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The ethnobotany and phenology of plants in and adjacent to two riparian habitats in southeastern Arizona

Adams, Karen Rogers, Ph.D.

The University of Arizona, 1988

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    THE ETHNOBOTANY AND PHENOLOGY OF PLANTS IN AND
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by
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A Dissertation Submitted to the Faculty of the department of ecology and eudlutionary biology

In Partial Fulfillment of the Requirements For the Degree of DOCTOR OF PHILOSOPHY

In the Graduate College THE UNIUERSITY OF ARIZONA

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 GRADUATE COLLEGEAs members of the Final Examination Committee, we certify that we have read the dissertation prepared by $\qquad$ Karen _R. Adams
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A number of individuals provided time and much appreciated assistance with this study. Rex K. Adams spent many hours as an able field assistant, providing a keen eye For recugnizing riparian plant taxa, and helping with all aspects of field callection and documentation. Field representatives Franik Hirst at Ramsey Canyon and Linda Lamma Sanders of Canelo Hills Cienega pleasantly accomadated the Field work schedule necessary to acquire the phenological data. Linda alsa jained in the field wark on numerous accasions. Both Frank and Linda kept the daily temperature and precipitation records presented in this research. Other able Eield assistants included Rebecca Van Devender, Phyliis Rogers and Mary Quitzau. A number of individuals offered post-Field work assistance. John and Charlotte Reeder verified the Gramineae identifications, and Miriam Fritts assisted with the Corex. Patricia Fall of the University of Arizona Geasciences Department offered guidance in the pollen acetalysis procedure, and then subsequently provided the actual pollen caunts. Five peaple assisted with the many details necessary to provide a Einal draft of the manuscript. Uiana M. Martinez checked hundreds of ethnographic citations against the condensed tables to ensure accuracy. Adrian J. Rogers assisted in compiling weather data into a computer-managed data base file, and proof-read the entire manuscript. Vida B. Martinez also helped in proof-reading. Louise M. Rogers spent many hours drafting the figures which became the final phenalogical profiles. Carla Y. Rogers worked the text and tables inta acceptable dissertation format.

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Many thanks go to those mentioned above, plus to my dissertation committee far letting me get my feet wet in an unfamiliar habitat type.

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Two riparian habitats in sou'cheastern Arizona provide the setting for a study of 127 plants useful to human Faragers. A view of plant part availability is based on annual phenological profiles, and on historic and prehistoric records of plant use. Food chaice is limited in March and April, but high August thraugh November. Riparian plants also offer numeraus non-food resources. Trees and shrubs serve more needs in relation to number of available species than do perennial herbs [including grasses] and annuals. Southwestern ethnographic literature hints that certain native taxa CPanicum, Rhusalis. Ropulus. Salix_ Iugha and Uitiss might receive special care.

Inherent qualities of parts, coupled with ethnographic records of preparation and use, provide a basis for speculation on which parts might survive in an ancient record. Most are expected to disintegrate in open sites. Parts sought for different needs can enter a dwelling via diverse routes that produce confusingly similar archaeological debris.

Modern experiments to wash pollen from 14 separate harvests permit evaluation of plant fruit and leaves as pollen traps, to help interpret pollen recovered from ancient dwellings. High amounts of Berberis. Rumex and Ribes pollen, sometimes in clumps or as tetrads, travel on harvested fruit. Arctastaghulos. Mongrdg. Qxalis, Rhus.

Rhamnus. Uitis and Juniperys parts carry lower amounts. Quergens and Gramineae pollen grains travel on parts of other taxa, as well as on their own fruit.

The phenological profiles offer insight into group life-form activities in response to local temperature and precipitation trends. Rising and maximum temperatures caincide with intense vegetative and reproductive activity for trees, shrubs, herbaceaus perennials, and annuals. Increased levels of precipitation coincide with maximum Flowering and fruiting of herbaceous perennials and fall annuals. Limited data on six taxa from Utah generally agrees with observations in this study, suggesting strong genetic control in the phenalogy of some riparian taxa.

