SEASONALITY AND SEDENTISM

ARCHAEOLOGICAL PERSPECTIVES FROM OLD AND NEW WORLD SITES

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Seasonality in the Tropical Lowlands of Northwestern South America: The Case of San Jacinto 1, Colombia

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INTRODUCTION

Seasonality in the tropics is regulated by precipitation. Rainy seasons regulate flooding and changes in the landscape of stream and river channels. As a result, rainfall generates different strategies of human mobility, depending on the rain’s unimodal or bimodal distribution on the landscape. In the present paper I deal with two problems relating to mobility strategies in tropical environments. The first is the effect that rainy and dry seasons have on the location of sites of mobile populations and of more sedentary occupations. The second problem is how to recognize the frequency of site reoccupation during a season and what kinds of patterns we should look for to demonstrate frequent reoccupation or continual occupation of a site during a season. This second problem is considered in more detail in the second half of this paper.

I argue that there is a direct relation between rainy and dry seasons and the location of sites for mobile as well as sedentary populations. I propose that risk management of such seasonal changes in the tropics generates two patterns of landscape occupation. Sites of residentially and logistically mobile hunter-gatherers most likely will be located on unstable terrain such as point bars or active stream terraces (T0) during the dry season, when there is no risk to occupation and the payoff of the locations is very high (see Kelly 1991, 1992:46–48). During the rainy season, a preference for stable areas (river terraces [T1, T2, T3], hill tops, ridges, rock shelters) is predicted (table 1). More sedentary populations will tend to select more stable landscapes during both seasons in order to avoid seasonal flooding and constant destruction of settlements.

These seasonal variations act as constraints and affect the archaeological recovery of base camps or other kinds of sites created by mobile populations during the dry season (see Johnson and Logan 1990:293–295). Dry season sites would be strongly underrepresented in the archaeological record as a result of the natural dynamic of alluvial landscapes. Contrarily, as a result of more stable landscape preference during the rainy season, evidence of camps or special purpose sites of collectors and foragers and even early sedentary populations would be highly represented at these locations.

As a case study, I consider the chance discovery of the Late Archaic site of San Jacinto 1. The lack of comparative sites in the neotropics similar to San Jacinto 1 illustrates the problem of underrepresentation of dry season sites expected in the variable pattern of mobility of foragers and collectors (Kelly 1983). I address the nature of seasonal occupation at San Jacinto 1 through the climatic and landscape context of the site’s formation.

THE CASE: SAN JACINTO 1

San Jacinto 1 is located in a synclinal valley that runs in a south-north direction parallel to the anticline of the Serranía de San Jacinto. The site is at an altitude of 210 meters above sea level in a small alluvial floodplain. The valley is cut by a west to east stream channel
### Table 1
Seasonal risk variation in alluvial environments

<table>
<thead>
<tr>
<th>Season</th>
<th>Unstable</th>
<th>Stable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile (residential or logistic)</td>
<td>rainy</td>
<td>avoid</td>
</tr>
<tr>
<td>Sedentary</td>
<td>rainy</td>
<td>strongly avoid</td>
</tr>
</tbody>
</table>

Known as the "quebrada San Jacinto" (figs. 1–2) (see Instituto Geográfico Agustín Codazzi 1975, 1977, 1982; Ballesteros 1983).

This site was initially evaluated in 1986 (Oyuela 1987). As a result of the preliminary work, the importance of the site was seen not so much in its early fibertemper pottery (the earliest in the continent, see Hoopes 1994; Oyuela 1995) but because it was the starting point for the study of inland adaptations in the neotropics and for testing models relating to the origins of food production and sedentism (Oyuela 1993, 1996). San Jacinto 1 was expected to indicate very different strategies of adaptation from those described for coastal and riverine sites in the tropics. The site was covered by approximately four meters of alluvial soils. A deep open area of 75 square meters (figs. 3–4) was excavated between 1991 and 1992 (seven months). A program of augering, using computer assisted interpolation of the stratigraphic data from each auger hole, permitted a visual reconstruction of the site paleotopography. This information was used to define the size of the site as well as to decide where to excavate. The excavation represents a 20 percent sample of the site. The purpose of exposing a relatively large area was to recover enough data to evaluate models of mobility and food production as well as of household structure. The site provides a starting point for the analysis of the strategies developed by humans in an inland transitional zone of dry forest, wet forest, and savanna environments, which should be very different from those described for coastal adaptations (Gordon 1957; Hammond 1980).

