functionally equivalent* to perimeter defense? Peterson (1975) has argued that it is in that both function to regulate population density. This argument, however, is based on a notion of group selection developed by Carr-Saunders (1922) and Wynne-Edwards (1962) which is inconsistent with the generally accepted tenets of evolutionary theory (Williams 1966, Smith 1976; cf. Wade 1978). Cashdan does not repeat Peterson's line of argument, instead pointing to the effect of both perimeter defense and reciprocal access in limiting access to resources. By this broad criterion, however, we would have to include any institutions or ceremonies that restricted resource utilization under the rubric of territoriality. Effects should not be equated with adaptive function.

If we look at the costs and benefits of these two systems of spatial organization at the *individual* level, we notice a marked asymmetry: the benefits of reciprocal access systems are distributed among both residents and outsiders (as Cashdan herself points out), while in perimeter defense systems only the residents benefit. Two sorts of reciprocity appear to be involved in the social boundary systems: information exchange and reciprocal access itself. First, visitors are given information on the location of resources and told where to forage (thus helping residents keep track of which areas are being depleted through foraging, so that their own foraging effort can be efficiently allocated, in a manner similar to that modeled by Cody [1971; see Smith 1981:44]). Second, a system of reciprocal access to different areas is established such that over time people can

count on neighboring groups to grant them access to (and information on) resource areas in response to asynchronous local fluctuations in resource density. But all of this is very different from perimeter defense (what I would call "true territoriality"), in which the residents are interested in *exclusive* use, not efficient mapping of people onto resources via a system of reciprocal access. The first system is one of reciprocity, suitable for situations of fluctuating and unpredictable resources; the latter system is nonreciprocal, exclusionary, and adapted to cases in which the resource base is dependable (Dyson-Hudson and Smith 1978). Hence, the two systems are not functional equivalents, and we gain little by considering them so. However, they are both systems of spatial organization and resource management and in that sense are worthy of comparison.

The primary goal of both ecologists and anthropologists concerned with explanation is to account for the existence of very diverse systems by means of general, rigorous, and parsimonious theories. Contemporary evolutionary ecology (Pianka 1978, Krebs and Davies 1978, May 1981, Stearns 1982) has advanced theory development rapidly by building formal models, deducing precise hypotheses from these, and testing these predictions with quantitative data, revising or rejecting the models when results warrant it. In contrast, ecological anthropologists, when venturing beyond empirical generalizations, tend to rely on rather loosely framed "plausibility arguments." Cashdan's effort is better than most in this regard but still suffers from an absence of formal models and explicit hypotheses. It would be difficult or impossible to falsify the "economic defensibility model" as modified by Cashdan. The currency with which costs and benefits are to be assessed is not explicitly defined. Territoriality is expected when resources are dense and predictable (perimeter defense), when they are dense but unpredictable (surpluses are stored), and when they are scarce and unpredictable (social boundary defense)—whether the unpredictability is regional (!Ko) or localized (!Kung). Not only that, but Cashdan agrees that some human foragers (many Great Basin Shoshone, for example) are *non-territorial*, as discussed by Dyson-Hudson and Smith (1978). If increased resource abundance and predictability lead to perimeter defense territoriality, while decreased abundance and predictability lead to social boundary defense territoriality, when do we predict the situation described by Stewart (1938) for Great Basin Shoshone, one of fluid group composition and absence of land tenure? Cashdan's arguments are simply too vague to allow unambiguous predictions about human spatial organization, let alone their testing. We all need to strive to improve the quality of theory building and theory testing in anthropology. While it would be foolish to ape the explanatory efforts of evolutionary ecology, I believe ecological anthropologists have much to learn from this source, in terms of both method and substance.

