Other titles in this series:

Walnut Canyon National Monument:
An Archeological Overview

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The Western Archeological Center
National Park Service  Tucson, Arizona
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The publication of this paper culminates the efforts of many people besides myself. Foremost among these is Keith Anderson, Chief of the Division of Internal Archeological Studies at the Western Archeological Center, who has provided the major impetus for the writing of archeological overviews for national parks and monuments in the Western Region. Keith was extremely encouraging and helpful to me while I was researching and writing this overview; I appreciate his patience, as well as his many and varied comments.

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Jeanette Schloss drew the cover illustrations, which depict artifacts found by McGregor with the burial of the "great magician" at the Ridge Ruin. Sharon Urban and Joanna McComb drew the maps and figures found in the body of the report.

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Finally, I must acknowledge my friends and fellow Park Service employees, Yvonne Stewart and Susan Purves, who helped me maintain my sanity through all of this.
Walnut Canyon National Monument is viewed here in the environmental context of the region surrounding Flagstaff, Arizona, and in the archeological context of the Sinagua culture area, with emphases on the effective environment and on the importance of the canyon to the Sinagua. Each phase of Sinagua culture history is outlined and related to the culture history of the canyon. Neighboring prehistoric groups, including the Southern Sinagua, Cohonina, Prescott and Anasazi, are discussed in order to suggest possible inter-group influences; Schroeder's Hakataya concept is examined. A brief ethnography of the Flagstaff area follows, with emphasis on subsistence patterns; although no ethnographic groups inhabited the immediate area, the Hopi, Navajo, Hualapai, Havasupai, Yavapai and Apache Indians used the area for seasonal hunting-and-gathering and/or passed through it along trade and warfare networks. The history of research in the Sinagua area and in the canyon is traced from the first exploratory expeditions of the late 19th century through the archeology of the present decade.

Because the major occupation of the cliff dwellings and less spectacular rim sites was short, spanning the years from AD 1125 to 1200, possible reasons for the late settlement and early abandonment of the canyon and for the abandonment of the larger Sinagua area, centering on the effects of environmental stress on an agricultural economy, are examined. The overview concludes with a general discussion of research problems in the canyon and in the broader area, suggesting directions for future research. Appendices summarize all archeological investigations within monument boundaries, including stabilization projects, and locate and evaluate collections of artifacts and other materials from the monument.
INTRODUCTION

An archeological overview, as defined by the National Park Service, is designed to provide archeological synthesis, evaluation and recommendations beyond project specific planning. It should present information which reflects the present knowledge of the study area and should discuss the distribution and significance of the archeological resources. An overview should also contain recommendations for future research directions and predictions concerning the impacts of current developments in the region on archeological resources. It is hoped that this overview will provide background information for National Park Service personnel who interpret the Walnut Canyon area to the public. The overview also should give non-archeologists an idea of the direction of current archeological thought and of general research goals which might apply to the Sinagua culture area and to Walnut Canyon in particular.

This overview will provide an inventory and evaluation of the archeological work done in Walnut Canyon and of the canyon's prehistoric resources. To place this research in its proper perspective in northern Arizona prehistory, the overview includes a discussion of Sinagua archeology, the culture area in which Walnut Canyon is located. Also included are discussions of the environment and the ethnography of the Flagstaff area. The final section of the overview contains research directions of current interest to archeologists, which may help to structure future research. This discussion also indicates areas in which the research in Walnut Canyon has been deficient and the role canyon resources can play in adding to the understanding of prehistory in the Flagstaff area.
Because the relationship of people to their environment is currently of major interest to archeologists, the following discussion reflects that orientation. Several factors, known as effective environmental variables (Ford 1972), affect the productivity of the plants and animals used by prehistoric populations and act to limit cultural adaptations to the environment. The effective environment, or those resources which people select to use for their survival, will be stressed here, along with inferred and specific uses of those resources by the Sinagua and by historic Indian groups.

Walnut Canyon is part of the larger Flagstaff area, a region characterized by great environmental variation. Environmental zones range from desert at an elevation of 4500 feet along the Little Colorado River to alpine at the tops of the San Francisco Peaks, slightly below 13,000 feet. This change occurs within a distance of 35 air-miles. C. Hart Merriam, in a pioneer 1890 study, proposed seven vertical Life Zones, each characterized by a unique plant assemblage (Fig. 1): (1) the Desert Zone (4000-6000 feet) is characterized by salt bush (Atriplex); (2) the Pinyon Zone (6000-7000 feet) by pinyon (Pinus edulis) and juniper (Juniperus monosperma); (3) the Neutral (or Pine) Zone (7000-8000 feet) by ponderosa pine (Pinus ponderosa); (4) the Canadian (or Balsam Fir) Zone (8200-9200 feet) by Douglas fir (Pseudotsuga menziesii); (5) the Hudsonian (or Spruce) Zone (9200-10,500 feet) by Engelmann spruce (Picea Engelmanni) and bristle-cone pine (Pinus aristata); (6) the Sub-alpine (or Timberline) Zone (10,500-11,500 feet) by the stunted growth of Picea Engelmanni and P. aristata, and (7) the Alpine Zone above 11,500 feet. These zones are delimited not only by altitude, but also by decreasing temperature and increasing precipitation with increasing altitude. Merriam's zones still are referred to, but it should be noted that certain plants are not limited to these zones; for example, oaks and cottonwoods grow along major drainages in several zones.

Horizontal zones, as well as Merriam's vertical zones, exist in the Flagstaff area. Horizontal zones are defined by variations in vegetation at similar elevations. Jameson (1969) has suggested that this zonation is caused by differences in the seasonal distribution of rainfall. Summer storms from the Gulf of Mexico bring about a reduction in rainfall from south to north. These storms are caused by convection and are heaviest in areas of abrupt topography, such as the Mogollon Rim. Winter storms from the Pacific Ocean cause a reduction in rainfall from west to east. These storms drop most of their moisture on the mountains in southwestern and central Arizona, particularly along the Mogollon Rim. During the winter, a rainshadow develops downwind from the rim, accounting for the relatively dry winter climate of the Little Colorado River basin and the Flagstaff region in general (Jameson 1969).

While the concept of horizontal precipitation zones generally shows a decrease in precipitation with distance from oceanic weather system sources, Colton (1958) has presented data which indicate that the local topography, dominated by the San Francisco Peaks, may have as much affect on rainfall as do the more general weather patterns. Colton noted more variation in precipitation with both elevation and horizontal distance in the area.
Fig. 1: Vertical Life Zones (Merriam 1890).
of the peaks than north of them; more rainfall was also recorded west of the Peaks than east of them at similar altitudes. This pattern, however, does not persist in the pinyon-juniper and salt-bush zones, which are farther from the peaks; here greater precipitation was recorded at the more eastern and northern weather stations.

The climatic conditions recorded for Flagstaff are generally the same as those for Walnut Canyon 7.5 miles to the east. Flagstaff, at an elevation of 6993 feet, is situated on a volcanic plateau amidst the largest standing ponderosa pine forest in the United States (Sellers 1960). Summer rainfall occurs from July to September as afternoon thunderstorms. Winter precipitation, 75% of which falls as snow, is less predictable. The mean annual precipitation for Flagstaff is 20.27 inches.

The summer temperature ranges from the 40s to the 70s, while winter readings vary from 0° to the 40s. The growing season averages about 120 days, with the last spring frost occurring at the end of May and the first autumn frost near the end of September (Smith 1956). Summer temperatures at Walnut Canyon average about 86° during the day and 52° at night; winter temperatures average 44° during the day and 17° at night (National Park Service n.d.). The growing season at Walnut Canyon presently is 125 to 150 days. The canyon annually receives about 15 inches of moisture, one-third of which falls as snow, which is ample for dry farming.

Walnut Canyon is about 12 miles long and extends from Upper Lake Mary to the Little Colorado River, skirting Anderson Mesa. The eastern sector of the canyon is in the pinyon-juniper zone, the western sector in the ponderosa pine zone. The canyon rim elevation varies from 6300 to 7000 feet and the canyon floor elevation ranges from 6100 to 6400 feet. Walnut Creek, historically a perennial stream, was dammed at two points upstream of the monument in 1904 to form Upper and Lower Lake Mary, the water supply for Flagstaff. The stream now runs only during very heavy floods.

Although the environment in Walnut Canyon is basically similar to that at Flagstaff, deep canyons permit an extension of the vegetation of one zone into other zones (Stein 1964) and there are two extensions into the ponderosa pine zone at Walnut Canyon. These are characterized by Douglas fir, usually found at higher elevations on the sheltered parts of north-facing slopes, and by pinyon and juniper, which are characteristic of lower elevations on the more exposed south-facing slopes.

Joyce (1974) did an ecological analysis of the flora of Walnut Canyon, sampling the east and west ends of the canyon and collecting from four vegetation areas: the north rim, the north slope, the canyon bottom and the south slope. The dominant vegetation on the north rim, homogenous throughout the samples, is pinyon pine (Pinus edulis) and juniper (Juniperus osteosperma). On the north slope, the dominant vegetation is blue grass (Poa fendleriana) and sagebrush (Artemisia frigida). The plant assemblage on the canyon bottom is not so homogenous as in other zones, but consists mainly of box-elder maple (Acer negundo) and Arizona walnut (Juglans major). Douglas fir (Pseudotsuga menziesi) is dominant on the south slope. Joyce postulated that the differences in vegetation might be due to temperature range, exposure, relative humidity and soil temperature. The north slope has almost constant exposure to direct sunlight and, consequently, the highest average temperature and the widest temperature range. The south slope, characterized by vegetation
common to higher elevations, has the lowest average temperature and the narrowest temperature range. The relative humidity also is higher in cooler, more protected areas, such as the south slope and the canyon bottom. Finally, there is more moisture and more duff on the north-facing slope, resulting in a lower soil temperature. The soil temperature influences the rate at which soil moisture is lost (i.e., the higher the soil temperature, the faster soil moisture is dissipated) and, therefore, the rate at which plant processes occur. Joyce also noted differences in vegetation between Walnut Canyon National Monument and the rest of Walnut Canyon, which he attributed to the constant state of disturbance in the monument.

The vegetational differences between the north and south slopes (see also Arnberger 1947; Haldeman and Clark 1969) are reflected in the distribution of natural resources probably available to the prehistoric inhabitants of Walnut Canyon. Pinyon nuts are available, as are yucca and cacti, on the south-facing slope. Walnuts and canyon grape are found along the stream. Walnut Creek probably provided water during at least part of the year and wild animals undoubtedly were available in and around the canyon. Thus, because of the depth of the canyon, many natural resources existed in an area that otherwise would be too small to encompass so many vegetational zones.

**Effective Environment**

Perhaps one of the best ways to consider the effective environment, or the natural resources actually available to and used by the prehistoric inhabitants, is to note the uses to which natural resources were put by ethnographic groups. One must first make two assumptions. The first is that although the boundaries of plant zones may have changed through time, the basic plant assemblage available to modern Indian groups was also available to prehistoric people. Second, although no ethnographic groups actually inhabited the Flagstaff area, several groups did use the region for hunting and gathering and one must assume that the food resources listed in ethnographic sources were also used by the area's prehistoric inhabitants.

The Havasupai, who lived northwest of Flagstaff, were mainly agriculturists, farming land in tributaries to the Grand Canyon. They did, however, rely on wild plants and animals to supplement their food supply, especially from the autumn to the spring of each year when they moved from the canyon to the plateau (Spier 1928). Their annual round included gathering prickly pear fruit, mesquite pods and yucca fruit, all of which ripened near the end of September. Prickly pear fruits were dried, mesquite pods were ground and mixed with water for a drink and the fruits of banana yucca (Yucca baccata) were formed into thin sheets, which would keep for half a year; pieces of a sheet were broken off and eaten dry or boiled. Rope also was made from the yucca and soap was made from the roots for ceremonial purposes (Bell and Castetter 1941). Pinyon nuts, gathered by the Havasupai in late October, were parched and ground. During the winter they hunted antelope, mountain sheep, deer, rabbit and squirrel on the plateau. When spring came they descended to the benches of the Grand Canyon in search of agave, which ripened in May and was roasted in pits for two days before it was eaten. The Havasupai also ate young plantain
leaves (which were boiled), Mormon tea, the seeds of pigweed and goosefoot and juniper berries.

The Hualapai, who inhabited the land west of Flagstaff, depended almost totally on wild foods, as there were few places in their territory that could be farmed (Kroeber 1935). August was the month for gathering prickly pear fruits, the pulp of which was dried; seeds were parched and pounded. Mesquite also was gathered in August. The pods and beans were pounded together and stored, later to be made into flour or mixed with water for a beverage. In September pinyon nuts, Yucca baccata and juniper berries were collected. The Hualapai prepared yucca in the same fashion as did the Havasupai, but they also used the inner bark of the roots for red decoration in basketry (Hrdlicka 1908). Juniper berries were crushed and soaked in water to make a sweetish drink, which was considered a starvation food by the Hualapai. Black walnuts ripened in late October and November and were eaten raw or were stored. In the spring the Hualapai gathered agave, which they roasted and pressed into large thin cakes for their own use and to trade with the Hopi for maize (Castetter, Bell and Grove 1938). Other wild plants used by this group included squashberries, grapes, mulberries, wild onions and the seeds of herbs and grasses. The Hualapai supplemented their diet by hunting such game as deer, antelope, mountain sheep, rabbits, birds and many kinds of rodents.

The Northeastern Yavapai, who lived south of Flagstaff, also practiced little agriculture; corn and tobacco were their only crops (Gifford 1936). Their most important plant food probably was the agave, which they gathered in November and for two or three months thereafter and which they used throughout the year. In the spring the Yavapai collected various greens, seeds and berries. They gathered palo verde seeds and saguaro fruit in mid-June (both of these are lower desert plants and are not available in the Flagstaff area). Mesquite pods, walnuts and manzanita berries were gathered later in the summer. In the autumn the Yavapai collected acorns, juniper berries, yucca, sunflower seeds and pinyon nuts. Like the Hualapai and the Havasupai, they hunted deer, antelope, rabbit, woodrat and birds.

All three groups used yucca, agave, pinyon nuts, mesquite and juniper berries and hunted similar game; all of these resources are to be found today in the Flagstaff region. Since two of the three groups subsisted almost entirely on hunting and gathering, it seems likely that prehistoric groups in the Flagstaff area could have had similar subsistence systems. None of the ethnographic groups, however, inhabited the immediate Flagstaff area, so it is impossible to be certain that prehistoric people could have supported themselves in the region year-round solely by hunting and gathering. Agriculture probably played some part in the subsistence system of the Sinagua, even during the early pithouse phases and in the decline of the Sinagua after the Elden phase. In sum, there were probably enough natural resources in the Flagstaff area to support, at least seasonally, a predominantly hunting and gathering population, especially if supplemented by agriculture.

Table 1 is a partial ethnobotanical list for Walnut Canyon. It shows some of the plants known to grow in the canyon (Arnberger 1947) and to have been used ethnographically. The ethnographic information is adapted from Bartlett (1943), who presents a list of edible wild plants of northern Arizona; from Whiting (1939), who has written an ethnobotany of
Table 1: Partial ethnobotanical list for Walnut Canyon.

<table>
<thead>
<tr>
<th>Family</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anacardiaceae</td>
<td>Rhus trilobata</td>
<td>skunk-bush, squaw-bush</td>
<td>fruits for beverage</td>
</tr>
<tr>
<td>Berberidaceae</td>
<td>Berberis repens</td>
<td>creeping mahonia</td>
<td>berries, root as tonic</td>
</tr>
<tr>
<td></td>
<td>Berberis fremontii</td>
<td>barberry, holly-grape</td>
<td>wood, root as tonic</td>
</tr>
<tr>
<td>Boraginaceae</td>
<td>Macromeria viridiflora</td>
<td>none</td>
<td>smoked ceremonially by Hopi</td>
</tr>
<tr>
<td>Cactaceae</td>
<td>Opuntia spp.</td>
<td>prickly pear cactus</td>
<td>fruits, pads</td>
</tr>
<tr>
<td>Caprifoliaceae</td>
<td>Sambucus neomexicana</td>
<td>elderberry</td>
<td>fruits</td>
</tr>
<tr>
<td></td>
<td>Sambucus coerula</td>
<td>elderberry</td>
<td>fruits</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>Chenopodium fremontii</td>
<td>goose-foot</td>
<td>spring greens, seeds for mush</td>
</tr>
<tr>
<td></td>
<td>Chenopodium incisum</td>
<td>goose-foot</td>
<td>spring greens, seeds for mush</td>
</tr>
<tr>
<td></td>
<td>Eurotia lanata</td>
<td>winter-fat</td>
<td>medicine for burns and fever</td>
</tr>
<tr>
<td></td>
<td>Atriplex spp.</td>
<td>salt-bush</td>
<td>greens, seeds for meal</td>
</tr>
<tr>
<td>Compositae</td>
<td>Brickellia californica</td>
<td>none</td>
<td>medicine for headache</td>
</tr>
<tr>
<td></td>
<td>Chrysopsis villosa</td>
<td>golden-gate</td>
<td>medicine for chest pain</td>
</tr>
<tr>
<td></td>
<td>Hymenopappus lugens</td>
<td>none</td>
<td>medicine for toothache</td>
</tr>
<tr>
<td></td>
<td>Artemisia frigida</td>
<td>sagebrush</td>
<td>flavoring, medicine</td>
</tr>
<tr>
<td></td>
<td>Artemisia dracunculoides</td>
<td>false-tarragon</td>
<td>spring greens</td>
</tr>
<tr>
<td>Family</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Use</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------</td>
<td>-----------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Cruciferae</td>
<td>Lesquerella intermedia</td>
<td>bladder-pod</td>
<td>antidote for rattlesnake venom</td>
</tr>
<tr>
<td></td>
<td>Descurania pinnata</td>
<td>tansy-mustard</td>
<td>greens, seeds for meal</td>
</tr>
<tr>
<td></td>
<td>Descurania obtusa</td>
<td>tansy-mustard</td>
<td>greens, seeds for meal</td>
</tr>
<tr>
<td></td>
<td>Descurania richardsonii</td>
<td>tansy-mustard</td>
<td>greens, seeds for meal</td>
</tr>
<tr>
<td>Fagaceae</td>
<td>Quercus gambelii</td>
<td>Gambel oak</td>
<td>acorns, wood</td>
</tr>
<tr>
<td>Gnetaceae</td>
<td>Ephedra viridis</td>
<td>Mormon tea</td>
<td>stems for beverage, medicine</td>
</tr>
<tr>
<td>Juglandaceae</td>
<td>Juglans major</td>
<td>Arizona walnut</td>
<td>nuts</td>
</tr>
<tr>
<td>Labiatae</td>
<td>Moldavica parviflora</td>
<td>dragon-head</td>
<td>seeds for meal</td>
</tr>
<tr>
<td></td>
<td>Salvia reflexa</td>
<td>Rocky mountain sage</td>
<td>medicine</td>
</tr>
<tr>
<td>Liliaceae</td>
<td>Yucca baccata</td>
<td>banana yucca</td>
<td>buds, flowers, fruits, seeds, emerging flower stalk roasted, fiber, roots for soap</td>
</tr>
<tr>
<td>Loasaceae</td>
<td>Mentzelia albicaulis</td>
<td>stick-leaf</td>
<td>meal from seeds</td>
</tr>
<tr>
<td>Loranthaceae</td>
<td>Phoradendron juniperinum</td>
<td>mistletoe</td>
<td>coffee-like beverage</td>
</tr>
<tr>
<td>Pinaceae</td>
<td>Pinus edulis</td>
<td>pinyon pine</td>
<td>nuts</td>
</tr>
<tr>
<td></td>
<td>Pinus ponderosa</td>
<td>ponderosa pine</td>
<td>timber</td>
</tr>
<tr>
<td></td>
<td>Pseudotsuga taxifolia</td>
<td>Douglas-fir</td>
<td>ceremonial (Hopi)</td>
</tr>
<tr>
<td></td>
<td>Juniperus spp.</td>
<td>juniper</td>
<td>berries</td>
</tr>
<tr>
<td>Polygonaceae</td>
<td>Rumex crispus</td>
<td>curly-leaf dock</td>
<td>seeds for meal, greens, medicine</td>
</tr>
<tr>
<td>Family</td>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Use</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------------------------</td>
<td>------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Ranunculaceae</td>
<td>Delphinium scaposum</td>
<td>larkspur</td>
<td>flowers for blue coloring</td>
</tr>
<tr>
<td></td>
<td>Clematis ligusticifolia</td>
<td>none</td>
<td>medicine for sore throat and colds</td>
</tr>
<tr>
<td>Rosaceae</td>
<td>Amelanchier bakeri</td>
<td>service-berry</td>
<td>fruits</td>
</tr>
<tr>
<td></td>
<td>Amelanchier oreophila</td>
<td>service-berry</td>
<td>fruits</td>
</tr>
<tr>
<td>Saxifragaceae</td>
<td>Ribes cereum</td>
<td>currant, goose-berry</td>
<td>fruits</td>
</tr>
<tr>
<td></td>
<td>Ribes inebrians</td>
<td>squaw currant</td>
<td>fruits</td>
</tr>
<tr>
<td>Solanaceae</td>
<td>Lycium pallidum</td>
<td>wolf-berry</td>
<td>fruits</td>
</tr>
<tr>
<td></td>
<td>Nicotiana attenuata</td>
<td>tobacco</td>
<td>ceremonial (Hopi)</td>
</tr>
<tr>
<td>Valerianaceae</td>
<td>Valeriana arizonica</td>
<td>valerian, tobacco root</td>
<td>roots boiled</td>
</tr>
<tr>
<td>Vitaceae</td>
<td>Vitus arizonica</td>
<td>canyon grape</td>
<td>fruits</td>
</tr>
</tbody>
</table>
the Hopi, and from Kearney and Peebles (1951), who mention aboriginal uses of the plants included in their taxonomy. These plants may have been used by the prehistoric inhabitants of the area, but whether they could entirely support a population in and around the canyon has not been determined. A study of the present capacity of the wild plant resources, as well as of the changes that may have occurred in the plant assemblage between prehistoric times and the present, would give some indication of the amount of wild plants needed to support a given population.