Evidence of dwellings indicates ephemeral structures like windbreaks or temporary shelters. During the most extensive occupation, the cultural activity area was approximately 380 square meters and may have accommodated a population of between 10 to 15 people (stratum 9). From the spatial context, it is clear that pottery was not used as the primary means for daily cooking (Oyuela 1993, 1995). The San Jacinto economy appears to have revolved around harvesting and processing seeds of wild plants by means of an expedient ground-stone lithic technology (Bonzi 1995). These resources were cooked mainly in roasting or fire pits. The diet may have been supplemented by hunting deer, tapir, and small animals such as mud turtles and grassland turtles, as well as iguanas and small fishes.

![Figure 1. Location of the study region and Early Formative sites.](image1)

![Figure 2. Location of the San Jacinto 1.](image2)
(few bone remains were recovered in contrast to the abundant carbonized plant remains). These animals were procured and processed with a diverse assemblage of unifacially flaked stone tools. All the raw materials employed for lithics at the site are found in the region in a radius of five to ten kilometers (Castro 1994). There is no evidence of exotic materials or exploited resources that indicate an extensive circuit of mobility. Instead, mobility seems to have been very restricted to a territory that may not have been larger than ten kilometers in radius.

How did the climatic and hydraulic conditions at the site operate in the past? In general, it is accepted that in tropical areas glacial climatic changes had little effect on temperature below an altitude of 2,000 meters. Fluctuations in temperature are thought to have been only 1° or 2° C above or below the present-day normal (Van der Hammen 1986:571). The sedimentation rates and the definition of dry periods during the Holocene in this part of the tropics have been addressed for the lower part of the Magdalena River and the Cauca and San Jórgé Rivers (Plazas et al. 1988). These changes seem to correlate well with more distant areas such as the Caquetá River in the Amazon (Van der Hammen et al. 1991). In this context, San Jacinto 1 was occupied during a progressively drier period of the Holocene, but with another important component indicated by sea level data: a lower stream-level gradient (Oyuela 1996).

Figure 3. General view of the San Jacinto 1 floodplain and new channel cut.

Figure 4. General view of feature distribution (pits) at San Jacinto.

RAINS AND STREAM FLOODING AS SEASONAL FACTORS IN THE SAN JACINTO 1 FORMATION PROCESSES

The Serranía is mainly affected by the climatic conditions of the Depresión Momposina (Mompos Depression) where the Cauca and San Jórgé Rivers join the Magdalena River. This depression is characterized by large water surfaces forming cienagas (shallow lagoons). The highly humid environment of the depression favors the formation of saturated clouds that, when pushed by the winds in a northwestern direction, develop into torrential storms. The Serranía operates as a barrier, favoring strong rains in a short amount of time. The pluvial spatial variation of the region is demonstrated by the fact that only ten kilometers from the site is the Cerro Maco (850 meters above sea level), an area that because of its elevation maintains a tropical humid forest and has an annual precipitation of
close to 2,000 mm. The rest of the lower part of the Serranía is drier. In this sense San Jacinto 1 is located marginally to the waters and humid environment of the depression as well as to the main area of precipitation of the Serranía.

The San Jacinto zone has an annual mean precipitation of 1,097 mm (based on data from 1931–1987) and a mean annual temperature of 27.5 degrees Celsius with a small fluctuation of three degrees. The zone has two major seasons: rainy and dry. The first rainy period starts in late April–June, followed by a small dry month around July–August (Veranillo de San Juan). After this, precipitation increases until the end of November, reaching a peak in October. Then the rains stop in early December, leaving the driest times in January and February, with some years having no precipitation at all. This climatic regime drastically changes the green landscape of November into a dry environment of dead grasses from January to March. This bimodal climatic regime also has a strong impact on the availability of fruits and the growth cycle of annuals and perennials (see Walsh 1981; Bonzani 1995), as well as on the cycles of animal availability (for example, mud turtles, iguanas, and fluvial and land snails).

