BEHAVIORAL CORRELATES OF POPULATION GROWTH:
A SPECULATIVE EXAMPLE FROM THE MIDDLE CHATTAHOOCHEE

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Abstract
Proxy estimates of population size through time are compared for a small drainage near Columbus, Georgia and an adjacent portion of the Chattahoochee River valley. Resulting estimates of population growth differ most for the Mississippian (Late Prehistoric) period. A model linking the introduction of new cultigens to population growth, relocation, and changing modes of cultural transmission, is proposed to explain the rapid cultural change apparent from the archaeological record for the Southeast during this period.

Sears: I was talking to Scotty MacNeish, who has become a maize addict of late, about this awhile back. The point that Scotty made, and I gather that he has good documentation for this, is that what we apparently have coming in ... is not just a new kind of corn but one which is particularly adaptable, which can be grown in more kinds of environments successfully than the types of corns that we might have had on an earlier level. That would make it possible, for example, for people to take advantage of the wet bottomland habitat, which is something we see happening through the Southeast. When we get the real Mississippian sites, we tend to move down onto these floodplains.

—from the Round Table on the Definition of Mississippian Culture, 1961 SEAC, Macon, Georgia

In a series of papers published in the 1950s and 1960s, William H. Sears elaborated his views on the information inherent in settlement patterns, becoming a pioneer in the attempt to apply to southeastern North America approaches suggested by the work of Martin and Rinaldo (1950), Willey (1953), Beardsley et al. (1956), Chang (1958), and others. In these papers Sears differentiated between the "settlement pattern," a broad concept incorporating both adjustment to the natural environment and socially-determined aspects of site patterning, and the "community pattern," which included both microcosmic and macrocosmic manifestations of "the strictly social aspects" of location (Sears 1961:226). His decision to focus on community pattern in most of his work was based on the assumption that internal site layout (Sears 1956:94) and areal distribution of sites (Sears 1968) were strongly influenced by social and religious considerations, which Sears has repeatedly challenged the profession to discover and interpret. Quoting with approval Naroll's (1956) ethnographic correlations between population size and several social, religious, and political variables, Sears (1961:224) urged archaeologists to be sensitive to the information contained in the magnitude of population aggregates as well as their distribution. This concern is reflected in his final report on Kolomoki (Sears 1956:93–94) where he hazarded a population size estimate based on ethnographic analogy, extent of midden, and time-rate estimates for mound construction.

The aim of this paper is to present new data on settlement intensity within a small drainage system in west-central Georgia. This will be compared with settlement data from an adjacent portion of the Chattahoochee River valley to provide a new perspective on the Woodland/Mississippian transition in one small—but perhaps typical—portion of the Southeast.

The Halloca Creek Survey
As a first step in compliance with Executive Order 11593, Fort Benning Military Reservation, Alabama and Georgia, requested the assistance of Interagency Archeological Services–Atlanta in contracting for an archaeological survey of portions of the Reservation located in Chattahoochee county, Georgia (see Fig. 1). The scope of work prepared by IAS–Atlanta called for pedestrian survey of a 1600-ha tract surrounding Halloca Creek. In addition to recording sites within this study area, the survey was designed to identify variables determining site location, allowing construction of a model for site patterning across similar portions of the Reservation to be used as an interim management tool until an additional survey could be completed.

The area selected for survey by IAS-Atlanta is on the
The survey is more fully reported in Kohler et al. (1980). The western border of the survey area is about 19 airline km east of the Chattahoochee River. The survey area lies south of the now-deserted settlement of Halloca and about 4 km north of Cusseta, the seat and only major town of Chattahoochee county. The western border of the survey area is about 19 airline km east of the Chattahoochee River. The survey is more fully reported in Kohler et al. (1980).

