In recent years there has been a convergence of ideas and methodological approaches among ecologists, geographers and anthropologists in the attempt to explain variations in community sizes, population densities and functional specialization among organisms and societies. It is clear from this body of work that the factors affecting the distribution of size and function among human settlements are numerous, and that their casual interactions are complex. This study is an attempt to delimit some factors which affect these distributions; in particular, it is an attempt to relate the structure of resource distribution to the distributions of population, settlement, and group size among Coastal Plain and Piedmont Late Woodland societies in Virginia.

That there is a positive relationship between the productivity of a habitat and its realized carrying capacity seems obvious. The relationship has been shown to hold for a large number of different organisms. However the relationship is a complex one (cf. Hayden 1975). It is certainly possible to mask the complexity by looking at very simple variables: for instance, Birdsell (1953) showed a linear relationship between rainfall and aboriginal population densities in Australia. The nuances of difference between small areas and between different types of societies become considerably more complex, however. Ethnohistoric material for the Monacan, or Piedmont societies, of the James and neighboring drainages are scanty. The author has reviewed original sources and has argued that the societies of the Piedmont were loosely joined in a segmentary confederacy (Mouer 1980). In such societies, the operational mating and interaction networks encompass several hundred individuals residing in a small number of villages or hamlets. Cultural and linguistic distance between such networks is high due to low levels of interaction. However, a confederacy of such groups may periodically form for purposes of exploiting highly clustered seasonal resources, or more typically, for defense against a common enemy (Evans-Pritchard 1940; Sahlins 1961). Edogamy and interaction rates between the local social groups of the confederacy are higher than those beyond the bounds of the confederacy, forming a higher-level ethnic-linguistic configuration alternatively referred to as a "tribe" or a "people". Within the confederacy, there may be ranking by residential or tribal groups (I will use the term tribe here to mean a highly interacting, endogamous cluster of co-residential groups which often shares a name, a dialect and a high proportion of symbolic culture).

Among the Monacan, we can assume that the regional society or confederacy consisted of at least two complementary subregional segments named the Monacan and the Manahoak. These were divided into a number of tribes. The Monacan division included at least four tribes: the Monacan, the Rassawek, the Monasuskapanough, and the Monahassanough or Nahassan. The Monacan tribe in the early 17th century was further divided into co-residential groups or "villages" named Mowhemcho and Massinacack. Numbers and names of local groups for the other tribes are unknown. The presumed location of these various groups is shown in Figure 1 and follows Bushnell (1939). I will specify the various social segments as tribe, division and confederacy in
their functions to the extent that centralization of economy, polity and religion are incomplete. In a complex society, there may be co-equal status between ritual leadership, economic leadership and military leadership, with these residing in separate statuses. Furthermore, group specialization in one or more of these domains may be expected. If the paramount chief retains dominion over the economic redistribution system, it does not necessarily follow that his dominion includes the ritual system of the society.

A complex society, then, might be expected to vary from Christaller geometry in its settlement pattern due to overlapping lattices of different function, and due to the ease with which promotion or translation of functions between settlements can take place. Losch's (1954) well known revisions of the Christaller model deal with these kinds of added complexities. The point to be made here is that an approximation to the Christaller situation with functionally ranked settlements should not be taken prima facie evidence for a ranked social system, but may be an expression of an intermediate step in the evolution of complex societies in which an initial ranking of local groups and settlements emerges as a response to population growth.

Given homogenous resource distribution, we might expect a region to undergo an evolution from 1. a resource-focused pioneering settlement system to 2. an approximation of an equal-area hexagonal lattice, to 3. a nested hexagonal hierarchy, to 4. a complex pattern of interlocking and overlapping functional hierarchies. In the ideal case, complex social and spatial organization would be governed by division of labor in response to growing populations. At the chiefdom level, this latter stage will be characterized by a dendritic flow of information and goods between a paramount center and district centers whose territories are skewed towards and major center. In market-based economy, the lattices tend to even out as the functional size of centers and their territories become regulated by supply and demand considerations.

I would contend that the settlement pattern expectations for a segmentary confederacy would most likely tend towards number 3, above. The nested segments of the tribal world so well described by Evans-Pritchard (1980) are the expected outcome of competition between groups for limited resources (Sahlin 1961), typically, agricultural land. A high level of inter-group conflict suggests that no single group has either the sheer numbers or the organizational mechanisms for completely dominating the others.

Ranking among individual social statuses in egalitarian society is generally seen as the ordering of acquired status based on factors such as prestige or age. In a similar way, we may see ranking of settlements or tribal groups evolve in a regional configuration due to factors of centrality, population or prestige. No social group has a legitimate claim to vested authority imparted by its name, totem or other symbolic, permanent device. It is not, therefore, anathema to speak of "ranked" status between tribes or settlements within a segmentary system, so long as the ultimate levelling and disassociative characteristics of segmentation are considered.

Ranking and Resource Distribution

Vandemeer (1973) has presented a theoretical framework of ecological niche theory which incorporates a great deal of the literature concerning succession and the relationships or organisms in heterogeneous environments. He has subsumed in his framework such landmark ecological works as those of MacArthur Pianka and others. Vandemeer's model attempts to predict the distribution of organisms and the structure of communities under the influences of density-dependence. That is, he has isolated processes of feedback which result from competition both within and between species in the evolution of "settlement patterns" of organisms, and
the points he makes can be used to understand the evolution of human communities, with some allowances made for the adaptability of human culture and technology. The author has modified Vandemeer's model to one which incorporates anthropological concepts and applies these to the evolution of tribal settlement systems. This work will be presented in a doctoral dissertation (Mouer n.d.) later this year. For the present, I will simply present some concepts and outcomes of the model.