As a consequence of this climatic regime, today the alluvial floodplain of the San Jacinto stream is affected by flooding episodes during the torrential storms. The flooding episodes last for short amounts of time, such as a few hours, and occur when the stream channel cannot cope with the waters of the upper part of the drainage system (see fig. 3). The chances of flooding are especially high during the months of April to November. It is important to note that even if flooding is likely during these months, most of the year is characterized by a water deficit in the region (fig. 6), which favors the concentration of resources around streams during the dry season.

Much of the depositional and postdepositional history of the San Jacinto site seems to have been affected by the same kind of processes that modify the landscape today. The floodplain where the site is located is very small and parallel to the entrenched stream of San Jacinto, extending no more than 500 meters from the channels (see fig. 5). The catchment area of the San Jacinto stream is located close to the site of San Jacinto 1 in a radius of two kilometers to the west. Most of the streams that contribute water and form the main stream are seasonal. The only permanent water is of aquifer origin and supplies the main stream even during the driest months (January–February).

What kind of material is carried by the stream and runoff episodes that produced the sedimentation at the site? The exposed material is from sedimentary rocks of marine origin. In relation to the pedogenesis of the site, San Jacinto 1 was possibly located at different moments of its depositional sedimentary history in a stream forest gallery, close to a savanna woodland, or in an open savanna (Oyuela 1993).

A total of 26 layers or strata and facies were defined during systematic augering of the site and its surroundings. These strata were numbered from top to bottom. Evidence of anthropic activity is found in nine layers. The most recent corresponds to the present topsoil or humus, called stratum 1. The second period of human activity is registered in stratum 2, which developed between 2120±90 B.P. (Beta 79780) and 1750±80 B.P. (Beta 78619). The most ancient period of anthropic soils, and the subject of this paper, occurred in strata 9, 10, 12, 14, 16, 18, and 20. According to three radiocarbon dates, these anthropic soils were formed between 5300 B.P. and 6000 B.P. (based on ten uncalibrated radiocarbon dates; see Oyuela 1996:table VII).

The physical and chemical analyses of the soils (fig. 7) indicate that the human activity of the early occupation (strata 9, 10, 12, 14, 16, 18, and 20) developed beside and/or close to the channel of a stream. With the help of a computer program that extrapolates data from the augering it was possible to establish the spatial distribution of stratum 9, confirming an oval form for the settlement and reconstructing a U-shaped
dumping area. By considering the stratigraphy, the paleotopography, and the spatial distribution of sediments and soils, I conclude that the early human occupation was located on a point bar of a meandering stream system (Oyuela 1993).

Given the stratigraphic sequence and process of formation, the relationship of the soil with flooding episodes is the major factor of accretion. The process of soil and sediment formation at San Jacinto 1 seems to be similar to that of other alluvial systems studied around the world (see Gladiolus 1985; Hassan 1985; Ferring 1986; Guccione et al. 1988; Mandel 1992). Considering the known models of soil deposition of point bars (Reineck and Singh 1975; Collinson 1986), it was expected that the excavation would yield evidence of characteristic features in the development of a point bar such as lateral accretional (epsilon) cross-bedding related to the migration of the point bar in a meander and the current of the water (see Brooks and Sassaman 1990). There was some evidence of epsilon formations in the augering, but its confirmation was obtained only during the excavation. Based on these results, an interpretation of the pedogenic changes that occurred at San Jacinto 1 are presented in table 2. As noted in table 2, the accretional sequence depended mainly on flooding during the rainy season and the mobility of the stream channel.

In conclusion, from the geoarchaeological perspective alone, it can be said that: (1) the people settled in a point bar environment, (2) flooding was a variable that affected the site during the rainy season, making it too risky to be occupied at those times, and (3) the
migration of the channel was a variable that affected the development of living floors, producing cross-bedding stratigraphy. The end of the human reoccupation of the site was very likely the result of a displacement of the stream by a neck cutoff process or avulsion.

