The Effects of the Landscape on the Archaeological Record of Foragers: Contrasting the Kalahari and the Ituri Rain Forest

Paper presented at the
Society of Africanist Archaeologists
Bloomington, 1994

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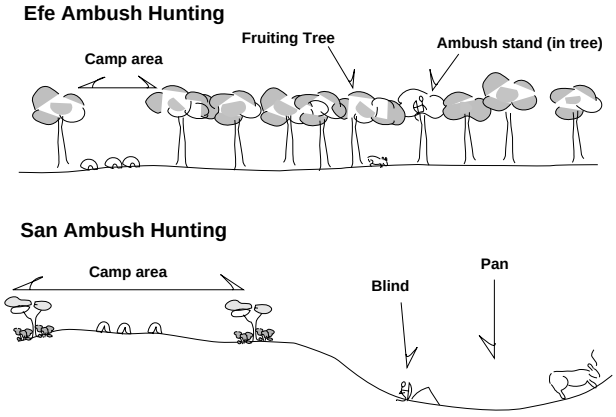
In the Dobe area of the Kalahari at the start of the dry season, when the rains have finished but restricted areas of surface water are still available, and several water-dependent animals such as zebra, warthog and buffalo are still in the area, and the moon is full, and everything else is just right, Ju/'huasi (bushmen) hunters would visit for a night a water hole or pan once or a few times for the purpose of ambush hunting. This involves the use of a previously built hunting blind, fixed up during the day, located in one of a few suitable spots, accounting for visibility, wind direction, etc., located around the pan. The night is cool during this season, so the hunters excavate a pit inside the blind, and maintain hot coals covered with earth to keep warm while waiting for the moon to rise and the prey to arrive. While waiting, the hunters may eat, or repair or make weapons.



The hunting blinds are small, restricted activity areas, and although they are used infrequently, consistent reuse of a very restricted spot could lead, over a long span of time, to the accumulation of an impressive archaeological site.

Alison Brooks and John Yellen have in fact documented archaeological materials at that appear to represent such an accumulation. Interestingly, such a highly visible site, while representing the results of a very effective hunting technique, nonetheless represents only a few hours of activity by a few men, a strong contrast to the year round regimen of activities of The whole group of foragers of both genders and of all ages.

Ambush hunting is much more common among the Efe Pygmies of the Ituri Forest, Zaire. It is less effective than San ambush hunting, but because it is so often done, returns a large part of the meat the Efe obtain. Efe hunt from scaffolds built in trees, that overlook fruit falls that attract small forest animals. Efe do not spend more than an hour or so in the evening and/or morning in these blinds, and conduct no activities there but to wait and observe. Furthermore, the San and Efe ambush hunting strongly contrast in the apparent "lifespan" of the features to which the hunt is oriented.

The Dobe water pans are more or less permanent features, (although the water itself isn't) persisting on the landscape for thousands of years. The fruit falls of the Efe have less than the lifespan of a particular tree. The San ambush blinds can be located in only a few choice spots, and these exact spots will thus be maintained, rebuilt, and reused over and over, while the Efe ambush blinds may be located in any one of several, perhaps several dozen, trees that overlook juicy fruit falls. Thus, the tendency to accumulate artifacts (if any were produced by the Efe in this activity) would be very different than for the San in ambush hunting, due to both the difference in potential age of the feature to

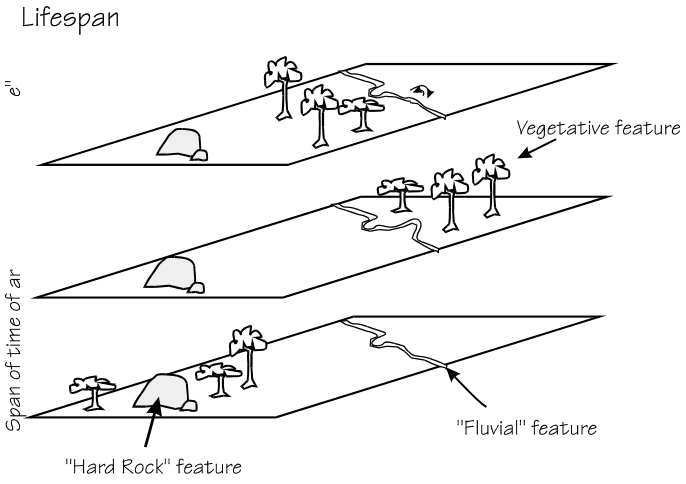
which the activity is fixed, and the dispersion or degree of focus (or lack there of) of possible activity areas. The situation of camps in the two areas is quite different.