The scheme for the evolution of settlement patterns presented earlier was based on the assumption that resources were distributed homogenously throughout the area. The settlement process then is only bounded by the size of the occupied area. The major feedback effects of increasing density are those required to organize increasing interaction. It was posited that face-to-face, egalitarian organization would fail or lose efficiency beyond some threshold of interaction densities. It was proposed that a hierarchy which involved group ranking for specific and temporary purposes would emerge in a segmentary system, and that the structure of such a system would be based on ritual and locational centrality rather than on political or economic hegemony.

That real-world ethnographic situations often reflect the segmentary structures alluded to above suggests that in some environments resources are distributed more or less homogenously or, perhaps, randomly across territories. Significant alterations to the settlement pattern model are required when resources are not uniformly distributed. In order to model processes of settlement evolution in a non-uniform environment, certain concepts are briefly introduced here. Vandemeer makes a useful distinction between the fundamental niche and the realized niche of an organism. In human culture the fundamental niche of a group can be taken to mean the potential exploitative regime which would be used by a group if it could occupy a habitat ideally suited to its technological capabilities and which was free from the effects of competition due to population density. In an optimal habitat, the fundamental niche would allow a thriving population which could be internally self-sufficient and self-reproducing. Population would level out at or near the carrying capacity, and excess population would split off into daughter groups which would move away without causing resource stress or competition with the parent group.

The realized niche is the actual exploitative regime of a population under conditions of both internal demographic pressures and external competition. The realized niche often requires groups to settle in sub-optimal and marginal habitats. A sub-optimal habitat is one which will support a stable population which is either a. insufficiency large to be a closed, self-reproducing system (and therefore external mating networks are required), or b. is insufficiently productive or diverse to maintain a population which is economically self-sufficient over long periods (so external economic relations are required). A marginal habitat is one which is not capable of maintaining either a self-sufficient or self-reproducing society, because it is deficient in crucial resources. It should be noted that even a highly productive habitat which is too small (perhaps because regional populations are so large) can be subject to periodic droughts or other severe shortages which might render it marginal in the sense used here.

If a region is sufficiently productive, but characterized by a zoned or patchy resource distribution, we might expect the following to occur:

1. Optimal or nearly optimal habitats will be filled first with population levels approaching the local carrying capacity.

2. Sub-optimal habitats will be filled next. Connections between populations in these habitats and populations in the optimal habitats will be maintained.
These relationships will comprise an unbalanced reciprocity among tribal societies, with the larger and more stable populations of the optimal habitats gaining a certain political or economic hegemony over those in suboptimal habitats. An optimal habitat can become sub-optimal under the effects of increasing density and competition. Likewise, sub-optimal habitats can become marginal as they are compressed or circumscribed. Increases in population will tend to expand the rank distance between groups in a patchy or zoned environment, while increasing the need for interaction between groups. As density rises, autonomy decreases and ranked interdependence increases.

3. Marginal habitats, by definition, can only be permanently settled once unequal relations between groups are present. Further, a marginal habitat can be promoted to sub-optimal status if a stable system of unbalanced reciprocity exists. That is, if social factors are present which can negate the effects of crucial resource shortages or periodic "droughts", then it is possible that a substantial, permanent population can occupy an otherwise marginal habitat.

From the above, it can be deduced that regional carrying capacities in a zoned or patchy environment are capable of being increased if non-egalitarian structures evolve which allow for the permanent occupation of smaller or less optimal habitats. Such a situation may result under conditions of regional competition, where larger population can mean a competitive advantage. If we assume that segmentary systems are "normal" for tribal society, then we would expect population densities to even out at a level below those requiring coercive structures. While some sub-optimal habitats could be inhabited through a segmentary, ritually controlled set of relations, fairly large, autonomous territories would be the norm. Relatively large territories would be selected in order to guarantee optimal levels of productivity and diversity of resources.

Marginal habitats would only be inhabited on an occasional or seasonal basis. From this we can infer that density-dependent effects from outside the region might be a prime cause for the evolution of non-egalitarian structures within a region (cf. Binford 1968).

If we look at a regional boundary, then we see processes similar to those of tribal boundaries, but on a larger scale. If two regions, both inhabited by segmentary societies, attain some threshold density level, then the degree of competition between them will be determined by a, the nature of resource distributions across that boundary and b, the relative size and state of internal organization of each region (following postulate 4). A regional boundary can be expected to be viewed by a segmentary society as yet another inclusive sphere of external relations. These relationships would be considered competitive and co-equal, engaged in only when necessary. Such necessity would involve the typical competitiveness for access to resources at the boundary, and the willingness to join together for such purposes as mutual defense against a common enemy. From the perspective of a ranked, highly integrated society such as a chiefdom, the boundary takes on quite a different meaning. The chiefdom is a symbolic entity with a figurehead and a territorial identity. The sort of competitive raiding which takes place between many tribal societies might be looked upon more seriously as a breech of sovereign territory. The willingness to unite against a common threat with a bordering region might instead be replaced by a general feeling that all outsiders are the enemy. The rules of segmentation would be replaced by the rules of sovereignty.

At the time of the founding of Jamestown, the colonists were aware of two major aboriginal social groups living in Virginia: The Powhatan and the Monacan. These names refer to two distinct regional societies. The former were found in the Coastal Plain physiographic province and the latter were found throughout the
Piedmont. These groups belonged to two major linguistic families and cultural traditions: the Atlantic Algonkian and the Eastern Siouan, respectively. They apparently shared much in terms of material symbolic culture. 17th and 18th century colonial writers found only minimal differences in religious beliefs, house forms and daily patterns of domestic life.

None-the-less, there were considerable differences in the way these groups were organized. The relationships between local co-residential units (households, hamlets, and descent groups) appear to have been quite different among the Powhatan from those found among the Monacan. In fact, their terms "Monacan" and "Powhatan" do not describe the same sorts of entities at all. The Powhatan can be thought of as a society: an interacting, territorial group which shared a culture. The term "Monacan", on the other hand, seems to have related to a loose grouping of more-or-less autonomous small societies (Mauer 1980).