## INTRODUCTION

Existing wetlands in the American Southwest are good candidates for an "endangered" habitat list. Many semipermanent streams and cienegas in southern Arizona, once fostering dense growth of water-loving plants, have passed Fram the landscape within the last century [Bryan 1925]. While perhaps " $70 \%$ of the original areas of riparian ecosystems have been cleared" in the entire United States, some estimates suggest that less than $10 \%$ [and as low as $2 \%]$ of certain native riparian Southwestern vegetation types remain today [Johnson and Carothers 1982:4]. The rales of climate, geamarphic pracesses, and humans in the shrinkage and destruction of riparian sites has been addressed by numerous researchers [Antevs 1983; Cooke and Reeves 1976; waters 1986]. Certain points of view stress the role of humans in the changes. For example, a whole sequence of historic and prehistoric human activities have been labeled as likely contributors to dramatic altering of the Gila river drainage system in the late 1800's [Dobyns 1981]. It has even been suggested that the Colorado river is so under human control that it is no longer a natural phenamenon, but rather a product of the political process [Fradkin 1981].

Since the nature and extent of southwestern riparian habitats seems to have altered dramatically withir the last century, it is with some surprise that one encounters the
small number of studies that have focused on wetland natural history and management．Far example，a classified bibliography on native plants of Arizona published in 1978 was able to devote a mere 2 of 144 pages to references on studies of aquatic and riparian vegetation［Schmutz 1978］． Following some outstanding initial natural histary $[0 f$ fishes］and gealogical studies in the 1940＇s and 1950＇s by C．L．Hubbs and R．R．Miiler［Brown 1982：23］，interest in wetlands and their biological components lagged for two decades befare a camprehensive publication again adriressed basic habitat characteristics and plant and animal life ［Johnson and Jones 1977］．Since then three major symposia have focused on Southwestern riparian habitats，though strongly emphasizing the management point of view［Johnson and McCormick 197日；Warner and Hendrix 1984；Jahnson et al． 1985］．

Other recent works that document Arizona wetlands include：twa digitized classification systems［Brown and Lowe 1974；Brown，Lowe and Pase 1979］；vegetation analyses of major drainages CHasse 1972；Iurner 1974；Lacy，Odgen and Foster 1975；Turner and Karpiscak 1980；Brown，Carmony and Turner 19日1；Minckley and Clark 19日1J and smaller areas ［Joyce 1976；Toolin，Uan Devender and Kaiser 1979； Yatskievych and Jenkins 19813；and a synthetic overview of Southwestern wetlands which includes descriptions of basic natural history［Brown 1982］．Two studies of the San Pedra
and its tributaries focused on relating plant caver ta local biotic and abiotic factors［Barstad 1981；Zimmerman 1969］．

Natural histary studies also include a few autecolog－ ical reports．These include monitoring seedling establish－ ment of Populus［Moss 1938；Engstram 1948；Horton，et al． 1950］，Regspgis［Glendening and Paulsen 1955］，Salixx Bocchacis and Plucheq［Harton et al．1960］，Rlatanus wightij［Bock and Bock 1985：493－494］，and gathering data an Allencalfeg，ChEusgthamnus．Distichlis．Medicage and Snccobatus 〔Rabinsan 1958〕．Much effart has been directed to studying intraduced species of Iama［ix［saltcedar］，as summarized in warks by Rabinson［195日；1965］and warren and Turner［1975］．Beyond these publications，little is known about the individual life histories and requirements of the majarity of plants that flaurish in riparian habitats．

Definition/characteristics of riparian associations

A fiparian association has been defined as "one which occurs in or adjacent to drainageways and/or their flood plains and which is further characterized by species and or life-farms diEferent fram that of the immediately surrounding non-riparian climax" [Lawe 1964:100]. A similar definition suggests that "wetlands are periodically, seasanally, or continuously submerged landscapes papulated by species and/or life-farms differing from immediately adjacent biotas" [Brown 1982:224]. In the Southwestern United States, riparian can refer ta vegetation associated with a variety of settings, from large rivers to small and intermittent drainages such as arroyos (Dick-Peddie and Hubbard 1977:86]. It alsa includes fresh and saltwater marshes, lakes, seeps, springs, oases, and ephemeral playas [Brown 1982].