In synthesis, the major factor that regulated the occupation and formation process of the site was the rainy season. The high risk of flooding inhibited the occupation of such areas during those times. Furthermore, during the dry season, due to the deficit of water in the region, these areas became optimal locations for the concentration of subsistence resources.

Let us now ask how frequent and for how long the point bar was occupied during the dry season. To answer this question a new approach and methodology is required.

**Feature Density and Distribution as an Indicator of Seasonal Occupation**

It is argued that the variation in the pattern of distribution of features is directly related to the frequency of occupation and indeed even to the strategy of mobility. Features as a unit of analysis have the advantage of not being distorted by redeposition, which affects artifacts and other remains. Features are affected by the rates of sedimentation and geomorphological dynamics of their site location. Even in environments of high sedimentation rates, geological events occur at a slower rate than does feature formation by human activity. Therefore, two different occupations of a site in the same season are not recognizable in the archaeological...
Table 2

Soil formation sequence of San Jacinto 1

<table>
<thead>
<tr>
<th>Formation Sequence Units</th>
<th>Stratum</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVd</td>
<td>1, 2</td>
<td>Flood basin, slow rate of sedimentation, development of organic soils.</td>
</tr>
<tr>
<td>IVc</td>
<td>3</td>
<td>Single flooding event, high rate of sedimentation.</td>
</tr>
<tr>
<td>IVb</td>
<td>4-6</td>
<td>Flood basin, low accretion and rate of sedimentation, development of organic soils.</td>
</tr>
<tr>
<td>IVa</td>
<td>7</td>
<td>Flood basin, medium rate of sedimentation of fine materials (finely laminated).</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>Abandoned channel is filled with fine sediments of flood basin, medium rate of sedimentation.</td>
</tr>
<tr>
<td>IIc</td>
<td>9-20</td>
<td>Upper point bar, epsilon, forest beds of cross stratification, high rate of sedimentation.</td>
</tr>
<tr>
<td>IIb</td>
<td>21-23</td>
<td>Lower point bar accretion, high rate of sedimentation.</td>
</tr>
<tr>
<td>IIA</td>
<td>24</td>
<td>Lower point bar-scarp pool, high rate of sedimentation, single flooding event.</td>
</tr>
<tr>
<td>Ib</td>
<td>25-26</td>
<td>In-channel deposits, coarse/fine material.</td>
</tr>
<tr>
<td>Ia</td>
<td>27</td>
<td>Channel floor.</td>
</tr>
</tbody>
</table>

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record. Accepting this, the alternative to studying this problem is to look for patterns that show the asynchronous effect of different events that are the product of occupations within and between seasons. The following analysis explores this approach.

The study of patterns of feature distribution as a function of hunter-gatherer seasonal behavior is important since it contributes to (1) defining the kind of mobility pattern that most likely produced the observed synchronous pattern of features, (2) refining the relationship of mobility strategies and environmental seasonality of the area, if there is one, (3) establishing the frequency of site reoccupation within a season, and (4) defining the probable seasons of reoccupation.

Binford (1983, 1989) considers the patterns that we should expect in archaeological assemblages of different kinds of camps. One of the variables he discusses is the degree of assemblage redundancy generated by logistically mobile populations (Binford 1983:357–378, 1989:223–263). In his analyses, “assemblage” is used to indicate artifactual remains and may apply to eco-factual remains as well. “Redundancy” indicates the amount or quantity of reoccurrence of an artifact type.

The pattern of assemblage redundancy is interpreted according to a “middle range theory” that is very limited in its development. The most useful components of it are based on studies of the logistically mobile Nunamiat, a population that depends to a high degree on hunting (Binford 1978). Before reviewing this pattern, we must consider whether the interpretation of assemblage redundancy creates a problem when the population in the case study more likely has plant resources as its major food supply. It seems not. Other studies conducted in relation to foraging hunter-gatherers in Africa and Australia (see Gould and Yellen 1987; O’Connell 1987; Gamble and Boismier 1991; Kroll and Price 1991; cf. Ebert 1992) seem to corroborate and refine the interpretation of the reoccupation of sites from assemblage redundancy and feature density.