The geology of Walnut Canyon also was part of the effective environment. At the base of the canyon is the cross-bedded Coconino sandstone, which is covered by alternating layers of limestone and dolomite, called Kaibab limestone. The rock shelters in which the Sinagua cliff dwellings were built formed under a weather resistant layer of limestone, about 150 feet from the floor of the canyon (Shimer and Shimer 1910). The mortar used in building the cliff dwellings contains sand from the stream bed and the rooms themselves were constructed of limestone boulders and blocks. Thus, the inhabitants of Walnut Canyon had not only a variety of vegetal materials available to them, but also building material and protected areas in which to construct dwellings.

Climatic Reconstruction

It is difficult to determine how the present environment of the Flagstaff area relates to the prehistoric environment, but by using pollen and tree-ring studies some inferences can be made. The climate of the Southwest seems to have remained essentially arid through the period of human occupation, but rainfall, temperature, the number of frost-free days and the amount of erosion and aggradation have changed.

Schoenwetter and Dittert (1968) have, on the basis of palynological and other studies, proposed a paleoclimatic sequence for the Anasazi area that has some relevance for the neighboring Sinagua. Few data exist for reconstructing the environment before AD 200, but these investigators feel that erosion was rare and that winters may have been long. The data also are limited for the years AD 200 to 700, although there is known to have been a drought in the third century. From AD 300 to 700 the environment was characterized by aggradation, long winters and abundant moisture, conditions very favorable for the growth of maize. From AD 700 to 1100 there was more summer rainfall, greater erosion and shorter, milder winters. The latter increased not only the growing season, but also the length and severity of the spring drought. Water control methods and more drought-resistant corn were developed during this period and the population was able to shift location in response to environmental pressures. The twelfth and thirteenth centuries are crucial to both Anasazi and Sinagua prehistory. Summer rainfall and erosion were dominant, but most of this period was drier than at present and the Great Drought, a period known from tree-ring information to have been extraordinarily dry, occurred from AD 1275 to 1300. The use of water control systems was common. Widespread population movements took place near the end of the period, possibly because of the stress induced by the Great Drought. A cooling trend started during this time and the period from AD 1300 to 1600 was characterized by long winters, short growing seasons and aggradation.
This change in climate may have caused a shift in population from many areas to regions which could still accommodate the established settlement patterns.

Schoenwetter and Dittert believe that until AD 900 agriculture could have been maintained by moving to new locations when environmental conditions became unfavorable. After this time, technical improvements were needed in crops and in the systems used to control the effects of the environment. Using this model, it is clear that one would not have to rely solely on the eruption of Sunset Crater in AD 1066 to explain the population increase of the twelfth century around Flagstaff (Richard Hevly 1975: personal communication). The initial climatic changes during this time included increasing effective moisture for plant growth (more summer rainfall) and warming temperatures, which lengthened the growing season. Prehistoric populations would definitely have expanded in or been attracted to an area in which these conditions prevailed; the ash fall from the eruption of Sunset Crater may have been a secondary attraction.

The dendroclimatic reconstruction for northern Arizona proposed by the Laboratory of Tree-Ring Research at the University of Arizona agrees with the major climatic trends proposed by Schoenwetter, Dittert and Hevly (William J. Robinson 1975: personal communication; see also Robinson, Harrill and Warren 1975). Robinson and Dean (1969) note that throughout the Southwest there were intervals of 20 or more years when the precipitation departed from the norm. From AD 1110 to 1129 rainfall was particularly high, while during the intervals from 1030 to 1049, 1090 to 1109, and 1140 to 1189 there were widespread areas of low precipitation.

The tree-ring record for the Flagstaff area is quite complete, with dates ranging from AD 623 to 1966, the chronology having been extended with living trees. The dendroclimatic reconstruction for Flagstaff shows that before about AD 1000 the variations in precipitation over 10-year periods were small and of short duration. After 1000 the fluctuations in precipitation were much larger and of much longer duration. This pattern is, in fact, found throughout the Southwest, but the reasons for it are as yet unknown. The tree-ring record for the Sinagua region shows that AD 1070 to 1089 was a period of higher than average precipitation, supporting the hypothesis that more than the eruption of Sunset Crater accounts for the population increase in the area. After AD 1090, the precipitation values are generally slightly below average, possibly indicating climatic deterioration.

The tree-ring laboratory is currently working on a dendroclimatic reconstruction for the Southwest, based on seasonal rather than on annual data. Such a reconstruction would give information about changes in summer and winter rainfall patterns and would be invaluable in testing hypotheses concerning human adaptations to changing climatic conditions.

Walter Stein (1964) has compared the modern tree types and zones with the prehistoric tree types and zones in the Flagstaff area in order to determine whether vegetation boundaries have changed over time. Stein found that the majority of the prehistoric sites contained wood from all vegetation zones (pinyon-juniper, ponderosa and douglas fir), which yielded no information on changes in the zones. It did indicate, however, that the prehistoric inhabitants transported certain types of wood over some distance. In the course of the study, Stein noted that Pueblo I and
early Pueblo II (AD 800-1100) sites were restricted vertically to the ponderosa zone and the overlap zone between the ponderosa and pinyon-juniper zones, but that later Pueblo II and III sites were not so restricted. It must be remembered, however, that the ponderosa boundaries may have changed through time, so that these sites may not have been located in the vegetation zones in which they now appear. Finally, although the building styles changed, the types and percentages of wood used remained constant from pithouse to pueblo times (Basketmaker III to Pueblo III).

No ecological analysis of the faunal materials from any Sinagua site has been published, but mammal bones from Wupatki Ruin (N.A. 405), excavated by the Museum of Northern Arizona in 1936, have been studied (Lincoln 1962). Wupatki is about 45 miles north of Flagstaff and dates by tree-rings from AD 1073 to 1230. The purpose of the faunal analysis was to compare the prehistoric mammalian community with the present one, in order to determine the prehistoric ecology of the area. It was found that jackrabbits were most numerous in the faunal assemblage, followed by cottontails and pronghorn antelopes; some prairie dogs, deer mice and woodrats also were present. The conclusion of the investigator was that the species distribution of these mammals had not changed noticeably through time, so that there was no indication that ecological conditions had changed. However, a morphological difference was noted between the prehistoric and modern populations of the white-throated woodrat (Neotoma albigula) and the deer mouse (Peromyscus maniculatus); the prehistoric animals were larger. It is not obvious how this change relates to the ecology of the area and to the remainder of the faunal assemblage. Although Wupatki is in a lower vegetation zone than are most of the Sinagua sites, this analysis may indicate a lack or small amount of climatic change. Changes in the rodent population, such as those shown by the woodrat and deer mouse, must be better explained biologically before their relationship to the climatic conditions is known.

Agricultural Potential

Since the basis of later Sinagua economy was agriculture, it is important to know the agricultural potential of the Flagstaff area. Erosion and water-control systems, such as the check dams on the small tributaries to Walnut Creek, indicate that prehistoric inhabitants farmed the area, but it is not known how important domestic crops may have been in Sinagua economy.

The effects of the changing climate on agriculture and on prehistoric populations have been discussed, but other studies have relevance to the land's agricultural potential. Investigations into the relationship between the phosphate content of the soil in and around prehistoric settlement areas have been done to determine where middens and house structures were located; phosphate content of the soil is one indication of arability. Arrhenius (1963) noted that both the site areas and the ash from the Sunset Crater eruption were high in phosphate, but that the land used for agriculture was not. He believed that the fields were not fertilized, so that phosphate present in agricultural produce was returned not to the farm.
land, but to trash areas in the form of food waste and fecal materials. Farming, therefore, reduced the phosphate content and the fertility of the soil and may eventually have caused abandonment of sites.

In the summer of 1961 Hopi corn was planted at Wupatki Ruin in an effort to determine the conditions under which maize can be grown in the area (Maule 1963). Since the corn was planted in the middle of July, germination did not occur until late August and growth continued until late September. The plants were killed by frost at the end of October. It was found that the most successful plants were those set in one inch of cinder mulch. As the amount of cinders was deepened the number of plants decreased; there were no plants in the row planted without cinder mulch. Thus, the optimum planting condition was mulching with the smallest amount of cinders which could stop runoff and evaporation, a condition which prevailed prehistorically near the edge of the Sunset Crater cinder fall. Repetition of experiments such as this could provide considerable information on prehistoric agriculture in the region.

Conclusions

It may be concluded that the Sinagua area was marginal for both agriculture and hunting-and-gathering. Flagstaff was generally too high to grow corn (corn in the Kayenta Anasazi area was usually grown below 6500 feet) and the growing season was marginal (William J. Robinson 1975: personal communication). The ash fall from the eruption of Sunset Crater provided improved conditions for agriculture and population around Flagstaff began to increase about 20 years after the eruption. The ash mulch and a longer growing season, with increased summer rainfall and warmer temperatures, may have combined to provide the impetus to population growth and an agricultural economy characteristic of the pueblo phase of the Sinagua.

Hunting and gathering were also marginal to the Flagstaff region, in that it is uncertain whether the area could have supported full-time hunters and gatherers. The ponderosa pine forest which surrounds Flagstaff is a poor gathering environment, as are the plant zones of higher altitudes. Gathering is better in the pinyon-juniper zone, but such plant resources as pinyon nuts are available for only a short period each year and produce a good crop only every four or five years. Ethnographic information supports the contention that a full-time hunting and gathering economy could not be practiced around Flagstaff. It is possible that the pre-pueblo Sinagua occupation was so limited by the climate and the vegetational zones that it was seasonal.

Because of variation in altitude, exposure and moisture, Walnut Canyon provides an exception to the limitations of the general Flagstaff area. There is an unusually large quantity of wild foods available in the canyon; even so, the major occupation did not occur until the pueblo phase of the Sinagua. Perhaps earlier use of the canyon did not include habitation and so evidence of this use is sparse. The canyon seems to have been most valuable when the increasing Sinagua population forced people to occupy what they considered geographically marginal areas.
When other major prehistoric groups, such as the Anasazi and the Hohokam, are considered, it seems that the Sinagua area was a backwater. It may have been used mainly on a seasonal basis until climate and a chance volcanic eruption combined to provide conditions suitable for an agricultural economy. When the environment deteriorated from this optimum, the occupation of the Flagstaff area may again have become seasonal, with its residents following a hunting and gathering economy. This situation continued into the ethnographic present, when no historic Indian groups permanently inhabited the region.
Colton's chronology divided Sinagua prehistory into eight periods, beginning at AD 500 and ending just after AD 1300. It was based on pottery types, which already had been dated in other areas, and on tree-ring dates. In 1962 Thomas P. Harlan re-examined all tree-ring specimens available for the Sinagua area and proposed a chronology that differed slightly from Colton's (Table 2). Although Harlan's chronology may reflect more accurately the phases of Sinagua occupation, it has never been used by archeologists working in the area. In order to maintain continuity with the Sinagua literature, Colton's chronology will be used here.

The following discussion will describe the phases of Sinagua culture history and will detail the important trends of each phase, based on interpretations by Colton (1946; 1960), Bartlett (1953) and Wilson (1969). The major archeological work performed for each phase will be noted, as will the geographical limits of each.

As previously mentioned, Colton's work is predicated on ceramics and architecture and, like most archeologists of his time, he relied on population movements to explain cultural changes in the prehistoric record. While this explanation certainly should not be discarded, it does not necessarily account for all prehistoric culture change. Bartlett's chronology and interpretation seem to be based on those of Colton and, therefore, share the same biases, strong points and deficiencies. Her article serves as a succinct summary of Sinagua chronology as it was viewed in the 1950s. Wilson's discussion also is based on that of Colton, with the addition of information gathered at sites excavated after Colton published. Wilson notes the architectural and pottery types for each phase and mentions the changes in population size. His dissertation, however, was a summary of the Sinagua rather than a new synthesis.

**Pre-AD 500**

Little is known of the prehistoric occupation of the Flagstaff area before AD 500, but more than 70 lithic sites have been recorded on gravel benches above the Little Colorado River between Holbrook and Cameron (Bartlett 1943). Although these sites, many of which are found near the mouths of Canyon Diablo and Deadman Wash northeast of Flagstaff, have no depth and no other associated artifacts, the "heel"-shaped scrapers and hand axes that characterize them do not appear in lithic assemblages after AD 500. For this reason, along with the functional specificity of the sites, the crudity of the tools, the lack of bifacial points and the lack of associated pottery, these assemblages are believed to predate AD 500 and are considered part of the Tolchaco Complex. Because of the previously mentioned problems, this complex cannot be dated accurately.

The only other indications of early occupation in the Flagstaff area are the split-twig figurines found by Euler and Olson (Euler and Olson 1965; Olson 1966) in a cave near Walnut Canyon. These figurines, similar
<table>
<thead>
<tr>
<th>Phase</th>
<th>Colton</th>
<th>Harlan</th>
<th>Anasazi–Pecos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Creek</td>
<td>1300 – 1350</td>
<td>1300 – 1320+?</td>
<td>Pueblo V</td>
</tr>
<tr>
<td>Turkey Creek</td>
<td>1200 – 1300</td>
<td>1250 – 1300</td>
<td>1300 – 1700</td>
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<tr>
<td>Elden</td>
<td>1120 – 1200</td>
<td>1150 – 1250</td>
<td>Pueblo III</td>
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<tr>
<td>Padre</td>
<td>1070 – 1120</td>
<td>1100 – 1150</td>
<td>1100 – 1300</td>
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<tr>
<td>Angell–Winona</td>
<td>1070 – 1120</td>
<td>1070 – 1100</td>
<td>Pueblo II</td>
</tr>
<tr>
<td>Rio De Flag</td>
<td>900 – 1050</td>
<td>980 – 1100</td>
<td>900 – 1120</td>
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<tr>
<td>Sunset</td>
<td>700 – 900</td>
<td>? – 980</td>
<td>Pueblo I</td>
</tr>
<tr>
<td>Cinder Park</td>
<td>500 – 700</td>
<td>?</td>
<td>Baskemaker II</td>
</tr>
</tbody>
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Table 2: Comparison of Sinaguan chronologies.
to those found throughout Arizona, Nevada and California, lacked clear
associations, but have been dated by the radiocarbon method to 3500-4000
B.P. The figurines and their archeological implications are discussed
more fully in the section of this report entitled "History of Research
in the Sinagua Area."

**Cinder Park Phase**

The Cinder Park phase (AD 500-700) is the earliest phase defined by
Colton. Little is known about this phase, since only three sites have
been excavated (Wilson 1969). DeLaguna (1942) dug three pithouses in
Cinder Park northeast of Flagstaff at site N.A. 3996. Two of the pit-
houses were circular and one was square with rounded corners. Tipi-like
roof supports, which differed from the roof types of later phases, were
noted. DeLaguna also recovered charred maize from these excavations
(Wilson 1969).

Breternitz (1959) excavated the only other two Cinder Park phase sites
which have been scientifically investigated. These sites, N.A. 6873 and
6589, also were located northeast of Flagstaff, which seems to be the
major area of Sinagua occupation during this period, as defined by Colton
(1946). Timbers set in a groove in the floor may have lined the walls
of one pithouse. Breternitz also noted the tipi-like roof structure
found by DeLaguna.