Both groups were characterized by social and settlement hierarchies. That is to say that certain groups within the larger groups were considered more "important" both within the societies themselves and to outsiders. These between-group differences were not of the same structure in Powhatan and Monacan society, however. I propose that some of the differences between Coastal Plain and Piedmont social structures can best be explained by reference to differences in environmental structure between these two provinces.

In comparing the environments of the Powhatan chiefdom and the Monacan confederacy, very significant differences are noted. The Coastal Plain can be characterized as a highly zoned, patchy environment, while the Piedmont can be seen as a relatively uniform one (Mouer, Ryder and Johnson, this volume). The variations in Piedmont habitats are probably largely related to the amount of floodplain available for agriculture. That agriculture was the economic basis of Piedmont Late Woodland society has been argued elsewhere (Mouer 1980, Holland 1980). The low level of regional integration among Piedmont tribes is attested by the large amount of stylistic and technological variation in Late Woodland ceramics in this area (Mouer 1978), as compared with the relative uniformity of the Townsend Series ceramics of the Chesapeake Coastal Plain. This diversity is reflected in economic and linguistic patterns as well.

Smith transmits the report of a Manahoac from the Rappahannock that his division was comprised of numerous diverse tribes which were confederated and these, in turn, were confederated with the Monacan. The informant used the term "Monacan" to describe his "world" in complementary distinction from the Powhatan to the East and the Iroquois, the common enemy of Powhatan and Monacan. Smith (1910a:71) lists the named "tribes" or districts of the Manahoac whose five "kings" were communally hunting nearby. He states that the confederacy consisted of these "and diverse others, though many different in language, and be very barbarous, living for the most part of wild beasts and fruits". Elsewhere Smith mentions that the Monacan and Manahoac spoke mutually unintelligible languages, but that all the Powhatans understood each other's speech.

A hierarchy of sorts probably existed among Monacan groups, Smith noted, for instance that the "chiefest town" of the confederacy was Rassawek, presumably located at the confluence of the James and Rivanna. Figure 1a illustrates the location of Rassawek in relation to the presumed locations (following Bushnell 1930) of the other tribal districts.

Clearly, Rassawek is centrally located with respect to communications routes. Its selections as a "central place" is in accord with what would be expected of a segmentary confederacy following the model presented here. It may also have enjoyed
Figure 2

<table>
<thead>
<tr>
<th>DISTRICT CENTER</th>
<th>POPULATION</th>
<th>DISTANCE FROM PAMUNKEY (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powhatan</td>
<td>240</td>
<td>48</td>
</tr>
<tr>
<td>Arrohattoc</td>
<td>255</td>
<td>48</td>
</tr>
<tr>
<td>Appomattoc</td>
<td>380</td>
<td>45</td>
</tr>
<tr>
<td>Weanock</td>
<td>530</td>
<td>45</td>
</tr>
<tr>
<td>Orapaks*</td>
<td>180</td>
<td>10-20</td>
</tr>
<tr>
<td>Baspehegh</td>
<td>240</td>
<td>32</td>
</tr>
<tr>
<td>Chickahominy**</td>
<td>1500</td>
<td>25-40</td>
</tr>
<tr>
<td>Quiyoughcohanock</td>
<td>255</td>
<td>42</td>
</tr>
<tr>
<td>Waraksoyak</td>
<td>210</td>
<td>67</td>
</tr>
<tr>
<td>Nansemond</td>
<td>850</td>
<td>83</td>
</tr>
<tr>
<td>Chesapeake</td>
<td>425</td>
<td>105</td>
</tr>
<tr>
<td>Kecoughian</td>
<td>180</td>
<td>80</td>
</tr>
<tr>
<td>Youghtanund***</td>
<td>400</td>
<td>30</td>
</tr>
<tr>
<td>Pamunkey****</td>
<td>1500</td>
<td>0</td>
</tr>
<tr>
<td>Mattaponi****</td>
<td>360</td>
<td>0</td>
</tr>
<tr>
<td>Werowocomoco</td>
<td>200</td>
<td>25</td>
</tr>
<tr>
<td>Chiskiac******</td>
<td>210</td>
<td>38</td>
</tr>
<tr>
<td>Nantaughtacund</td>
<td>640</td>
<td>64</td>
</tr>
<tr>
<td>Cuttatowomen 11******</td>
<td>150</td>
<td>70</td>
</tr>
<tr>
<td>Pisassasec</td>
<td>300</td>
<td>61</td>
</tr>
<tr>
<td>Rappahannock</td>
<td>500</td>
<td>32</td>
</tr>
<tr>
<td>Moraughtacund</td>
<td>340</td>
<td>30</td>
</tr>
<tr>
<td>Cuttatowomen 1</td>
<td>210</td>
<td>38</td>
</tr>
<tr>
<td>Tauxenent</td>
<td>170</td>
<td>128</td>
</tr>
<tr>
<td>Potomac</td>
<td>750</td>
<td>90</td>
</tr>
<tr>
<td>Onawanmanient</td>
<td>425</td>
<td>64</td>
</tr>
<tr>
<td>Secacawoni</td>
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<td>58</td>
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<tr>
<td>Wighcomoco</td>
<td>550</td>
<td>58</td>
</tr>
<tr>
<td>Accomac</td>
<td>340</td>
<td>90</td>
</tr>
<tr>
<td>Accohannoc</td>
<td>170</td>
<td>96</td>
</tr>
<tr>
<td>Piankatank</td>
<td>210</td>
<td>38</td>
</tr>
</tbody>
</table>

Notes on Table 1

Population estimates follow Turner (1976). Locations of district centers follow McCary (1957). Distances are straight line distances. These are thought to be adequate approximations of travel times due to the fact that none of the distances are very great and a well used system of overland trails is thought to have existed at the time.

