In 1949 the scientific community was astonished by the discovery of the oldest known corn (*Zea mays*) in the dust-dry deposits of Bat Cave, a rock-shelter in the rugged Mogollon Mountains of Catron County, New Mexico (Mangelsdorf 1950). Excavations at Bat Cave were jointly undertaken by Harvard University and the University of New Mexico, and the great impact of the finds was the result of a pioneering application of radiocarbon dating. The radiocarbon method allowed researchers to assess the age of organic material, and at Bat Cave it indicated an antiquity for Southwestern agriculture (ca. 6000 B.P.) that was several thousand years older than expected (Dick 1965). The Bat Cave results were followed several years later by excavations at Tularosa Cave, also in the Mogollon Mountains, that confirmed the region as the earliest known agricultural center in North America (Martin et al. 1952) and soon led to a productive search for early agriculture in other parts of the New World (Stark 1986).¹

During the 1960s New Mexico continued to provide significant information on the evolution of prehistoric agricultural systems. The Albuquerque area was the scene of several excavations, particularly on the mesas west of the Rio Grande, that produced the earliest known examples of Maiz de Ocho, a variety that provided the genetic material necessary for the spread of corn agriculture to the northern areas of North America (Galinat, Reinhart, and Frisbie 1970; Galinat and Gunnerson 1963). The high yield and increased adaptability to varying environments found in Maiz de Ocho eventually contributed to the economic basis of complex social developments throughout eastern North America.

By the late 1960s archaeology was undergoing major changes in research orientation, and in 1968 Lewis R. Binford of the University of New Mexico published a paper that marked a radical shift in the way archaeologists study agricultural origins. Binford (1968) proposed that cultivation was a result of intensified foraging activity caused by demographic imbalances between human populations and the carrying capacity of their environment. He advocated treating hunter-gatherer economies systemically, observing that their various procurement tactics were interrelated rather than functionally separate. Nearly all subsequent researchers have sought the causes of incipient food production within the framework of changing patterns of hunter-gatherer land use (see, e.g., Flannery 1973, 1986; Hayden 1981).

In recent years field investigations of early agricultural sites have been an important research focus in New Mexico. New research at Bat Cave has led to a reinterpretation of its age, with the earliest maize now being dated almost
three thousand years later than the original project estimated (Long et al. 1986; Wills 1988). Advances in radiocarbon dating have made it possible to date extraordinarily small samples, permitting new chronometric assessments of collections from previously excavated sites. One outcome has been that some sites, such as Jemez Cave, a rockshelter in the Jemez Mountains of northern New Mexico excavated by the University of New Mexico in the 1930s (Alexander and Reiter 1935), can now be identified as much older than the excavators thought (Ford 1975). Another result is the recognition that very early agricultural sites occur throughout the Southwest in differing ecological contexts, from Las Cruces, New Mexico, to Chaco Canyon, to Tucson, Arizona (see Long et al. 1986; Upham et al. 1987).

The Southwest is a particularly appropriate area for studying the developments in forager economies that preceded the appearance of agriculture because maize, beans, and squash were adopted as fully domesticated resources (Ford 1981). Indigenous hunter-gatherers had to make immediate decisions about whether to incorporate these new, culturally dependent food items into their economic systems, as domesticates require a great deal of human attention. Since the requirements for successful cultivation of maize, beans, and squash are well known, it should be relatively easy to identify the factors that might have influenced these decisions. Scholars have increasingly looked to conditions producing a decline in foraging productivity as the selective milieu for the adoption of cultivated plants in the Southwest (Cordell 1984; Minnis 1985a; Hard 1985; Hunter-Anderson 1986).

Similarly, increased reliance on food production in the Southwest following its adoption has been linked to declining success in hunting and gathering. Cordell (1984:188) has argued that the first foragers to adopt farming as a supplemental food source were probably less mobile than foragers who did not. In Cordell's model, hunter-gatherers who cultivated plants found the territory for foraging increasingly utilized, and hence degraded, by other, more mobile foragers. The loss of hunting areas encouraged even more investment in cultivation and, presumably, less mobility. Other archaeologists have presented similar arguments for increased reliance on domesticates in the prehistoric Southwest, generally following the position taken by Martin and Plog (1973:282) that “increasing productivity will lead to increasing utilization.”