**Sunset Phase**

The Sunset phase probably extended from AD 700 to 900, but again,
little is known. The population began to increase, possibly because of
the increasing moisture available. The population center remained north-
east of Flagstaff, while expanding somewhat from the area occupied during
the Cinder Park phase. The pithouses were made deeper, had four-post
roof supports and sometimes were timbered. While excavating pithouses
that dated before AD 1065, Breternitz (1957a; 1957b) encountered two
possible irrigation ditches, which may have been used during the Sunset
phase. One of the ditches was clay-lined; the margins of the other were
defined by volcanic rocks over about half its length and it was filled with
alluvial gravels. A 22-meter section of the latter ditch was excavated.
It seems that the purpose of the ditch was to transport water from a
nearby creek into a field near the pithouses. If these ditches date this
early, it may alter ideas about the amount of agriculture practiced at
this time and about the technological capabilities of these people.

**Rio de Flag Phase**

Pithouses became deeper still during the Rio de Flag phase (AD 900-
1060) and were entered through the roof. The sloping entrance of the
Sunset phase pithouse was replaced by a ventilator, which helped circulate
fresh air through the structure. Alcove houses--pithouses with what
amounted to a side extension--also were common. It is possible that
rectangular timber surface structures, which may have been used as

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granaries, are associated with the phase. Thus, along with a slight increase in population, the Rio de Flag phase is characterized by several new types of architecture. As in preceding phases, the population center remained among the cinder cones northeast of Flagstaff.

N.A. 10,754, a Rio de Flag phase site at the base of Mount Elden, was investigated by the Queens College Archaeological Field School under the direction of Paul R. Fish (Fish and Ryan 1973). The site was on the lower edge of a talus slope on land administered by the Coconino National Forest. The land was part of a parcel to be traded to private firms for housing development. Three pithouses, three possible check dams, a ramada and three isolated roasting pits were excavated. The major emphasis of the work was recovery of information concerning agriculture, food and activity areas, data never before retrieved for the Rio de Flag phase.

Winona-Angell and Padre Phases

Settlement patterns and architectural types become much less clear after a series of eruptions from Sunset Crater around AD 1066. Three phases, Winona, Angell and Padre, originally were defined for the period from AD 1060 to 1125, but it is now believed that the three "phases" overlap with so much confusion that it is better to dispense with specific phase names. Instead, one could characterize this time as one of population growth and culture change, possibly due to changing rainfall patterns; of increased agricultural potential, and of more contact with neighboring prehistoric groups.

The Winona phase centered around the town of Winona, east of Flagstaff, where there existed shallow pithouses with vestibule entrances and center ridge poles like those of the Hohokam in the Salt and Gila valleys. In the late 1930s John C. McGregor (1941) excavated six of the pithouses at Winona Village. The structures were accompanied by trash mounds, ball courts and pottery similar in form, construction and color to that of the Hohokam. McGregor postulated that Winona Village was evidence of an invasion of the Hohokam in search of the improved agricultural potential brought about by the ash fall from Sunset Crater. However, because of the limited area and time span covered by this Hohokam material and considering that the pottery forms were in use before the Winona phase and that the full range of Sacaton Red-on-Buff designs were not present, it is equally probable that Winona Village represents an outpost of traders from the south (Peter J. Pilles 1975: personal communication).

The Winona and Angell phases were differentiated only on the basis of architectural styles. In Winona pithouses the wall poles extended to the floor, while in Angell pithouses the wall poles were set on ground level and the earthen part of the pithouse often had a masonry retaining wall. Since these different house styles appear in the same village and since the two phases cannot be differentiated by ceramics, the phases now are combined.

The Padre phase (AD 1100-1120) originally was defined on the basis of deep, rectangular masonry pithouses, with ventilators and gabled roofs formed by a center ridge pole. Padre sites are located near Winona-Angell phase sites and none of the ceramics of the three phases can be
distinguished (Pilles 1969). Although pithouses are diagnostic for each of these phases, other structures were in use. Pilles (1969) reported a circular masonry surface room dating between AD 1075 and 1100, but this might be explained by the lack of deep earth at the site.

Elden Phase

With the Elden phase (AD 1125-1200) came the culmination of 60 years of changes. Habitation structures changed from pithouses to above-ground masonry pueblos of from one to 70 rooms. Population peaked during this phase, climaxing two growth trends; the first originated about AD 500 and gathered momentum slowly through time, while the second started around the time of the eruption of Sunset Crater and developed more rapidly. The Sinagua seem to have spread north and east into the Big Hawk Valley, 25 miles northeast of Flagstaff on the Sinagua-Anasazi border (Smith 1952).

It was during the Elden phase that the cliff dwellings at Walnut Canyon were built and that the small masonry pueblos on the rim of the canyon were occupied. Since the canyon shows very light use before this time, the occupation of rock shelters in the canyon may indicate increasing population pressure and the need to live in areas previously considered marginal.

The Elden phase was named for Elden Pueblo, first excavated by Fewkes in 1926 (Fewkes 1927; Hargrave 1929) and later researched by Kelly in 1966-67 (Kelly 1970). The pueblo, located at the base of Elden Mountain just north of Flagstaff, has about 40 rooms, some of which may have been two stories high. The goals of the two archeologists are interesting, in that they show the change in research emphasis since the 1920s. Fewkes wished to discover the culture of ancient people and to compare it with the culture of their descendants. At the time, one of the major interests of archeologists was the relationship between the Hopi and their prehistoric predecessors. Fewkes wanted to verify the Hopi claim that some of their clans had come from the Flagstaff area. Fewkes, who excavated 34 rooms, also performed the first ruins stabilization in the area, as he felt that the ruins should be suitable for public viewing. Kelly, on the other hand, excavated only four rooms. His interests included variation in the ceramic assemblage, the inhabitants' use of flora and fauna, obtaining tree-ring dates and pollen samples, remapping the pueblo and training students in archeological methods.

While excavating at the Ridge Ruin in the 1930s, McGregor (1943) uncovered a burial which contained an incredible number of grave goods and which probably represented the burial of a person of high status. McGregor's representation of this adult male as a "magician," however, probably does not denote his actual function in Sinagua society. The burial was located in a pueblo of 20 to 25 rooms. The burial pit had been roofed with poles and covered with earth. Six hundred thirteen artifacts were found in the burial pit, including 25 whole or restorable vessels, eight fragmentary baskets (one of which was covered with a mosaic of turquoise, rodent teeth, red argillite and black stone), 420 projectile points, stone and shell ornaments (some of which are illustrated on the cover of this overview), wood objects (including small painted bows,
arrows, ornamental sticks and a painted cup, minerals, cinnabar-filled sacs and trapdoor spider nests used as rattles. This assemblage certainly represents more luxury goods than usually are associated with the Sinagua and shows that a high degree of ceremonialism was present in the society.

There may be an overlap between the Padre and Elden phases. Lee (1962) has published a report on the Beale's Saddle Site (N.A. 7350) east of Flagstaff on the north slope of a low saddle. Architecture typical of both the Padre and Elden phases is present on this site, but the ceramics are indicative of only the Elden phase. Lee hypothesized that the structures were contemporaneous, constituting a functional unit. The masonry surface structures might have been habitation units, while the pithouses may have served as kivas or ceremonial units. While the hypothesis has not been adequately tested, it points out the confusion caused by the overlap of the criteria designed to define different phases. It is possible that while pithouses were the main habitation unit during the time preceding the Elden phase, they served a different function during the Elden phase. Obviously, more research needs to be done to determine the function of different structures, rather than simply to ascertain their place in the time sequence.

Turkey Hill Phase

After AD 1200 the population in the Flagstaff area began to decrease rapidly. The people that remained concentrated into larger pueblos during the Turkey Hill phase (AD 1200-1300). Around Flagstaff, only Turkey Hill Pueblo (N.A. 660) and Old Caves Pueblo (N.A. 72) were occupied during this time, although Elden Pueblo and Wupatki possibly were in use at the beginning of the period. There seems to have been a population shift to the southeast, where Chavez Pass North (N.A. 658), Kinnikinnick Pueblo (N.A. 1629) and Pollack Pueblo (N.A. 4317), all near Anderson Mesa, were occupied. There also was a major population shift south to the Verde Valley, where the groups of this time are referred to as the Southern Sinagua.

Little archeological work has been done on sites dating from the Turkey Hill phase. Byron Cummings (1930) did some excavation at the Turkey Hill site, a pueblo of about 30 rooms 9 miles east of Flagstaff. Cummings published only a one-page abstract of his excavations, in which the pueblo was described as a long two-story structure with an open court to the east. North and east of the courtyard was a one-story structure and trash areas were found outside the pueblo. The structure of this pueblo seems to differ from that of Elden phase pueblos, but this is not entirely clear from Cummings' description.

One room at Kinnikinnick Pueblo on the southern boundary of the Sinagua area was tested in order to fill a gap in the tree-ring dates for the area prior to AD 1317 (Conner 1943). Based on tree-ring dates between AD 1290 and 1311, it was postulated that the room was used and repaired from the middle 1200s. Polychrome pottery from the Hopi area and Jeddito Black-on-yellow sherds also indicated a late date for this room. Charred corn, corn cobs, kidney beans, walnut shells, serviceberrys and cotton seeds were found in the room, along with the bones of antelope, deer, jackrabbit, cottontail, wood rat, prairie dog and red-tailed hawk. It is possible
that because of the pressure put on the agricultural capacity of the land by preceding populations, groups during the Turkey Hill phase had to depend more on hunting and gathering wild foods. With no comparative data, however, it is difficult to assess the floral and faunal assemblages at Kinnikinnick.

Clear Creek Phase

The final phase in the Sinagua sequence is the Clear Creek phase, which extended from AD 1300 to some time in the middle of that century. By this period the Flagstaff area was abandoned and all occupied sites were 40 miles southeast of Flagstaff. Sites of this phase were pueblos of 40 to 100 rooms and included Chavez Pass South (N.A. 659), Kinnikinnick, Grapevine Pueblo (N.A. 2803) and Pollack Pueblo. Wilson (1969) has postulated a movement to the Hopi area via the middle Little Colorado Valley during this phase, but it is not certain where the groups who left the Flagstaff area went. There is little evidence for reoccupation of the Flagstaff region until Indian groups were noted in the area by the Spanish and Anglos during early historic times.

Walnut Canyon Culture History

The culture history of Walnut Canyon reflects the later phases of the Sinaguan sequence. There was limited occupation of the canyon area before the eruption of Sunset Crater; Van Valkenburgh found two pre-eruption sites and Euler found one Cinder Park sherd scatter and two Rio de Flag sherd areas. The major population concentration occurred after AD 1066.

As previously discussed, Walnut Canyon may have been considered a marginal area by the Sinagua, although the canyon itself offered a wide range of natural resources. The Sinagua may have used Walnut Canyon intensively only because of increasing population pressure, possibly brought about by more available moisture and the improved agricultural capacity provided by the ash fall from Sunset Crater. Walnut Canyon was abandoned at the end of the Elden phase, before the rest of the Flagstaff area was completely depopulated (Kelly 1971). This fact may also point to the marginal nature of Walnut Canyon in the subsistence strategies of the Sinagua.

Euler (1962) recorded five Elden phase sites, which contained Turkey Hill Red sherds and a few late Kokop Black-on-orange and Jeddito Plain sherds. These sites, however, are not the large pueblos of the Turkey Hill phase and the Kayenta Jeddito sherds may signify only a temporary camp of a group from the east.

Neighboring Prehistoric Groups

Because the Sinagua were not isolated in space (Map 1), we will consider here the influences different prehistoric groups may have had on one another. Some of these groups, such as the Cohonina and the Prescott, are less well known than the Sinagua and seem to have had a less elaborate material culture. Other groups, however, such as the Kayenta
Map 1: Prehistoric groups neighboring the Sinagua.
Anasazi to the northeast of the Sinagua, are very well known and had a cultural assemblage which included beautifully executed black-on-white pottery and a well-developed ceremonial system, as evidenced by the large number of kivas. Few regional studies on the amount of interaction, both in ideas and materials, that may have occurred between the prehistoric groups of northern Arizona have been undertaken, but a discussion of the different cultures may suggest some possibilities.

Southern Sinagua. The archeology of the Verde Valley, which is south of Flagstaff, is best known for masonry pueblos and cliff dwellings, which date after AD 1100 (Breternitz 1960). These sites, which include Tuzigught and Montezuma Castle National Monuments, are ascribed to the Southern Sinagua, who began to move in from the north during the 1100s. Earlier pithouse phases are thought to be part of the Hohokam tradition because of the architecture, the red-on-buff pottery and the presence of ball courts. During the Honanki phase (AD 1100-1300), groups are thought to have moved into the valley from the Flagstaff area, eclipsing the Hohokam. Schroeder (1947:1960) has postulated that the Hohokam may have moved south, along with some of the Sinagua. This is part of Schroeder's Hakataya concept, which will be discussed later in this section. If the Sinagua did begin to move south from Flagstaff, they encountered in the Verde Valley an environment which differs considerably from that of their original area. The altitude of the middle Verde Valley is 3000 to 3500 feet, much lower than that of Flagstaff, and vegetation differs greatly from that of the Northern Sinagua region. The differences in subsistence and settlement patterns between the two groups and the changes the Sinagua must have undergone in their move south have never been discussed in the archeological literature.

A number of prehistoric trails connect the Verde Valley with other parts of Arizona. Although these trails cannot be assigned to specific time periods, they indicate the degree of interaction between the groups in this major river valley and groups elsewhere. Breternitz (1960) noted trails to the Agua Fria River, to the Gila-Salt Basin, to the Cohonina and Cerbat groups in the Chino Valley and to the Mogollon Rim and Flagstaff.

Cohonina Branch. The Cohonina inhabited the area north and northwest of the San Francisco Peaks, as far as the Grand Canyon. They were separated from the Sinagua by the mountains and the ponderosa pine forest. Colton (1968) considered the forest a barrier to intermingling of the two groups, as agriculture is impossible in the forest. Colton mentioned what have been called "forts" in the Coconino Divide, a pass in the San Francisco Peaks. These structures had thick masonry walls and a large major room, with several associated long, narrow rooms. It is true that these structures differ from other Cohonina and Sinagua buildings, but an analysis of the materials found at these forts might determine whether their function was defense against the Sinagua.

The Cohonina Branch was first named by Hargrave in 1938 and is part of the Patayan Root, along with the Prescott and Cerbat branches (Colton 1939). The three are considered related because of the similarity of ceramic techniques, but the Cohonina Branch is distinguished from the
others by the presence of San Francisco Gray Ware. McGregor (1951; 1967) felt that the typical Cohonina habitation structure, a shallow pithouse with a sloping entrance, may have been influenced by early Sinagua forms. Other house types include brush ramadas, alcove houses, patio houses (a combined room and open work area) and the forts already discussed. The sites may have been occupied several times, as shown by superimposed floors, remodeling and varied post patterns on the brush shades. Along with the lack of firepits in many of the habitation rooms and the lack of protection from the weather provided by the numerous outside work areas, this reoccupation might imply seasonal occupation of the Cohonina area, although there is no evidence that the entire area was abandoned during winter months. Perhaps the environmental situation of the Cohonina area was much more marginal than that of the Sinagua. An investigation into the environmental limits on year-round habitation might be in order.

The Cohonina area was occupied for a shorter time than was the Sinagua region. Schwartz (1956) has determined that there was a steady population increase between the years AD 600 and 900, with concomitant improvements in techniques for dealing with the environment. The population leveled off from AD 900 to 1100 and then went into a great decline. By AD 1200 the area was deserted. Schwartz offered three explanations for this depopulation, none of which adequately explain the events: (1) a simple movement out of the area for no explained reason, (2) a period of erosion or pressure from nomadic groups, although there is no evidence for the latter, and (3) a shift to a life-style with no material remains or a change to a location which has not yet been investigated archeologically. None of these explanations consider what actually caused the population decline. A period of erosion comes closest; the deteriorating environment of this time may have forced the people from this more marginal area earlier than from other regions.

Prescott Branch. The Prescott Branch, located southwest of the San Francisco Peaks, was first named by Colton (1939) and is characterized by Prescott Gray Ware, an unpolished pottery with mica temper. Again, little work has been done in this area, since the material remains are quite unspectacular. In fact, Euler and Dobyns (1962) noted that the cultural traits, excluding architecture, changed very little between AD 900 and 1200, the major period of occupation in the Prescott region. Shallow rectangular pithouses with rounded corners characterized the earlier Prescott phase (AD 900-1100), while small masonry pueblos, "forts" and, possibly, oval rock outlines were common during the Chino phase (AD 1025-1200).

Spicer and Caywood (1936) reported on some of the earliest excavations in the Prescott area. The first site, King's Ruin, is 35 miles northwest of Prescott and consists of a 12-room pueblo and oval pithouses. The presence of the two architectural types may indicate a continued occupation over a long period. The density of sites in the area led Spicer and Caywood to believe that the region supported a larger population in the past than it now does. The second site was the Fitzmaurice Ruin, located on a steep hill 7 miles east of Prescott. The site is one of the largest in the area and has more than 30 rooms, some of which are located in separate outliers.
Work in the Prescott area also has been done by Euler and Dobyns (1962), who excavated the Yolo Site (N.A. 5854) on the border between the Prescott and Cerbat branches; by Barnett (1970), who worked on five small sites of from one to eight rooms, and by Ward (1975), who excavated three pithouses at the PC Ruin on the Prescott College campus. Although it is difficult to determine the relationship between the Sinagua and the neighboring Prescott Branch because of the few investigations, it is interesting to note that the Prescott area also was essentially depopulated by AD 1200. As may have been the case for the Cohonina Branch, this might have been due to the effects of a deteriorating environment on a subsistence system that was marginal to the area. A study of the relationship between the Prescott culture and the prehistoric environment would help solve this problem.

Anasazi. The Kayenta Anasazi bordered the Sinagua on the northeast, but were separated from them by a 14-mile wide strip of uninhabited land along the west side of the Little Colorado River (Colton 1968). The center of population for the Kayenta was in the Black Mesa-March Pass area. This culture group has been described innumerable times in the archeological literature for the area (Beals, Brainerd and Smith 1945; Kidder 1969; Wormington 1947). Only their specific relationship with the Sinagua will be discussed here.

Watson Smith's work (1952) in the Big Hawk Valley, about 25 miles northeast of Flagstaff, has shown the intermingling of Kayenta, Sinagua and Cohonina groups in the area. Smith thought that the groups maintained their own identities, as the pottery styles remained those of the original groups. He presented ethnographic examples of groups peacefully intermingling to demonstrate the validity of his idea. Smith attributed the mixed population in the Big Hawk Valley to the improved agricultural potential of the land following the eruption of Sunset Crater. The ash fall covered the grassland of Big Hawk Valley and people from the Kayenta, Cohonina and Sinagua groups moved in to take advantage of it. The ceramic assemblages and architectural styles in the valley indicate that, with the passage of time, the relative amounts of Sinagua and Cohonina components decreased, while those of the Kayenta increased. The Big Hawk Valley was abandoned by the middle of the 12th century, possibly because of over-population. The Kayenta group seems to have moved a short distance to the northeast, to the Citadel (N.A. 355), Wupatki (N.A. 405) and Crack-in-Rock (N.A. 537) sites (now located in Wupatki National Monument).