Environmental and Cultural Background

Fort Benning Military Reservation lies just south of the transition between the Piedmont to the north and the Coastal Plain. While the Fall Line itself can be placed precisely at the point where the Chattahoochee River formerly descended the falls at Columbus, a broad belt stretching east-west across Georgia—some 90-km wide at the Chattahoochee—is known as the Fall Line Hills (Fenneman 1938:67). This zone is characterized by a rolling, highly-dissected landscape. Fort Benning lies entirely within this physiographic province. The soils of the northern two-thirds of the Reservation are underlain by layered mixtures of gravel, sand, and clay of the Tuscaloosa Formation, the oldest of the Upper Cretaceous series that outcrops all along the Georgia Fall Line (Cooke 1943:8-13). The Tuscaloosa Formation is porous and many of the wells to excessively-drained soils in the Reservation, such as the soils of the Norfolk series, are derived from it. These soils support a less dense vegetation than those in the southern portions of the Reservation, and one more heavily dominated by various pines.

The Eutaw, a later Upper Cretaceous formation, crops out to the south and east of the Tuscaloosa in the southern and eastern third of the Reservation. The formation is characterized by coarse, heavily ferruginous sands from which soils such as those of the Ruston series are derived. In the survey area, exposures of the formation occur primarily in moderately to steeply-sloped areas, many of which have been severely eroded by past agricultural and landclearing activities.

The third formation that constitutes a significant portion of the substratum of the Reservation is the Blufftown, occurring in the most southern and southwestern portions of the Reservation where it rests unconformably on the Eutaw. This formation is composed primarily of clays and marls (calcaceous sands) from which soils of fine micaceous sands typically have developed. These soils tend to support a denser and more deciduous forest than the soils derived from the Tuscaloosa formation to the north.

Crosscutting all these zones is a series of streams draining towards the Chattahoochee. These range in size from first-order streams (small, normally dry ravines which flow during periods of run-off or in some cases originate at small springs or seeps) to fourth-order streams such as Halloca Creek with floodplains typically ranging from 200 to 500 m in width. The major interior drainage trunk of the Reservation, Upatoi Creek, is a sixth-order stream with a floodplain as wide as four km. Upatoi Creek, in turn, flows into the Chattahoochee, one of the major rivers of the Southeast, with a floodplain occupying some 44 km² of the western and southwestern portions of the Reservation. The alluvia in the floodplains and on the first terraces of the larger streams are immature soils composed of lenses of sand, silt, and clay. These soils, though typically poorly drained, represent one of the few substrata on the Reservation that is not impoverished in organic material, because the warm temperatures and heavy rainfall enhance the decay and leaching of organic material unless it is regularly replaced through flooding (Knobel et al. 1928:104). The better-drained areas within these floodplains and on the first terraces support dense hardwood vegetation with a high species diversity.

The Halloca Creek survey area contains soils derived from all these formations. The northern portion is underlain by the Tuscaloosa Formation, while areas to the south and east are based on soils of the other two major formations. In its high ridges with well-drained soils and open vegetation, numerous small streams imbedded in narrow floodplains that cut heavily into the underlying substratum, and limited extent of the loamy, well-drained soils best-suited for agriculture, the Halloca Creek area is characteristic of many small drainages in the interior of the Reservation, but bears little resemblance to the Chattahoochee River valley to the west.

Prior to this survey the known archaeological resources of the study area included the Halloca Creek site (9Ce4), a 2.5-ha village tested by Chase (1955, 1957), who obtained from it a radiocarbon sample later dated to 60 B.C. ± 150 (uncorrected). This site has gained some prominence in the literature. Caldwell (1958:37) used it in conjunction with the lower levels from the Swift Creek site in central Georgia to define an Early Swift Creek Focus; McMichael (1964:126) cited it as providing a more accurate date for Early Swift Creek than the later dates from Mandeville II. Other previously-reported sites were 9Ce50, a large, diffuse historic aboriginal site overlooking Halloca Creek, and 9Ce7, a multicomponent site also tested by Chase (1955).