Following the initial widespread adoption of cultigens, the development of economic dependency on food production in the Southwest was a long, slow process (LeBlanc 1983; Cordell 1984). If sedentism is taken as a probable correlate of heavy reliance on agriculture, then a period of two thousand or more years passed between the adoption of the first domesticates and the promotion of agriculture to a position of economic primacy. This long period suggests that the first domesticates either stabilized an essentially successful foraging adaptation or that the requirements of foraging made it very difficult to allocate the labor needed to intensify food production. In either case, the selective conditions favoring both the adoption of cultigens and eventual economic reliance on them appear to be closely related to foraging productivity.
CULTIVATION WITHIN FORAGING ECONOMIES

While the ultimate causality for agricultural origins remains elusive (consider Rindos 1984, Pryor 1986, or Redding 1988), recent studies of the spread of agriculture among hunter-gatherer societies outside the Southwest indicate that the adoption of domesticates is a tactical decision designed to complement foraging strategies (Nishida 1983; Zvelebil 1985). Archaeological and ethnographic evidence shows that hunter-gatherers select specific domesticates that fit their foraging system in a way that does not interfere with that system (Zvelebil 1981; Akazawa 1982, 1985; Rowley-Conwy 1984; Barker 1985; Smith 1985; Bogucki 1987; Lee 1979; Hitchcock 1982; Cashdan 1984; Brooks, Gelburd, and Yellen 1984). Thus the adoption of domesticates contributes to the productivity of an essentially hunting and gathering economy without requiring any significant changes. From an evolutionary point of view, these empirical observations are entirely expectable, as change is conservative rather than revolutionary (Binford 1972a; Dunnell 1980).

Most archaeologists seem to assume that early domesticates helped support existing forager systems by improving resource security in some portion of the system (Flannery 1973; Kislev and Bar-Yosef 1988). In temperate environments early domesticates are frequently seen as providing a key food source during spring months. Spring is often a disastrous period for hunter-gatherers who have suffered through both the physical harshness of winter and its relative lack of food resources. Speth and Spielmann (1983) have outlined the nutritional problems of temperate foragers, noting that protein metabolism becomes particularly difficult when reliance on lean meat increases, as it typically does during late winter among hunter-gatherers in regions of distinct seasonality. It is possible for foragers to starve even with plentiful access to animal protein. Consumption of fat or carbohydrates assists in protein metabolism and is therefore critical in the spring, precisely when these nutrients are least available. Thus stored domesticates allow foragers to “overwinter” (Binford 1983b); this is one obvious explanation for their adoption.

In most areas of the world, the adoption of domesticates by indigenous hunter-gatherers eventually led to the development of agricultural economies wherein a major portion of the diet was derived from cultivated resources. However, as in the Southwest, agricultural economies seldom emerged immediately after the introduction of domesticates. While some researchers assume that the promotion of agricultural economies is inverse to the productivity of foraging components, so that agricultural intensification is a simple reaction to declining success in foraging, it seems likely that the relationship is more complex. There are indications that hunter-gatherers often become involved with food production in order to maintain the productivity of their foraging activities. This suggests that agricultural intensification has an active, rather than passive, relationship to foraging.

For a mixed economy to receive a majority of its calories from agriculture, there must be a means to buffer the risk associated with agricultural reliance,
since an inadequate harvest obviously threatens group survival. O'Shea (1988), Minnis (1985a), Speth and Scott (1985), and others have outlined the major buffering tactics, which include group mobility, storage, intergroup exchange, and intensification of wild resource procurement. The functions of storage and exchange during periods of resource stress are self-evident. Those of group mobility and wild resource intensification are less so, in part because these buffers are interdependent. Crop failure might be offset by simply moving to a new location and/or increasing the range of hunting and gathering; any reduction in the capacity for mobility or for enlarging procurement range implies that local resources, including both agricultural and wild species, will be utilized more intensively (Binford 1983a). Since increased investment in cultivation should entail greater amounts of labor being devoted to food production, there may be less opportunity for hunting and gathering and more need for organization and planning. Thus communal hunts and extended overnight foraging trips are a likely development as agricultural production increases (Binford 1983a; Speth and Scott 1985; Bayham 1982).