Southwestern riparian habitats tend to be limited in area, and have often been omitted on maps of a region whose scale could not accomadate their delineation. But their small size belies the relative importance of these lacations, since such habitats often support faunas and floras composed of a larger number of species and individuals than inhabit the surraunding envirans [Johnsan and Carothers 1982:2]. Diversity seams espacially high for birds [Kendeigh 1961:336], which may nest in greater numbers in riparian habitats [100 pairs/100 acres], than in adjacent
open deserts [0-37 pairs/100 acres].
Temperatures in wetlands are often lower than those of the surraunding terrain, for twa reasons. First, the ability of water to absorb heat provides cooler temperatures in the immediate area. Second, cald-air drainage can lower local temperatures in areas that are low-lying (streams, rivers, lakes] relative to the surrounding terrain. Lower temperatures can permit plants within riparian habitats to span a greater elevational range than those in dier sites [Lowe 1964; Hastings and Iurner 1965:7].

Wetlands can be viewed as both "routes to migration" and "biogeagraphical islands". For example, down-canyan drainage of cool mountain air permits cold-water fishes, other animals and riparian plants to penetrate into warmer lowland biomes [Braun 19日2:230]. Animals such as birds, bats, deer and elk have all been documented to use them as such [Thamas et al. 1979:7]. On the ather hand, wetlands can also be looked upon as "biogeagraphical islands", hosting species that are nat found anywhere else in the region, or not encauntered until the next adjacent wetland [Jahnsun and Carathers 1982:2].

Other characteristics generally set riparian habitats apart From drier locations. Far example, they are among the most productive ecosystems [Johnson and Carathers 1982: 2]. DEten if a plant species grows in an area, its productivity will be higher in a wetland setting. This
higher productivity will carry up through trophic levels, with increased biomass of insects, birds and other animals. Riparian communities are alsa dynamic, subject to Erequent change fastered by the unstable nature of the physical environment [Campbell and Green 1968; Brawn 19日2]; such physical instability might be expected to provide optimal conditions Eor plants that thrive in disturbed habitats. Finally, certain wetland ecasystams [rivers, streams] are incomplete From the energetics standpaint; that is, some large partion of their energy flaw is based on arganic matter imported from adjacent terrestrial ecosystems [Ddum 1566:118].

There are a number of unique characteristics of southwestern riparian zones [Johnsan and Carothers 1982:4]. One is their high visibility. They are easily seen from long distances because they pravide an abrupt visual change with the surraunding vegetation. Southwestern wetlands are alsa less physically stable. Generally they have rather narrow zones of established vegetation along the margins, and receive a high influx of water and soil during storms from more barren nearby slopes.

It has been suggested that wildlife use ripariani zones dispropartionately more than other habitats. For example, in the Great Basin of southeastern Dregon, $79 \%$ of 363 animal species were considered to be either directly dependent on
riparian habitats, or utilized these zones more than any other; many of the species could be faund nowhere else [Thomas, et al. 1979:2-7]. In addition to altered microclimates, riparian zones offer animals cover, increased diversity and productivity of plants, and more complex vegetation structure.

The plants that inhabit wetlands in deserts may do so For critical conditions found only there. Such "obligate" riparian species must have access to riparian conditions at some paint in their life-cycle. For example, they might require a certain level of maisture anly during seedling establishment, or the adult plant: must have continued access to water via the root zone. The presence of generally lower temperatures can provide an optimum location for certain obligate species. At times the disturbance fostered by river settings permits species that are high light-requirers to became established and thrive. Certain riparian habitats may host only obligate species because they are poorly aerated, or are so high in tatal soluble salts that few species can live there [Dick-Peddie and Hubbard 1977:86].

Other plants that live in wetlands can be labeled "facultative", that is they can survive and reproduce in drier sites but experience increased vigor when in a riparian situation [Dick-Peddie and Hubbard 1977:B6]. Lacations that experience good drainage or only intermittent inundation [such as arroyos] may host many facultative species.