*Orapaks was reported by Smith to have been a small seasonal hunting village prior to 1608. At that time, Powhatan removed his "seat" from Werowocomoco on the York River to Orapaks, just above the Chickahominy settlements. The reason given was that Powhatan was displeased living so close to the English. It is notable that Powhatan was engaged in a political struggle to bring the Chickahominy under his dominion. The placement of Orapaks, between the Chickahominy settlements and their upstream hunting quarters may have been politically motivated. The exact location of Orapaks is unknown. A tribal district
becoming the name appears on a mid-17th century map on the south bank of the Pamunkey, opposite Manquin Creek. The 1608 location is given to be "in the deserts" between Chickahominy and Pamunkey. I believe it was slightly east and south of its location on the mid-17th century map.

**Chickahominy is not, properly speaking, a district of the Powhatan. It is best considered a division of its own. There were no "King's Houses" among the Chickahominy. The extent of Powhatan influence or dominion over the Chickahominy fluctuated throughout the early 17th century. For certain social purposes, they can be considered a part of the polity. I have calculated their "center" at about 30km. from Pamunkey.

***Youghtanund did not have a "King's House" on Smith's map. Their proximity to Pamunkey and to Orapaks probably left no need for a separate King's House. Their "center" as such was probably a major settlement near the mouth of Manquin Creek where Totopatomoy, the paramount in the 1650's, was located, at the present Pamunkey reservation. While no King's House, per se, was found at Youghtanund, it is likely that they were ruled by the royal lineage of Powhatan.

****Pamunkey, like Chickahominy, should be considered a division rather than a district. It was composed of four districts, including the ritual center of Uttamussak. The main center was probably at Menapacunt, and all distances have been measured from the probable location of this center.

*****Mattaponi (Mattapanient) was a frequently used name in the Virginia Coastal Plain. No King's House is listed at Mattaponi on the river which, today, bears that name, but the district was frequently mentioned. It, like Youghtanund, may have been so well integrated into the chiefdom, and so close to Pamunkey, that no King's House was needed. However, I have considered Mattaponi a separate district, and have treated it as being located on the Mattaponi River, within 10 km. of the Pamunkey centers.

******Chiskiac, or Kiskiac, was located on the lower York River at the time of Smith's mapping. However, it soon removed to the Middle Peninsula. It is treated here in its original position.

*******Cuttatowomen was the name given to two villages. One on the lower and one on the upper portions of the Rappahannock River. Smith estimates a slightly lower population for the upper, or Cuttatowomen II, but Turner gives the two centers the same population. I have followed Smith and estimated a slightly lower number for Cuttatowomen II.
increasing order of inclusiveness. Figure 1 illustrates the organization of the Monacan Confederacy.

The Powhatan chiefdom was divided into approximately 32 district groups which may be considered the equivalent of the "tribes" of the Monacan. Along the James and its immediate tributaries, these included the Powhatan, Arrohatock, Weyanoke, Appomattoc, Paspahegh, Warraskoyak, Nansemond, and Chesapeake. Each of these contained a number of villages or hamlets, most of which were not named on Smith's map. The Upper James River division, which included all those tribal districts between the mouth of the Chickahominy and present day Richmond, was highly allied with the groups of the York River (Pamunkey) division of the chiefdom. Other divisions, such as the Chickahominy, Lower James, Rappahannock, Potomac, and Eastern Shore Divisions appear to have retained somewhat more autonomy. Following the analyses by Binford (1964) and Turner (1976), it is clear that sufficient internal status differentiation existed in the Powhatan society to characterize it as a ranked society (Fried 1967) or chiefdom (Sahlins 1968). It is not necessary to completely review the social organizational characteristics of such a society except to note the presence of ranked social statuses ascribed by birth. Settlement function specialization and ranking are generally considered typical of chiefdoms as well (Smith 1976, Sahlins 1968) and are often considered to follow from the hegemony of certain settlements over valued resources.

Ethnographic data for the distribution of population and settlements among the Powhatan and to a lesser extent, the Monacan have been supplied by the writings of John Smith (1910a, 1910b). These data will be used here in order to draw inferences concerning the spatial and social organizations of these societies. Interpretations of boundaries and estimates of population for the Powhatan follow those of Turner (1976).

Segmentary Confederacies and Chiefdoms

Segmentary society is based on nested spheres of interaction and relationship. The basic producing and consuming unit is the household, kindred or lineage segment. Beyond that, relationships are voluntary, temporary, and on an as-needed basis. As the domestic unit cannot be a source of mates, a tribe exists. Because a tribe cannot necessarily provide the full range of commodities required or desired for everyday life, a division - in the terms used here - exists. Because the tribal division of a single drainage segment cannot adequately protect itself from the incursions of foreign enemies, a confederacy exists.

Relationships between segments are non-coercive and are not sustained by the implicit structures of a conical clan or the ideologies of divine right. If this is true, it remains unexplained how a hierarchy in settlement patterns might emerge.