O'Shea (1988:9) argues that wild resources can adequately buffer an agriculturally dependent economy only if they occur in dense patches and are storable, predictable, and available at times that do not conflict with cultivation. The aridity of the Southwest generally precludes vegetation that is dense or very predictable in maturation. An exception is found in the abundant plant and animal resources available during autumn in the pinyon pine–ponderosa pine zone, typically located between elevations of 1,800 and 2,200 m north of 33° latitude. However, these upland areas are limited in size and distribution, and in comparison with other areas of North America, the Southwest lacks the density of wild resources that might support sedentary communities without agricultural surpluses (Ford 1984). Since the development of agricultural dependence appears to require wild resource procurement intensification as well as food production, the eventual emergence of agricultural economies in the Southwest may actually have been a product of efforts to increase wild resource productivity.

AGRICULTURAL ECOLOGY IN THE MOGOLLON HIGHLANDS OF NEW MEXICO

These general observations about the economic potential of agriculture within a broad-spectrum economy are useful for assessing local changes in the Mogollon Highlands, where numerous early agricultural sites have been studied. The appearance of maize agriculture in upland regions of the Southwest (above 1,800 m) was once attributed to higher levels of precipitation (Haury 1962), but it is now clear that higher precipitation is countered by extremely short and unpredictable growing seasons (Sullivan 1982). Moreover, maize occurs just as early (if not earlier) at lower, drier elevations (Fish et al. 1986; Upham et al. 1987). Upland agriculture appears to have been a precarious endeavor.
that requires a separate explanation due to the high risk of crop failure at higher elevations. Part of the answer may be that the highlands of west-central New Mexico and east-central Arizona include the richest wild resource zones in the Southwest (Hevley 1983).

Before the appearance of agriculture in the Southwest, hunter-gatherer groups followed seasonal mobility patterns that positioned them geographically with respect to available resources. By 4000 B.P. the vegetation zones that characterize the Southwest today were established (Van Devender, Betancourt, and Wimberly 1984; Hall 1985; COHMAP 1988), and hunter-gatherers were adapting their movements to a complex environmental mosaic characterized by extreme verticality and seasonality. The major environmental contrast for foragers was between highlands and lowlands. During the winter and spring, wild resources were available, but widely dispersed, in lower elevations, particularly in desert regions of the southern Southwest. Desert resources consisted primarily of succulent plants and small game such as rabbits and various rodents.

In summer and fall, resources were concentrated in upland areas where nut-bearing trees (piñon, walnut, oak) and large game were simultaneously available. These upland foods were not just abundant; they provided critical nutrients in nut oils and animal fat (see Lanner 1981). Winter in the mountain regions is severe and protracted, making survival on naturally available food sources very difficult. Given these contrasts, archaeologists generally believe that Southwestern hunter-gatherers moved seasonally between elevational zones (cf. Hunter-Anderson 1986; Toll and Cully 1983).

Archaeological data from the Mogollon Highlands support this hypothetical preagricultural pattern. In the San Augustine Plains, on the eastern margin of the Mogollon Mountains (Figure 1), campsites from the Paleo-Indian and Archaic periods (ca. 10,000 to 1000 B.P.) are well documented (Hurt and McKnight 1949; Dick 1965; Beckett 1980; Formby 1986). These sites typically consist of broken projectile points, fire-cracked rock, grinding-stone fragments, and lithic debitage. They are usually located around or near ancient playas and springs. At Bat Cave, on the southwestern margin of the plains, preagricultural deposits contain only scattered broken projectile points and a few firepits. Resource use is indicated primarily by site location and artifact assemblages, which point to hunting and seed grinding as important site activities. The San Augustine Plains are a classic ecotone, with extensive grasslands bordered by forested mountains, and camps in this location undoubtedly provided easy access to several types of habitat. No evidence for structures or storage pits has been identified at these open-air sites, suggesting relatively short-term use, probably by fairly small groups.

In contrast, no conclusive evidence yet exists for preagricultural sites in the forests of the Mogollon Mountains. The Wet Leggett Site (Martin, Rinaldo, and Antevs 1949) is purportedly such a site, but reanalysis indicates that no artifactual material can actually be attributed to the preceramic period (Wills
Thus we have good evidence that hunter-gatherer groups were in the region, probably in late summer and fall, but no evidence for extensive use of the forests or prolonged site occupation prior to the appearance of agriculture.