Geographic setting is importent when assessing whether a species might be "obligate" or "facultative". For example, plants that are "obligate" riparian species in dry desert regions could well act as "facultative" riparian species at higher elevations. Therefore, in order to accurately distinguish obligate from facultative species, one must explore how plants are distributed over a specific local area, including both wetland and drier sites.

A number of plant species chosen for this study are clearly confined to the riparian zones visited, and have been labeled as "obligate" in a list of plants intraduced further in the text. It is likely that the reasons these are "obligate" taxa extend beyond the presence of moisture to edaphic and other enviranmental factars.

Twa additianal terms characterizing riparian plants provide some overlap with the concepts of obligate and facultative. A "phreataphyte", or plant that obtains its water from the zone of saturation [Meinzer 1923], may be difficult in practice to distinguish from generally "obligate" species. Likewise, "pseuda-riparian" plants, or those woody species that are capable of completing their life cycle in relatively mesic or xeric sites but which achieve maximum size and density when additional subsurface moisture is available [Campbell and Green 196日], may be hard to distinguish in practice from "facultative" species.

## Aims of this study

There are two majar goals for this dissertation. The First involves accumulating natural histary information on native plants in and adjacent to southeastern Arizona wetlands, and then cansolidating existing ethnographic and archaealogical litarature to pravide a broad view of the potantigl value of these plants to humans. The secand goal is to make methodological contributions to understanding the archaealogical recard of riparian plant remains.

As part of the first gaal, I assembled detailed phenological infarmatian an 127 plant taxa in Arizona wetlands. None of the studies on Sauthwestern riparian plants known to me has focused on the seasonality of plants. In fact, detailed studies an flawering, Fruiting, and periads of vegetative grawth and dormancy of any sauthwestern species are rare [Humphrey 1975; McGinnies 1986〕.

Apart fram the use af phenalogieal data intended for this study, such information has value Ear ather reasans. Wildlife bialogists attempting to understand animal use of wetlands will now have a schedule of repraductive and vegetative events that might carrelate with animal lifecycle events or strategies. Plant ecologists interested in different plant strategies can also make use of the phenological data [Grime 1979]. For example, timing of vegetative activity, Flawering and Eruiting can be compared ta
general enviranmental data. This would single out certain competitive taxa that maximize photasynthate production by having fully expanded leaves when days are langest, light intensity highest, and temperatures most favorable for high rates of photosynthesis.

Ta complete the first goal, the phenological data has been combined with ethnagraphic and archaealogical citations to view the potential value of the riparian habitat type to humans living in prehistaric southeastern Arizona. The purpose is to offer an overview of the availability of a suite of plant species and their parts to humans as the seasons vary aver a full calendar year.

The second major goal of this dissertation is to make methodalogical contributions to help understand the sparse prehistoric record of past human selection of riparian plant resources. In the Southwestern United States there has been relatively low recovery of wetlands plant parts in ancient sites. This may be related to reasons regarding cultural habits of plant chaice and use as well as to the often poor preservation of plant remains in archaealogical sites. Waterlogged sites that foster preservation of organic remains are poorly known in the American Southwest. Deposits from well-protected cave locations have revealed some details an riparian plant acquisition, but often mainly upland plants are represented.

Dne methodalogical contribution of this study involves
making informed predictions on what the archaeological record is likely to preserve, based on histaric accounts. One can view the ethnographic record for parts of plants historic groups have commanly chosen, reasons they gathered these parts, and how they actually prepared or processed them. With such data one can make suggestions as to what taxa and their parts might be expected to be carried into a dwelling. Also revealed would be parts not likely to be retained due to cultural habits $[$ such as choice of part, location of use], or parts that might be lost from the record due to certain preparation techniques or low inherent likelihood of preservation.

Anather methodological contribution invalves a series of modern experiments to understand the mechanisms of pollen transport into ancient dwellings. Fruit, seeds and other patentially harvested parts such as leaves and stems may or may not be likely to harbor pollen (their own or that of other plants] when picked and carried to living quarters. One can harvest certain parts, wash their surface with distilled water, and examine the wash water residue to identify any pollen contained therein. Predictions made priar to this process, based on plant structural and flowering characteristics, can pravide insight into ways in which poilen might enter an ancient site.