Vance (1970) has argued that the emergence of a central place hierarchy in Christaller's (1966) classical study area was due to an increasing productivity within a closed system. It can be argued that increased productivity and population in the relatively homogeneous interior river valley habitats of the Piedmont could also result in a kind of hierarchical settlement solution. Such productivity increases may have occurred with the introduction of efficient maize horticulture in the Late Woodland Period. The hierarchies of a segmentary system are, by definition, non-coercive. Therefore, the only requirement needed in the territory of an emergent center is a competitive advantage for fulfilling limited higher-order, organizational functions. That is, a higher-order center in a segmentary system need not be militarily or organizationally superior to lower level settlements; it must simply have an advantage in performing a specific function. Tribal centers function at the level of mating networks and for the adjudication of disputes between households or lineage segments.
centers, if present, might serve as co-
ordinators of ritual systems with
mechanisms for the periodic or occasional
exchange of necessary commodities. Such
systems act as levelers or dampers to
offset temporary local resource inequities.
As there is no central system of resource
redistribution, there are no statuses
allocated for collecting and distributing
surpluses. Division centers would
probably emerge due to locational
centrality rather than political hegemony.
They may appear at key positions in the
routes of exchange of ritual objects. This
sort of ritual bonding of autonomous tribes
is well described by Leach for Highland

A regional confederacy center, if
present, would almost certainly emerge in
a centralized location. If the primary
function of the confederacy is defense,
then the role of such a center is to
collect and disseminate information in
order to effect a quick response to a
threat. It is likely that, among all
possible centers which could be selected,
that which emerges as the chief center of
the confederacy will also be one which
enjoys sufficient centrality and prestige to
lend a greater authority to its military
efforts. As the organization of such
efforts is by nature a voluntary
association, the "competitive advantage"
needed is one of group prestige or
symbolic centrality rather than one of
political authority.

The hierarchical nature of both sizes
and functions of the chiefdom, as
described earlier, is quite different from
that found in the segmentary system.
While coercion is limited when compared
with certain social relationships in state
societies, it is still present. While
segmentary hierarchies are temporary and
specific in nature, the chiefdom is imbued
with a basic structure of inequality.
This inequality applies not only to
statuses of individuals, but to tribes and
settlements as well.

The Powhatan chiefdom is rather
typical of such systems in that the
paramount chief had established his
authority throughout his realm by placing
siblings and classificatory siblings of his
matriline in positions as district chiefs
over as many tribes as possible. He
likewise augmented the authority of his
royal lineage by taking a wife from the
ruling lineages of most tribes within the
chiefdom. Local chiefs thereby became
affinally linked with the ancestral clan of
the paramount, expanding the conical
hierarchy of lineages in a system
resembling feudal alliance. This could
have only been possible if the local tribal
groups had been organized in something
other than a purely segmentary system.
That is, a world view and political
structure which permitted the coercion of
one group by another and which prevented
the dissipating effects of segmentation,
must have existed prior to the consoli-
dation of the chiefdom. The question
which remains to be answered is this:
how did a system which permitted the rise
of ranked lineage social groups emerge in
the Coastal Plain, while egalitarian,
segmentary systems evolved in the interior
valleys of the Piedmont?

SETTLEMENT SYSTEMS: AN EVOLUTIONARY
MODEL FOR TRIBAL SOCIETIES

It will serve my purpose here to offer
some postulates which will not be
rigorously defended here, but which are
generally well established in the anthro-
pological literature. These will be used
for subsequent model construction.

Postulates:

1. At some time following the coloni-
zation of an area a population density
will evolve which is directly proportional
to the carrying capacity (predictable
productivity) of the habitats within that
area.

2. Above some threshold of population
density, face-to-face egalitarian structures
fail to effectively structure interaction
and must be replaced by hierarchical and
specialized structures.
3. Social complexity is directly proportional to the population of the interacting group. This postulate is basically that of Carneiro (1967). A corollary of postulates 2 and 3 is that the number of hierarchical ranks in social status, settlement specialization etc., is directly proportional to the population of the interacting group.

4. The competitive advantage of a social group is directly proportional to its population and its degree of effective hierarchical organization. This is essentially Sahlin's Law of Cultural Dominance.

5. The competitive advantage of one group over another is inversely proportional to the distance between them.

The actual functions which describe the relationships given in the above postulates are not specified here. These require considerably more theoretical and empirical treatment. Carneiro's empirical function (postulate 3) is logarithmic with a log linear plot having a slope of .6. The number of organizational units in the society is proportional to the square root of the population up to a limit of approximately 3000 persons. Beyond that, Carneiro speculates a flattening sigmoid curve as increasing population requires the addition of fewer organizational units. Postulate 4 requires some measure of internal organizational efficiency. Postulate 5 is probably a gravity function, with some measure of competitiveness related to some proportion or coefficient of the inverse of the square of travel time between population centers or administrative outposts. Despite the obvious need for more rigorous stipulation of the above postulates, it is felt that these shall suffice to explore a number of corollary model implications.

We may also make some assumptions concerning social behavior and economic principals with regard to the societies at hand. Let us assume that one social group may not transgress upon the exploitative territory of another unless it meets the conditions of postulates 4 and 5 and has a clear competitive advantage. Let us further assume that we can characterize the exploitative or annual territory of a sedentary group by drawing an irregular polygon around the presumed center of that territory such that boundaries are formed halfway to the center of the nearest neighbor territory in all directions. Given an environment which can be characterized as an isotropic plane with homogenous resource distribution, we would expect to find a population evenly distributed between rectangular or hexagonal territories of equal size, providing that the density threshold stipulated in postulate 2 had not been reached.

Above this threshold, we would expect a series of nested hierarchies with ranked centers to emerge. This is the familiar Christaller geometry of settlement patterns (Christaller 1966). While Christaller's model assumes a market economy, I would argue that the basic geometry is equally efficient and necessary for organizing decision-making or political authority, mating networks, and information systems. However, it is well to note objections by Steponaitis (1978) with regard to expectations of central-place theory and the settlement patterns of rank societies or chiefdoms. He argues that a redistribution economy characteristic of chiefdoms would create a skewed lattice with district centers pulled closer to the paramount center than what one would expect in a market situation. Presumably, the paramount center would hold looser control over more distant centers which, in turn, would service larger hinterlands. A corollary might be that population densities can be expected to fall with distance from the paramount center as the efficiency of hierarchical organization and economic redistribution also decreases.

A further distortion from Christaller geometry can be expected in chiefdoms if we consider the fact that lower order centers probably cannot be considered as equal, competitive loci, as one would expect in an ideal market economy. District centers will vary in
a slight population advantage over other tribal districts in that its territory contains a greater amount of alluvial floodplain than the others.