by HIDEAKI TERASHIMA

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Cashdan explains well some characteristics of territoriality among the Bushmen by developing the idea of social boundary defense. For example, by considering only the costs and benefits of social boundary defense, we can understand why the !Ko, inhabiting an area of very scarce and unpredictable resources, are able to maintain strong territoriality. In her argument on the relevance of cost-benefit theory to the explanation of the variation in territoriality among the Bushmen, however, there are some important problems on the level of the data. I would like to point out two of them:

First, Cashdan, along with Barnard (1979), referring only to Silberbauer, concludes that the G/wi are less territorial than

the !Ko but more so than the !Kung. This conclusion is not at all secure because Tanaka, the other G/wi ethnographer, gives a very different description of G/wi territoriality. While Silberbauer (1981:138) says that a G/wi band is a community occupying a defined territory and controlling the exploitation of the resources of that territory, Tanaka (1980:94) says that Central Kalahari San (i.e., the G/wi and the //Gana) residential groups have neither territory nor fixed membership. He also writes that they may camp wherever there is food within their broad range, selecting their sites in the light of the locations of other groups (Tanaka 1980:121). Thus we find two rather different territorial strategies among the G/wi, the one described by Silberbauer being rather close to the strategy of the !Ko and the one described by Tanaka being very close to that of the !Kung. To what can this difference be attributed? Before advancing an ecological argument, we need to consider this problem.

Second, making the distinction between scarcity on the local and scarcity on the regional level, Cashdan explains why the !Ko should respond to the scarcity of their environment by limiting social ties with outsiders. I think her discussion at this point is premature; we do not have sufficient evidence that the !Ko are subject to regional scarcity and the others only to local scarcity. So far as the rainfall data are concerned, the environmental conditions of Lone Tree appear very close to those of ≠Kade.

by POLLY WIESSNER

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Cashdan's extension of animal models to make them applicable to human foragers is a most welcome contribution to hunter-gatherer studies. It emphasizes the importance of social group boundary defense (Peterson 1975), rather than perimeter defense, and is sensitive to the fact that animal models cannot directly be applied to humans, but must be adapted to our cognitive and cultural capacities. However, before ecological models are applied to a test case such as that of the San, it would be valuable to consider the influence of past and present relations with surrounding pastoralists. Most San groups today live side by side with pastoralists or ranchers who have a profound influence on their lives and patterns of land use (Guenther 1979, Lee 1979, Schrire 1980). Relations with pastoralists vary radically, as does the availability of domesticated resources which have been introduced to the San. For example, the !Kung live in friendly symbiosis with neighboring Tswana and Herero (Lee 1979); the Nharo are, for the most part, permanently settled on ranches in the Ghanzi area (Guenther 1979), where they gather and are employed but no longer engage in regular hunting; and the !Xo live near, and at certain times of the year with, the Kalagadi, with whom relations are often strained. In view of these differences, distribution of domesticated resources as well as traditional ones should be taken into consideration when discussing patterns of land use.

In addition, because the history of contact between San and other pastoralists has often been conflict-ridden, attitudes towards strangers and outsiders are not necessarily results of the internal systems of land allocation, but are more likely to be the outcome of past and present relations with other groups. The !Xo group studied by Heinz, for instance, has had unusually bad experiences with ranchers ensuing from a past incident of cattle theft (Heunemann, personal communication), while the Herero in the !Kung area, unlike many pastoralists, have tried to prevent cattle theft by befriending the !Kung and offering them regular and generous economic support in return for labour (Lee 1979). Thus the !Kung's openness and the !Xo's hostility towards strangers may be a factor of history and not one of territoriality as Cashdan defines it.