Applicability of this study to other areas

Riparian habitats in dry deserts would serve as easily visible magnats to humans, drawing them to water, shade, shelter and the diverse plant and animal resources concentrated there. Therefare, a study of the potential value of wetland plant resources to humans has merit. However one could question the value that such a study in two specific wetlands would have to colleagues in a broader area.

Two paints can be addressed regarding the transfer value of this study to other areas. The first has to do with the expanded elevational distribution and geographic spread of many riparian plants when contrasted ta upland species. The second involves the notion that food gatherers the world over are often attracted to similar plants, so insight gained about plants in one area may well apply to related plants in distant areas.

The first paint regarding riparian habitats includes the idea that hydrophytes "exhibit considerable indifference to climate, in comparisan with mesaphytes and xerophytes" [Daubenmire 1978:27]. Thus certain species of Elodeg. Phragmites. and Potamogeton, as well as Iypho latifolig, range over a wide variety of climates in marsh and pond habitats in diverse worldwide locations.

Certain facultative riparian species seem also widely distributed. In the American Southwest, an examination of

50 local Flaras pertaining to the Basin and Pange and Colorado Plateau Physiographic Provinces, CMcLaughlin 1986: 46] revealed a tatal of 81 of 5458 [1.5\%] species to be in $50 \%$ or more of the floras. Df the 127 native species studied for this dissertation there were $16[12.5 \%]$ included in that list bF broadly distributed plants [Table 1]. Such representation lends support to the idea that riparian species may generally be mare widespread in braad regions. Mclaughlin alsa found that of species in camman between the American Southwest and adjacent peripheral regions much of the overlap could be accounted For by species of both mesic and disturbed habitats [1985:54]. These comments suggest increased likelihood af encountering a riparian species in a broad geagraphic area.

The secand paint that Eavars applicability of this study to other regions in the American Sauthwest cancerns Fundamental similarities in human chaice of food the world over. When Jack R. Harlan wrate "It appears that foad gatherers are attracted to similar plants" [1975:17] he was discussing how the grass Panigum had been a favarite of grass seed gatherers living in North America, Mexica, Africa, Australia, Eurasia and India. But his braader implication is that humans are attracted to similar rejources, regardless of where they live. It seems reasonable to assume that food chaices for humans are generally canstrained by human physiology and nutritional

# Table 1. Species listed in this study that were encountered in 25 or more of 50 southwestern United States floras examined by McLaughlin [1986:53]. 

| Species | Subspecies | \% of floras |
| :---: | :---: | :---: |
| Sitanion hystrix | 2 | 88 |
| Descurainia pinnata | 12 | 日6 |
| Rhus trilobato | 6 | B2 |
| Poa fendleriana | 3 | 70 |
| Mimulus guttatus | 6 | 70 |
| Bouteloua curtipendula | 2 | 66 |
| Sporobalus airaides | 0 | 62 |
| Helianthus annuus | 0 | 60 |
| Populus Eremontii | 2 | 58 |
| Bouteloua gracilis | 2 | 58 |
| Cercocarpus montanus | 7 | 5 B |
| Plantaga patagonica | 3 | 55 |
| Bramus carinatus | 0 | 54 |
| Juncus ensifalius | 2 | 52 |
| Pseudatsuga menziesii | 2 | 50 |
| Salix gooddingii | 0 | 50 |

requirements, as well os by the overall effort invalved in acquiring and processing any resource. Dne might expect humans in different areas to choose Eoods that enhance their Fitness, with energy expenditure costs as low as can reasonably be kept. In an environment of limited plant choices, it is likely that a genus utilized by humans in other areas may have an increased chance of being selected. In sum, the braad geographic range of riparian species, caupled with the suggestion that humans tend to be attracted to similar resources regardless of location, means that this study may have a wider applicability far archaealagists than might at first be thought.