Figure 1b shows approximate locations of major divisions of the Powhatan chiefdom. Turner (1976) has demonstrated the pattern of higher population densities in the inner Coastal Plain portions of the chiefdom. Density concentrations are found especially in what Binford (1964) referred to as the salt-freshwater transition zone. Both authors attribute these population distributions to high habitat productivity and diversity in these areas. Binford stresses the importance of fishing efficiencies in the zone while Turner emphasizes the greater extent of soils suitable to aboriginal horticulture.

John Smith reflected a basic inequality among settlements on his map by designating villages with "kings houses" versus those with just "ordinary houses". As he depicted approximately 31 or 32 "kings houses", located at major villages, and elsewhere stated that Powhatan had in his realm 32 "kingdoms", it has been assumed that villages with such map symbols could be taken as tribal or district centers (Turner 1976). The map shows numerous villages with just "ordinary houses". This alone might be taken as evidence for at least a two-fold ranking of settlement territories. Figure 2 list district populations and their distance from Pamunkey.

By charting the distribution of population as a function of distance from the Pamunkey Nuclear area, we can see a relatively smooth fall-off of the numbers of persons included within the polity of Powhatan (Figure 3). This is partly a function of high productivity in the 40-50 kilometers or so around Pamunkey. It is also partly a phenomenon of the boundaries of the chiefdom. Radii over 70 km. tend to take in portions of Chesapeake Bay and the Piedmont. None-the-less, this chart demonstrates the central position of the Nuclear area within the chiefdom and suggests the possibilities of higher ranking in this area among the territories or district centers.

In fact, the 30 km. radius takes in all the territories of the York and James River systems inherited by Powhatan, as well as the Chickahominies. A 40 km. radius includes the Plankatank and the most important district centers on the Rappahannock. Beyond 70 km. lie the more autonomous districts of Chesapeake, Nansemond, the Eastern Shore and the Upper Potomac groups. The three Potomac River groups which fall within the 70 km. radius are those which were apparently more closely tied to the Powhatan (Onawmanient, Secacawoni and Wicomoco).

If we graph the population served by district centers (Figure 4), we get what appears to be a normal curve truncated at the lower end (which reflects the fact that settlement territories with populations below 100 are rare). Since population appears to follow a function similar to the population per district center ratio, we would expect the spatial distribution of centers to follow a similar function unless some centers are functionally distinct from the others. It would of course be more to the point to know whether any centers were politically or economically dominant over groups of lower centers. However, we do not have that information without more intensive study of the historical record. For the time being, it might be suggestive to demonstrate that some centers were functionally distinct in that they had much larger domains.

I have attempted to do this by first graphing the distribution of distinct centers as a function of distance from Pamunkey (Figure 5). While this graph at first appears similar to the others, it more clearly shows the possibility that centers are ranked. There is a cluster of centers within a 10 km radius of Pamunkey, perhaps illustrating Stepona itis' which reaffirms the redistributive economy of the chiefdom. There appears another peak in the number of centers between 30 and 50 km, after a distinct trough between 20 and 40 km.
FIGURE 3

DISTRIBUTION OF POPULATION BY DISTANCE FROM PAMUNKEY

Including Chickahominy

Excluding Chickahominy

Distance (Km) 10 20 30 40 50 60 70 80 90 100 110 120 130
Number of Persons Belonging to Chiefdom 160 200 1660 1575 150 1030 1260 425 170
This is followed by a plateau of sorts and then a possible mode between 90 and 100 km. This graph suggests that there are, perhaps, 3 "rings" of centers within the chiefdom. Presumably, each would have its "ordinary house" settlements, its lower order "kings house" centers and, perhaps, some superordinate center or centers.

That such superordinate centers may have existed can be illustrated by graphing the population/district center ratio as a function of distance from Pamunkey (Figure 6). Part of the variation in the population/district center ratio is a function of distance from the nuclear area as shown by the lower, solid line in the graph. This line seems to reflect the fact that the polity's hold relaxed as one travelled away from Pamunkey. That is, the further away one goes from the "capital" of the chiefdom, one finds fewer "chiefs" and more Indians. However, distance was apparently not the only cause of variation in the population/district center ratios.

The upper, dashed line, suggests a series of higher order centers which are distributed throughout the chiefdom. The average number of persons per center within the nuclear area is quite a bit higher than that which would be predicted if distance alone caused this ratio to vary. Likewise, if the Chickahominy are included within the polity, then the ratio at 30-40 km. is much higher than that predicted by the lower line. Another "glitch" in the line occurs between 60 and 90 km.

While the frequency distribution of population sizes per district center (Figure 4) does not suggest the presence of higher ordered centers, the spatial distribution of different center sizes is suggestive. The dashed line in Figure 6 seems to represent the possibility of higher order centers arranged at the distance intervals of 0-10 km., 30-40 km., and 60-90 km. These distances might represent the travel time of a day trip, an overnight trip, and a two or three-day trip, in different directions from Pamunkey.

Care must be taken in interpreting this last figure, however. The upper points include major centers such as Menapacunt (at Pamunkey), Nansemond, Potomac, Nantaughtacund and Chickahominy: all relatively independent tribal divisions. Such divisions, comprised of groups of five of fifteen hundred persons seem to be the building blocks from which the chiefdom was formed. The major centers may not be superordinate "central places" with sub-centers below them so much as they appear to be "chiepest towns" of what may once have been segmentary tribes. That such centers had taken on functions distinct from other district centers by 1607 seems likely, however.

Figure 1b illustrates spatial organization in the Powhatan Chiefdom. Centers of both size functions are found in the "rings" around Pamunkey. The centralized distributions of both population and political structures are suggested in this schematic representation.