When the effects of present and past contact are removed, I

question whether one San group can be said to be more territorial than another. Certainly the organization of access to land is radically different between, say, the !Xo and the !Kung, but both have systems for opening access to some and excluding others. Among the !Xo, bands can move rather freely within the nexus territory, which contains two to six other bands, while internexus movement is more restricted. Nonetheless, interaction occurs when bands of different nexus meet for ceremonial occasions and for exchange and in extremely hard times, when members of one nexus may be permitted to use land of another (Heinz 1979). In addition, about 20–30% of all marriages take place between members of different nexus (Heinz 1979). Among the !Kung, there is no clear-cut organizational unit comparable to the nexus, but persons engage in long-term exchange partnerships (*hxaro*) (Wiessner 1977, 1981), which permit the utilization of the land of partners who may live up to 200 km away. This gives the average !Kung access to the land of two to four other bands in the immediate area, as well as to that of two or three bands in more distant areas (Wiessner 1981), creating an interaction sphere similar in size to that of the !Xo but differently organized in space. For 80 out of 86 visits, lasting between one week and ten months, recorded for 20 !Kung over two years, only six were made to a band in which the person did not have appropriate exchange ties. Four of these six visits occurred in the context of wage labour (Wiessner 1981). The !Kung would not conceive of asking permission to utilize areas in which they do not have appropriate ties any more than we would think of asking a stranger or an acquaintance for permission to use his house for a few weeks.

Thus both !Xo and !Kung have formal systems for specifying who has access to which resources. Persons not holding these rights who encroach on the land of others will be met with hostility (Heinz 1979, Marshall 1976, Wiessner 1977). Differences which occur between these systems can be largely attributed to the highly localized rich resources in the !Kung area, which make widespread ties advantageous, in contrast to the less rich, more evenly distributed resources of the !Xo area, in which local scarcity cannot be as easily absorbed by regional abundance. Given this situation, whether one San group can be said to be more territorial than another needs to be carefully reexamined with the extensive data available on the San. Certainly Cashdan's hypothesis merits such an effort.

## Reply

by ELIZABETH CASHDAN

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While most of the commentators have reacted favorably to my theoretical arguments (Bishop and Smith being the chief exceptions), there is more disagreement about the empirical Bushman data. Indeed, the commentators disagree among themselves over how to interpret this material. Because the primary contribution of this paper is theoretical rather than empirical, I will address the theoretical comments first.

Two commentators question my use of the word "territoriality." Smith argues that social boundary defense is functionally different from perimeter defense and suggests that the word "territoriality" should be limited to the latter. For this reason, he prefers his more restricted definition of territoriality to mine. Ehrenreich, while supportive of the analysis, also objects to my lumping these different strategies under the heading of territoriality and feels that students of human adaptation would do better to avoid the word altogether.

I use a definition of territoriality that encompasses both perimeter defense and social boundary defense for two reasons. First, the long history of debate about Australian and Bushman spatial organization is framed around the word territoriality.

The word is already entrenched in the literature of these social-boundary-defense societies, and I do not think that the debates will be resolved by simply calling it something else. Second, I feel that the word "territoriality" is appropriate because in important respects social boundary defense and perimeter defense are functional equivalents (they need not be functionally identical to be usefully described by the same word). The function of excluding outsiders from resources is not simply a side effect of social boundary defense, as Smith suggests. The Bushman system of land rights does permit reciprocal access, but if there were no need to *limit* that access there would be no need for a system of land rights in the first place; individuals could simply wander at will over the landscape. Cultural norms concerning land rights are necessary only because there is often a "conflict of interest"; while it may be advantageous for each individual to have access to as many places as possible, it may also be advantageous, especially under conditions of resource scarcity, to keep others out.

I believe, therefore, that there are good reasons for continuing to use the word territoriality. However, the arguments in this paper would not be affected if the word were not used, and if more confusion than clarity is generated by the term I am quite willing to do without it.