Worldwide perspective on the historic
and prehistaric significance of water to groups

Worldwide records reveal that historic and prehistoric groups have chosen to live in or adjacent to riparian habitats. A dramatic example can be faund in the Andean highlands between Peru and Boliva where the Uru Cand likely the Inca befare them 3 have Fashioned homes and boats from the totora reed [Spicpus califocnica] for use on Lake Titicaca [Marden 1971]. These reeds are made into floating, occupied islands; as the bottom layers rot, new reeds are added to maintain a platform for habitation. Inhabitants of Lake Chad in Africa still navigate in reed boats similar in appearance to those on Lake Titicaca [Heyerdahl 1971 J.

In Europe, Hungarian plant gatherers/hunters/Fisherfalk known as qakasz lived in the marshes of the Great Hungarian Plain up to the 2Oth century, making reed huts for housing and eating the available plant and animal resources [Gunda 1977:4]. In summer the peaple wandered about the marshes, moving as the local flora and fauna were explaited. A special kind of shoe was worn to keep them from sinking into the bags, and many of their household needs came from marsh resources. These people were poor, landless folk who survived quietly until the marshes were drained.

In the southwestern United States the high plateaus of the Kaibab Paiute are well-watered, but deep snows prevent habitation in the winter. In the lower arid elevations,
campsites are governed strigtly by the gyailgbility of water. While streams were of some importance, springs were often the contralling factor in choice of a semi-permanent settlement location. At times the mast important springs were privately owned by a family. Dccupants of nearby watering places tended to share the same seasanal cycle, canstituting informal economic groups. Agriculture came very late to these people [Kelly 1964:E-8].

The Kiliwa of southern California provide linguistic clues to the importance of riparian habitats. As inhabitants of a fairly hot and dry area, they recognized both mountains and bodies of waters as principal geagraphic landmarks. In a list of 57 place names, 31 were of mountains and 23 of springs or arrayos. While the mountains provided important landmarks, it was the watering places that commonly gave their names to the rancherias where people spent a good portion of the year [Meigs 1939:12-13].

Prehistaric records strangly suggest that more than one group derived its livelihood from riparian habitats. Between 2000 and 4000 years aga peaple now known as the Swiss Lake Dwellers lived in structures built directly over shallow lakes. Apparently long-term accupation yielded extensive accumulations of burned and unburned arganic plant and animal debris preserved in the soft muck below the platform dwellings [Heer 1日7日]. Heer hypothesized that these
peaple had strong ties to the Mediterranean area, especially to the Egyptians, who appeared to use the same cereals and materials of cloth manufacture. He considered the dwellings to be occupied year-round, due to multi-seasonal information gleaned from the plant record; he also thought cattle were kept on the platforms above the water.

In the southwestern United States, researchers intensively studied the adaptations of prehistaric people to the Dolores, Colorado area. Through time the occupants of the region located their habitations near riparian ecosystems [Kane 1984:50]. Seasanal camps and areas of suspected limited human activity during the Archaic period [2000 B.C.A.D. 5003 are concentrated in an area with easy access to marsh resaurces [Kane 1984:27]. Later in time when villages were constructed around A.D. 日75, marsh resources were still relatively clase by [Kane 1984:29].

In a possible prehistaric United States parallel to the historic Sauth Amsrican occupation of Lake Iiticaca, Northern Paiute tradition recounts that an ancient graup, the Achomawi Indians, ance lived on tule [SEEiEpus] rafts in the Humboldt Lake. Eventually the Northern Paiute exterminated this lake-inhabiting group, first by burning the tule on the lake, and then by suffocating the survivors seeking refuge in nearby Lovelock Cave [Loud and Harringtan 1929:1653.

The ancient record shows that people lived near riparian habitats far lengthy intervals. From copralites representing Archaic deposits from Danger and Hogup Caves in northern Utah, Fry [1976:25] concluded that the basic Archaic lifeway and diet persisted virtually unchanged far 10,000 years, until around 1 A.D. when Anasazi and Fremont peoples came into the area. These two caves are situated near abundant springs and marshes.

The ancient Great Basin human coprolite record at Lovelock Cave speaks not anly of a continuaus reliance upan riparian resaurces such as Scirpus and Iypha but alsa of diverse meals comprised of seed, bird and fish [Cowan 1967:26-27]. The Glen Canyan coprolite record from southern Utah streamside sites [A.D. 1-1300] alsa expresses a similar diversity of diet [Fry 1976:3, 25], as daes the A.D. 9001500 coprolite record of ancient Lake Cahuilla in the Salton Basin of California [Wilke 197日:85].