Stanislawski (1964) studied the materials excavated from Wupatki Pueblo and determined that the site was occupied from AD 1080 to 1225. Settlement of this 100-room pueblo became possible with the change in environment after the ash fall from Sunset Crater. Stanislawski estimates maximum population of the site from AD 1150 to 1170, dates which correlate well with those proposed by Smith for the movement of people from the Big Hawk Valley. There was much competition for land in this area after the eruption and large compact pueblos characterize the architecture. Wupatki was abandoned by AD 1225, possibly because of wind erosion of the ash or other deteriorating environmental conditions.
The Little Colorado River Valley, just northeast of the Sinagua area, has been considered the boundary between the Anasazi and Mogollon and seems to have been a major trade route. The central part of the valley today is very arid and is separate from surrounding higher and wetter regions. Gumerman and Skinner (1968) consider this arid environment to be a major factor in the formation of a subculture of the Anasazi group, which they call the Winslow Branch. The branch is defined by the distribution of Little Colorado White Ware and begins in Pueblo II times (about AD 1075) with the introduction of Holbrook Black-on-white. The population increased during this period. During Pueblo III (AD 1100-1250), Walnut Black-on-white, Flagstaff Black-on-white and Padre Black-on-white were introduced from the upper Little Colorado area. Much of the river valley, especially the desert uplands, was deserted by AD 1250, with population convergence to larger pueblos along the river and to the Hopi mesas.

Evidence for the Sinagua in the Little Colorado Valley is minimal, reflected in a few sherds and possibly in the rectangular kivas and extended burials (Gumerman and Skinner 1968). Still, there must have been extensive contact between the two areas, as evidenced by the amount of Little Colorado White Ware found at Sinagua sites. Virtually all of the painted pottery in the Sinagua area is indigenous to the Anasazi culture, although it has never been determined whether it was traded or whether it was made in the Sinagua area in the Anasazi style.

The Hakataya Concept. A discussion of the prehistoric groups related to the Sinagua would not be complete without consideration of the Hakataya concept proposed by Albert H. Schroeder (1947; 1957; 1960; 1961). Schroeder considered the Hakataya a folk tradition which preceded both the Sinagua and the Hohokam, but which remained viable during later periods in the Cerbat, Prescott and Cohonina branches of the Patayan Root. Characteristics of the Hakataya included flood plain agriculture, wild plant gathering, small game hunting, stone-lined pits for roasting, paddle and anvil pottery, use of the mortar and pestle, few projectile points, choppers rather than axes, cremations and individual living units in random arrangement (Schroeder 1957). The Hakataya were supposed to have occurred first in the Gila Basin, where by AD 700 they were dominated by the Hohokam. A mixture of the Anasazi and the Hakataya was introduced into the Flagstaff area from the Upper Little Colorado Valley by AD 700. This hypothesis differed from Colton's idea that the basic Sinagua pattern originated in the Mogollon region and spread northwest to the similar environment around Flagstaff (Schroeder 1961). Schroeder postulated that the groups near Flagstaff were influenced by the Pioneer Period Hohokam after AD 700 and that this pattern continued until the eruption of Sunset Crater.

Schroeder noted the movement of the Sinagua during the Elden phase into the Verde Valley, where they seemed to have imposed their way of life on the Hohokam inhabitants. He accounted for the introduction of new traits into the Salt River Valley after AD 1150 by postulating that some of the Southern Sinagua and Verde Hohokam moved south (Schroeder 1947). The Sinagua pattern was supposed to have dominated that of the Hohokam in the
Gila-Salt region, especially after AD 1300, when luxury items were dropped in favor of practical ones and hunting and gathering became more common.

The difficulties of identifying the different populations which may have occupied an area simultaneously make Schroeder's Hakataya concept unsupportable as it stands. Schroeder identifies population by using such categories as architectural styles, burial types and pottery construction, but these criteria are too gross for determining this kind of population movement. Design analysis of pottery, along with a determination of tradewares, might better show who was moving where.

Much of what has been called Hakataya can be better explained by indigenous development, rather than by migrations of people. For example, it is not necessary to invoke a combination of Anasazi and Hakataya as the basis for the Sinagua pattern. The Sinagua more likely developed from a population that had inhabited the region and that was well adapted to the peculiarities of the environment. As this original population grew it developed traits characteristic of the Sinagua, but it may have been influenced by some outside traits and ideas. The domination of the Hohokam by the Sinagua pattern after AD 1300 can also be explained by indigenous development. The "Sinagua pattern" originally was an adaptation to the high, relatively cold region around Flagstaff. This adaptation would have undergone changes in the lower, warmer Verde Valley and even more changes in the hot, dry Gila-Salt area. Therefore, it is more likely that the Hohokam began practicing more hunting and gathering because of overpopulation and environmental change than because of influences from the Sinagua.

Although there is presently little evidence to support the Hakataya concept, Schroeder is one of the few archeologists to take a regional perspective and to consider the interactions between prehistoric groups. More detailed studies would better show just how prehistoric groups influenced each other and what the causes and effects of the population movements were.
The study of the ethnographic groups which have inhabited or used the Flagstaff region (Map 2) since the 1600s is relevant to the investigation of prehistoric adaptation to the area. Although ethnographic studies have limited utility in providing exact models of subsistence patterns and land use for the archeologist, such studies can furnish ideas and hypotheses which could be investigated archeologically. There are inherent problems in attempting to draw parallels between prehistoric and ethnographic adaptations. Although different groups of people have inhabited the Flagstaff area at various times, it is not certain that environmental conditions have remained constant through time. Even if one assumes the same environment, ethnographic studies have shown that two groups may use the same area in very different ways. The Navajos and Hopis, for example, occupy the same environmental area, but their social and technological adaptations rarely parallel one another. Nor is there much value in speculating that certain modern groups of Indians descended from specific prehistoric groups. It would be difficult to prove a direct link, as archeological studies of social patterns are only in the early stages. Ethnographic studies can be used as examples of ways to exploit a specific environment, but there is not necessarily a direct correlation between the adaptations of different groups to a given environment.

Ethnographic studies in the Flagstaff area have limited utility in providing hypotheses concerning Sinaguan adaptation to the area. Prehistoric land use, especially after AD 1125, seems to center around agriculture, while ethnographic use of the plateau has been dominated by hunting and gathering. It is possible that ethnographic investigations could provide research directions for studies of pre-1125 pithouse groups, but very little is known archeologically about this adaptation.

Ethnographically, the plateau around Flagstaff has been used for seasonal hunting and gathering and for trade and warfare networks. During historic times, no sedentary groups have occupied the area on a year-round basis. The major groups living around Flagstaff were the Pai, divided by the United States government into the Havasupai and the Hualapai. Their boundaries in the Flagstaff area extended from the San Francisco Peaks to the Little Colorado and Colorado rivers (Dobyns and Euler 1970), with the major concentration being west of the San Francisco Peaks to the Colorado River. The Havasupai were first definitely contacted by the Spanish (Father Garcès) in 1776. At that time they ranged north of the San Francisco Peaks from Cataract Canyon on the west, across the Little Colorado River to Moenkopi Wash on the east (Schroeder 1963b).

The Hualapai and the Havasupai had the same land use patterns (Dobyns and Euler 1970). In the summer they used canyon bottoms for agriculture and during the winter they hunted and gathered wild plants on the plateau. The annual cycle of the Havasupai (Spier 1929) included moving to Cataract Canyon in the early spring to take advantage of water from the snow melt; planting was done in the middle of April. The move to the plateau was made in the middle of October. Groups of about 25 people lived in semi-permanent camps, which moved occasionally in response to the availability
Map 2: Ethnographic groups in Arizona.
of food. The territories of each hunting and gathering group were flexible, the locations of camps changing yearly, and the area of each depended on the amount of land required to furnish the necessary quantity and variety of food for the members of the group. The Havasupai used the greatest altitudinal range of any group in the Southwest; they gathered agave along the Colorado River at 1800 feet and hunted game on the San Francisco Peaks at 12,000 feet. The traditional range of the Havasupai was cut by the government when this group was assigned to its present reservation in Cataract Canyon. The officials who set up the reservation boundaries in 1880 believed that the major emphasis of the Havasupai subsistence system was agriculture. Because the reservation boundaries precluded hunting and gathering on the plateau, the Havasupai were forced to seek wage labor (Dobyns and Euler 1971). The growing Anglo population on the plateau usurped that land for ranching and Indian children were required to attend school during the winter (Schwartz 1956). All of these factors combined to break down the traditional annual cycle of the Havasupais.

The Yavapai, now living on the Camp Verde Reservation in the Verde River Valley, are related linguistically to the northern Pai groups. The cultural differences between the groups might be attributed to the different potentials of the areas inhabited by each. The Havasupai farmed in a riverine environment and hunted and gathered on the plateau, while the Yavapai had a hunting and gathering adaptation to a more arid environment (Dobyns and Euler 1970). The latter moved seasonally as wild foods ripened and also planted small amounts of corn (Schroeder 1952).

The territory of the Yavapai included an area 200 by 100 miles, from the confluence of the Gila and Colorado rivers to the Mazatzal Mountains on the east. Three groups were recognized by the Yavapai themselves: the Southeastern, Northeastern and Western Yavapai. Each group used a different tract of land. Among the Northeastern Yavapai there were two subgroups. The Yavepe subgroups occupied the Upper Verde Valley and the mountains on either side, while the Mat-haupapaya subgroups ranged from Prescott to Crown King. The land north to Ashfork, Picacho Butte and the San Francisco Peaks belonged to the Northeastern Yavapai, but they did not inhabit the area. They occasionally gathered juniper and mescal near Ashfork, traveling north of Ashfork only to fight the Hualapai and the Havasupai (Gifford 1936).

There is some confusion concerning the term "Tonto Apaches" and the ethnographic group to which this label might apply. Schroeder (1963b) states that the name "Apache" was originally applied to any nomadic group and that the term "Tonto Apache" was often given to Yuman-speaking groups, such as the Yavapai or the Hualapai. The "Apaches" recorded near the Hopi mesas in the 1600s and 1700s were Utes or Yavapais. These groups were neighbors of the Hopi and were alternately friendly and hostile to them. In 1851 Sitgreaves encountered "Tonto or Yavapais" near the San Francisco Peaks; they had come to gather pinyon nuts on the southern and eastern slopes.

Until 1863 only Yavapais were called Tonto Apaches, but confusion arose when new military troops unfamiliar with southwestern Indians entered Arizona in the 1860s. Athapaskan Apaches (the groups today called Apaches) bordered on the Yavapais in the Pinal Mountain area and were near Flagstaff in the late 1860s, a period of disruption and unrest for Indian groups in Arizona.
Navajo Indians were not recorded west or southwest of the Hopi villages until the 1860s. After the 1859 campaign against the Navajos in Canyon de Chelly many wealthy Navajos moved with their flocks to the San Francisco Peaks area (Schroeder 1963a, 1963b), only to flee southwest of the Little Colorado River in the face of Kit Carson's 1863 campaign. While in the Flagstaff area the Navajo raided both the Yavapais and the Anglos. During the period of the Navajo incarceration at Bosque Redondo, enough Navajos remained free to trace a line of occupation from the San Francisco Peaks up the Little Colorado River and into New Mexico to the Datil and Gallina mountains. By early 1865, however, most Navajos had left the Flagstaff region to return to their traditional territory.

The plateau around Flagstaff also was used by the Hopis, who maintained trade and ceremonial routes to the Havasupai area and the San Francisco Peaks (Colton 1964). A major trail from the Hopi mesas to the Havasupais in Cataract Canyon ran from Hotevilla to Moenkopi Wash, across the Little Colorado River and through the Coconino Basin to Supai, a distance of about 150 miles. A somewhat shorter trail crossed the Little Colorado at Black Point, ran northwest past Moqui Tanks and then to Cataract Canyon. The Hopis used these trails to trade for Havasupai buckskins, hematite, shell, turquoise from the Mohave Desert and agave fiber. A trail to the San Francisco Peaks, used historically by the Hopi to gather materials for Kachina dances, started at Oraibi, crossed the Little Colorado at Black Falls and arrived at the peaks by way of Heiser Spring.

Based on ceremonial shrines and ceremonial uses of the Flagstaff area, such as gathering spruce for Kachina dances, the Hopi consider the region part of their aboriginal territory (Emory Sekaquaptewa 1975: personal communication). Relations with the Havasupai were friendly and it is probable that each group respected the other's use of the area. Government permits are presently issued to Hopis who wish to gather wild materials on federal land around Flagstaff. Such permits are based in part on their aboriginal use of the land.

The Hopi also have an oral tradition of their predecessors inhabiting pueblos near Flagstaff. Nequatewa's narrative (1955) of the destruction of Elden Pueblo describes an attack by a Yavapai war party from the Verde Valley. The story is that a cuckolded Hopi husband from a pueblo in Chavez Pass convinced the Yavapais to attack the pueblo at which the Hopi's wife and her lover lived. This the Yavapais did, killing all the inhabitants except the young women and girls. Nequatewa identified the destroyed village as Elden Pueblo, but Farmer (1955) notes that exact identification of the prehistoric pueblo in the story is difficult. He proposes that it was Grape Vine Pueblo (N.A. 2803) in the Anderson Mesa area, since the occupation dates of that site (AD 1300-1400) correspond well with those of the Chavez Pass Pueblo (N.A. 659) (AD 1275-1400). In fact, the destroyed village of the story might be any of the late prehistoric sites in the Flagstaff area and only excavation would ascertain whether any of these sites had been violently destroyed by a hostile group.

When examining the uses to which different groups put the land, mention should be made of the Anglo occupation. Flagstaff originally was a work camp for construction crews employed by the Atlantic and Pacific Railroad.
Company. The railroad to Flagstaff was completed in 1882, bringing an influx of Anglo ranchers and loggers. The rise of ranching around Flagstaff is shown particularly well in the history of Fort Moroni, built on the Leroux Prairie by John W. Young and his crew of Mormon railroad workers as protection against predicted Apache attacks (Kelly 1964). The fort was never attacked. After the construction of the railroad the fort became headquarters for the Moroni Cattle Company, the first cattle business in northern Arizona. In 1883 the cattle company was grazing 16,000 head of cattle northwest of Flagstaff.

Research Implications

Although it is difficult to infer backward in time from the ethnographic data, it is probable that the Sinagua had a wide range of natural resources available to them. Agricultural groups such as the Sinagua generally make secondary use of wild animal and plant resources, but such a potential food supply would have become increasingly important with deteriorating environmental conditions during the 12th and 13th centuries. The lack of archeological investigations of the Sinagua after AD 1200 hinders any interpretation of their dependence on a hunting and gathering subsistence pattern. If it is found that late groups in the Sinagua area were forced to return to a hunting and gathering adaptation, with secondary emphasis on agriculture, then the ethnographic models provided by the Havasupai and Yavapai for the seasonal round and the specific flora and fauna used would provide research directions for archeological investigation.

The Havasupai and Yavapai hunting and gathering patterns, especially around the San Francisco Peaks, also could provide general models for pre-agricultural pithouse groups, indicating what topographic areas and which plant products and animals might be used at specific times during the annual round. This kind of model could only serve as a starting point and, as excavation of a site of this type progressed, the model would have to be modified to fit the data recovered. For example, it might be discovered during excavation that the number of pithouses at a site could not have housed the approximately 25 people that lived in a semi-permanent Havasupai winter camp. The original Havasupai model would then be changed to reflect smaller winter hunting and gathering groups and a possibly smaller total population than that of the Havasupai over the plateau area around Flagstaff.
Early Explorers

Archeological work in the Sinagua area began in the 1880s with major exploratory expeditions sponsored by the Smithsonian Institution. In 1883 and 1884 James Stevenson (Powell 1887) examined cave dwellings and cliff dwellings near Flagstaff. The cave dwellings were 10 miles northeast of the city and were located on the summit of a lava hill. Stevenson thought these dwellings had been carved from the lava, but they actually were made in hollow spaces that had formed naturally in the rock. Stevenson's expedition also examined the Walnut Canyon cliff dwellings and collected such artifacts as matting, sandals, spindle whorls and stone implements to take back to the Smithsonian.

In 1885 J.W. Powell (1891) also explored west of the Little Colorado River and north of the San Francisco Peaks. He noted many scattered sites of from one to three rooms constructed of basalt, but he made no specific mention of Walnut Canyon.

Jesse Walter Fewkes (1900; 1904) also explored extensively in the Sinagua area during the late 1800s and the early 1900s. He hypothesized the relationship between the sites in the Chavez Pass area (now known to be late Sinagua) and the Verde Valley. Fewkes also discussed the cavate ruins—those dwellings situated in large air pockets formed in volcanic rock during the cooling process—northeast of Flagstaff and the sites in the Wupatki area.

The goal of these early explorers was to describe the sites they found and to collect materials suitable for museum display. Although archeological emphases have changed over time, the work of these early people remains valuable. They described and photographed the major sites of the Southwest before they had been destroyed by construction projects or looted extensively by pothunters. Because most of the expeditions covered large areas of the Southwest, these early archeologists were able to compare the material remains of different regions and to propose interrelationships between culture groups, many of which still are considered valid. Finally, the reports of these investigators contain many hypotheses concerning subsistence strategies and settlement patterns that were beyond their methodology to test. Rereading these reports demonstrates that the major problems of concern to archeologists have changed less through time than one would imagine. The methodology, however, has improved, allowing these hypotheses to be tested.

Colton's Work

As discussed previously, Harold S. Colton began a continuing survey of the Flagstaff region in 1916. In 1918 he and Mary-Russell F. Colton published a paper describing the small sites around Flagstaff, which they proposed as summer residences. Colton's survey continued intermittently for several decades and the results are well referenced in the archeological literature (Colton 1932; 1946; 1960). The Coltons also were instrumental in founding the Museum of Northern Arizona, an institution devoted to the
Colton's major goal was to develop a culture history for the vicinity of the San Francisco Peaks. His work was predicated on the development of a ceramic typology by which sites could be dated and Colton himself defined many of the pottery types found in northern Arizona. He also relied heavily on changing architectural styles to define the phases of Sinagua prehistory and used tree-ring dates when they were available. Although Colton's work is mainly descriptive, he did suggest reasons for culture change, such as the improved agricultural potential after the eruption of Sunset Crater acting as a magnet for migrants from surrounding regions. The emphasis in Colton's writings, however, is not on the theories behind culture change, since at the time he began his studies of the Sinagua there was no descriptive base from which to work. Archeologists today can propose models concerning population growth, environmental stress and prehistoric social systems only because they are able to build on a descriptive base, of which Colton's work is a major part.