Figure 1a gives a schematic representation of the social and spatial relationships between the segments of the Monacan Confederacy. This scheme approximates the actual spatial relationships of the segments while presenting a graphic model of segmentary, complementary organization, with a degree of centrality in the riverine confluences. Note, for instance, the position of Rassawek in the major confluence of the larger of the two drainage systems. If this model is valid, one would expect to find a degree of symbolic and organizational centrality in the Stegara district on the Rappahannock as well. Confirmation or negation of this requires further ethnohistorical or archeological research.

While the centrality of Rassawek and, possibly, Stegara, are evident in the diagram, this does not compare with the type and amount of central control evident for Pamunkey and some of the division centers of the Powhatan. The core lineages of the Powhatan were seated in an arc that transepted the inner ring of
Figure 4

Figure 5

DISTRIBUTION OF DISTRICT CENTERS BY DISTANCE FROM PAMUNKEY
FIGURE 6

RATIO OF POPULATION PER DISTRICT CENTER AS A FUNCTION OF DISTANCE FROM PAMUNKEY
the Pamunkey Nuclear Area as well as the westernmost settlements of the Upper James and Chickahominy divisions. This gave the core lineages dominion over not only the most valuable agricultural land and fishing localities, as documented by Turner and Bindord, but it also effectively gave them control over the upstream hunting and nut harvesting territories of the Inner Coastal Plain. Control of the western hunting territories and the buffer zone between the Powhatan and Monacans also gave the core groups the responsibility for defending the areas from seasonal incursions by Monacans. This is discussed further below. However, it should be stressed here that the combination of economic and military power appears to have been well established in these western settlements.

Population density estimates for the Monacan confederacy have not been calculated, although McCary (1957) estimates that the confederacy was smaller than the Powhatan chiefdom by a factor of two to three, even though it occupied an area three or four times larger than the Powhatan. Spacing among Monacan tribal units was much greater than among the Powhatan. In the ca. 50 miles of the James River between the falls and Rassawek, there were two tribal districts with an estimated maximum population of approximately 1000 persons. In the fifty miles below the falls, there were four or five tribal districts with a population of approximately 2000 persons, not counting the neighboring Chickahominies. The disparity between regions becomes much greater when the interfluvial areas are considered.

An accurate analysis of the potential productivity of habitats in both regions remains to be done. Specific data cannot be presented, but it is clear that Coastal Plain habitats tend to be considerably more diverse and productive than those of the Piedmont. It does not seem reasonable, however, to expect that typical Coastal Plain habitats were several times more productive. Instead, the increased carrying capacity of the Coastal Plain is almost certainly a result of a substantial history of non-egalitarian relations between groups and the consequent promotion of marginal or sub-optimal habitats to the status of permanently occupied tribal districts. The high densities found near the Pamunkey Nuclear area probably reflect social, as well as environmental conditions.

The processes which brought about the evolution of a ranked society in the Coastal Plain are not clear. Turner (1976) argues strongly that increased population densities and resource stress led to a reorganization of social relations. I would agree and argue along with Cohen (1977), Sanders and Price (1968), and others that population/resource ratios are, indeed, pivotal in the formation of the social complexity. However, I would stress external pressures or circumscription, in Sander's term, of the society as a prime element. Prior to Late Woodland times, there is ample evidence that substantial populations of agricultural, tribal societies were established in the neighboring Piedmont (cf. Mouer, Ryder and Johnson, this volume). Piedmont resources are, essentially, a subset of resources available in the inner Coastal Plain. This latter area, however, contains numerous freshwater swamps, fish spawning grounds and other potentially valuable resource areas not found in the Piedmont.

We could expect Piedmont groups to regularly attempt to expand their exploitative territories across the Fall Line. This would place pressure on the Fall Line "buffer zone" (Turner 1978, an area perhaps viewed as a hunting-gathering ground under "royal" control by Powhatan. On the Potomac, there is a distinct possibility that, in Late Woodland times, a Piedmont society managed to establish itself well into the Tidewater zone as suggested by the spread of Potomac Creek pottery. This apparently did not happen on the James or York systems, however, due to the evolution of a competitively superior chiefdom in Tidewater. However, the Powhatans
considered the Monacan confederacy as "the enemy" and they complained to the English about Monacan seasonal incursions into their "soverign" territory. Late Woodland ceramics of Piedmont affiliation are moderately common on sites along the James and Chickahominy drainages just below the Fall Line.

In 1654, several hundred persons - remnants of the Monacan confederacy - moved to the Fall Line and requested that their neighbors give them refuge from their common enemy, the marauding Iroquois. Such a move and request is to be expected of a society based on segmentary affiliation. The Powhatan viewed the move as an invasion and met the request with an army of both Indian and English troops. This army was defeated at the so-called Battle of Bloody Run, and the Powhatan chief, Totopotomoy, was killed. The Monacans dispersed and moved on, many eventually affiliating with the Iroquois confederacy.

Summary

In this paper, I have presented two contrasting models of tribal regional society: the segmentary confederacy and the chiefdom. I have attempted to explain the evolution of these social types in the form of two Late Woodland Virginia regional societies, the Powhatan and Monacan. The differences in the course of social and settlement evolution between the Coastal Plain and the interior river valleys of the Piedmont can be explained by differences in the structures of the regional environments. A model for the evolution of ranked societies from egalitarian, segmentary societies has been presented. This model considers the effects of a zoned or patchy environment along with the effects of both intra-regional and inter-regional competition. It has been suggested that ranked societies can result from conditions of boundary closure and competition at the regional level, and the evolution of unbalanced economic and social relations within a patchy environment.