Survey Method and Results

Although the surveyed area reported here is relatively small, the survey coverage was intensive. Transects were spaced at 30m intervals across the tract, with small subsurface test pits placed at 30m intervals along each transect in areas slope less than 10 degrees, and at 90m intervals in steeper areas. Thirty-
Figure 1. The Halloca Creek study area in southwest Georgia.
one sites were defined or relocated in the course of the survey. Twenty-one of these are primarily aboriginal, spanning the period from Middle Archaic to historic. Early Archaic materials were occasionally encountered as isolated finds. No certain Paleo-Indian materials were noted, although they are known to exist in the region. The sites with components dating to each of five broad periods and the materials used to define these components are shown in Table 1.

Table 1: Aboriginal Sites in the Halloca Creek Survey Area.°

<table>
<thead>
<tr>
<th>Components</th>
<th>Diagnostic Artifacts</th>
<th>Periods and Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSA 5, 14, 18(?)</td>
<td>Layfayette- and Savannah-like points; quartz bifurcated-base points</td>
<td>1: Early and Middle Archaic; 8000–3000 B.C.</td>
</tr>
<tr>
<td>RSA 2, 7, 15, 17, 19, 9Ce4, 9Ce7, 9Ce50</td>
<td>Orange Plain, Nonwood Plain, Dunlap Fabric Marked, various simple and cross-simple stamped types, Swift Creek Complicated Stamped (early)</td>
<td>2: Late Archaic and Early Woodland; 3000 B.C.–A.D. 300</td>
</tr>
<tr>
<td>RSA 7, 22; 9Ce4</td>
<td>Swift Creek Complicated Stamped (late), Cartersville/Wright Check Stamped, Crooked River Complicated Stamped</td>
<td>3: Middle and Late Woodland; A.D. 300–A.D. 800</td>
</tr>
<tr>
<td>RSA 20, 23; 9Ce7</td>
<td>Averett or Etowah Brushed, Averett (?) Incised, Lamar Bold Incised</td>
<td>4: Mississippian; A.D. 800–1500</td>
</tr>
<tr>
<td>RSA 2, 9, 14, 22, 23; 9Ce50</td>
<td>Abercrombie Plain, Ocmulgee Incised, Chattahoochee Brushed</td>
<td>5: Protohistoric and Historic Aborigi nal; A.D. 1500–1836</td>
</tr>
<tr>
<td>RSA 3, 11, 13, 16, 21, 24</td>
<td>none</td>
<td>Indeterminate</td>
</tr>
</tbody>
</table>

°In sites with more than two components, only the two dominant occupations are listed here and used in the construction of Fig. 2. In some cases where diagnostic types overlap more than one of the broad periods, arbitrary decisions were made concerning which period the component belonged to; Abercrombie Plain, for example, although occurring in prehistoric and protohistoric Lamar sites, is taken here as a marker for period 5.

Following fieldwork, several statistical techniques were used to compare the locations of components to the distribution of various environmental variables. Strong, significant tendencies are found for sites to be located on well-drained but fertile soil types such as Norfolk Sandy Loam. Even taking into account the different sampling intensities, sites are strongly associated with areas of less than 10 degrees slope. Weaker but still significant trends were noted for sites to be located in areas of positive relative elevation in relation to their surroundings (reflecting both view and drainage values), with the closest water source a larger stream than would be expected by chance. When soil types were lumped into three ordinal classes on the basis of agricultural productivity as set forth in Knobel et al. (1928), the 19 aboriginal sites with demonstrably post-Archaic components were found to be located away from low-potential soils and on high-potential soils more often than would be expected by chance. Finally, when the distance to the nearest soil in the highest-productivity class was compared for all sites classified by the period of their major component, a statistically weak but anthropologically interesting tendency was found for Archaic sites to be further from these soils than were all sites taken together. Middle and Late Woodland sites, on the other hand, were consistently closer to these soils than sites of any other period.

Based on the interactions among the distributions of loamy soils, slope categories, and distance to nearest water course, the Reservation has tended to confirm this locational model (Thomas et al. 1983). The conclusions that can be drawn from a 1600-ha survey are limited, however, and this account might stop here but for the location of the Halloca Creek survey area near the Chattahoochee, affording a comparative area with a long history of survey and excavation in a different environmental setting.