Early Excavations

The period of the 1920s and 1930s was devoted to the excavation of major ruins. This work helped provide the basis for the definition of Sinaguan phases. Elder Pueblo was excavated in the 1920s by Fewkes (Fewkes 1927; Hargrave 1929; Kelly 1970), whose work defined the Elder phase, the period of pueblo development and major population concentration in the Sinagua area. In the latter part of that decade, Cummings (1930) dug at the Turkey Hill site, 9 miles east of Flagstaff. Although Cummings published only a one-page abstract of his work, the Turkey Hill phase was described on the basis of his investigations. In the 1930s McGregor (1941) excavated at the Winona and Ridge ruins east of Flagstaff and described the Winona and Angell phases. Wupatki also was excavated in the 1930s and early 1940s by Hargrave and Colton of the Museum of Northern Arizona and by Erik K. Reed and other National Park Service personnel (Stanislawski 1964). The major sequence of Sinagua prehistory had thus been described by 1940, based on the work of Colton and these archeologists. Although the methodology and theoretical background of these investigators are not used today, their culture history model of the Sinagua sequence is still the foundation of all discussions of the archeology of the Flagstaff region.

Major excavations continued into the 1950s with McGregor's work at the Pollack (1955; 1965) and Pershing sites (1958), late pueblos in the Anderson Mesa area southeast of Flagstaff.

Salvage Archeology

Salvage archeology also began in the late 1950s, with projects run by Gordon Vivian (1956) on the approach road to Sunset Crater and by David A. Breternitz (1957a; 1957b) in the general Flagstaff area. Salvage work represented an entirely new orientation in archeology. Projects
usually were paid for by the agencies planning construction activities, such as the Highway Department, and archeologists were expected to retrieve as many materials and as much information as possible before sites were destroyed. Salvage projects were hampered by a lack of money and time. The major concern in some cases became how to dig the maximum number of artifacts out of the ground before the bulldozers working just behind the archeologists plowed the site under. Clearly, research interests could easily become secondary with this approach.

Salvage archeology also constituted the major projects of the 1960s, as exemplified by the publications of Albert E. Ward (1969), Roger E. Kelly (1969) and Peter J. Pilles, Jr. (1969). Ward excavated eight structures at the Tse Tlani site, 31 miles east of Flagstaff. The architecture at this site was varied, consisting of four rectangular or "D"-shaped pithouses, two contiguous masonry surface rooms and one or two small surface storage units. Ward failed to mention whether these eight structures constituted the entire site. Pottery analysis revealed that the site was inhabited during the Elden phase, from AD 1100 to 1150, making the presence of contemporaneous pithouses anomalous. Kelly excavated six sites north and east of Flagstaff under the auspices of the Museum of Northern Arizona for American Tel. and Tel. Two of these sites were temporary camping areas with no structures, two were one-room seasonal shelters or storage units, one was a trash mound with pithouses and one was a three-room Elden phase pueblo with two ramadas. The pottery from this salvage work was typed and counted in order to date the sites. Pilles salvaged four sites in a highway right-of-way east of Flagstaff. One consisted of an unusual circular masonry surface room dating from AD 1075 to 1100. Pilles postulates that this structure may have been built on the surface in the pithouse style because of the shallow soil in the area. Two of the remaining sites were seasonal field houses and one was a sherd area.

The main emphases in these reports and most others done for salvage archeology were to gather as much information as possible before destruction of the sites and to determine the cultural and temporal affiliations of the sites. The reports usually contain artifact counts and descriptions and architectural descriptions necessary for cultural-temporal placement. There is little connection made between the material remains and the types of human behavior that they might reflect, although Pilles does discuss the nature of field houses and their importance in determining the size of the population around Flagstaff and the way in which the agricultural system might have worked.

Contract Archeology

The 1970s largely have been devoted to contract archeology, which serves the same function as salvage archeology, but which places more emphasis on research goals and on early project planning. The National Environmental Protection Act of 1969 requires that any project receiving federal funds must file an Environmental Impact Statement (EIS), stating the effects of the project on the environment. Since archeological resources are considered part of the environment, work must be done to
determine what sites will be affected by a project and to mitigate the adverse effects. Such a program ideally allows for archeology to be considered in the planning stages of the project, since major archeological resources in a project area may force planners to move their project. A second emphasis of the 1970s, which parallels the increased planning time for projects, is the need for each archeological project to have a research design, a statement of the project's research goals and the hypotheses the investigator wishes to test. In this way contract archeology not only retrieves artifacts, but also recovers information concerning the subsistence strategies, settlement pattern, population movements and social stratification of prehistoric groups. By stating hypotheses concerning these problems before a project begins, archeological work can be structured to uncover information which will specifically test the hypotheses that have interested researchers for so long.

Examples of contract reports prepared by the Museum of Northern Arizona are those of Pilles (1971), which discusses a short survey in Coconino National Forest near Turkey Hills, and of Brook (1974), which reports a cross-canyon survey in the Grand Canyon. Contract archeology, however, has had a limited effect on the concept of the Sinagua, since little construction on federal property or requiring federal money has been done around Flagstaff. Most contract archeology in northern Arizona has been done in the northeast section of the state in the Anasazi area.

Research in Walnut Canyon

The preceding discussion of the history of archeological research in the Sinagua area and the different research strategies applied at various times provides a framework into which the archeological investigations at Walnut Canyon can be placed. Archeologists who have worked in Walnut Canyon have been products of their time, in that their methodologies and theories generally reflected those then current in the discipline of archeology. Investigations done in the past, therefore, cannot be judged by present standards, but must be viewed in the context of the period in which each was performed.

Walnut Canyon National Monument is small, but, as emphasized in the discussion of environment, its available natural resources are extensive. It is clear that Walnut Canyon and its immediate vicinity provided food, water and shelter to prehistoric inhabitants.

Given the abundant resources, it is surprising that the major occupation of the canyon occurred mainly between the years AD 1125 and 1200. Two things might account for this short period of intense occupation: (1) earlier groups might have been better adapted to other microenvironments in the Flagstaff area or (2) evidences of previous occupation of the cliff shelters at Walnut Canyon might have been swept away with each successive settlement. If the latter is true, evidence may remain on the talus slopes below the cliff dwellings. However, it is obvious that until about AD 1000 prehistoric groups in the Flagstaff area showed a preference for settlements on the uplands and near the upper ends of drainages. With the change in settlement pattern to lower sections of the drainages and flatter, lower land, the heaviest population concentration occurred in Walnut Canyon (Map 3).
Map 3: Archeological sites in Walnut Canyon National Monument.
The Walnut Canyon cliff dwellings first were described by Stevenson (Powell 1887), who traveled through the Flagstaff area in 1883 and 1884. The doors in the rooms, which at that time probably were still mostly intact, were large enough to admit a person without stooping. Stevenson mentioned that the rooms were large, with walls two to four feet thick and hearths in the corners on an elevated rock.

Even as Stevenson explored the canyon, a story was published in the "San Francisco Call" which demonstrates the problem of early vandalism of the cliff dwellings, a problem which was to continue until few floors in the rooms were left intact and little artifactual material or its contextual information remained for scientific study. The article, reprinted in Plateau, included a popular description of Walnut Canyon and the following quote:

"In one of the first dwellings that we visited we struck a bonanza. . . I began to dig in the debris, after moving the heavy stones that had fallen upon it from the walls. . . We dug for an hour or more, and found, among other things, an old stone mill (metate and mano). . . cornstalks, corncobs in abundance, beans, gourds, uncracked nuts, reeds, arrows, bowstrings, other strings of different size, coarse cloth, a child's sandal, a measuring stick with notches at regular intervals, smoothly worn sticks of hard wood, bone needles, a fish line, soapweed needles, broken pottery, etc. In other dwellings, we added to these relics and came away heavily laden" (Cross 1954:20).

The first work of archeological import in Walnut Canyon was done by Colton in 1921, when he surveyed the canyon as part of a continuing effort to record and describe the prehistoric ruins in the Flagstaff area. Colton was interested particularly in the distinctive features of individual ruins, the relationships of prehistoric cultures with those of neighboring regions and the relationships of occupied regions with the external environment (Colton 1932a).

Although Colton's survey was considered intensive for the time, it is obvious from later work in Walnut Canyon that he concentrated on cliff dwellings, recording only some of the sites on or set back from the canyon rim. The large area covered by Colton on his survey, as well as the limited number of people who worked with him, no doubt contributed to the fact that only the obvious sites were recorded. In the area of Walnut Canyon, Colton (1932a) recorded 120 sites, including pueblos of one to five rooms, cliff dwellings, "forts" and a few pithouses. He also wrote the first archeological description of the cliff dwellings. He noted (Colton 1932b) that the front walls of the cliff dwellings did not connect with the side walls and that both the floors and the walls were plastered with adobe. The masonry rested on foundations made of two rows of slabs. Over the doors were vent holes, which allowed free circulation of air in the rooms.

The first archeological excavation in Walnut Canyon was done in 1932, when it was decided that one of the cliff dwellings required stabilization (Hargrave 1932: Colton 1946). The site, N.A. 739, is on the south side of Third Island, so called because it is connected only by
a "saddle" of land to the canyon rim. The site is one of those observed today by visitors on the self-guiding Island Trail. It consists of nine rooms under a limestone overhang. Two of the rooms, N.A. 739A and 739B, were excavated and stabilized by a crew from the Museum of Northern Arizona, directed by Lyndon L. Hargrave. These two rooms will be described, as they seem to be typical of the cliff dwellings at Walnut Canyon. N.A. 739A was 17 feet long and 10 feet wide, with a firepit back from the door and what has been called a "T-shaped doorway." The latter does not resemble the T-shaped doorways characteristic of Mesa Verde, but has two rocks set at the base of the door, constricting the entrance. This room had a small bench at the back, as did N.A. 739B. The second room had two floor levels, with a clay-lined firepit back from the door in the lower floor. This unit also had a "T-shaped doorway," with a vent hole over it. Two tree-ring dates, taken from wood in loose trash beneath the floor of the first room, correlate well with the pottery recovered and place these rooms in the early part of the 12th century.

Because all of the details of all of the archeological projects conducted in Walnut Canyon since Colton's early work will not be of interest to the general reader, an outline of each investigation is included in Appendix I. A short synopsis of the research is presented here, to acquaint the reader with the amount of work done in the canyon and with changes in research goals through time.

Paul Ezell (1940) stabilized three cliff dwellings at Walnut Canyon in the spring of 1940. These sites are located along the Cabin Trail, which is not presently open to visitors. The cliff dwellings, however, can be seen from other areas of the monument. Although Ezell's main purpose was stabilization, some dirt must have been moved; the crew recovered many artifacts, including restorable pots. Ezell worked at N.A. 311, which has six rooms; N.A. 312, which has two, and N.A. 313, which has one room and a terrace area in front and which yielded most of the artifacts. Ezell also noted a trail running from the gully edge, level with the ledge on which N.A. 312 is located, across the ledge in front of N.A. 313 and on to the stream. The trail was filled in with large boulders across the gullies and had retaining walls on the steep slopes. It may have been constructed to enable the inhabitants of the cliff dwellings to obtain water from the stream, or it may have been built by early Forest Service personnel. Ezell's work, which was not finished when he left the monument at the end of June, was resumed in October, probably under the direction of Paul Beaubien, then superintendent of Walnut Canyon. One hundred seventeen person-days were spent on this part of the project before winter weather forced its suspension (Beaubien 1940).

In late 1948 Raymond Rixey of the National Park Service Ruins Stabilization Unit stabilized rooms in five reported and, possibly, two unreported cliff dwellings along the Island Trail. The reported sites (Rixey n.d.; 1948b; 1948c; Rixey and Voll 1962) had from one to nine rooms, with the number of rooms depending on the space available. Two other sites, N.A. 741 and 742, seem to have been worked on (Rixey 1948a), although the latter was so badly disintegrated that it was a total ruin, except for three walls. Again, the major goal of this work was stabilization and scientific data collection seems to have been secondary.
Regardless of this and of the vandalized nature of the ruins, a list of the artifacts recovered by Rixey and his crew gives some indication of the original richness of the cultural deposits in the cliff dwellings. The artifacts, most of which were found outside rooms or under the debris of fallen walls, included several thousand sherds and nine complete vessels (mostly Alameda Brown Ware, the type ware for the Sinagua), cotton fabrics, sandals, basketry, cordage, pottery anvils, arrow shaft straighteners, manos, metates, axes, projectile points, cane cigarettes, a reed arrow shaft, wooden spindle whorls, weaving tools, bone awls and tubes and antler flakers. Pumpkin, squash, several varieties of beans, yucca seeds, corn, pinyon nuts, walnuts and yucca or agave quids were among the vegetal remains. Faunal material included evidence of rabbit, squirrel, gopher, packrat, deer, turkey, bobcat and mountain sheep. Rixey offered no interpretation of these materials, except to say that they seem to date to the Elden phase (AD 1120-1200) on the basis of ceramics and architecture.

No further work was done in Walnut Canyon until 1955, when Gordon Vivian and Roland Richert of the National Park Service spent a couple of weeks stabilizing rooms in three cliff dwellings: N.A. 331, 333 and 334 (Richert 1956). These sites, located on Fourth Island across the canyon from the Administration Building, were repaired so that visitors who could not walk the Island Trail could see prehistoric cliff dwellings. In order to preserve scenic and interpretive values, Vivian and Richert repaired eroded foundations, several wall sections and gaping holes and capped walls exposed to the weather. These stabilization repairs typify those done on all such projects in Walnut Canyon.

In 1958 Vivian and Richert returned to Walnut Canyon to stabilize nine sites along the Cabin Trail (Richert 1958). Since this trail is not open to the public, the purpose of this stabilization was to preserve the scenic value of the cliff dwellings. The sites originally proposed for stabilization included N.A. 317, 318, 319, 320, 321, 322, 323, 324 and 328, but because of a lack of standing walls or a large amount of debris, only six sites actually were worked on. It was noted in both this and the 1955 work that the sites had been severely damaged, not only by pothunters, but also by cattle using the rooms for shelter. The materials recovered from both stabilizations were not discussed.

During brief periods in 1955, 1957 and 1958, Sallie Van Valkenburgh (1958; 1961) performed the first intensive survey of the north rim of Walnut Canyon. This survey was particularly important, as it demonstrated a shift of interest away from the more obvious cliff dwellings to the smaller, less spectacular sites in the rim area. Van Valkenburgh wanted to determine the distribution and intensity of sites on the rim and the types of use to which the area was put. She was interested in evidence of occupation before the eruption of Sunset Crater. She also was charged with locating sites which might influence the planning of the interpretive program.

Van Valkenburgh found 78 sites on the north rim, bringing the total of such sites recorded to 104. Although Van Valkenburgh surveyed the area between the rim and the monument boundary (about three quarters of a section) quite intensively, it is possible that some sites remain unrecorded. The ground cover in some sections is very dense, making sites, especially
pithouses, difficult to see and Van Valkenburgh did part of her survey
during the winter, when snow also hampered visibility. The variety of
sites recorded, as well as their density, shows the intensity with
which the rim area was used. Van Valkenburgh noted seven sherd areas,
two of which are pre-eruptive; five dirt mounds, possibly used to
prevent stored crops from freezing; 77 boulder shelters, which may have
functioned to support windbreaks; five pueblos; one rock terrace, which
may have been used to retard erosion; six spaced stone outlines, again
possible shelter areas, and two boulder shelters within enclosures.
The surveyor believed the latter to be the only evidence of the village
compound tradition, but excavation is needed before one can say definitely
that the walls enclose a cultural area. Van Valkenburgh also noted that
the boulder shelters clustered near open "parks," which contain deeper
soil and have better moisture retention. These areas may have been used
for agriculture and the shelters may have served as temporary field
houses.

In August of 1960 Stuart Maule performed the first excavations not
associated with vandalism or stabilization. His purpose was to clear two
sites to be destroyed by a new residence and residence road. After
digging three test trenches he decided that the Residence Seven Site
was not a site at all, as the rock alignments which showed on the surface
were, in fact, a random scatter. The second site, N.A. 5891, was
determined to be a use area, characterized by a hard surface with rocks
pushed away from it.

In Paho Cave in Walnut Canyon, Robert Schley (n.d.; 1964) found archeo-
logical materials which represent a part of prehistoric culture not
evident elsewhere in the monument. Schley located 16 prayer sticks
(pahos), made from the vine of canyon grape, far back in the cave. The
prayer sticks were one-quarter inch in diameter and two to three inches
long, with cotton string wrapped around the midsections. Two sticks had
feathers attached to the strings. Two rectangular rock outlines were
near the entrance of the cave and there were pictographs on the west wall.
Investigators noticed that after spending time in the cave without
respirators they began to have high temperatures, headaches, chills and
chest pains. These symptoms were thought to have been caused by a large
amount of nitrate in the air. The physical effects of the cave, along
with the presence of prayer sticks, seems to indicate ceremonial use.

Although the prayer sticks of Paho Cave could not be dated, split-twigs
figurines found in a cave just outside monument boundaries suggest an
early use of the area (Euler and Olson 1965; Olson 1966). The figurines
were scattered throughout the less accessible parts of a small limestone
rock shelter. Excavations were done in the floor of the cave, but the
artifacts, including yucca fibers, knots, yucca leaf needles, split and
unsplit willow twigs, an antler punch, three large projectile points and
Cohonina sherds, were not diagnostic. Two of the figurines, however,
dated by the radiocarbon method to 3880 ± 90 B.P. and 3500 ± 100 B.P.
These dates are the first evidence of the earliest habitation of the
Flagstaff area. Because of the wide geographical range of these figur-
ines and their antiquity, the investigators have proposed that they are
part of the Pinto complex of the Desert Culture, an early Great Basin
culture group. While this may be true, it is difficult to assign the figurines to a definite culture without associated artifacts. The importance of the figurines remains in their age, since they serve as indicators of the earliest habitation of the region.

In 1961, at the request of the National Park Service, Robert Euler (1962; 1964) performed an archeological survey of the south rim. Euler did an intensive survey of the area between the south rim and the monument boundary, excluding Wild Cherry Canyon. As with Van Valkenburgh's survey, the thick pine needle cover may have hidden some sites. Euler and his crew recorded 38 sites, most of which were occupied during the Elden phase. One sherd scatter indicated minimal occupation during the Cinder Park phase, two sites showed use during the Rio de Flag phase and three were used during the Padre phase. Unless a large number of unrecorded pithouses and sherd scatters exist below the dense ground cover, present indications are that the area around Walnut Canyon was used mainly during the 12th century. Besides pueblos, sherd areas and rock shelters, Euler also noted three masonry check dams, showing use of the area for agricultural purposes.