With the introduction of agriculture at about 3000 B.P., both the character of archaeological sites and the nature of the settlement pattern changed. At Bat Cave and Tularosa Cave, the earliest cultigens are found with storage pits, occupation floors, superimposed hearths, and extensive amounts of domestic debris. The preceramic deposits at Tularosa Cave all contained cultigens, including thousands of maize cobs (Martin et al. 1952). Other Archaic agricultural sites in the Mogollon Highlands include Cordova Cave (Martin et al. 1952), O Block Cave (Martin, Rinaldo, and Bluhm 1954; Peterson 1988), and the Cienega Creek site in eastern Arizona (Haury 1957).

Given current information, it seems apparent that the use of domesticates in the Mogollon Highlands involved a shift to fairly intensive utilization of rockshelters, particularly in forested areas, as storage and processing stations. Although the rockshelters exhibit deep stratification, none is very large or
indicates use by a large group. The initial agricultural period thus seems to have involved small groups reoccupying the same location on a repetitive basis.

The ecological requirements of maize cultivation provide a clue about what these changing patterns might mean in economic terms. First, cultivation in the uplands must have involved spring planting, so some individuals had to be present during the time of the year when it seems least likely that hunter-gatherers would have utilized the uplands. Second, since cultigens mature in early fall, when other resources are exceedingly plentiful, and early cultigens were not particularly productive in yield (Galinat 1985), it appears unlikely that they provided an important autumn food source. If cultivation forced some individuals out of the logical seasonal round and did not offer an important fall resource in the highlands, then cultivation must have been intended to generate a storable food supply for spring consumption.

Why would people make the effort to generate a surplus for spring use in the mountains if it made ecological sense for them to be at lower elevations during that time of year? The answer seems to be that their presence in the uplands was important during the spring and that cultivation made this possible or easier. Since the attractiveness of highland resources comes during summer and fall, it is likely that being there in the spring, accomplished though an agricultural surplus, must have been related to fall resource procurement. Spring occupation made it possible to monitor patterns of resource availability in the coming summer and fall months; while it is not always easy to assess in advance where certain plants and animals will be available in the highlands, it is often possible to determine where they will not be. If this interpretation of conditions surrounding the introduction of agriculture to the Mogollon Highlands is correct, then it indicates some degree of competition among forager groups for fall resources and suggests that cultivation was an active tactic for improving hunting and gathering success. It also implies that cultigens were first adopted at lower elevations and then transferred to higher locations, a position supported by recent discoveries in the southern Rio Grande Valley of maize that may be older than the early cultigens known from the highlands (Upham et al. 1987).

The agricultural pattern established in the Mogollon Highlands at 3000 B.P. remained archaeologically the same for at least a thousand years, until about 1800 B.P. when several indications of economic change appeared. The first change was the introduction of ceramics as a well-developed technology from Mesoamerica (LeBlanc 1983). The second was the appearance of a bison herd on the San Augustine Plains. Both developments are well represented at Bat Cave, where a small structure radiocarbon dated to 1710 B.P. was built on a layer of bison bone and had bison bone and ceramics associated with its floor and central firepit. The ceramic deposits at Bat Cave also exhibit a decline in the frequency of maize cobs from preceramic levels, a change from large storage pits to small caches of tools and food, and several thousand bison skeletal elements (Dick 1965; Wills 1988). These patterns suggest that the
economic role of the site had shifted from a generalized base camp for hunting and cultivation to a specialized hunting station (Wills 1988).

Hunters using Bat Cave during the early ceramic period were probably operating out of larger settlements in adjacent forested areas. Shortly after bison became a resource in the eastern highlands, a dramatic development in pithouse architecture took place. There is some evidence of pithouse construction prior to the appearance of agriculture (O’Laughlin 1980), but an increase in pithouse settlements is positively correlated with early agriculture (Fritz 1974; Smiley 1985). In the Mogollon Highlands, large pithouse settlements appear between A.D. 300 and 500 during what is generally described as the Early Pithouse period (Anyon, Gilman, and LeBlanc 1981). Gilman (1987) has argued that all pithouse settlements in the Southwest reflect a system of seasonal occupation, a position that stresses the economic significance of wild resource procurement. Perhaps the best known of these pithouse settlements is the SU site, located on a forested ridge within the drainage system of the San Francisco River (Figure 2).