San dry season camps are located preferentially on high points within 0.5 kilometers of permanent water, but the locational requirements of these camps allow for significant latitude. For this reason, San dry season camps can be located almost anywhere in a region of nearly four square kilometers, as opposed to the few square meters of the ambush hunting sites.

Efe forest camps are located in any of several spots that are topographically suitable, but the camps should always be located in a clearing. The Efe tend to relocate their camps on almost exactly the same spot numerous times and a particular forest camp will almost always be reoccupied within a year or two of the last occupation. This occupation involves maintaining the clearing through cutting and trampling all vegetation in the area. For this reason, Efe camps are a little like San ambush sites, and San camps are a little like Efe ambush sites, with respect to reuse and spatial focus.

These observations of San ambush hunting and the archaeology of the Dobe area led my co-author, Alison Brooks, and John Yellen to propose a model of preservation of activity areas, in a 1987 publication. Subsequently, Alison and I have undertaken a project, now ongoing, that endeavors to use the ethnoarchaeological observations made in the Kalahari and the Ituri as the basis for a series of computer simulation models, using a variety of techniques, to examine the dynamic interaction between foraging behavior and the landscape on which that behavior is played out. We are particularly interested in using the dry-country San and the rain forest Efe as starting points for interpolation of activity-landscape systems in intermediate environments.

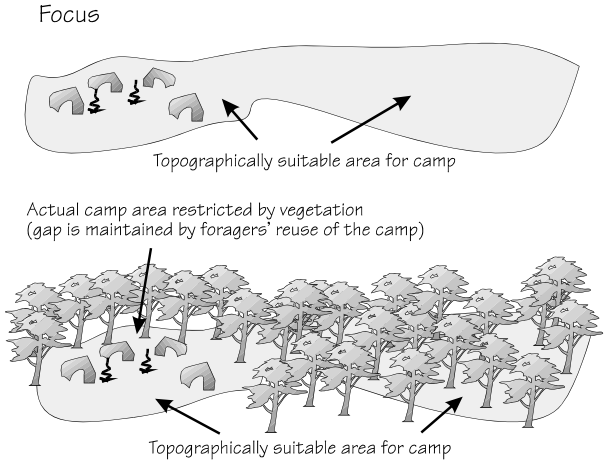
Today we focus mainly on results of examining the specific property of redundancy in activity area use. We consider two separate features of redundancy: Lifespan of landscape features, and focus of activity areas. These are closely related concepts but can be defined and measured separately.



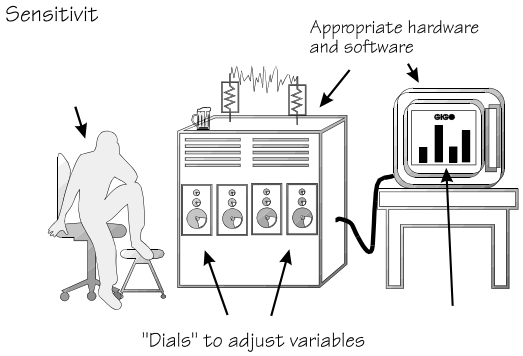
Lifespan refers to the period of time over which a particular feature that may focus activities persists on the landscape. “Hard rock” features may be expected to last on the landscape for long periods. Other features, for example the distribution of specific plants, may be quite ephemeral. Between these virtually permanent and highly ephemeral features are probably a number

of moderately long lived landscape features such as elements of riverine systems, sand dunes, etc.

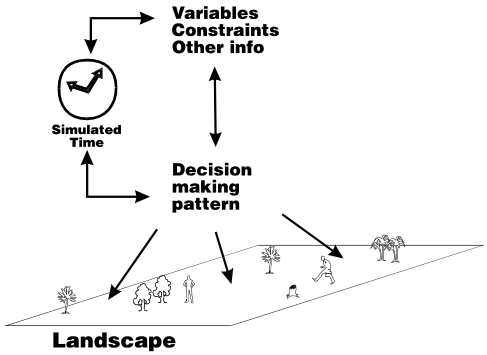
Focus refers to the relative size of an area in which an activity can occur and the actual size of the activity itself. This depiction compares the contrast between San dry season camps (on top), which may be placed over a large area from occupation to occupation, but in fact take up only a small part of that large area. Thus San camps and the activities carried out in them are only moderately or poorly focused. Efe camps, because of the effect of reuse of clearings that are maintained by the reoccupation of camps, are relatively highly focused. The potential area for an Efe camp is only about twice the size of the actual camps, on average, whereas the potential area for the San dry season camps is about 400 times the actual size of the camp. (Rainy season camps are even more diffuse and are unlikely to be reoccupied.