Cramer (1965) surveyed the tributary drainage systems in the northwest corner of the monument for Sinaguan field systems in an attempt to better understand the economic base of this prehistoric group. Cramer intensively covered several small tributaries and recorded what he referred to as "terrace plots." These features were constructed by coursing limestone blocks across an intermittent stream and filling behind the wall with rubble. The walls ranged from 4 to 31 feet long and were one to three courses high. These "terraces," more commonly called check dams in the archeological literature of the Southwest, functioned to increase the water absorption in the plots behind them and to prevent erosion. Field houses on the banks or rims of several canyons seemed to be associated with check dams. Cramer postulated that the location and density of field houses in the vicinity of check dam systems demonstrates the intensive agricultural use of large open glades on the rim of the canyon. The check dams themselves may have provided plots of increased fertility and dependability and may have been used for specialty crops. The results of this survey may point to the increasing importance of run-off from summer showers at the end of the 13th century, but this assumes that the check dam systems actually are associated with the Elden phase field houses. It is interesting to note that Cramer recorded more than 40 check dams in a relatively small area after most of the monument had been surveyed, suggesting that other agricultural systems may be unrecorded in Walnut Canyon. The total number may indicate the importance of agriculture in the Sinaguan subsistence system and the number of people the land was able to support with these agricultural methods.

Edwin R. Littmann (1967) studied the technology of the mortars and plasters used in canyon cliff dwellings. Littmann wished to compare mortars and plasters of the prehistoric Southwest with those of the Maya area in Mexico, but he obtained few results from the materials at Walnut Canyon. He did note that the mortars were brown and earth-like, while the plasters were soft, white and friable and that the technology for manufacturing these materials was the same as that of the Maya. This
does not necessarily imply a relationship between the two groups, however, as there are only a limited number of ways to make mortars and plasters.

In 1966 Norman Ritchie (1970) of the National Park Service undertook the only large scale excavation in Walnut Canyon. Ritchie was to excavate, for research and interpretive needs, sites close to the visitor areas to augment the interpretive program at the monument. N.A. 103, a two-room Elden phase pueblo, was chosen for excavation. The structure was built of unshaped, but selected, limestone blocks and Ritchie believed it might have been two stories high. The pueblo was built as one unit, with a wall across the center. Each room had a doorway and a hardpacked earth floor. The southern room had an ash area west of the door, while the northern room contained two hearths.

N.A. 476 and 478, both Padre phase masonry pithouses, also were excavated by Ritchie, as was a trash area north and east of N.A. 103. The pithouses were constructed of unshaped limestone blocks. N.A. 476 had a circular firepit and N.A. 478 contained two hearths. The relationship of these pithouses to the pueblos on the rim is unresolved. The pithouses were not filled with pueblo trash, although one might expect to find trash in the pithouses if they were abandoned before the pueblos were occupied. The pithouses were filled with hard-packed clay, which suggests that they might have been filled purposefully. Ritchie thought that the pithouses might have been used as storage areas concurrently with the pueblos or that the dwelling type may have changed from pithouse to pueblo over as short a time as a generation. Ritchie also suggests the possibility that the rim sites were occupied during the summer growing season, while the more protected cliff dwellings were inhabited during the winter. All of these are interesting hypotheses, which unfortunately were not tested during the excavations. They do, however, provide research directions for future work in the Walnut Canyon area.

As Ritchie did not finish work on N.A. 478 or the trash deposit near N.A. 103, Roger Kelly (1968) completed the excavations in 1967. Kelly was also puzzled by the function of the pithouses, with their small size and lack of floor features. He again suggested that they were used for storage while pueblo N.A. 103 was occupied.

In 1968 Martin T. Mayer of the National Park Service Ruins Stabilization Unit directed stabilization of sites along both the Rim Trail and the Island Trail (Mayer and Waggoner 1968a; 1968b). The work along the Rim Trail was to provide an exhibit showing the prehistoric use of the canyon rim and completing the interpretive story of Walnut Canyon. N.A. 103, the two-room Elden phase pueblo excavated by Ritchie (1970), was stabilized as an example of a masonry pueblo structure. This project had two interesting results: the measurement of the rock rubble associated with the building indicated that it had been only one story high and a third room was partially uncovered. The latter was covered up again, as stabilization of it was not included in the original plans. To complete the interpretive program a pithouse was to be stabilized. Two masonry-lined Padre phase pithouses had been excavated, N.A. 476 by Ritchie (1970) and N.A. 478 by Kelly (1968). N.A. 476 was chosen for display and N.A. 478 was backfilled.
Along the Island Trail, Mayer and his crew performed minor repairs on the cliff dwellings stabilized by Rixey in 1948. The sites included N.A. 735 through 739 and N.A. 742, in which the two southernmost rooms were stabilized.

In 1973 Ed Sudderth (National Park Service n.d.; Sudderth 1973) of the National Park Service Ruins Stabilization Unit repaired the masonry walls of 22 small cliff dwellings. Several of these sites previously had been stabilized by Rixey and Richert, but were in need of further maintenance. The sites were located in the north and south canyon walls, as well as above and below the Island Trail, and contained from one to eight rooms. No final report has been issued for this project and the letter report (National Park Service n.d.) submitted on completion of the work is concerned mainly with the difficulties encountered while working in Walnut Canyon. It is impossible, therefore, to determine what effects the stabilization had on the archeology of the sites.

The most recent archeological work in Walnut Canyon was a survey done by the List of Classified Structures (LCS) Team from the Western Archeological Center (National Park Service 1975). The purpose of the LCS evaluation was to provide a list of all structures on the monument which should be preserved because of historic, architectural, archeological or esthetic values. LCS also is responsible for determining the significance and treatment of the structures and for providing a basis for planning and budgeting. The LCS team evaluated 56 sites, all but two of which (N.A. 103 and 476) are cliff dwellings. All sites listed belong to the Elden phase, except N.A. 476, which was occupied during the Padre phase. One of the major values of this report is the listing of sites which still contain archeological deposits, associations of various types of artifacts and vegetal materials. Such information is extremely useful to investigators who may wish to obtain what archeological information remains in the cliff dwellings.

**Summary and Conclusions**

It is clear from the preceding discussion that, aside from pothunting, there have been three types of archeological operations at Walnut Canyon: stabilization, survey and excavation. The goals of the stabilization crews have consistently been to repair and maintain sites for the appreciation and safety of visitors. As the interest in cliff dwellings shifted to include sites on the canyon rims, stabilization also was done on these less spectacular sites. The one shortcoming from which all stabilization projects have suffered is the lack of attention paid to archeological materials and methods. In the past, stabilization often has neglected the archeological aspects of the sites in order to finish the job at hand.

The archeological surveys done in Walnut Canyon demonstrate the same shift in interest from the obvious cliff dwellings to the rim sites. Colton's (1932) survey was considered intensive for its time, but Colton recorded mainly the cliff dwellings and a few sites on the rim. The surveys of Van Valkenburgh (1958; 1961) and Euler (1962; 1964) were the first indication of the increasing interest in rim sites. The excavations by Ritchie (1970) and Kelly (1968) are substantial evidence of this new interest on the part of the National Park Service.
Future research goals in and around Walnut Canyon National Monument should include problem orientations, so that specific areas of interest can be investigated intensively. Such problems might include whether different kinds of sites were inhabited seasonally; the roles that hunting, gathering and agriculture played in the subsistence base of the Sinagua; changes in settlement patterns, and the causes of population increases and decreases. Such problems will be discussed in more detail in the following section.
RESEARCH DIRECTIONS

Research Problems in the Sinagua Area

The Sinagua area seems to have been environmentally marginal to the major regions of Southwest prehistoric development, just as the Sinaguan population seems to have been on the fringes of developments in the Anasazi, Mogollon and Hohokam areas. The constraints of high altitude, a short growing season, cool climate and poor plant gathering conditions have already been discussed in the section on environment. Prehistoric Sinaguan groups reacted to these constraints with a late pithouse-to-pueblo transition, the pueblo occupation being of short duration. In the heartland of the Anasazi region the pithouse/pueblo transition occurred between AD 750 and 900, but the transition in the neighboring Sinagua area did not happen until about AD 1125. The Sinagua produced little, if any, decorated pottery (Colton 1946) and few fancy items, in comparison with the Anasazi, Mogollon or Hohokam. Much of the small amount of painted pottery found on Sinagua sites is trade ware from the Anasazi. Finally, the area around Flagstaff was one of the earliest to be abandoned in the Southwest. Depopulation had begun by AD 1200 and was virtually complete by AD 1300. Thus, the poor environmental conditions, along with evidence of a late pithouse/pueblo transition, an economy poor in luxury items and an early abandonment of the area, point to the Sinagua as a backwater in southwestern prehistory.

The characterization of the Sinagua area as a backwater does not imply that it is of little importance to archeologists. In fact, there are several research problems which suggest themselves in the examination of the Sinagua literature. First, what was the nature of the pithouse occupation around Flagstaff? If the environment was so marginal, then this occupation may have been seasonal, much like that of the ethnographic groups who hunted and gathered in the area. In the investigation of this question it is critical to establish just what the environment was during the period of pithouse occupation. The pattern of winter and summer rainfall, as well as the amount of rainfall and the average and extreme temperatures, would determine, in part, the presence and amount of agricultural produce and wild plants available for gathering. Study of the prehistoric environment is also important for the remainder of the research problems to be discussed.

A second research interest centers on the circumstances surrounding the pithouse/pueblo transition. The impetus for the change from pithouses and a predominantly hunting and gathering economy to above-ground pueblos and an agricultural economy may have come from improving climatic conditions, the eruption of Sunset Crater and population pressure from surrounding areas. The climatic changes early in the twelfth century included increased summer rainfall, which provided more effective moisture for plant growth, and warmer temperatures, which lengthened the growing season (Richard Hevly 1975: personal communication). Coupled with the positive effects of the ash fall from Sunset Crater, these changes may have resulted in increased agricultural potential. Population growth in the Sinagua area during this period suggests that agriculture was, in fact, becoming more feasible. Population pressure from surrounding groups may...
be indicated in the population movements that converged on the Sinagua area, especially northeast of Sunset Crater around Wupatki National Monument.

While the population may have grown because of improved agricultural potential, there are other explanations for changes in the Sinagua area after the eruption of Sunset Crater. Pilles (1974) has proposed that most of the sites used to infer population increase are field houses in the pinyon-juniper area, where soil development is limited and where effective moisture is lower. As pre-eruption sites were located mainly in the ponderosa zone near arable alluvial soil, Pilles believes that the ash fall may have made agriculture in the pinyon-juniper zone possible and that the presence of numerous field houses in this area can be explained by the indigenous population making use of the newly available agricultural land. It is possible that agriculture on the new land would encourage population increases and that it might have attracted groups from other areas, but Pilles believes that the apparent increase in sites after AD 1066 can best be explained in terms of environmental adaptation, rather than in terms of population increases. Even a large number of field houses would not necessarily indicate a large population, as the intensive planting of several areas might be needed to support a small group of people (Pilles 1969). However, the amount of actual population increase could be determined by the number of pueblos, assuming that the field houses were not used for permanent occupation. If the number of pueblos increased after the ash fall, the total population probably also increased.

A consideration in the problem of population growth and increases in agricultural potential after the eruption of Sunset Crater is the negative effects that a volcanic eruption can have on the surrounding environment. Malde (1964) and Wilcox (1959) cite several such effects, which definitely could discourage habitation of a region of recent volcanic activity. Volcanic fumes, especially sulfur dioxide, fluorine and chlorine, are expelled for a considerable time after an eruption. Low concentrations of these gases damage plants. When the temperature rises above 5°C and the relative humidity is high, plant damage increases proportionately. Evergreens, the dominant vegetation around Flagstaff, are more susceptible to volcanic fumes than are deciduous trees, because their leaves are not as easily replaced. If the vegetation of an area is destroyed by fumes, gullied topography and the associated physiographic effects usually associated with arid lands will develop.

Volcanic ash also can have negative effects on both flora and fauna--on plants through smothering mechanical overload or chemical attack and on animals through the loss of food supply and the damage to teeth and joints caused by fluorine on the ash. The ash from the eruption of Paricutin Volcano in Mexico reduced the animal population and severely damaged crops. As the food supply was destroyed, deer, rabbits and coyotes disappeared first; squirrels and jays remained until pine cones and acorns vanished. Bugs battered by debris in the air formed a temporary food supply for crows, foxes and mice, but lizards and snakes had difficulty moving on the loose ash.

Augmented erosion also usually results from an ash fall. With increasing distance from the source, ash becomes finer and better sorted and, therefore, less permeable, increasing runoff and erosion. Ash fell
from Paricutin during the dry season, clogging arroyos. When rain fell, runoff was heavily charged with ash and erosion accelerated. In the area of heaviest ash fall, however, the ash absorbed and conserved rainfall, so that formerly intermittent streams flowed continuously.

The long-range effects of a moderate ash fall may ultimately be beneficial to agriculture, especially if the area escapes heavy erosion. The beneficial aspects of an ash fall are felt faster in areas of high temperature and rainfall, which Flagstaff is not. Wilcox (1959) reports that most soils are improved chemically and physically by an ash fall, with the chemical composition of the soil being similar to that of normal soil, except for low nitrogen content and low percentages of chemically combined water and organic material. He also notes that the increased growth rates of recolonized plants is due not to added nutrients, but to the mulching effect of the ash mixed with the old soil and to the destruction of competing plants.

Although the physical and chemical characteristics of each individual ash fall must be known before the role of ash in the recovery of the environment can be evaluated, the preceding discussion points out that ash fall can have effects other than simply forming good mulch for agriculture. Various plants recover from the effects of volcanic activity at different rates and nothing is known of how quickly such domesticates as corn can recover. The eruptions of Sunset Crater no doubt had some positive effects on the agricultural potentials and possibly on the available water in the Flagstaff area, but the impact of the negative effects on the indigenous population and on the potential for population growth requires further research.

After the initial climatic changes in the twelfth century, which led to increased agricultural potential, the climate became drier and cooler than it is at present (Schoenwetter and Dittert 1968). This may have cancelled out the increased summer rainfall, which had opened up the area to agriculture, and the Sinagua economy, which was based on agriculture, may have been threatened. Roger Kelly (1971) has proposed a model for the prehistoric occurrences during most of the twelfth and the thirteenth centuries in the Sinagua area. Kelly assumes that worsening climatic conditions, increasing use of agriculture and growing population put enough stress on the Sinagua system to cause certain changes. He uses an hypothesis stated by Hill and Plog in 1970 to account for these changes: as stress, especially environmental, on a cultural system intensifies, increasing experimentation in technological, economic and social areas, together with increasing cooperation between units of the cultural system, will evolve as countering responses. Kelly divides the Sinagua system into three subsystems—procurement, protection and social regulation—and proposes several hypotheses concerning the effects of a deteriorating environment on these subsystems.

In the procurement subsystem, Kelly proposes that agricultural groups would begin to emphasize other procurement methods, such as hunting and gathering wild plants, and would broaden procurement activities, while decreasing the intensity with which each resource was exploited. Kelly does not consider an intensification of agriculture, possibly because such processes as heavy fertilization and double cropping either were not used by the Sinagua or were not possible in that environment. However, increasing
numbers of agricultural terraces, check dams and canals might indicate an intensification of agriculture in certain areas. In the protection subsystem, agricultural groups subject to continuing environmental stress might: (1) experiment with more efficient shelter types and with those suitable for less sedentary occupation in certain locations, (2) experiment with shelter types more suitable for centralization of larger social and economic groups, (3) abandon certain marginally productive areas in favor of more productive ones, (4) lose less-productive people through death, warfare or disability or (5) have lower resistance to organic ailments. In the social regulation subsystem, Kelly hypothesizes that increasing environmental stress will prompt the restructuring of access to necessary resources, in order to restore equality between different settlement populations, and the use of such mechanisms as social stratification to foster the exclusive use of certain scarce resources by some segment of the population.

Kelly's hypotheses form a model of increasing experimentation and of cooperation in the face of worsening environmental conditions. The lack of available moisture, however, probably was not the only factor in the deterioration of conditions for the Sinagua. A population that seems to have been increasing after the eruption of Sunset Crater and the possible overuse of prime agricultural lands would also have negatively affected the Sinagua subsistence system.

Kelly used data from past work in the Flagstaff area to test his hypotheses. The data, however, were insufficient either to confirm or to disprove many of the hypotheses; for others the data yielded only tantalizing indications of the cultural processes that might have been at work. The present lack of data does not reduce the validity of Kelly's model, but points to the need for research directed specifically to some of the questions he poses.

The available data do indicate certain changes in Kelly's three subsystems. In the procurement subsystem, for example, hunting should increase as agriculture becomes less reliable and this should be evident by increases in the numbers of projectile points, species hunted, bone tools and hunting rituals. While there was no increase in rituals, as shown by animal figurines, or in types of animals hunted, there was a definite increase in all projectile point forms through time and in the number of bone tools in certain areas. There may have been a greater use of wild plants during the Elden phase, but this is uncertain because more pollen samples have been collected for that phase than for others.

In the protection subsystem it is interesting to note that public health may have been deteriorating and that the death rate may have been rising as population concentrated into pueblos. Whipworm, pinworm and tapeworm have been identified from Elden Pueblo; eggs of these parasites were plentiful in samples from the upper room fills, which were deposited late in the occupation of the pueblo. Unfortunately, there is no comparative data for the increasing presence of parasites during late Sinagua pueblo occupation, but this is an interesting problem. Kelly also points out that there may have been an increase in the percentage of deaths among pueblo dwellers over those among pithouse dwellers because of the close quarters and the permanence of the habitations. The death rates
of individuals below the age of 12 and over 30 varies with the demographic concentration into pueblos during the Elden phase and later.

Finally, in the social regulation subsystem, Kelly points to renewed seasonality and to the use of more agricultural constructions, such as check dams, terraces and linear borders, as an artificial clustering of resources, demonstrating attempts at structuring food procurement to increase productivity. Although Kelly saw no data for this trend in non-architectural sites, the Walnut Canyon rim surveys of both Euler and Van Valkenburgh show an increase in the number of sherd areas from the Cinder Park phase to the Elden phase. Also, agricultural constructions are used extensively during the Elden phase in Walnut Canyon.

Kelly's model of social change postulates a point of diminishing returns for the Sinagua system. The Sinagua used basically the same methods of procurement in the face of a deteriorating environment, opting for small adjustments to maintain the status quo rather than for long term adaptations. In the absence of technological advance the Sinagua were forced to increase their labor input. The point at which labor became too expensive, the point of diminishing returns, was reached at different times for different Sinaguan areas. The point of diminishing returns perhaps was reached earliest at Walnut Canyon, since it was abandoned earlier than other Sinagua areas.

Kelly's proposal of a point of diminishing returns brings attention to another research interest in the Sinagua area: the nature of the abandonment and possible reasons for it. Paleoclimatic reconstruction indicates that the climate continued to deteriorate until at least AD 1300, by which time the Flagstaff area had already been abandoned. Loss of nutrients in the volcanic ash mulch, as well as erosion of the mulch by wind and water, may also have contributed to poor agricultural conditions. It seems that the pueblo inhabitants left the Flagstaff area because it was returning to the marginal conditions of the pithouse period. In fact, the only evidences for human use around Flagstaff after AD 1300 occurs in a few small late sherd scatters and in the ethnographic groups present at the time of European contact.