The SU Site was first excavated by Paul S. Martin between 1939 and 1946 (Martin and Rinaldo 1947; Martin 1974). Martin discovered twenty-eight structures and several extramural features dating to about 1525 B.P. (Bannister, Hannah, and Robinson 1970). Grinding stones were found in place on some...
house floors, indicating agricultural production. Several additional aspects of the site draw our attention. For example, the pithouses are extremely large, averaging nearly 40 m² of floor area and ranging up to almost 100 m². Within the houses are large floor pits that collectively average over 2.5 m³ in volume per structure; exterior pits would have provided additional storage potential. These metric dimensions contrast with other pithouse settlements throughout the Southwest: the SU houses are over twice as large and have a tremendous amount of interior storage, whereas contemporaneous dwellings elsewhere rarely have any sort of interior storage (Wills n.d.). A recent study of subsurface storage by DeBoer (1988) notes a positive correlation between such features and periodic settlement abandonment, further supporting the interpretation that the SU site was seasonally occupied.

Large dwellings with interior storage are expectable features as economies typical of foragers, but involving some cultivation, shift to intensified agricultural production. Flannery's (1972) ethnographic survey of settlements similar to prehistoric Southwestern pithouse sites, where individual round houses are physically separate from one another, reveals a close correlation with group-level production and frequently shifting membership. In these settlements, which Flannery (1972:30) called "compounds," houses are generally small, households may occupy multiple dwellings, and resources are shared among all members of the settlement. Flannery notes that settlements with large dwellings and private (or internal) storage are good markers of a shift from communal to family-based modes of production. Since surplus can be controlled and retained within a family more easily than in a larger social unit, intensification of production is an important capacity of familial economic units.

The recovery of fifty-three burials from the Early Pithouse occupation at the SU site supports the inference of family-based production. Burials are an excellent indication of group investment in land tenure, and emergent mortuary practices are generally associated with group stability and control of access to particular areas (Binford 1972b; Shipton 1984; Bentley 1988). The large number of SU burials is unusual for early architectural sites in the Southwest and suggests that kinship ties to the SU locality were important.

New investigations at the SU site by the University of New Mexico in 1987 and 1988 have helped refine this interpretation (Wills and Mauldin 1988). Excavations concentrated on areas between pithouses, where most of the daily activities at the site probably took place. Numerous features were found, including roasting pits, a burial, and a small structure. Radiocarbon assays (Table 1) and stratigraphic data indicate that the structure and one deep pit are probably preceramic. This means that occupation of the site began before the appearance of pottery and its subsequent use spanned several hundred years. Carbonized maize was present in preceramic and ceramic features.

Cultivation of wild plants may also have taken place at the SU site. Agave (Agave parryi) grows on the site today but is there well outside its natural range in lower, hot desert habitats. Minnis and Plog (1976) have argued that the presence of agave on archaeological sites in eastern Arizona and western
New Mexico indicates that humans deliberately transferred it to higher elevations. In the area around the SU site, there is definitely an exclusive association between agave and archaeological sites.

Despite the solid evidence for agriculture at the SU site, it is not situated in an ideal place for cultivation. The site is on a low ridge that forms a dividing line between drainages to the south and east. This location is far from springs and is well above local riparian communities. However, the SU site is at the geographical center of a valley system and is its highest point. If the SU site was important as the settlement of a specific group of people over an extended period of time, as the architectural and mortuary patterns suggest, then its location may be symbolic of that group's claim to the local area.

The SU site therefore seems to reflect intensified agricultural production effected through changes in the organization of production. The occurrence of this process in the uplands, where conditions for cultivation are marginal at best, indicates that wild resource procurement was critical enough to promote increased investment in food production. The most likely reasons for this agricultural intensification would have been to allow for longer periods of site occupation, thus extending foraging time in late autumn, as well as for annual reoccupation of the settlement, which would have enhanced any territorial claims to the area. This was undoubtedly still a seasonally mobile society, one that moved to lower elevations in winter, but the increased commitment to agriculture suggests that maintaining access to upland resources was under some strain during the Early Pithouse period.