The San Pedra River Valley: an overview

Certain river valleys in the western United States have hasted humans far millenia. The San Pedra river valley in southeastern Arizona [Fig. 1$]$ currently contains some of the best preserved examples of riparian habitat, so it is not difficult to imagine that this area has had a long history of human occupation. Through time the San Pedro and its tributaries have served as a magnet for both humans and animals, with evidence of its drawing power uncovered by paleontalogists and archaeologists.

The earliest human evidence. The first people to leave evidence of their passing were Big Game Hunters, who appeared in the San Pedra basin near the end of the Pleistocene after 11,000 years ago. Then mammoth, tapir, horse, camel, sloth, bison and various carnivares inhabited the San Pedro area [Smiley 1983:20]. The Big Game Hunters left stone tool evidence of hunting young mammoth, horse, bison and tapir at the site of Lehner chaury et al. 1959; Haynes 1982], of felling a mammoth with no less than eight projectile points at the site of Naco [Haury 1953], and of hunting mammoth and bison at Murray Springs [Haynes 19日1]. Lehner was thought to be a favored hunting spot where animals, attracted by water, were periodically ambushed by the same band of people within a relatively short period of time. Based on artifact similarities, archaeologists


Figure 1. Portion of the San Pedra River Vallay of scutheastern Arizona, study sites and geagraphic features referred to in the text.
speculated that the two sites of Lehner and Naco could represent kill sites used by the same band $[$ Haury et al. 1959].

In eastern Arizona the Big Game Hunting tradition was Followed by what is referred to as the Cochise Cultural Sequence, beginning with the Sulphur Springs stage [Sayles 1983c:58]. The range of artifact remains left 11,000 years ago indicates a way of life based generally on a gathering economy, with same hunting activities [Sayles 1983b: 日5-88]. The Fallowing Cazador, Chiricahua and Cochise cultural stages, spanning the period of 11000-2000 years ago; have artifact assemblages reflecting various degrees of hunting and Food gathering [Sayles 1983c:90; Sayles 1983d:117; Sayles 1983e:125].

Agricultural villages. When A.F. Bandelier made a trip through eastern Arizona in the 19th century, he wrote of abundant traces of former habitation in the San Pedra valley [Tuthill 1947:13]. Evidence Far smail clustered villages whose residents cultivated plants and made ceramic vessels exists for the A.D. 600 period in the region. Prehistoric agricultural sites dating after A.D. 1000 have often been found around springs and on stream benches or flood plains where simple ditch irrigation or floodplain agriculture could be practiced [Bahre 1977:9-10]. Hohokam influence was strong in the area until after A.D. 1300, probably a time of major dislocation and perhaps of massive crop failures.

The archaealogical periad from A.D. 1350-1700 is only partially understood for southeastern Arizona. Iwo examples of settled village life include Babocomari Uillage on Babocomari Creek and the Garden Canyon Site. The time harizon of the Babocomari Uillage, where occupants grew carn, beans, squash and cotton as well as hunted, is the mid A.D. 1300's [DiPeso 194日-49:11-12]. The Garden Canyon Site, located near the main channel of Garden Creak in the Huachuca Mtns., is considered to be a late prehistoric village dating to the period 1400-1450 A.D. [Young 1972]. The site contains twa types of architecture, yet similarities in canstruction and pottery types suggested to excavators simultaneous occupation by two different groups of people.

Spanish visits. During A.D. 1539-1540 parties led by Fray Marcos de Niza and Francisco Vasquez de Coronado were the first Eurapeans to enter the San Pedro river valley. Unfortunately, they left rather poor accounts of the local peaple [Bahre 1977:93. It wasn't until Father Eusebio Kino and Captain Juan Manje came through in November of 1697 that more details emerged. These two explorers set off on a trip intending to visit all the Sobaipuri [Pima] villages. They visited the village of Quiburi, built on a high bluff likely as a defensive strategy against roving Apache bands. Leaving Quiburi on the 10 th of November, they traveled north along the river, and eventually came to Casa Grande. On
this jaurney Captain Manje estimated that aver 2000 people lived in a series of at least 14 villages, all along the river. Many of these riparian villages had irrigation ditches and the people raised extensive crops [Bolton 1919:170-1713.