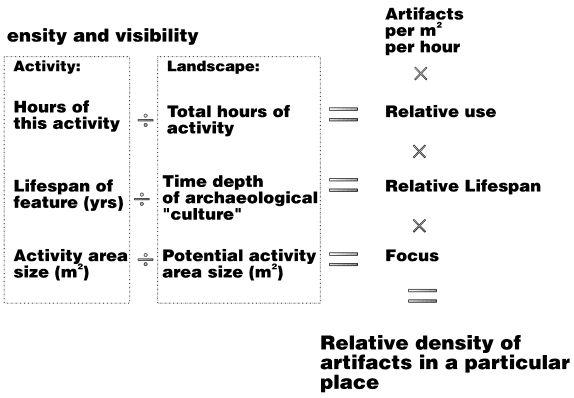


We employ two broad classes of simulation techniques. The first is Sensitivity modeling, whereby a mathematical model is developed, with variables combined to produce some sort of outcome. One can manipulate the variables over plausible ranges, observe the outcomes, and get information about what variables are more important than others, and what the possible outcomes are.



The second class of methods involves stochastic elements and is usually run over time, often with a landscape (in the computer) on which electronic actors play out restricted but not completely predetermined roles. This can lead to simulated archaeological landscapes that can be examined for patterning and compared with actual archaeological data. Most importantly, the state of the actors in this kind of model, at a given "simulated" moment, partly depends on historical factors. In this way the accumulation of an archaeological record can be observed as it unfolds over time.

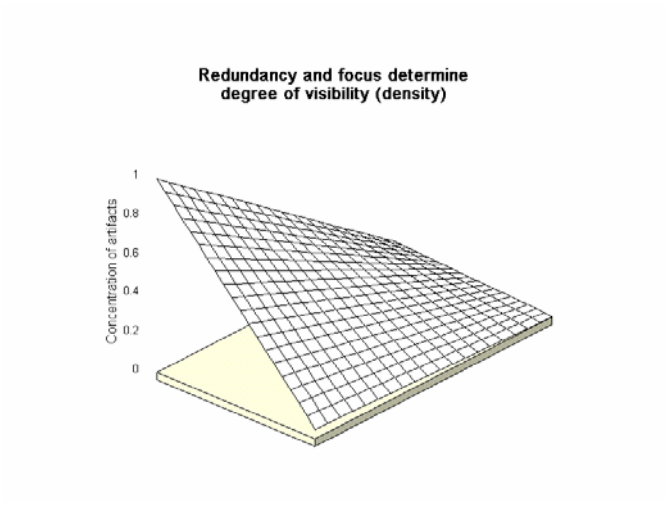




In considering the particular aspects of lifespan of landscape features, and focus, we can use a fairly simple model such as this one. The numeric result we seek by this equation is the location specific relative density of artifacts from a particular activity. This can consider the number of artifacts produced by the activity per hour, the relative time spent on this activity (among all the other activities carried out), the lifespan of any relevant landscape feature, and the focus of the activity with respect to the landscape feature. For most of the results I'm about to show you, we hold the artifacts per hour constant, and for some of the results we hold the relative importance of the activity constant, in order to allow us to specifically examine the dynamics of lifespan and focus.

It is important to note that lifespan is measured here relative to the time depth of the archaeological "culture" under investigation. In other words, for an archaeological phase and region that was created over a very short period of time, a tree and a rock cliff have the same relative lifespan. After dozens, hundreds, or thousands of years, the lifespan effect of the cliff will dominate over the effect of trees and other relatively ephemeral landscape features. I'll come back to this important point shortly.

Relative lifespan and focus are both represented as numbers from 0 to 1.0. A feature that persists for the entire time period under study has a lifespan value of 1.0, while a feature that lasts for hours or for a few years has a lifespan nearer to zero. An activity that is confined to a particular locus, and fills that locus up, such as the San ambush blinds, has a high degree of focus, while an activity that takes up little space but could be done anywhere, has a focus of near zero.