Considering that the variation of the spatial distribution of assemblages reflects the function of a site (e.g., base camp, special-purpose camps) and that it is directly related to mobility strategy (Binford 1983, 1989), increases in assemblage redundancy are expected more often in what are generally referred to as special-purpose locations and least likely to occur in residential camps of logistically mobile groups. Residential base camps are relatively long occupations in which the full array of daily activities takes place each day until the occupation is abandoned. Special-purpose camps are short-term occupations in which only specific tasks, for instance resource acquisition, are performed. Residential base camps are generally occupied for longer periods of time and contain a greater array of activity types than do special-purpose sites. Furthermore, in the considered ethnographical cases it is rare for one base camp to be directly on top of another. Instead different types of occupations tend to occur in the archaeological sequence of a site. Special-purpose sites, however, do tend to occur in the same locations due to the patterning of the required resource. With these considerations in mind, variation of the artifact assemblage is expected to be greater in base camp sites than at special-purpose locations (Binford 1983:328). Assemblage redundancy is expected for special purpose locations.

Residential sites are more flexible in their location and more variable in their content. Special-purpose locations are more discrete in their location and more redundant in their use and contents (Binford 1983:330). Furthermore, the systemic characteristics of an adaptation will condition not only variability among sites in their contents, but it will also equally condition the pattern of re-
dundancy or variance in the sequence of archaeological remains that accumulate through multiple occupations at a single site (Binford 1983:331).

The variation and/or redundancy in assemblages allows for the diagnosis of the strategies of seasonal mobility that most likely generated the archaeological record under study (Binford 1980; O'Connell 1987). The set of relationships proposed can be synthesized as follows in table 3.

From this perspective, the development of a concept of redundancy by taking into consideration the spatial configuration of features seems to be the way to approach the diagnosis of the kinds of occupations at San Jacinto 1. It also permits the anticipation of the kinds of sites that are expected in a region with a variable system of logistic mobility (see Ebert 1992:127–156). Furthermore, this analysis of redundancy of features allows for the differentiation between features generated by residential mobility in contrast to those generated by logistic mobility, at least at the two extremes of the mobility spectrum prior to sedentism.

The term “feature” is used to refer to the material (artifacts, ecofacts, or soils) manifestation of a discreet activity. Redundancy of features refers to the recurrence of that feature type as defined by its material components, spatial patterning, and density. The concept is important because as the reader will note in table 3, the degree of assemblage redundancy at permanent camps or special purpose sites of sedentary populations seems not to differ from redundancy at the corresponding sites produced by logistically mobile populations. When addressing how to differentiate the assemblage redundancy generated by sedentary populations of hunter-gatherers from that produced by logistically mobile populations, the answer logically appears to exist at the level of feature spatial patterning and density. Thus feature spatial distribution as well as feature type (or diversity) must be incorporated into the definition of redundancy when discussing features.

Before passing to the analysis of the case of San Jacinto 1, it is important to consider that there are factors that may affect the visibility of the spatial arrangement of features in the archaeological record. It is necessary to acknowledge that the pattern of feature density variations can also be the result of unknown activities unrelated to the type of occupation. The problem is that so far, ethnoarchaeological studies of the behaviors that can produce alternative effects on feature density and spatial arrangement are still very poorly developed.

In order to analyze the degree of redundancy, each cultural stratum must be studied in its own context. It is in this vertical context that it might be possible to see variation in the strategies of seasonal occupation and mobility. Interpreting Binford's (1983, 1989) argument of assemblage redundancy and the ethnoarchaeological work of O'Connell (1987), I propose the following. (1) If the settlement formation process is the result of a permanent year-round occupation lasting for several years, we should expect nonredundant behavior in the base camps, nonredundant feature types, and a spatial pattern of aggregated or clustered features with low density as a consequence of the result.