The Middle Chattahoochee River Valley

In contrast to Halloca Creek and its environs, the Chattahoochee River valley offers wide stretches of nearly level alluvial soils. Not only do many of these soils appear to be well-suited for agriculture, but the abundant fish in the river were also an important resource for the historic aboriginal occupants of the Fall Line area, particularly in the spring and summer. The many well-known ethnohistoric accounts of the Chattahoochee area include remarks by Captain Tobias Fitch (Fitch 1916), an anonymous companion of Governor Oglethorpe (in Mereness 1916), David Taitt (Taitt 1916), William Bartram (in Harper 1958), Benjamin Hawkins (1916), Adam Hodgson (in Swanton 1922:224–225), and Lord Featherstonaugh (in King 1966:154). This wealth of ethnohistory is due partly to the intersection, in the area of present-day Columbus, of the important north-south water route of the Chattahoochee and a major east-west Indian trail (later a Federal Road) that generally followed the Fall Line: the Lower Creek Trading Path. Ethnohistoric accounts and archaeological data point to a high concentration of Lower Creeks and confederated groups such as the Yuchi in the Fall Line area along the Chattahoochee.
Fairbanks (1940:5) reports that “the west bank of the Chattahoochee from Fort Mitchell [about 17 km by water below Columbus] to the falls at Columbus is heavily blanketed with aboriginal pottery and artifacts.” The largest, best documented towns in the Columbus vicinity after the Yamassee War were Kasita, on the left bank in present Lawson Field, and Coweta and Yuchi towns on the right bank below the falls.

Several major archaeological projects were undertaken in conjunction with reservoir construction along the Middle Chattahoochee in the late 1940s and the 1950s (Kelly et al. 1962: Huscher et al. 1972; DeJarnette 1975). The Oliver Basin surveys and excavations (McMichael and Kellar 1960) are the closest to the Halloca Creek area. The dam axis for this reservoir is located in Columbus and backs water up as far as 16 km to Goat Rock Dam. McMichael and Kellar (1960:176) divide the basin into an upper and a lower portion. In the upper portion, about 10 km long, there were few shoals or rapids, and many small, impermanent streams traversed the wide bottomlands. The fall of the river over the 10 km was only about 3 m. Though only half as long, the lower basin descended about 12 m. Here the river contained frequent shoal lines and rapids before reservoir construction, and was bordered by little or no bottomland. Disregarding differences in settlement through time, McMichael and Kellar (1960:180) described site location in these two portions of the basin as follows: “In the lower basin small campsites are found next to the river on first terraces and frequently near shoals and creek mouths. In the upper basin, while still mainly campsites, a few villages are found, again both are usually near the river on sandy bottomland but with an increase in number of sites found up tributary streams.” The villages in the upper basin were assigned to the Ocmulgee Fields (historic) and Lamar periods.

Synthesizing trends in site location through time, McMichael and Kellar (1960:182) observe that

In the earliest periods (Paleo-Indian, Archaic, and partially Early Woodland) there is some preference for higher ground removed from the river, but during the Early Woodland period this begins to change and bottoms close to the river are the preferred locales for campsites. This situation prevails from Early Woodland time through Lamar and partially into the historic, but in this latter period a slight tendency is to be seen for a return to the upland areas. In the lower basin a trend transcending culture periods is the location of campsites near shoals and about the mouths of small streams.