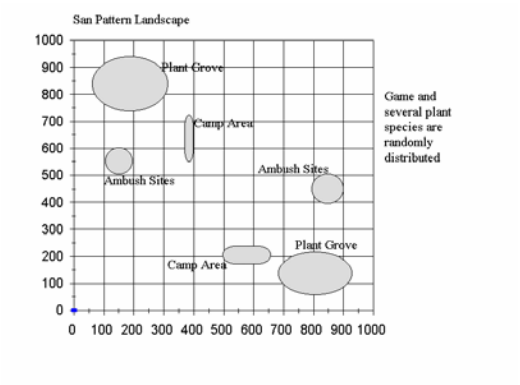
This simple graph shows the range of possible values obtained when combining the effects of lifespan and focus. In our model, this combined value, lifespan times focus, is multiplied by the rate of artifacts produced and the relative amount of time spent on an activity, so values near one, up hill on this chart, would be much more densely represented in the archaeological record than values near zero. The higher up on this hill you go, the more

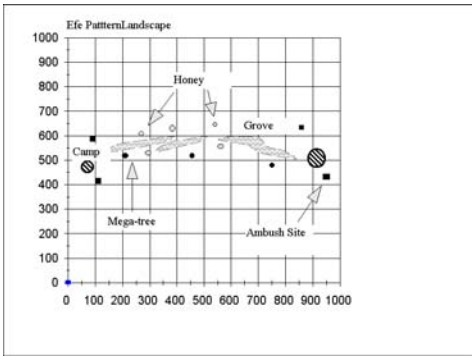
archaeologically visible and well represented we may expect an activity to be, holding artifact production and relative importance of the activity constant.

One question we may ask is this: Are all mathematically possible values of lifespan times focus realized in human foraging systems? Alternatively, is there a fundamental patterning we might expect given what we know about geology, geography, plant and animal ecology, and foraging behavior? For example, do dry country foragers frequently make use of "hard rock" features, thus sometimes having high values on this chart, while forest foragers make use of trees, thus usually engaging in activities that have low values on this chart?

Most importantly, are there patterns in this relationship that dictate the nature of the archaeological record independently of the actual behavior of the foragers on the landscape, so we will often be studying ambush hunting among dry country foragers, and always be studying something else among forest foragers?

Let's look at the results of a particular set of stochastic simulations based roughly on San dry season activities and Efe forest activities. These simulations take account of relative importance of each activity. In each case, four classes of activity area are considered: Ambush sites, camp sites, high density plant food gathering sites, and randomly located foraging sites.



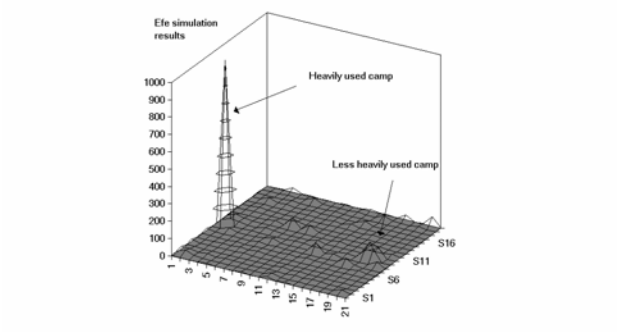


The San pattern is examined by creating two potential camp site areas, a couple of plant groves where important plants are concentrated, and two pans which posses several good ambush hunting sites. In addition, plant and animal foods can be obtained randomly throughout this made up landscape.

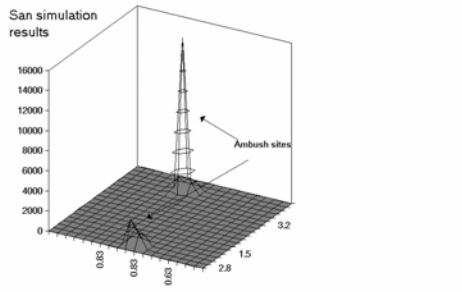
The Efe pattern is examined by creating a system of two camps connected by a trail, along which are groves of useful plants, honey bearing trees, and a few "megatrees" (these are specific species of long lived trees that produce tremendous amounts of fruit or nuts seasonally), and a number of possible ambush sites.

This is the resulting plot for San. (San and Efe plots are attached to the end of this manuscript.) Each dot is an activity area, there are 1002 of them. The higher spikes represent more material accumulated. The tall spikes you see are all in ambush hunting

sites, and although you can also make out the plant groves and the camp areas, they are of very low density.



The Efe pattern looks very similar, but note that the scales are different. The previous axis was an order of magnitude higher than this one. Otherwise the patterns look similar in some ways, a few dense spots, and a general background scatter, more organized in the San simulation than in the Efe simulation. However, the Efe spikes, or hot spots, are mostly in camps, with all the ambush hunting sites appearing as part of the scatter.