<table>
<thead>
<tr>
<th>Mobility strategy</th>
<th>Variation between sites</th>
<th>Seasonal reoccupation of sites</th>
<th>Degree of assemblage redundancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>low</td>
<td>none or low for base camps</td>
<td>low or none</td>
</tr>
<tr>
<td>Logistic</td>
<td>high</td>
<td>none or low for base camps</td>
<td>low</td>
</tr>
<tr>
<td>Sedentism</td>
<td>high</td>
<td>high for special-purpose sites</td>
<td>high</td>
</tr>
<tr>
<td></td>
<td></td>
<td>permanent camp</td>
<td>low or none</td>
</tr>
<tr>
<td></td>
<td></td>
<td>permanent special-purpose sites</td>
<td>high</td>
</tr>
</tbody>
</table>
of features and of the spatial differentiation of activities that can take place. In the case of special purpose sites generated from a permanent camp, there should be high redundancy of the archaeological assemblage, but the density of features associated with the function of the site will be low as a consequence of feature maintenance and reuse. Clearer spatial differentiation of activity areas also should exist. (2) If the site is an accumulation of seasonal special-purpose camps, which in general are reoccupied several times during the same season (with resources moved to the base camp), we should expect high redundancy of the activities and, as a consequence, redundancy of feature type and a random spatial distribution of features related to the opportunistic behavior of gathering resources when available. There would be little concern for reuse of features and no clear definition of activity areas would occur. The density of such features should increase in direct relation to the number of times the site is reoccupied within a season as well as with the number of seasons of occupation. (3) In the case of seasonal base camps of a logistically mobile group, we should expect nonredundant behavior, nonredundant feature types, low feature density, and a near random spatial distribution of features. Furthermore, there should be observable differentiation of activity areas. These expectations can be restated in a simplistic and operational form presented in table 4.

In this study I assume the following. (1) The density of features has a relation with the length of occupation of a site. The longer the continual occupation of the site, the more likely the continual reuse of facilities or features and, as a consequence, the lower the density of features. In an inverse relationship, the shorter and more frequent reoccupation of the site during each season, the higher the density of features. (2) A base camp will have more variation in feature types as a consequence of more diverse activities. In a special-purpose site the diversity of feature types is less as a consequence of more specific activities.

To assess the lithic assemblage redundancy, Binford (1978:495–497, reinterpreting the work of Vierra 1975) suggests the use of factor analysis. Binford argues that techniques such as factor analysis can help in understanding the degree of redundancy of a site. Using this technique, he suggests that if a site was a seasonal base camp, then significant changes in the activities of the site are expected, and variability among the assemblages in each stratum would be explained by different factors. Contrarily, if the continual reuse of the site for the same seasonal special purpose occurred, then the variation of the assemblage by strata would be explained by a single factor.

For San Jacinto 1, a site that seems not to have a long sequence of occupation, factor analysis may be useful. The only problem with this technique is that it does not give us a definition of the degree of spatial patterning and the redundancy of this patterning. It is for this reason that other techniques such as nearest-neighbor statistics seem more appropriate. Nearest-neighbor statistics can give a measure of the degree of spatial feature distribution departure from randomness toward clustering or regularity in space. It measures the spatial relationship between items. The data used are the exact horizontal locations of features. It has the power to detect patterns of clustering or regularity of any size or scale.

The basic equations of nearest neighbor statistics have been described elsewhere (Clark and Evans 1954:447; Pielou 1959; for a review, see Earle 1976:197–200; Wilson and Melnick 1990). For the present research the methodology and equations described by Whallon (1974) have been followed, using corrections for the boundary effect proposed by Pinder, Shimada, and Gregory (1979). These calculations were made using the computer program elaborat-