None of the Mississippian sites in Oliver Basin was a large ceremonial center; most were considered by McMichael and Kellar (1960:180) to be campsites, with a few probable hamlets or farmsteads (to use the taxonomy suggested by Smith [1978:501]) in the upper basin. The single example of a substantial late prehistoric or protohistoric site in Oliver Basin was the large, predominantly Lamar-affiliated Soap Creek site, which according to Brannon (1909:188–189) appears once to have had a mound with an associated cemetery area. Brannon reports that the mound was devoid of artifacts, but it is impossible from his description to confirm its identity as a pyramidal substructural mound. Perhaps Soap Creek constitutes the local center for what Steponaitis (1978:420) has termed a simple chiefdom, that is, one with a single level of administrative control (Smith 1978:495). Certainly there is evidence for other approximately contemporaneous sites of similar magnitude in the Fall Line area along the Chattahoochee, but little evidence of a contemporaneous site of sufficiently large size to be interpretable as a second-order administrative center in this area. Indeed, if the early historic Lower Creek and Yuchi occupation of the Fall Line area can be used as an analogy, then simple chiefdoms with local centers such as Kasita and Coweta, each with a series of affiliated hamlets strung along the river and its tributaries, would seem to be the most satisfactory model for the prehistoric and protohistoric Lamar occupation of this area as well.

The McMichael and Kellar report is distinguished from the others available for the Middle Chattahoochee by its attempt to document the changing relative intensity of occupation through time. This is done through a “Use Intensity Index” (McMichael and Kellar 1960:199–200; McMichael 1960) defined for each period as the sum of the number of components times a weighting factor for each component ranging from one to three, divided by the number of 250-year units subsumed in the period. The subjective weight is based on the amount of cultural material at each site, and the division by number of 250-year units corrects for the different duration of the broad cultural periods used. McMichael admits that this formula may not reflect population, and that it is difficult to arrive at correct weightings for each component in multicomponent sites; nevertheless the method yielded results which he considered intuitively correct. He notes that the resultant curve (McMichael 1960:79) appears to reflect in its first portion a long Archaic occupation by small, dispersed populations relying on hunting and gathering. (I have smoothed his data by aggregating some of his chronological subdivisions into five broad periods also used for the Halloca Creek survey (see Fig. 2).) This is followed by a change in the index which McMichael ascribes to increased efficiency of a gathering economy in the early Woodland period. Finally, he notes a marked increase during the Mississippian period, which he attributes to the greater efficiency of a horticultural economy.

McMichael’s scheme is far from perfect because of its reliance on a subjective weighting factor and its disregard of site type, varying collection conditions, and so forth. Other more objective, but also more elaborate techniques, have been suggested for population estimation in probabilistically sampled sites hav-
ing ceramics (Kohler 1978). In general, techniques for estimating population or intensity of use from survey data have not been given sufficient attention in the Southeast. The few recent attempts to examine regional use intensity through time from survey data have relied upon variants of McMichael's approach (e.g. Fish 1978; Dickson 1979). Since comparability of results from Halloca Creek and Oliver Basin was highly desirable, I have applied the McMichael system to the Fort Benning survey data. To help compensate for the different extent and intensity of survey in the two investigations, the data sets have been standardized to the same mean of zero and standard deviation of one to compare relative changes in each against the other. In the following analysis I assume that changes in the resident population size are directly proportional to changes in the Use-Intensity Index.

![Graph](image)

**Figure 2.** Standardized use-intensity indices for Halloca Creek and Oliver Basin.

### Growth Rates in Halloca Creek and Oliver Basin

The ability to juxtapose the Fort Benning and Oliver Basin data sets makes it possible to examine propositions concerning cultural development in river valleys in the deep Southeast versus their neighboring hinterlands. It is commonly believed (as reflected in the opening citation from Sears) that during the Mississippian period habitation sites shift into the large river valleys, possibly better to exploit their greater soil fertility and fish protein resources. If these samples correspond to this expectation, then the use of Oliver Basin should increase more rapidly than the use of Halloca Creek during the Mississippian period. Figure 2 confirms this. The most obvious difference between the two curves is the decreased use of Halloca Creek during the Mississippian period, concurrent with greatly increased use of the adjacent large river valley. The use-history of the two areas during other periods is similar enough to be considered identical, given the vagaries of the measurement process.