Interestingly, the importance of highland agriculture may have declined during the succeeding Late Pithouse period (ca. 1500–1000 B.P.). Developments in the Mogollon Mountains during this period are poorly understood (Mauldin 1988), but there is a decrease in house size, a lack of large settlements comparable to the SU site, and little evidence for storage. The largest known Late Pithouse period settlement is Turkey Foot Ridge (Martin, Rinaldo, and Antevs 1949; Martin and Rinaldo 1950b). Although sixteen pithouses were

---

**TABLE 1**
Radiocarbon Assays from the SU Site (LA 64931), Catron County, New Mexico

<table>
<thead>
<tr>
<th>Laboratory Number</th>
<th>C(^{14}) Adjusted(^{a})</th>
<th>Calibrated Age(^{b})</th>
<th>Feature Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta 25543</td>
<td>1490 ± 40 B.P.</td>
<td>1413–1313 B.P.</td>
<td>4A (pit)</td>
</tr>
<tr>
<td>Beta 24309</td>
<td>1520 ± 140 B.P.</td>
<td>1560–1300 B.P.</td>
<td>2 (pit)</td>
</tr>
<tr>
<td>Beta 26135</td>
<td>2030 ± 50 B.P.</td>
<td>2044–1904 B.P.</td>
<td>3 (structure)</td>
</tr>
<tr>
<td>Beta 24716</td>
<td>2290 ± 110 B.P.</td>
<td>2360–2157 B.P.</td>
<td>2 (pit)</td>
</tr>
</tbody>
</table>

\(^{a}\) Each assay has been adjusted for C\(^{14}\)/C\(^{12}\).

\(^{b}\) Calibration according to Stuiver and Reimer (1986).

Note: The two assays obtained from Feature 2, a large pit, are significantly different in age. The older sample (Beta 24716) is interpreted as charcoal from an earlier occupation.
excavated there, many were probably structures built in the Early Pithouse period; almost every documented Late Pithouse site in the highlands is superimposed on an earlier settlement, including the SU site. Thus the typical settlement of this period appears to have been fairly small (see Rowe 1947; Wheat 1955; Anyon 1980).

This decreased investment in site occupation during the Late Pithouse period may have resulted from a montane land-use system in which the return from agriculture was no longer adequate. In this scenario agricultural intensification would now have occurred at less marginal lower elevations. Some support for this position exists from the Mimbres River Valley, approximately 100 km south of the SU site. Blake, LeBlanc, and Minnis (1986:463) note several developments during the Late Pithouse period in the Mimbres Valley, including rapid population growth, heavy occupation of river bottom agricultural locations and increased occupation of side drainages and local mountain parks, and habitation of large pithouse communities ranging from 50 to 124 structures. In addition Minnis (1985b:116) estimates that toward the end of the Late Pithouse period, nearly all available agricultural floodplain in the Mimbres Valley was in use. If the Late Pithouse economic system involved seasonal mobility, as Gilman (1987) argues all pithouse economies should have, then the increase in site numbers, site size, and agricultural field use seen in the Mimbres Valley might be evidence for an intensification of food production that could account for the evident land-use shift in mountain areas.

The end of the Late Pithouse period, which occurs at about A.D. 1000 (initial Reserve phase), is defined by the beginning of Pueblo architecture in the highland Mogollon region. This shift in settlement organization probably represents another change in the economic importance of highland regions. Characteristics of the Reserve phase include a high density throughout the highlands of typically small sites of five to ten rooms with one or more pit structures (Figure 3), occasional sites with twenty to forty rooms and large, presumably communal structures situated near the confluences of multiple stream drainages, a high frequency and diversity of nonlocal ceramics in some sites, and evidence for bison hunting on the San Augustine Plains (see Bluhm 1957, 1960; Peckham 1957; Peterson 1988; Dick 1965).

Excavations at early Pueblo sites during the 1950s (Martin and Rinaldo 1950a; Peckham 1957) and by the University of New Mexico in 1988 indicate that they often have deep, cobble-lined pithouses, masonry surface rooms with large firepits, and surface rooms designed for storage rather than occupation. The deep, insulated pithouses may indicate occupation during colder months (see Farwell 1981). In some cases there is evidence for the remodeling of rooms and the accumulation of deep rubbish deposits (see, e.g., Martin and Rinaldo 1950a; Peckham 1957; Bluhm 1957). The abundant ground stone, particularly trough metates and rectangular manos, points to an important agricultural component. In addition Peterson (1988) has identified water-control features such as check dams associated with local clusters of Reserve phase sites, the first local appearance of this technology (see also Doolittle 1985).
The architecture and settlement patterns of the early Puebloan occupation in the highlands are considerably different from those of the Late Pithouse period; especially notable is the vast increase in regional site density. Archaeologists have traditionally described this period as one of population or cultural incursion from northern areas, and a recent study has argued for "colonization" of the mountains (Peterson 1988). Stuart and Gauthier (1981) have proposed that people were driven into upland areas throughout the Southwest at this time as a result of widespread drought conditions which made lowland agriculture unproductive. Minnis (1985b) has posited that the early Pueblo population in the Mimbres Valley exceeded the availability of prime agricultural land, thus implying at least some resultant depopulation.