The purpose of this discussion of research directions for the Sinagua area has been to emphasize the marginality of the Sinagua and to present possible explanations for cultural change through time. The discussion has been kept on a general level; it serves to show some, but not all, of the large scale archeological problems that might be considered for the Sinagua area. One would have to narrow these research proposals considerably and add many tests of them before they would be usable in the field. These general directions can, however, help structure future research and it is hoped they will encourage the consideration of some of the larger theoretical problems that can confront archeologists in any area.

Research Problems in Walnut Canyon National Monument

Based on the previous discussion and on what is already known about the prehistoric occupation of Walnut Canyon, the area could be characterized as marginal even to the major Sinagua occupation. During pithouse periods Walnut Canyon seems to have been used only occasionally or
seasonally, as evidenced by the few early sherd scatters. The major occupation around the canyon occurred during the Elden phase, when population pressure in the Sinagua regions more favorable to habitation may have forced groups into areas considered marginal. The marginality of Walnut Canyon to the agricultural economy of the late Sinagua is emphasized by its early depopulation. Walnut Canyon may have been abandoned early because decreasing rainfall caused the water table to drop (William J. Robinson 1975: personal communication).

Walnut Canyon is unique in the Sinagua area because of its short, 125-year period of occupation. The nature of the archeological resources would encourage more investigation, but two conditions must be kept in mind. First, little, if any, material or information remains in the cliff dwellings, as years of pothunting, cattle traffic and uncontrolled stabilization excavation have removed what may once have existed. Some material still may be found on the talus slopes below the cliff dwellings and archeological investigations perhaps could be considered in these areas. Working on these extremely steep slopes, however, would be difficult, at best. Second, although further research into the nature of the occupation of the rim area after the eruption of Sunset Crater is possible, such research might best be done on sites outside monument boundaries. Because of the increasing destruction of nonrenewable archeological resources on non-federal lands, the National Park Service has a responsibility to maintain a base of archeological resources for future study and interpretation. Archeological resources within the National Park System should be protected and sites outside the system should be considered first for major excavations. In the case of Walnut Canyon, limited testing for pollen, soil and faunal samples might be permitted in order to make statements concerning the nature of the occupation in the immediate area. The entire monument is on the National Register of Historic Places, however, and any work disturbing the resources is under the jurisdiction of the Historic Preservation Act of 1966 and requires a Section 106 review.

Historic resources in Walnut Canyon are limited to the original ranger cabin, which was used before the present Administration Building was constructed. Interpretation of this structure, telling of the life of early park rangers in a relatively inaccessible location, would be possible, but the building first would have to be completely stabilized. Although public access to the area is restricted, the structure should be upgraded to maintenance standards, so that it will be available for future use and interpretation.

Current knowledge of the archeological resources of Walnut Canyon is good, but does not meet the standards of a complete inventory required by Executive Order 11593. Although Van Valkenburgh (1958; 1961) and Euler (1962; 1964) surveyed the north and south rims of the canyon and Colton (1932) recorded most of the cliff dwellings in the 1920s, it is probable that some sites remain unrecorded. Cramer's intensive survey (1965) in a small part of the monument points out that many terraces and check dams may have been overlooked by earlier surveyors. The LCS report (1976) lists cliff dwellings that Colton did not record. It also is possible that some unrecorded sites remain under the pine needle ground cover and in Wild Cherry Canyon, which was not surveyed.
There are many factors which make a complete resurvey of Walnut Canyon National Monument unnecessary. Although previous surveys may not have recorded every site in the monument, the majority of the sites were recorded, along with information concerning site type and artifacts present. The only possible reason for a complete resurvey would be a research question which required exact location, detailed environmental description and an exact site count to compare percentages of different types of sites. That the sites in the monument are in no present danger from pothunters or other disturbances also argues against resurvey. Finally, the amount of money and time needed for a complete inventory would be prohibitive, in view of the small amount of useful information to be obtained.

Recommendations. (1) A sample survey should be performed to ascertain the presence of water control devices in areas not surveyed by Cramer. Wild Cherry Canyon, an area not previously investigated, also should be surveyed. Such a survey should be tied in with research interests concerning the nature of occupation in the monument and the place of agriculture in the Sinagua economy. (2) Money should be appropriated to sort out the archeological site files at the monument, since much work needs to be done to coordinate site information. A compilation of unsorted site data would increase knowledge of monument resources and would prevent duplication of effort in any future archeological work.
APPENDIX I
RESEARCH SUMMARY

TITLE: Excavation and Stabilization of NA 739.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: L. L. Hargrave, Museum of Northern Arizona, under the jurisdiction of the National Park Service.

DATES OF FIELDWORK: 1932


SITE DESCRIPTION: Nine rooms with masonry walls under an overhang.

PURPOSE OF EXCAVATION: Stabilization.

SAMPLING PROCEDURES: Not stated.

EXCAVATION PROCEDURES: Not discussed, except to say that the two rooms were excavated and "cleaned out."

RESULTS: 739A - 17 feet long and 10 feet wide; "T-shaped" door with fire pit 4 1/2 feet back from door; doorway had collapsed; bench in northeast corner of room; tree-ring dates of 1094+ and 1092+. 739B - 14 feet long and 7 feet wide; "T-shaped" door with smoke hole over it; bench with two levels at back of room; roof about 6 1/2 feet high; two floors, with circular, clay-lined fire pit in lower floor and a covered-up slab-lined fire pit in the southwest corner of the same floor; tree-ring date of 1083+.

Ceramic evidence dates rooms to Elden phase (AD 1120 to 1200). Sherds were gathered only in front of 739B.

EVALUATION: This excavation and stabilization project was inadequate, even for its time. No final report was written and the statement by Colton, from which the above information is taken, does not mention excavation procedures, a complete list of artifacts (if any were collected) or the dates of the fieldwork.

RECORDS: Reports:

Colton, Harold S.

Hargrave, Lyndon L.

Collections: Some artifacts are at the Museum of Northern Arizona.
TITLE: Ruins Stabilization, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Paul Ezell, National Park Service.

DATES OF FIELDWORK: May - June 1940.

LOCATION OF SITE: No locations given.

SITE DESCRIPTION: N.A. 311 - six rooms (A-F); N.A. 312 - two rooms (A and B); N.A. 313 - one room and plaza area in front (A and B).

PURPOSE OF EXCAVATION: Stabilization.

SAMPLING PROCEDURES: Not stated.

EXCAVATION PROCEDURES: Not discussed; some excavation must have been done, as artifacts (even restorable pots) were recovered.

RESULTS: 311A--smaller than average room; no door; ventilator in east wall; firepit; south wall stabilized. 311B--two course rectangular stone "porch" in front of entrance; firepit; only 8 - 10 inches of fill in room; north and east walls and entrance stabilized. 311C--south and east walls curve together; firepit; north, east and south walls stabilized. 311E--no evidence of walls until excavation; no firepit; east wall stabilized. 311F--terrace rather than habitation; no stabilization. 312A--porch in front of door; north, east and south walls and entrance stabilized. 312B--about 4-5 inches of fill; firepit; possible porch entrance; textiles, cordage, quids, cotton, corn and pumpkin or squash recovered; north, east and south walls stabilized and room backfilled to provide drainage. 313A--"T" stones in doorway; floor almost complete; firepit; porch entrance; north, east and south walls stabilized. 313B--terrace area with many artifacts; rock surface used for floor; no firepit; east and south walls stabilized (north wall same as south wall of 313A). Water Trail--runs from gully edge level with ledge on which N.A. 312 is located, across ledge in front of N.A. 313 to stream; filled with large boulders across gullies; retaining walls on steep slopes.

EVALUATION: Ezell was concerned only with stabilization of these cliff dwellings and made almost no mention of the archeological materials recovered or of the thoughts he had concerning these materials. Therefore, one would have to say that this project was inadequate in terms of archeology.

RECORDS: Report:

Ezell, Paul

Collections: Unknown.
TITLE: Walnut Canyon National Monument Stabilization.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Raymond Rixey, National Park Service.


LOCATION OF SITES: Sites N.A. 735, 736, 737, 738 and 739 on west and south side of Third Island, south of the Administration Building; uses Colton's (1932) map. Map Reference: T21, R8E, Sect. 25.

SITE DESCRIPTIONS: N.A. 735 (one room), N.A. 736 (4), N.A. 737 (5), N.A. 738 (3), N.A. 739 (9). Number of rooms depends on the amount of space available; units were one room deep, but two tiers are known in the canyon; area in front of each room leveled as a work area, with a retaining wall on the canyon side; foundations of walls usually double row of vertical limestone boulders filled in with mud and rubble; masonry of large irregular limestone blocks with abundant mortar; no bonding between walls; each wall is a separate unit; walls about 7 feet high and rooms about 17 x 10 feet; most floors destroyed by vandals, but those that remain are of clay; "T-shaped" doorways, some with masonry stoops.

PURPOSE OF EXCAVATION: Ruins stabilization.

SAMPLING PROCEDURES: None.

EXCAVATION PROCEDURES: Foundations excavated, cleared of debris and reset; soil cement from screened debris used as mortar; good relationship between the goals of stabilization and the results.

RESULTS: Four intact floors, with as many as 10 clay layers. Pottery--Flagstaff Black-on-white (17%), Wupatki Black-on-white (10%), Tusayan Black-on-red (3%), Showlow Black-on-red (2%). Plainwares were Winona Brown or Sunset Red. Stone--pottery anvils, arrowshaft straighteners, knives, cylindrical stones, metates (troughed or oval), manos, one mortar, projectile points (triangular and side-notched), three uniface scrapers, azurite, hematite, agate, melachite, turquoise, copper. Bone--tubes, awls, flakers; rabbit, squirrel, gopher, packrat, deer, bobcat, mountain sheep, turkey (tentative). Shell--abalone pendant fragments, glycymeris bracelet, olivella beads. Perishable material--textiles, sandals (twilled), cordage and plaiting (hair, cotton, feather), basketry, cane cigarettes and one cane arrow, wooden spindle whorls. Vegetal materials--pumpkin, squash, kidney beans, yucca seeds, corn, pinyon nuts, walnut, yucca and agave quids, cotton. Analytic procedures consisted of counting and typing pottery from N.A. 739, which was considered typical. One tree-ring sample could be dated at AD 1256.

Rixey reached no conclusions, except to date the sites to the Elden phase on the basis of ceramics and architecture.
EVALUATION: No excavation techniques were discussed. Sampling strategy was not stated, but 100% of the areas in question seems to have been excavated. This work was only peripherally archeological.

RECORDS: Reports:

Rixey, Raymond

1948a Memorandum for the Regional Director, Region Three. Monthly report of the stabilization project at Walnut Canyon for the month of November. Walnut Canyon National Monument Library. Manuscript.


Rixey, Raymond and Charles B. Voll

Collections: Sherds at the Museum of Northern Arizona; location of other materials not known.
TITLE: Archeological Site Survey - North Rim, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Sallie Van Valkenburgh, National Park Service (SWAC).


LOCATION OF SURVEY: North rim of Walnut Canyon National Monument. No map.

PURPOSE OF SURVEY: To determine distribution, intensity and types of use in rim areas, to record occupation before the eruption of Sunset Crater and to locate sites which might influence planning of interpretive program.

TECHNIQUES AND INTENSITY OF SURVEY: Intensive survey; techniques of field examination and information recovery not stated, size of field crew not known; actual time in field not known; number of acres surveyed not known; type of terrain--low outcrops of limestone ridges and terraces, grading north to more level terrain; 78 sites recorded (104 total for north rim), but some areas more intensively surveyed than others.

RESULTS: Numbers and categories of rim sites: Sherd areas--seven; included two pre-eruption sites (N.A. 5051 and N.A. 6830A) which probably were pithouses. Dirt mounds--five; four are sites, but one may be natural; mounds possibly used for fieldside storage of crops to prevent freezing, as the soil was too shallow for pits; N.A. 5895, trenched; N.A. 6830, 100 feet in diameter; N.A. 6836, doubtful site, but may be typical of many small mounds which are remnants of sites. Boulder shelters--77; compact mounds of boulders or vertical foundation stones for windbreaks of loosely piled boulders or poles and brush; two sites (N.A. 6861 and 6832) have rock and mortar walls and are located at the head of canyon trails; latter two may have been lookout and liaison posts between the canyon and the rim. Pueblos--five; several contiguous rooms with enough rubble for substantial architecture (possible year-round occupation); abundance of sherds. Rock terraces and dams--one; N.A. 5894 is a boulder alignment less than 1 foot high, 4 feet wide and about 20 feet long; retarded soil erosion. Spaced stone outliers--six; single boulders on ground a foot or more apart and aligned in straight or slightly curved lines with corners; areas possibly used as camps while tending gardens. Boulder shelters within enclosures--two; N.A. 464 and 465; the only sites showing evidence of village compound tradition; N.A. 465 is a low wall alignment, enclosing about 608 square feet; within enclosure are two boulder mounds and one circular depression; post-eruptive sherds.

Shelter locations--sites cluster near open "parks" of deeper soil and better moisture retention. Sherd analysis--sherds were typed and counted; percentage of each type in pre-eruption and post-eruption sites noted; percentage of sherds in chronological units in pre- and post-eruption sites also figured. Interpretation--sherd analysis indicates the times of occupation (9th-13th centuries) and trends in ceramic popularity; post-eruption sherds show diminishing influence of Cohonina Branch and
greater attention to wares of Kayenta and Winslow branches, which is interpreted as a new influx of people.

EVALUATION: Effectiveness of survey strategy and techniques not discussed; reliability and extent of sample not known exactly, but survey seems to have been more intensive and reliable in some areas than in others; conclusions are minimal and the influx-of-people explanation for the changing pottery types may not be the only explanation for this phenomenon; survey was data-oriented and did contribute knowledge of the number, types and locations of sites in the area, but the few conclusions presented are not particularly significant.

RECORDS: Reports:

Van Valkenburgh, Sallie P.


Collection: Sherd collections at the Museum of Northern Arizona; site cards at Walnut Canyon National Monument and the Museum of Northern Arizona.
TITLE: Stabilization, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Gordon Vivian, National Park Service, Ruins Stabilization Unit of Southwestern National Monuments.

DATES OF FIELDWORK: 10-4-55 to 10-17-55.

LOCATION OF SITE: 800-1000 feet across canyon west of Administration Building on Fourth Fort Island; used enlargement of Colton's (1932) map.

SITE DESCRIPTION: N.A. 311--six rooms; front wall and many side walls collapsed because of cattle using rooms for shelter. N.A. 333--four rooms under very deep recess; fourth room later addition. N.A. 334--three rooms; entire front wall collapsed because of moisture dripping from ledge above.

PURPOSE OF EXCAVATION: Stabilization to preserve scenic and interpretive values.

SAMPLING PROCEDURES: Not stated.

EXCAVATION PROCEDURES: Repaired eroded foundations, several wall sections and gaping holes and capped walls exposed to weather. Good relationship between these procedures and the project goals, as cliff dwellings visible to visitors who could not walk the Island Trail were repaired.

RESULTS: Cliff dwellings stabilized.

EVALUATION: The purpose of the project was fulfilled, but little consideration was given to the archeology of the sites.

RECORDS: Report:

Richert, Roland
1956 Stabilization records, Walnut Canyon National Monument, for sites N.A. 331, 333 and 334. PropCon Library, Western Archeological Center, National Park Service, Tucson.

Collections: Not known; materials recovered not discussed.
TITLE: Stabilization, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATORS, SPONSORING INSTITUTION: Gordon Vivian and Roland Richert, National Park Service, Mobile Unit of Region Three.

DATES OF FIELDWORK: 7-6-58 to 8-7-58.

LOCATION OF SITES: In same peninsula with Administration Building, but 200 feet below it; used Colton's (1932) map.

SITE DESCRIPTION: N.A. 317 & 318--probably single rooms; no standing walls; no work done. N.A. 319--one room; badly damaged by people and cattle; parts of two walls stabilized. N.A. 320--four rooms (A-D); walls or portions thereof stabilized; clearing done to locate foundations and to preserve room plan and entrance; sherds saved were all post-eruptive. N.A. 321--about seven rooms; large amounts of debris would require almost complete excavation to stabilize; no work done. N.A. 322--15 to 20 rooms; possibly double-tiered in parts; 10 rooms (A-J) stabilized. N.A. 323--14 or 15 rooms, about half of which were rubble; eight rooms stabilized. N.A. 324--six or seven rooms; walls missing, but some floor areas remained. N.A. 328--five rooms; about 75 feet above the trail on the second ledge; all rooms stabilized.

Work was performed on 29 rooms at six sites.

PURPOSE OF EXCAVATION: To preserve the scenic values of the Cabin Trail sites.

SAMPLING PROCEDURES: Rooms were selected for stabilization which were not completely destroyed or which did not have to be completely excavated.

EXCAVATION PROCEDURES: Usual stabilization techniques; good relationship between the excavation procedures and the project goal, as the latter was to stabilize the cliff dwellings.

RESULTS: Cliff dwellings stabilized.

EVALUATION: Although the purpose of the project was fulfilled, archaeological methods and recovery were questionable. Stabilization seems to have gotten in the way of archeology.

RECORDS: Report:

Richert, Roland

Collections: Unknown.
TITLE: Salvage Excavations at Walnut Canyon.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Stuart H. Maule, National Park Service.

DATES OF FIELDWORK: August 8 and 10, 1960.


SITE DESCRIPTION: Residence Seven Site--surface sherds and possible wall alignments, very slightly mounded. N.A. 5891--sherd area and questionable rock outline.

PURPOSE OF EXCAVATION: To give archeological clearances for sites to be destroyed by new residence and residence road.

SAMPLING PROCEDURES: Portion of sites sampled unknown; sampling procedure uncontrolled.

EXCAVATION PROCEDURES: Residence Seven Site--three trenches: AB 9m x .5m x .2m (through sterile clay; rocks on east side of site were an outcrop); CD, parallel to AB, 5.5m x .5m x .25m; EF 3m x .3m x 15m (rocks here were random scatter). Relationship between excavation procedures and goals was good, in that the nature of the sites was determined and clearance was given.

RESULTS: Residence Seven Site was not a site; N.A. 5891 had a hard surface surrounded by a ring of stones 2.5m in diameter. The stones probably were pushed out of the area being used. The ground below the use area was sterile. Analytic procedures consisted of sherd counts. The only conclusion was that N.A. 5891 was a campsite or use area.

EVALUATION: The excavation strategy was acceptable, in that the purpose of the work was to determine the nature of the sites and to gather information from them. The sampling methods cannot be assessed, as it is not known how much of each site actually was sampled.

RECORDS: Reports:


Collections: Few artifacts were recovered; location not known.
TITLE: Archeological Survey of the South Rim of Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Robert C. Euler, Arizona State College, under contract to the National Park Service.


LOCATION OF SURVEY: South rim of canyon in the area extending to the park boundary and the land immediately adjacent to it, including all tributaries except Wild Cherry Canyon. Map included with both reports.