Smith argues that it would be difficult or impossible to falsify the arguments presented here; he asks, "if increased resource abundance and predictability lead to perimeter defense territoriality, while decreased abundance and predictability lead to social boundary defense territoriality, when do we predict the [nonterritorial] situation described by Steward (1938) for Great Basin Shoshone?" Perhaps a simple graph will clarify this. As figure 3 shows, territory size determines the *type* of territoriality, while competition for resources determines the *degree* of territorial exclusion. There are *two* variables being predicted here, and both are subject to refutation. For example, since the type of territoriality is a function of territory size, the model would obviously be refuted if the Bushmen, with their very large range sizes, exhibited perimeter defense. And while every population has the means to exclude outsiders, there should be little or no evidence of territorial exclusion with either type when competition for resources is minimal. This part of the model would be refuted, therefore, if the patterning in territorial exclusion exhibited by the four Bushman groups were the opposite of that described. Presumably this also explains the Great Basin case mentioned by Smith.

It should also be possible to test the bridging arguments that explain why social boundary defense works, although I have not attempted to do so in this paper. For example, do information costs concerning the location of resources increase with territory size and resource unpredictability? Is large territory size associated with longer occupancy of a territory by outsiders? These bridging arguments are important for the theory presented here, and tests of their validity should be both possible and of interest.

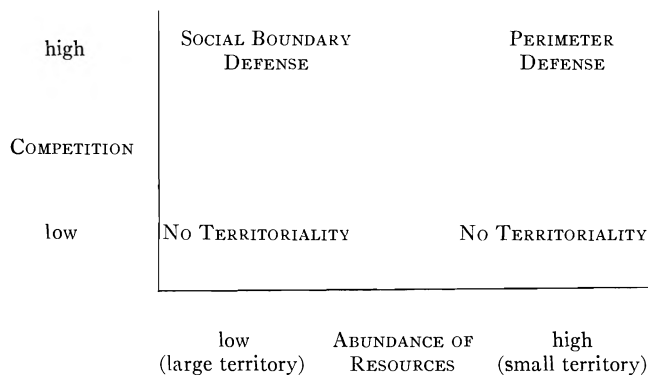


FIG. 3. Effects of competition and territory size on territoriality.

Bishop points to an alleged inconsistency in the model, saying "at some point on this hypothetical continuum between a situation characterized by relative abundance and predictability and one where ranges are sufficiently small to permit perimeter defense, there should be no territoriality." The problem here is that Bishop is collapsing territory size (which determines the type of territoriality) and competition (which determines the degree of territoriality) onto one dimension of resource abundance. While territory size is determined primarily by resource abundance (the empirical support for this relationship is well documented), competition is determined by both resource abundance and population density. Although I pointed this out in my paper and considered it where I had the data, my treatment of population density was cursory, and the discussion of competition was to that extent inadequate. Although none of the commentators mentions this problem, I consider it to be the major weakness of the paper and the probable source of Bishop's criticism. It is a weakness common to all the territoriality papers cited, and a solution is not suggested here. However, some comments may be of relevance.

How does one measure "competition" for resources? If a population favored with greater resource abundance is also denser, how do we weigh the two factors in determining the degree of competition? I noted that the !Kung work only about half as long at subsistence tasks as the G/wi (Lee 1979: chap. 9; Tanaka 1980:76-77), and I used this in conjunction with the environmental data to argue that the !Kung are under less competition for resources, their higher density notwithstanding. This isn't a bad bet, and it is the best indicator I can think of, but "work effort" data are clearly time-consuming to collect and are not readily available in the ethnographic literature. Given all this, it may be helpful to formulate and test general arguments that would help us predict the degree of competition. For example, we might expect competition to be related to the magnitude of temporal variation in resource abundance; if populations are "regulated" to environmental resources they are presumably regulated to the lean times, and consequently populations in varying environments would be below carrying capacity much of the time. We might therefore expect greater competition where resources do not fluctuate temporally. Competition should also be related to population structure (group size and aggregation), since the local density of aggregated populations could be high enough to cause competition even where regional population density is low. Greater attention to this issue by anthropologists concerned with the effects of competition and "population pressure" would be helpful.