<table>
<thead>
<tr>
<th>Table 4</th>
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<tbody>
<tr>
<td>Feature redundancy and mobility</td>
</tr>
<tr>
<td>Feature Characteristics</td>
</tr>
<tr>
<td>Degree of Redundancy</td>
</tr>
<tr>
<td>Special Pattern</td>
</tr>
<tr>
<td>Density</td>
</tr>
</tbody>
</table>
ed by Drennan (1986). In basic outline, the nearest-neighbor statistics can be interpreted as follows. The statistics of a random distribution are 1. A lower value, down to a minimum of 0, indicates agglomeration or clustering of items. A higher value, up to a maximum of 2.15, indicates more regular spacing. This value has to be interpreted with respect to the significance of the pattern and degree of departure from randomness (see Pinder et al. 1979:fig. 5). As mentioned above, each site type should generate a unique spatial distribution of features. Specifically, special-purpose camps of logistically mobile hunter-gatherers are expected to generate a random distribution of features as a consequence of the multiple reoccupations of a site and repetition of the behavior of the group (within the same season or during the same season year after year).

Features such as cooking pits, storage pits, or any other kind of pit in general are well represented in the archaeological record. In the present case, all the pits found at San Jacinto 1 seem to relate to food-processing activities (see fig. 8). Since pits reflect the kind of subsistence activities performed at a site, this makes it easy to differentiate special-purpose sites from base camps. The function of the pits is irrelevant to this part of the research; the aim is merely to establish their spatial arrangement. The data are the locations of all pits encountered in the excavation in their stratigraphic contexts. Only strata 10 and 12 are useful for this analysis because only a small sample of pits were found in the other strata (three in stratum 5, three in stratum 9, and four in stratum 14). The low number of pits in those strata is interpreted as being the result of a different occupational pattern at the site (the pits in stratum 14 are the product of other factors), which is considered in more detail at the end of this chapter. The thickness of each of the cultural strata ranges between 6 and 27 centimeters (see figs. 4, 9). The results of the nearest neighbor analysis are presented below (for the data, see fig. 10).

A total of 45 pits were excavated in stratum 10. The density of pits is 0.6 per square meter. The average observed distance from each pit to its nearest neighbor is 0.734 meters with a standard deviation of 0.335. The expected distance from each pit to its neighbor in a random distribution is 0.691 with a standard error of 0.059 meters. The ratio of the observed pit distance to the expected average nearest-neighbor distance is 1.063. This ratio means that the mean nearest-neighbor distance is only slightly different from that expected in a random distribution. The significance of this slight departure from the expected distance is also very low (df=44, t=0.729, p<0.5).

Figure 8. Detail of feature 57 (E24N38).

Figure 9. Southern section of the excavation; note overlapping features from strata 10, 12, and 14.
A total of 60 pits were excavated in stratum 12. The density of pits is 0.8 per square meter. The average observed distance from each pit to its nearest neighbor is 0.711 meters with a standard deviation of 0.289; the expected distance from each pit to its neighbor in a random distribution is 0.592 with a standard error of 0.044 meters. The ratio of the observed pit distance to the average nearest-neighbor distance is 1.201. This ratio means that the observed nearest-neighbor distance differs from that expected in a random distribution in the direction of more regular spacing. The significance of this departure from the expected distance is high (df=59, t=2.705, p<0.01).

The result of the nearest-neighbor analysis reveals that there is enough evidence to suggest that the high density and near random distribution of features is indicative of redundant behavior and very likely was the result of seasonal reoccupations of the site in which new features were produced with each reoccupation and without regard to previously emplaced ones. In other words, the results follow the expectations of a pattern that is very likely the product of a logistically mobile group that used the site as a seasonal special-purpose camp. Further, it is very likely that the site was occupied for a few days at a time but on several occasions during a season.

The tendency toward regular spacing or symmetry in the distribution of features in stratum 12 may be explained as a consequence of the lateral and forward accretion of the point bar. As the point bar grew
to the north, activities and feature emplacement moved northward as well. By the time of the occupations in Strata 10 and 9, point bar accretion northward would have been slower as the meander was cut off. It is also important to note that in each occupation there was a strong emphasis against the reuse of pits. This can be understood in terms of the function of the pits (as roasting and/or fire pits) and explains why the pits were refilled after each occupation.