In the Middle Chattahoochee region, population growth seems to be slow during the Archaic, perhaps on the order of 0.03% per year (see Table 2). While this rate of growth is about three times higher than that computed by Hassan (1978:78) for the world during the Upper Paleolithic, it is still a third lower than the average 0.1% rate of growth often suggested for the Neolithic in the Near East (Carneiro and Hilse 1966) and for areas in Formative Mesoamerica (Sanders 1974). The rate of change from the midpoint of Period 2 to the midpoint of Period 3 is similar in both areas, and about the same as the earlier rate, suggesting that, at least in these areas, the economic and organizational changes often suggested for the Early and Middle Woodland periods had little impact on the long-term average rate of population growth and on the selection of large river valleys over small drainages for site location. Between the midpoints of periods 3 (ca. A.D. 550) and 4 (ca. A.D. 1150), however, the rates of
population increase in Oliver Basin are high enough to suggest either immigration or a significant alteration in previous fertility or mortality rates. Given the concomitant (and only) decline in the apparent occupation of the Halloca Creek area, it might be suspected that immigration into the major river valleys from smaller surrounding drainages was a major factor in the relatively rapid population growth in Oliver Basin.

**Table 2. Proxy Growth Rates in Halloca Creek and Oliver Basin**

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Years Between Period Midpoints</th>
<th>Relative Growth Rate</th>
<th>Annual Relative Growth $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 1</td>
<td>Period 2</td>
<td>3850</td>
<td>0.03% (both areas)</td>
<td></td>
</tr>
<tr>
<td>Period 2</td>
<td>Period 3</td>
<td>2200</td>
<td>0.02% (both areas)</td>
<td></td>
</tr>
<tr>
<td>Period 3</td>
<td>Period 4</td>
<td>600</td>
<td>0.16% (Oliver)</td>
<td>0.06% (Halloca)</td>
</tr>
<tr>
<td>Period 4</td>
<td>Period 5</td>
<td>518</td>
<td>0.04% (both areas)</td>
<td></td>
</tr>
</tbody>
</table>

$^a$Relative growth rates are computed from the unstandardized Use-Intensity Index for each area. Except for the change between Period 3 and Period 4, the indices for each area are averaged together prior to computation. The growth rate is calculated using the exponential formula:

$$r = \frac{\ln N_{(at \ time \ t+1)} - \ln N_{(at \ time \ t)}}{(time \ t+1) - (time \ t)}$$  
(Odum 1971:180)

where the use-intensity index is substituted for the population size $N$. The instantaneous coefficient of population growth $r$ is multiplied by 100 to obtain the percent annual growth rate in the right column.

**Behavioral Correlates of Population Growth Rates**

To understand the patterns of growth suggested by the curves for Halloca Creek and the Middle Chattahoochee Oliver Basin in Fig. 2, it is helpful to differentiate between two models for population growth, the exponential and the logistic. In exponential growth, a constant rate of growth acting on an ever-increasing base results in an unbounded upward increase through time. Such rates of growth can exist only for short-periods of time before the effects of various types of environmental resistance begin to be felt. If the population growth rate declines in direct proportion to the degree of environmental resistance met, so that the population level asymptotically approaches but never reaches a certain level $K$, then $K$ is said to be the carrying capacity (Odum 1971:183). The resultant S-shaped pattern of population growth through time is called a logistic curve. Carrying capacity in human populations is significantly influenced by mode of subsistence, storage practices, and organizational considerations (for a more complete list see Hassan 1978:74) in addition to environmental factors.

In plant and animal species in general, these two growth patterns are successful strategies in different situations. The exponential or "r-selection" pattern is typical of populations of annual species first colonizing a disturbed environment. Logistic or "K-selection" growth is expected for climax species in a mature ecosystem. Eugene P. Odum (in Schacht 1980:784) has summarized the characteristics of the two growth processes as follows:

In early stages of succession species with rapid growth rates and ability to exploit unused resources are favored. We can say that the early seral community is under strong "r-selection" pressure. In contrast, capacity to live in a crowded world of limited resources is favored in the climax. Larger body sizes, which increase storage capacity, more specialized niches, longer and more complex life cycles, and more cooperation between species (mutualism) are attributes that become more important than reproductive capacity as the ecosystem matures. We can say that the community is now under "K-selection" pressures.