Two commentators discuss nonsubsistence resources. Bishop's remark that I do not "seem to consider the possibility that forms of territoriality can be based upon nonfood resources" is simply untrue. The empirical analysis explicitly considered water and food as two separate resources, since their abundance in the Kalahari can vary independently. The theoretical discussion did not specify the type of resource at all, but can be applied to both food and nonfood resources. Examples of the latter that come to mind include water, obsidian and other raw materials, fishing sites, and "locational" resources such as access to trade routes. The circumstances under which it would pay to control access to such resources, and the means employed to do so, can be explained by using the same cost-benefit arguments presented for resources in general. "Ritual" resources, mentioned by Bishop and Hamilton in their discussions of aboriginal Australia, are more problematic. If these ritual resources are tied in at some level with subsistence variables, as I expect they are, the theory may still be applicable. If they are not, and this is certainly possible, then what looks like territoriality may have a very different functional significance from that considered here.

Hamilton brings up the issue of individual vs. group benefit. After pointing out that "cost-benefit theory must have behind it the notion that certain 'strategies' are more advantageous than others," she asks "but one must enquire: advantageous to whom?" The assumption underlying cost-benefit models in biology is that an "advantageous strategy" maximizes fitness at the individual level. As Smith and Harpending note, the theoretical arguments presented here are also based on the costs and benefits that accrue to individuals. I am not quite sure what Harpending means when he says that I pose my problem in terms of what groups do, unless he is referring to my comparison of territorial exclusion among the four Bushman "groups." It is often useful to compare populations on such variables (Yellen and Harpending's [1972] comparative study of nucleation in several foraging and cultivating societies is a good example) so long as one recognizes that what appears as "fluidity" or "nucleation" on the level of the group results from the manipulation of land rights and kin ties by individuals. We are not in disagreement on this issue.

I now turn to comments on the Bushman data. Guenther and Howell wonder why I did not use my own data on the //Gana in the ethnographic comparisons. It was my original intention to do so (this paper actually began as an "introduction" to another paper on //Gana territoriality), but I chose not to for reasons of space. The only way to discuss four different populations and a body of theory in a single paper is to make summary statements and cite sources in which the ethnographic material is presented in greater detail. I could not do that with the //Gana, as the territoriality data have not yet been published, and I did not have the space to present new material here.

Howell also wonders why I use the term "Bushmen," which she finds derogatory, rather than "San." I do not have strong feelings about the matter, but since "San" is a derogatory word used by Khoikhoi ("Hottentot") peoples I see no reason to prefer it. Given the choice of a derogatory English term and a derogatory Khoikhoi term, I chose the former in the interest of comprehension. There seems to be no consensus on terminology among Kalahari researchers today, although in the interest of clarity I will be most happy to conform to any that develop.

Three commentators express disagreements with my interpretation of the Bushman literature: Wiessner doubts that the !Ko are more territorial than the !Kung, Bishop seems to think that they are but argues that this is most likely a result of contact, and Terashima thinks that conclusions about G/wi territoriality are premature in view of the different interpretations given by Tanaka and Silberbauer. On the other hand, of the five "Bushman experts" who have commented on the paper only Wiessner expresses such reservations, and the discussions of Bushman territoriality in Barnard (1979) and Guenther (1981) are in accord with the views expressed here. Perhaps Hamilton's comment contains the answer to these conflicting interpretations; I was fascinated and dismayed to learn that "the intricacies of [Australian Aboriginal] human-land relations are emerging in land-claim courts through Aboriginal testimony under cross-examination." After nearly a century of ethnographic studies of aboriginal Australians, it appears that the best data have been obtained by putting informants on the stand and cross-examining them! The implications for field methodology are interesting. While I expect that both court testimony and ethnographic interviews are colored by peoples' vested interests, one must wonder with Hamilton "how our concepts of territoriality would alter if 'Bushmen' and others were able to present their views in a similarly rigorous enquiry." In lieu of this, however, we must use the ethnographic accounts at hand. I turn now to the ethnographic criticisms mentioned above.