PURPOSE OF SURVEY: To inventory sites on south rim and within boundaries.

TECHNIQUES AND INTENSITY OF SURVEY: Intensive survey, but unrecorded sites may remain under pine needle cover. Investigated each sector on foot; surveyors in visual contact with each other. Sites located in field using Forest Service air photos (1 inch = 1 mile). Maximum field crew of five, 27 person-days.

RESULTS: 38 sites were recorded--10 sherd areas, three rock shelters, 18 masonry structures and three masonry check dams. The Cinder Park phase was represented in one sherd concentration; the Rio de Flag phase in two sites; the Elden phase in 26-34 sites, of which five may have continued into the Turkey Hill phase, and three sites were not placed in a cultural context.

Analytic procedures--ceramics typed and counted (Alameda Brown Ware dominant); ground and chipped stone counted and typed. Conclusions--use of south rim was primarily during Elden phase; no perennial use; used for farming, hunting and gathering by groups occupying the cliff dwellings. More variation in artifacts from cliff dwellings, but such a variation not needed on rim.

EVALUATION: Survey was quite intensive and coverage was 100%, except for sites under pine needle ground cover. Wild Cherry Canyon at east end of monument and areas outside boundary should be surveyed for comparative purposes. Survey lacked theoretical directions.

RECORDS: Reports:

Euler, Robert C.

1964 An archaeological survey of the south rim of Walnut Canyon National Monument, Arizona. Arizona State College Anthropological Papers, No. 1

Collections: sherds on permanent loan to Northern Arizona University; field notes, photos and chipped stone at Walnut Canyon National Monument.
TITLE: Survey of Prehistoric Field Systems at Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: John O. Cramer, no institutional affiliation.

DATES OF FIELDWORK: Summer of 1964.

LOCATION OF SURVEY: Tributary drainage systems in the northwest corner of monument. Ranger Canyon tributaries—Dead Tree Canyon, Steep Canyon, Ranger Canyon, Cow Skull Canyon; Walnut Canyon tributaries—Box Canyon, Boundary Canyon. Maps with report.

PURPOSE OF SURVEY: To locate field systems, in order to elucidate the economic base of the Sinagua.

TECHNIQUES AND INTENSITY OF SURVEY: Survey called "intensive," but no mention was made of methods, techniques, size of crew, length of field season or number of acres surveyed.

RESULTS: Cabin Canyon—three terrace plots. Dead Tree Canyon—12 terraces with field house (N.A. 6871 on south bank); 19 other terraces recorded; possibly another 12 present. Box Canyon—seven terraces with field house on rim of canyon and another at head of canyon. Boundary Canyon—two terraces with field house above upper one.

Terraces—constructed by coursing limestone blocks across an intermittent stream, then filling behind wall with rubble; 4-31 feet long and one to three courses high.

Location and density of field houses in vicinity of ravine terrace systems shows the intensive use of large open glades on rim of canyon. The terraces, usually called check dams, served to increase water absorption and so were important for increased fertility, dependability and possible use of specialty crops. This system may show the increasing importance of run-off from summer showers at the end of the 13th century.

EVALUATION: Survey strategy was not stated, but possibly 100% of the areas mentioned were surveyed. The conclusions were not verified, especially Cramer's belief that a great amount of work was needed to build these structures. Also, one would have to correlate terraces with time periods in order to make statements concerning increased need for water and land. The survey is the only study of water control systems in Walnut Canyon, but it lacks depth.

RECORDS: Report:

Cramer, John O.
1965 Evidence of prehistoric field systems (terraces) at Walnut Canyon National Monument. Western Archeological Center Library, National Park Service, Tucson. Manuscript.

Collections: None.
TITLE: Excavations at Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Norman N. Ritchie, National Park Service and Northern Arizona University.

DATES OF FIELDWORK: None stated, but sometime during 1966.

LOCATION OF SITES: 500 yards north of the rim on a rise east of the parking area and north of the picnic grounds; map of immediate area on page 4 of report.

SITE DESCRIPTIONS: N.A. 103--two room pueblo; N.A. 476 and 478--single room pithouses; N.A. 475--left unexcavated to show appearance of site, probably a two-room pueblo.

PURPOSE OF EXCAVATION: To excavate, for research and interpretive needs, those sites close to visitor use areas which were of sufficient size and condition to make a valuable addition to the interpretive facilities of the monument and to examine the prehistoric uses of the canyon rim.

SAMPLING PROCEDURES: Not stated, but probably excavated close to 100% of sites.

EXCAVATION PROCEDURES: Horizontal and vertical controls: N.A. 103--only general fill and floor fill levels, as the amount of wall fall was too great for stratigraphic levels; four test trenches outside walls with no result. N.A. 476--controls not stated, fill removed. N.A. 478--two segments, first removed when excavating trash area in gridded section, followed by a search for walls and excavation to floor level; Kelly finished this excavation. Trash area east of N.A. 103--gridded into 24 one-meter squares, 11 excavated in 10-centimeter levels; seven trenches through the area.

Recovery Techniques: Materials screened "when possible" through 1/15 inch screen; all floor fill screened.

If only purpose of excavation was to dig sites for display, then relationship between procedures and results was good. However, since archeologically significant results were desired, the relationship between the procedures and the results was poor; it is impossible to tell whether there were any culturally significant levels in the pithouses, any subfloor levels in the structures or whether the trash area was homogenous.

RESULTS: N.A. 103--unshaped, but selected, coursed Kaibab limestone blocks; two rooms built as a unit, with a wall across the center; doorway for each room; Room A--hardpacked earth floor with an ash area west of the door and large flat Moenkopi sandstone slabs on the floor (source for these is 10 miles away); Room B--hardpacked earth floor with two hearths; site may have been used by two related families, as it is a single structure with no door in the dividing wall. N.A. 476--single room pithouse; fill of hard clay (structure built along natural drainage line); rectangular, built with unshaped limestone blocks; floor vent in southeast wall; circular
firepit. N.A. 478—late Padre phase; original pit larger than structure; loose rock and earth placed between walls and exterior of pit; floor of hardpacked clay; two hearths; vent shaft in east wall; no subfloor. Trash area east and north of N.A. 103—12 extended burials uncovered.

Usual artifact assemblage, except that 18% of the Elden Corrugated sherds were white; possibly an attempt to copy Anasazi pottery by firing in a reducing atmosphere. Trade materials—shell, turquoise, sandstone slabs, figurines (no known sources, except perhaps the Prescott area). Analytic procedures—artifacts sorted and counted.

Conclusions—possibility of summer occupation of rim sites during growing season and winter occupation of cliff dwellings. Relation of pithouses to pueblos unresolved. Pithouses not filled with pueblo trash, but with hardpacked clay. (Was this filling purposeful? Were pithouses used as storage area concurrently with the pueblos? Or did the dwelling type change from pithouse to pueblo in as little time as a generation?)

EVALUATION: Excavation techniques did not allow for recording of all culturally significant data. Sample was not good, as a third room in N.A. 103 was discovered during stabilization. Interesting hypotheses were presented in the conclusions, but none were tested during excavation. Work and report inadequate by present archeological standards.

RECORDS: Reports:

Ritchie, Norman H.

Collections: Analyzed pottery was reburied near sites. Location of rest of material not stated, but probably at the monument.
TITLE: Excavations at Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Roger Kelly, Northern Arizona University, at the request of the National Park Service.

DATES OF FIELDWORK: 10-8, 10-15, 10-22, 10-29, 11-5 and 11-12-67.

LOCATION OF SITES: Near monument headquarters; map at end of report.

SITE DESCRIPTION: N.A. 478--probable Padre phase pithouse; N.A. 103--excavated in trash deposit near site.

PURPOSE OF EXCAVATION: To complete work started by Norman B. Ritchie.

SAMPLING PROCEDURE: 100% of N.A. 478; about nine 2m x 2m squares in N.A. 103 trash area.

EXCAVATION PROCEDURE: N.A. 478--levels were fill (probably disturbed) and floor fill (about 10 centimeters above the floor); walls and vent shaft were cleaned and two test trenches were dug, one to determine the placement and construction of the west wall and one to determine where sterile soil was.

RESULTS: N.A. 478--walls of unshaped limestone, with a minimum of chinking; west wall had foundation of vertical slabs; two hearths; possible ladder rest; no roof evidence; clay floor; stone-lined vent shaft. N.A. 103--two burials in trash area; sherds, lithics, faunal materials. Conclusions--difficult to determine function of N.A. 478, due to small size and lack of floor features; N.A. 476 probably same type of structure. Both may have been used for storage when N.A. 103 was occupied.

EVALUATION: No statement of the nature of the N.A. 103 trash area was made and no description was offered of the sample taken. Good relationship between procedures and goals, since unfinished work was completed.

RECORDS: Report:

Kelly, Roger

Collections: Artifacts at Walnut Canyon National Monument; photos at both Walnut Canyon and Northern Arizona University.
TITLE: Stabilization Along Rim Trail, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Martin T. Mayer, National Park Service, Ruins Stabilization Unit of SWAC.

DATES OF FIELDWORK: 6-21-68 to 7-24-68; 112 work-days.

LOCATION OF SITES: Sites on Rim Trail--N.A. 103 is 1/4 mile northeast of Visitor Center and N.A. 476 and 478 are about 40 feet east of N.A. 103; previously excavated by Ritchie in 1966; uses Colton's (1932) map.

SITE DESCRIPTIONS: N.A. 103--two-room Elden phase pueblo (AD 1150-1200); Room 1--15 feet x 23 feet; Room 2--17 feet x 19 feet. Measurement of rock pile indicates only one story (refutes Ritchie). Third room partially uncovered during work. N.A. 476 and 478--both pithouses (N.A. 478 excavated by Kelly), masonry-lined; Padre phase (AD 1100-1120). N.A. 476 chosen for display; N.A. 478 backfilled. N.A. 476 had a firepit in the center and a ventilator in the east wall.

PURPOSE OF EXCAVATION: To provide information and an exhibit to complete interpretive story of Walnut Canyon National Monument and to show the density of population and the intensity of activity on the rim of the canyon.

SAMPLING PROCEDURES: None.

EXCAVATION PROCEDURES: N.A. 103--provided drainage system; reset east walls of rooms 1 and 2 and north wall of room 2. N.A. 476--roofed the structure, as it was too deep for drainage system.

RESULTS: Display sites stabilized.

EVALUATION: Work corresponded well with the desired result of the project.

RECORDS: Report:

Mayer, Martin T. and William M. Waggoner

Collections: Artifacts probably are at Walnut Canyon National Monument.
TITLE: Stabilization Along Island Trail, Walnut Canyon National Monument.

PRINCIPAL INVESTIGATOR, SPONSORING INSTITUTION: Martin T. Mayer, National Park Service, Ruins Stabilization Unit of SWAC.

DATES OF FIELDWORK: 7-16-68 to 7-24-68; 34 work-days.

LOCATION OF SITES: Sites along Island Trail, previously stabilized by Rixey in 1948 (except N.A. 742); uses Colton's (1932) map.

SITE DESCRIPTION: N.A. 735 - 739; N.A. 742.

PURPOSE OF EXCAVATION: Maintenance stabilization.

SAMPLING PROCEDURES: None.

EXCAVATION PROCEDURES: N.A. 735-739--minor repairs made to wall bases and around doorways; N.A. 742--limited stabilization of two southernmost rooms, including capping and grouting all walls and respalling the bases.

RESULTS: Cliff dwellings stabilized.

EVALUATION: Work corresponded well with the desired results of the project.

RECORDS: Reports:

Mayer, Martin T. and William M. Waggoner

Collections: Few artifacts collected, probably at Walnut Canyon National Monument.
TITLE: Ruins Stabilization, Walnut Canyon National Monument.


DATES OF FIELDWORK: 5-1-73 to 6-30-73 (?) .

LOCATION OF SITES: North and south rims, above and below Island Trail; used blowup of Colton's (1932) map.

SITE DESCRIPTIONS: N.A. 740 (eight rooms), N.A. 396 (two), N.A. 397 (two), N.A. 398 (two), N.A. 400 (two), N.A. 401 (two), N.A. 742 (two), N.A. 743 (four), N.A. 747 (three) and N.A. 741 (one) are in the Island Trail area and on the north rim.

N.A. 394 (two), N.A. 395 (two), N.A. 744 (four) and N.A. 745 (five) are view sites seen from the east side of the Island Trail and sites on the south rim.

N.A. 331-338 (20 rooms total) are view sites on the south rim, west of the Island Trail.

PURPOSE OF EXCAVATION: To repair masonry walls of 22 small rock shelters.

SAMPLING PROCEDURES: None.

EXCAVATION PROCEDURES: Presumably followed usual ruins stabilization techniques; no statement of procedures or techniques given.

RESULTS: Sites stabilized.

EVALUATION: The first report cited below is concerned mainly with the difficulties encountered while doing stabilization at Walnut Canyon, not with the work actually done. The final report for the project is in preparation.

RECORDS: Reports:

National Park Service

Sudderth, William E.
1973 Field notes for stabilization at Walnut Canyon. PropCon Office, Western Archeological Center, National Park Service, Tucson. Manuscript.

Collections: Unknown.
APPENDIX II

LOCATION OF COLLECTIONS

Compiled by Marion Durham

Walnut Canyon National Monument was set aside for the protection of cliff dwellings and the majority of the catalogued items in its collections are of archaeological significance. In the past few years a greater awareness of the monument's natural history has developed and the collections pertaining to natural history gradually have received more attention. A list of the collections, their sources, their present locations, their possible value and any specific needs or recommendations follow:

Archeology: The prehistoric artifacts collected at Walnut Canyon presently are stored in several locations:

(1) Western Archeological Center, Tucson, AZ: Nineteen groups of material, most of it collected during stabilization projects in 1940, 1948 and 1958, are stored at the center. The material essentially is uncatalogued, as any numbers seem to be from the early NPS catalog system. The collection seems to be of little research or exhibit value, although the potentially restorable vessels might be used for exhibit. Most of the material is mixed together and probably is useful only as a source of type sherds. There are limited field reports on the stabilization projects, useful primarily for comparing photographs with the present status of the dwellings. The reports also serve as reference for periodic stabilization and repair work.

(2) Museum of Northern Arizona, Flagstaff, AZ: Excavation at Walnut Canyon was conducted under the auspices of MNA in 1932. One information source indicates 44 items from site N.A. 739, but MNA indicated only eight catalogued items from this site. One of these is on "loan" to Walnut Canyon for exhibit and the other material is of research value to the museum. In addition, MNA has 125 items on indefinite loan from sites N.A. 478 and N.A. 103, which were excavated in 1966 by Arizona State College (now Northern Arizona University) and the National Park Service. These items (type sherds and two clay samples) are for study only. Walnut Canyon has 12 items on exhibit from the MNA collection under loan #119, which is renewed each year.

(3) Northern Arizona University, Flagstaff, AZ: There are 34 catalogued groups of material (with Walnut Canyon numbers) from Walnut Canyon accession #103 on indefinite loan to NAU. This material, approximately 1,315 items, includes pottery, worked stone and miscellaneous vegetal and stone material. It was collected during surface survey of the south rim in 1962 by Robert Euler, under contract to the National Park Service. This material is valuable as a research-study tool for comparison with material collected from the canyon and from the north rim. It should remain at NAU for study.

(4) Smithsonian Institution, Washington, D.C.: There are two "lots" of material from the Walnut Canyon area stored at the cultural laboratory.
in the Museum of Natural History. The list supplied to us shows 28 items, not all of which are identified. No one has yet been able physically to examine this material because the Smithsonian catalog cards are not keyed to storage areas. Since this material was collected in 1883 and 1901, it has prime historic value. A concerted effort should be made to inspect this material or to request its return to Walnut Canyon.

(5) Walnut Canyon National Monument: There are approximately 1,700 items catalogued under the archeology category. The sources of these items range from contributed pieces to excavated material. The ethnological pieces are relevant in speaking of nearby Indian groups, as well as in showing a transition in pottery styles. The archeological pieces have varying value for research and exhibit; much of the sherd collection is good for comparison and many pieces are useful in exhibits and school talks. The collection is predominately of pottery and stone, with very little of a perishable nature. Vegetal material is adequate for proof of food resources, but could be expanded. To support the theory of a wider use area, pollen analysis is needed. The perishable material probably was pothunted, as the best place for preservation—the cliff dwellings—suffered most from vandalism. Local family collections should be checked for early material to help determine where other resources may be located.

Geology and History: There are perhaps 30 to 35 specimens of geologic and historic interest catalogued at Walnut Canyon. The geology items principally are fossils, along with a few pieces of clay found in the canyon. There are some minerals found archeologically. Most of the historic pieces were found near the Log Cabin and focus on early U.S. Forest Service administration of Walnut Canyon. Both collections have value for study and exhibit. The geology collection should be expanded, with a better reference orientation.

Flora and Fauna: The natural history collections have been neglected for years. The herbarium is in the best shape, with a nearly complete range of flowers and plants represented. More samples of species are needed and new species should be collected. There are approximately 350 specimens of plants collected by NAU botany personnel on file at NAU. Of those, about 100 are species not found in the Walnut Canyon collection. The NAU herbarium contains some early original collections from Walnut Canyon, c. 1902 and 1940. These have historic value, as the plant species generally are duplicated at the park.

The fauna and herpetology collections are minimal and much work is needed. The mammal collection has approximately 12 items, the avian collection approximately 12 items and the herpetology collection approximately six items. The insect collection is fairly extensive, but it lacks organization and is of little use for either study or exhibit.

Library and Archives: There presently are about 900 catalogued items in the library. These range from books to manuscripts to original visitor registers and other historical documents. Attempts to fill in research gaps will be made in an effort to make the library a comprehensive research tool, although we may not be aware of research publications located elsewhere. Tape recordings, as well as transcripts of the tapes,
of interviews with persons having information on the historic, pioneer and early settler period of Flagstaff and Walnut Canyon also are on file. Any publication or research material which would aid in the interpretation or management of the park should be added to the library.

Slide Collection and Photos: This collection includes color photos, black and white photos and color slides. The photo collection pertains primarily to Walnut Canyon's history and resources. An effort should be made to locate the negatives of those prints which lack them. Slides cover a wide range of topics, including other NPS areas, natural resources, archeology, environmental concerns, etc.

Archeological Site Records: The forms for recording site information have changed over the last 40 years, as have ideas about what constitutes a site. Therefore, although we have approximately 400 site cards, those cards often cover more than one cliff dwelling or surface ruin. The site numbering system also has changed. These factors have combined to lend an air of chaos to our site records. There are no adequate maps of site locations and a great deal of work needs to be done to coordinate our site information. Site records are useful for protection of the resources, for management and for interpretation. As these cards are our only source of written information on the sites, they should be retained in a fire-proof safe.

All material presently at Walnut Canyon should remain there. Material elsewhere should be left there, with the exception of that at the Smithsonian. Material in the personal collection of local families should be researched, catalogued and, hopefully, donated to the monument.
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