Of course, the early portions of a logistic curve are identical to an exponential curve. In human populations it is possible to speak of "r-selection" and "K-selection" as taking place on different portions of the same (logistic) growth curve; human population growth is never truly exponential. Periods of rapid population growth may take place in response to upward changes in carrying capacity and different types of behavior may be favored under rapid growth versus equilibrium conditions.

Under r-selection, **maximum power output** is the key to success. In these conditions, just as the animals and plants that reproduce most rapidly will become dominant (Odum 1971:213-220), so also will those human groups that colonize and fill up a new niche most rapidly. In the growth phase following a release in the ceiling of the carrying capacity, the energy expended on inter-group competition (the human analogy for some types of inter-specific competition) will be low. Under conditions of K-selection, maximum reproduction (power output) is no longer selected for in plant and animal populations; rather, ensuring maximum competitive ability in fewer offspring is a more typical adaptation. Schacht (1980:784) suggests that cultures that are successful under conditions of K-selection may increase their capacity to store materials and adopt more labor-intensive subsistence strategies (irrigation, for example) as a corollary to increase emphasis on **efficiency** of adaptation. As the new niche fills up, ability to compete successfully and cooperate with neighboring groups becomes more important than ability to expand in number.

Cavalli-Sforza et al. (1982) have elaborated a general theory of cultural change focusing on the transmission of cultural traits between parents and offspring (vertical transmission), between nonparental individuals of the parental generation and individuals of the filial generation (oblique transmission), and between members of the same generation (horizontal transmission). They argue (1982:20) that "if the number of transmitters per recipient is many-to-one, the rate of [cultural] evolution
is slow." This would appear to be the case in many small-scale societies where not just the parents but the entire corporate group act as transmitters of the same (conservative) message. In such a case within-group variability in distribution of cultural traits would be expected to be low, with high between-group variability. If the dominant mode of transmission is one-to-one or one-to-few, as in the case of vertical transmission, rates of change would be higher, but not so high as in the case of oblique or horizontal one-to-many transmission, as happens in modern mass media, for example (Cavalli-Sforza et al. 1982:20).

Looking again at the growth curves for Halloca Creek and Oliver Basin in Fig. 2, we can consider the long, early sequence of slow growth through the Archaic and into the Woodland to be a period of K-selection, during which populations maintained themselves under a carrying capacity limited by the economics of hunting and gathering. Growth during this time was probably due to minor technological changes and slow expansion into less desirable areas with no apparently significant changes in the basic subsistence mode. If the analogies suggested above have any validity, this should be a period of slow cultural change dominated by many-to-one transmission of traits, high intergroup competition and variability, and strong tendencies towards elaboration of more complex inter-group and intra-group roles. To the extent that such tendencies do seem to be expressed in the continuum culminating in the Hopewell-related cultures of the first half of the first millennium A.D., the analogies seem defensible.

Shortly after that time, change in factors determining the carrying capacity of the riverine environments seems to have precipitated rapid population growth, or at least relocation, during which r-selection behavior may have been favored. We might expect this to be a period of accelerated cultural change if the increased population density resulted in increased interpersonal and intergroup interactions, resulting in turn in more opportunities for oblique and horizontal transmission of cultural traits, and perhaps more one-to-few and one-to-many transmissions. The shift in the location of habitations into the major river valleys at this time is coincident with the appearance of the 8–10 rowed race of corn variously called Northern Flint (Cutler in Neuman 1961) or Caribbean Flint (Mangelsdorf in Bullen 1958) in Fort Walton sites. A review of the collections accumulated at the Missouri Botanical Garden (Cutler and Blake 1973) suggests that sometime between Hopewelian times and A.D. 1200 an 8-rowed flint replaced the smaller 12-rowed maize as the dominant variety east of the Rockies. Heavy carbon isotope studies of human bone from the same periods suggest no detectable amount of maize in the eastern woodlands diet up to about A.D. 600–700, in contrast to major contributions after about A.D. 900 (see, e.g., Vogel and van der Merwe 1977).