Bishop finds my ethnographic discussion flawed because I do not consider historical variables. He says that "while clearly

there is a relationship between resource densities and territoriality among the !Ko and other Bushman groups, we can't be certain that it doesn't reflect adaptations to nonforaging activities until more historical work is done." No, we cannot be certain, but that is the way of science. As Bishop knows, hypotheses can only be *disproved*, and he does not disprove the resource-density hypothesis. It is true that my theoretical arguments do not consider historical variables; all models are simplifications of reality, and the one presented in this paper is no exception. Such simplification is necessary if we are to gain analytical insights and predictive power. In my theoretical arguments I considered the variables that I think explain most of the variation in hunter-gatherer territoriality; the Bushman data provide encouraging support for this choice.

Bishop seems to feel that the greater territoriality of the !Ko is a response to "interference," arguing that "*recent forms* may be accommodations to conditions generated by pastoralism, which has been practiced in the Kalahari *for centuries*" (my emphasis). However, he does not specify how and why such contact increases territoriality. It is not enough simply to allude vaguely to "parallels" with the postcontact Northern Algonkian family trapping territory (an odd parallel, since the !Ko do not have family territories, nor are the other relevant phenomena the same). Any attempt to argue that !Ko territoriality results from contact, furthermore, must consider the fact that the Nharo are the *most* heavily influenced by contact of the four groups discussed (see comment by Guenther) yet are the *least* territorial. This suggests that historical factors cannot account for the variation that we see in territoriality among these four groups.

Wiessner also feels that I should have considered historical factors and contact with other groups, although she does not argue, as Bishop does, that such contact is associated with greater territoriality. She suggests that the !Ko's hostility to strangers does not indicate territoriality, but rather results from "bad experiences with ranchers ensuing from a past incident of cattle theft." This is unlikely, because the !Ko have a reputation for hostility not only to these ranchers, but to other groups—including other Bushmen (see Heinz 1972 for examples). It is difficult to see how unfriendliness to other Bushmen (including, on occasion, other !Ko) could result from the theft of a rancher's cow. Similarly, the anthropological descriptions of !Kung openness are based on the behavior of the !Kung to each other, not just to Herero or Europeans. Perhaps the generosity of the Herero is a response to the more open behavior of the !Kung themselves.

Wiessner also argues that because the !Ko have access to as many bands as the !Kung (four to seven for the !Kung, two to six for the !Ko) one cannot say that they are more territorial. However, the nexus is the territorial unit among the !Ko, and access to bands *within* this territorial unit is therefore not an appropriate measure of territoriality. As noted, the !Ko rarely visit outside their nexus boundaries, whereas the !Kung have a reticulate network of ties over the region. I agree in part with Wiessner's remarks about the two environments. However, because of the considerable spatial variation in rainfall in the !Ko region, which means that one area can be well-favored while another area is suffering severe drought, a widespread network of ties over the region might well be advantageous were it not for the overall scarcity of resources. This creates the situation "in which local scarcity cannot be as easily absorbed by regional abundance" and gives rise to the variation in territoriality observed here.

Terashima notes that Tanaka presents a rather different picture of G/wi territorial organization, one that more closely approximates that of the !Kung. Like Terashima, I am puzzled by the discrepancy. As I indicated in my paper, however, I based my discussion on Silberbauer's account because he gives quantitative data and an extended discussion of this topic, while Tanaka gives only a few sweeping generalizations about

territoriality, amounting in all to only a few sentences. On other matters (density, work effort) Tanaka provides excellent data, and I was glad to be able to use them.

These disagreements over how to interpret the Bushman literature point not only to inadequacies in the data, but to a lack of precision in the operational measures of territoriality. Finding precise measures that can be applied to literature sources is a thorny problem, but the empirical disagreements will not be resolved unless progress is made in this direction. The suggestions in Barnard's comment are helpful in this regard, and the comments of my critics are a useful indication of the complexities involved. I thank them, and all the commentators, for their thoughtful and interesting remarks.

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