It is further interesting to note that the mean distance between features is extremely low in comparison to that observed from ethnographic work on base camps in Africa and Australia. For the !Kung and desert Australian aboriginals (groups with residential mobility), for example, the distance between hearths range between 4.65 meters and 11.52 meters, and the distance between roasting pits is even higher (O’Connell 1987). The nearest-neighbor analysis conducted for such groups indicates that there is no relationship between distance between hearths and length of occupation or the size of household (Gould and Yellen 1987). As has been described elsewhere, features such as hearths are associated with activities that require less space than pits because most of the activities conducted around them are done by individuals that sit around the fire. Contrarily, pits require extensive activity areas, as they generally involve activities that are performed standing up. Binford (1988:169) estimates that an area of around 17–24 square meters of space is required for a pit. This ethnoarchaeological information gives us a clear idea of how a pattern of pits such as is observed in San Jacinto 1 is very likely associated with a logistically mobile group who performed the same activities at the same site, season after season.

This interpretation seems to be valid for strata 10 and 12, but what happened with strata 9 and 14 where pits were also found in lower densities? In the case of stratum 14, this is understandable because the stratum is a facie that only becomes differentiated in the secondary refuse area of the stream channel. In the case of stratum 9, the distribution of features as well as the spatial distribution of artifacts suggest a totally different pattern than that described above. The occupation of the site in this stratum seems to have more of the characteristics of a continual seasonal base camp occupied during the dry season, where activity areas were clearly differentiated. Stratum 9 is the only layer that permits the reconstruction of activity areas during the season of site occupation. The clustering of features, as well as activities (see distribution of fire-cracked rocks and pottery in Oyuela 1993), suggests that the site was occupied as a base camp for a longer period of time, very likely the whole dry season. It is interesting to note that no burials were found in any part of the early stratigraphic sequence. Human remains of an adult were found dispersed on the “living floor” of stratum 9, however.

**Final Comments**

The results from San Jacinto 1 complicate the traditional view that we have for the lowlands of the neotropics. This is mainly a consequence of the fact that for the first time we have started to look at sites that correspond to the variability expected in strategies of hunter-gatherer adaptations in this environment. The recognition of one kind of site with seasonal occupation (dry season), which is not very likely to be found due to natural high sedimentation conditions and instability of the landscape, shows the importance of recognizing the problem of seasonal variability in the archaeological assemblage of mobile hunter-gatherers in the tropics. After indicating with hard climatological data the importance of the rainy and dry seasons in the tropics, this work has shown that seasonality caused by precipitation can be expected to be a major factor in regulating the variation in hunter-gatherer mobility strategies in regions such as that illustrated in the case of San Jacinto 1. This is compatible with the basic structure of the mobility strategies proposed by Binford (1980) and Kelly (1991). It is in this context that research on the tropics may contribute to the understanding of the different strategies that hunter-gatherers may have developed in the past.

The use of concepts such as feature redundancy seems to be very useful for the recognition of patterns of camp variability as well as for confirming feature distribution patterns in terms of seasonality of occupation. Nearest-neighbor statistics seem also to be a powerful measure of spatial structure, facilitating the interpretation of the seasonal behavior that explains the distribution of features at San Jacinto 1. In this regard, the results presented here are still very preliminary. The final confirmation of the interpreted pattern can only be assessed more securely by finding and excavating other sites that correspond to different points in the cycle of collecting and seasonality. In this regard, only a regional study may contribute to a better understanding of the seasonal behavior of tropical hunter-gatherers.
Finally, the preliminary results from the research on the San Jacinto region has led to some speculations. One of these is that more sedentary populations may only occupy landscapes of high risk when a reduction in mobility pushes populations to intensify in such areas. The process of intensification would require mass modification of the environment by artificial construction that reduces the risk of seasonal flooding or by new construction technologies and more complex forms of social and political organization such as in the Sinú area and western llanos of Colombia and Venezuela (see Plazas and Falchetti 1981; Zuchin 1985). With future work in the region we hope to have more hard evidence to test some of the models proposed for the origin of sedentism as well as to refine the interpretation of the subsistence strategies in time and space.

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Note

1. Sedentary populations are defined as those that have a permanent camp as a base during a whole year.

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