NOTES

1. This statement is based on assumptions derived from ethnography as well as from organization and information theory; namely, that face-to-face, egalitarian and unspecialized interactions cannot effectively organize large group activities (cf. Harris 1975: 368-370). However, segmentary organization seems to permit integration of some types of activities by very large groups. Warfare, in particular, has been cited as a prime example (Evans-Pritchard 1940, Sahlins 1961). Highly ritualized organizations for the purpose of food-sharing and mate exchange are also known among egalitarian groups. It is postulated here that certain social and spatial loci in regional societies can emerge as more effective nexuses for organizing large group activities while not being able to monopolize crucial resources and, thus, gain political or economic control. The resulting relations among social groups and settlements may therefore be organizationally hierarchical without the presence of ranked or stratified statuses.

2. Steponaitis' notion that district centers would be "pulled" to the paramount center is complemented by a formal treatment of the spatial aspects of socioeconomic networks by Smith (1976). She presents a series of spatial models including one which is characterized by extended network organization, systemic closure and "polyadic" exchange. This model includes redistributive chiefdoms and also predicts the weighting of elite distributions towards a paramount center.

3. An example can be seen in the effects of a moving paramount center or "capital". It is apparent that Powhatan himself was from the Powhatan district at present day Richmond. Presumably, the "capital" of the chiefdom was originally in this position. At the time of the founding of Jamestown, Powhatan was seated at Werowocomoco on the York River. Following the establishment of the Jamestown Colony, Powhatan took up residence at Orapaks between the Chickahominy and the Pamunkey Rivers.
Orapaks had previously been a seasonal hunting village. Smith denoted the village with the symbol of a "chief's house". A mid-17th century map shows that the Orapaks tribal territory had moved to a spot on the southern bank of the Pamunkey River in proximity to the Nuclear Area of the chiefdom (the area where the Pamunkey "reservation was established by treaty in 1646 and where today it still remains).

4. Classical settlement pattern studies make assumptions of uniform resource distributions (Haggett, Cliff and Frey 1977). A stochastic model might be more realistic. Given a normal distribution of habitat productivities and diversities we would expect a normal distribution of population densities and group sizes in a given region. It may be that this very natural deviation from equality between local groups provides the start-up mechanism for evolving regional social and spatial complexity.

5. The evolution of settlement patterns in a Southwest U.S. valley have been modelled by Zubrow (1971) based on similar concepts of optimal and marginal habitats and their carrying capacities. However, Zubrow considered only habitat productivity. The present model includes considerations of diversity and stability. The need to overcome the cyclical or unpredictable nature of habitat productivity is crucial in understanding the relationship between carrying capacity and environment (cf. Hayden 1975). I suggest here that the evolution of social relationships must be considered in the light of the predictability of useable net production in habitats.

6. It should be noted that the hunting party of Manahoac "kings" referred to above was hunting just above the Fall Line. Manahoac permanent settlements were much further upstream. Likewise, Powhatan complained to the English that the Monacans "invaded his country" every autumn for hunting and gathering purposes. The author has observed the occurrence of some ceramic assemblages 10-20 miles west of the Falls of the James which may indicate Algonkian settlements or hunting buffer zone had moved east to the Fall Line by 1607. One Late Woodland settlement at site 44He3 may have been a permanent village. This site is right below the Fall Line on the Chickahominy. Current analysis at VCU is underway to determine whether this was a permanent village or a seasonal hunting station. If the former proves likely, then we can argue that this settlement was also abandoned and permanent settlements on this river were considerably to the east of this position in 1607. In these evidences (admittedly meager at present) we may have a case similar to that described by DeBoer (1981), who argues that the existence and movement of intertribal buffer zones are indicative of population stresses on resources. The abandonment of 44He3 may also indicate the takeover of communal hunting grounds by the Pamunkey elite.

REFERENCES

Binford, Lewis R.


Birdsell, J.B.
1953 Some environmental and cultural factors influencing the structuring of Australian Aboriginal populations. The American Naturalist 87:171-207.

Bushnell, David I.
1930 The five Monacan Towns in Virginia, 1607. Smithsonian Miscellaneous Collections, Vol. 89(7).
<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1933</td>
<td>Carneiro, Robert L.</td>
<td>Evidence of Indian Occupancy in Albemarle County, Virginia. Smithsonian Miscellaneous Collections, Vol. 94 (8).</td>
</tr>
<tr>
<td>1977</td>
<td>Haggett, Peter, A.D. Cliff and Allan Frey</td>
<td>Location Analysis in Human Geography. London, Edward Arnold.</td>
</tr>
<tr>
<td>1975</td>
<td>Harris, Marvin</td>
<td>Culture, People and Nature. New York, Thomas Crowell Co.</td>
</tr>
<tr>
<td>1671</td>
<td>Lederer, John</td>
<td>The Discoveries of John Lederer. Printed in facsimile.</td>
</tr>
<tr>
<td>1954</td>
<td>Losch, A.</td>
<td>The Economics of Location. New Haven.</td>
</tr>
<tr>
<td>1980</td>
<td>N.D.</td>
<td>A Comparative Study of Late Archaic through Late Woodland</td>
</tr>
</tbody>
</table>
Regional Economy and Society in the Piedmont and Coastal Plain Sections of the James River Valley, Virginia.

Mauer, L. Daniel, Robin L. Ryder and Elizabeth G. Johnson
1981a Down to the River in Boats: The Late Archaic/Transitional in the James River Valley, Virginia. This volume.

1981b The Elk Island Tradition, an Early Woodland Regional Society in the Virginia Piedmont. This volume.

Sahlins, Marshall


Sanders, William T. and Barbara Price

Smith, Carol

Smith, John
1910a The General History of Virginia, New England and the Summer Isles 1624. In Travels and Works of Captain John Smith, Edward Arbor (ed.). Edinburgh, John Grant


Steponaitis, Vincas


Turner, R.M.

1978 An intertribal deer exploitation buffer zone for the Coastal Plain-Piedmont regions. ASVQB 32(3).

Vandemeer

Zubrow, Ezra B.W.