The appearance of 8–10 rowed varieties at about this time perhaps supports Sears's contention that a new maize variety may have had a very important role in changing the carrying capacity of certain local environments. Of course this may not have been the only factor. From a Midwestern perspective, Hall (1980:438–440) has suggested that the introduction of the bow and arrow in terminal Middle Woodland may have had important implications for the post-Hopewellian "readaptation." Indirect local support for this notion comes from Fish's (1978) analysis of the intensity of prehistoric use of the Ebenezer Creek drainage in southeastern Georgia. By quantifying the occurrence of projectile points datable to various periods recovered during survey and photographed in the collections of local amateurs, Fish concluded that this interior tract near the border of the pine barrens and coastal sector was used most intensively during late prehistoric times for bow and arrow hunting by populations residing in other areas.

I suggest that for a short period of r-selection growth following a change in carrying capacity, groups with high birth rates and/or willingness to immigrate into the newly-expanded riverine niche would have had a selective advantage. Further predictions are that earliest adaptation to these conditions entailed little energy expenditure on intergroup warfare and definition of group boundaries. Mechanisms for conservation of cultural traditions may not have been as successful as during previous periods.

By A.D. 1100–1200, fortified towns were common in the interior Southeast, suggesting the presence of a warfare that has been interpreted either as the result of inter-group competition for arable river-bottom soils (Larson 1972) or intra-group competition for a limited number of status positions (Gibson 1974). This apparent return to conditions of K-selection might also be predicted to have been accompanied by slower population growth, increased cultural conservancy as heightened intergroup barriers decreased opportunities for horizontal transmission, and intensification of subsistence activities, including, for example, an increase in storage capacity.

Implications and Conclusions

Further study is needed to determine whether the relationship between population growth in large river valleys and smaller surrounding drainages seen for Oliver Basin and Halloca Creek is a common pattern in the late prehistoric Southeast. If it is, then the population growth usually assumed for the period may be more a local relocation of population leading to growth in circumscribed areas than a homogeneous trend throughout the region. Following the arguments given above, rapid cultural change is expected to accompany such local relocation and growth. Conceivably such
change might be mistaken—in the temporal resolution available to archaeologists—for intrusion of non-local populations.

The simple analogies presented here and by Schacht (1980) between adaptive strategies in natural populations and human groups under r- and K- selection require further examination. It seems to be true that large-scale changes in subsistence mode and cultural complexity are accompanied by population increase (Hassan 1981:261). It may also be true that, in general, rates of cultural change are closely correlated with rates of population change. In this case, it is suggested that the causal process resulting in these correlations begins with the successful introduction of a new variety of cultigen arriving on the heels of a new hunting technology. This leads to a higher productivity for riverbottom agriculture and a greater attractiveness for riverbottom site location. Groups able to take advantage of this new opportunity will be those already located in the river valleys, who could move to expand into the new niche as rapidly as possible, and groups located in the nearby hinterlands (e.g., Halloca Creek). Rapid population growth in the riverbottoms results, with little intergroup competition until the new niche begins to fill up. The growth and relocation in turn lead to more diverse types of cultural transmission acting on a larger pool of traits, and more opportunities for the one-to-few and one-to-many types of transmission which result in the most rapid change.

The cultural-ecological approach to explaining cultural change has often, and rightly, been criticized for a naive correlation of climatic or technological change with changes in other spheres of life. The assertion that the availability of new varieties of corn led to profound cultural change has an old-fashioned ring to it. However, I try here to show some of the intermediate steps that may serve as linkages between a new, productive cultigen and the rapid social change accompanying the spread of "Mississippianism." One important mechanism for this process may involve local changes in the ways in which culture is shared and transmitted.

NOTE ON CURATION

The materials collected during the Halloca Creek survey reported in this paper are curated at the Fort Benning Infantry Museum.

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