Whether the settlement patterns of the early Pueblo period represent a demographic change is not as clear as that they indicate changing land-use strategies. With this change there are suggestions of major buffering tactics: first, exchange connections with other regions as reflected in the presence of nonlocal ceramics from distances that extend more than 150 km to the north and west; second, possible local integration through communal structures (cf. Bluhm 1960; Anyon 1980); and third, intensive water-control agriculture. The existence of water-control technology fits with the distribution of Pueblo sites
in linear patterns paralleling streams and with the clustering of sites at stream confluences and indicates a concern with field location that was not previously evident. In total, these Puebloan features seem likely products of economic intensification in several areas and may denote a system geared toward extended upland occupation. In other words, while a population "migration" is not obvious, a shift toward year-round residence could have taken place. If so, many of the traits assumed to have been derived from outside cultural "influences" are probably the result of economic adjustments required by the ecology of mountain regions and the high risk of food production in such an agriculturally marginal environment.

**SUMMARY**

This brief overview of archaeological patterns in the Mogollon Mountains finds several periods of economic transition that seem attributable to increasing competition for highland resources. The simple presence of maize and other cultigens in the mountains implies an acceptance of risk and an alteration of mobility patterns that only make sense in terms of the wild resource potential of higher elevation regions. The development of stable communities in this agriculturally marginal area indicates an intensification of efforts to maintain access to montane resource zones. The reduced agricultural presence apparent through most of the Late Pithouse period may stem from efforts to increase agricultural production in less risky environments, with the subsequent reinvestment in highland occupation during the Pueblo period being dependent upon intensified social and technological buffering tactics.

This scenario for human occupation in the highlands between 4000 and 1000 B.P. is not offered as a demonstration of the factors responsible for agricultural production, but rather as an illustration of the need to consider wild resource productivity in our explanations for change in agricultural economies. The patterns evident in the Mogollon region correspond to patterns of agricultural intensification found elsewhere in the world, provided we take a regional perspective that accounts for the extensive systems of land use that characterize mixed economies (see, e.g., Ford 1968; Plog 1980; Ferguson and Hart 1985; Spielmann 1986). If, however, we rely on explanatory conventions which assume that only variables directly relevant to agriculture, such as precipitation or arable land, are responsible for changing settlement patterns, then we will often produce paradoxes that require elaborately speculative explanations (cf. Cordell 1977). The famous examples of Chaco Canyon, which lacks adequate farmland, and of the enormous late prehistoric villages in cold regions of the northern Rio Grande Valley have always been puzzling because they contradict our expectations for primarily agricultural economies. Such long-standing puzzles might be less mysterious if they are considered from a perspective that views food production and wild resource procurement as interdependent strategies.
NOTE

1. I am particularly grateful to Ray Mauldin for his advice and support during the last two years of field research in the Mogolion Highlands. I thank Steve Lekson, Steve Plog, Pat Gilman, Bob Leonard, Lew Binford, Lawrence Straus, Bob Schiowitz, Rich Newton, Lynne Murphy, Roger Anyon, Mike Schiffer, Barbara Mills, and Phil Bock for sharing their ideas and experience with me.

REFERENCES CITED


Binford, L.R., 1983a, In Pursuit of the Past: Decoding the Archaeological Record. New York: Thames and Hudson.

Binford, L.R., 1983b, Long Term Land Use Patterns: Some Implications for Archaeology. Pp. 27–53 in Lulu Linear Punctated: Essays in Honor of George Irving


Dick, H.W., 1965, Bat Cave. School of American Research Monograph no. 27. Santa Fe.


Peterson, J., 1988, Change or Continuity? Pithouse to Pueblo Transition along the
Middle San Francisco River, West Central New Mexico. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix.


Wills, W.H., and R. Mauldin, 1988, New Investigations at the SU Site, West Central New Mexico. Unpub. ms. on file U.S. Forest Service, Silver City, N.M.