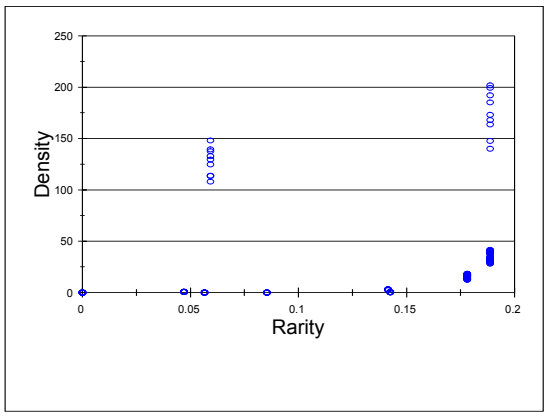


Remember the point we made earlier about the importance of the relationship between the time depth of the archaeological culture, which you may translate in some cases as meaning the degree of time averaging in your archaeological assemblage, with respect to the effects of lifespan. This graph (Attached) shows the frequency of reuse of Efe and San ambush hunting sites in a simulation run. Since the San sites have a long lifespan and are rare, they accumulate reuse over time while the Efe sites, with a short lifespan, never manage to accumulate a large number of reuses.

This is a blow up (attached) of the first several years of the same simulation run. Note that since the Efe do more ambush hunting than the San, Efe sites are actually out competing San sites for the first several years. Sometime after the average lifespan of the Efe ambush sites is attained, the Efe line begins to flatten out, while the San sites continue to accumulate use.

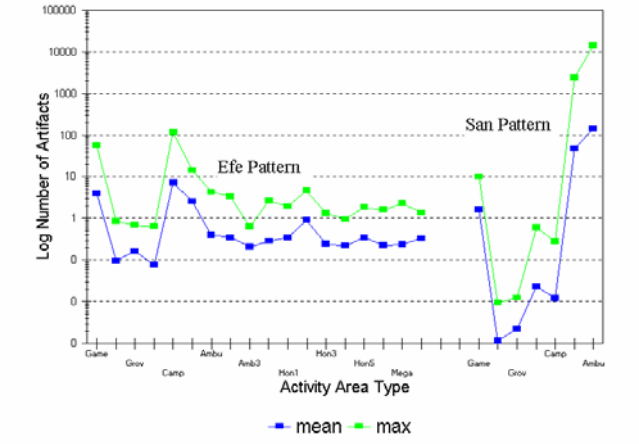
Thus it is possible that the degree of time averaging in an archaeological record determines the apparent relative importance of particular manifestations. Consider two similar areas, with similar ecologies and similar foraging systems, one with little time averaging and the other a lot of time averaging. They may appear archaeologically as having very different behavioral systems due only to these effects!

As part of a broader reaching sensitivity study, we have attempted to begin to ask questions about general patterning of different behaviors represented in the archaeological record as a function of focus and lifespan. Are all the possible values of focus times lifespan represented in actual systems? We start by defining 33 forager tasks including various types of hunting, gathering, resource procurement, etc., done by Efe, San and other foragers. This is just a preliminary list, but there is not time to describe it in detail here.



This graph shows the distribution of lifespan times focus across these activities, the solid dots mostly running along the bottom, compared with a null model of what we should see if all values were possible and equally represented. Depending on the time depth of the archaeological culture, there are relatively few activities that might have a very high redundancy.

We could conclude that the relationships between lifespan, focus and artifact accumulation may not be uniform or random over a wide range of values, but rather are patterned with most values being low and a few being high. This would results in an archaeological record that contains concentrations of artifacts with a broad scatter in between, regardless of the specific nature of those activities. In the worst case, all archaeological landscapes would look the same, their patterns driven by the nature and distribution of landscape features, regardless of the behavioral systems that created them.



We see a difference in patterning between the potential archaeological visibility of activities when divided by inferred gender-association. As perhaps expected, males are an order of magnitude more dense than females!

Finally, we would like to suggest that the difference between two regions in the relative importance of long-lived and highly focused landscape features can make the difference between artifact producing behaviors being visible and invisible. Climate change within a region can also lead to a change from visibility to invisibility or back. Were we to superimpose the distribution of sties in Africa on a map averaging climate over the last millions years or so, we might see that topographically mediated drainage points, serving as long term foci of hominid activities, should have the oldest and richest archaeological record. This may be why we have such a poor showing of early sites in the western rift and the Central African forest.

Perhaps more interesting, certainly more daring, would be to suggest that the appearance of stone tools in East and Southern Africa bout 2.5 to 1.8 mya is not an innovation in behavior or the arrival of a new, tool using species, but rather a focusing of the traces of a previously existing behavior into the range of archaeological visibility as a result of climate change. Perhaps we should not be asking which hominid made the

notable accumulations of stone and bone, such as that of FLK Zinj, or for what reason, but rather, we should ask what landscape feature served to focus this activity at this point on the African landscape.