In the late 1600's and early 1700's a series of attempts at livestock raising were made in the valley by people coming up from Mexico [Mammerson 1972]. Riparian habitats would have been critically important for damestic animals, no less than for native peaple and for wild animals through millennia. Soon the presence of raiding Apaches made such livestock ventures extremely risky. Later land grants established in the early 1800's again had to be abandoned due to Apache raids.

Anglo American settlement. After the Civil War Anglo settlement in the San Pedra river valley intensified. Fort Buchanan, Camp Wallen, Camp Crittenden and Fort Huachuca were established in the period 1857-1877 [Bahre 1977:15]. By the 18BO's towns such as Tombstone, Charlestan and Fairbank began to serve the many silver miners that were drawn to the area. Demand for wood to fuel the bailers and furnaces at the mill sites, and to serve the domestic needs of an ever growing population, led to substantial reduction of the farests of the area [Bahre 1977:16]. Heavy domestic grazing in the late 1800's fostered changes in the diversity and composition of the grass and shrub communities,
including invasion of weedy species, and compaction of soils. By 1900, if not before, the channel of the San Pedra river began entrenching and the number of people living in the valley had drapped dramatically [Bahre 1977:17].

The changing nature of the San Pedra River Valley and other southeastern Arizona drainages

Combined historical and archaealogical records provide insight into the changing nature of southeastern Arizona river valleys over the last century and a half. For example, in 1846 the Mormon Batallion found the San Pedro river flowing bank-full thraugh grassy marshes, with extensive flooding behind beaver dams [Cooke 1848]. Dense areas of cottonwood, ash, and mesquite bosque were common. In the late 1840's and early 1850's the San Pedra river valley near the present international barder was largely open grassland; farther north one encountered extensive grassy marshes [Bartlett 1854: 323, 378-379; Emory 1857:94]. Richard J. Hinton [1878] later wrote that in the early 1870's the Rio Babocomari was a clear year-round stream, about 20 feet wide and 2 feet deep. It ran in the midst of $a$ broad rolling grass-covered plain, with banks supporting a large stand of cattonwoad trees. In this area taday the Babocamari river is a dry wash except in floods; its banks are currently lined with mesquite [DiPesa 1948-49]. A similar view by Hammersan [1972] echoes the theme that, even though it might not have been a perennial stream thoughout its entire length, the San Pedra river valley farmerly had more water with widespread swampy areas. Hammersan speculates that an earthquake in the late 1800 's may have partly altered the nature of the San Pedro river by breaking
through same artesian wells, at least in the Saint David area.

Historic documents regarding the beaver trade, and prehistoric fish remains, echo the view that the San Pedro river formerly had permanently flowing water. Beaver fur trappers came in large numbers in the 1820's and 1850's; there was enough beaver to make trapping profitable for some time [Wasley 1983:15]. References to catching large Fish near the town of Fairbank complement the recovery of fish vertebrae during excavation of the nearby 16-1Bth century A.D. Quiburi mission [Wasley 1983:15].

In summary, the major changes the San Pedra river valley experienced since the mid 1800's included a reduction in the number of well-watered stream courses fed by permanent springs, and a decline in the number of both dense grasslands and mature riparian communities of cottonmad, willow, ash, walnut, sycamore and oak.

In addition to major shifts in the composition $u$ plant species, the altered vegetative and hydralogic regimes have promated a change in the animals that inhabit the area. For example, former populations of deer, antelope, wolf and bear have shrunk or vanished [Wasley 1983:16]. Bath habitat loss and human efforts at capture and eradication were involved.

The hydralogic, vegetative, and faunal differences just discussed have not been limited to the San Pedro valley in southeastern Arizona. Immediately to the west, Empire
valley Cwhose waters ultimately drain into the Santa Cruz river] experienced a period of erosion and arrayo cutting that began sametime between 1890 and 1905. These events promoted a general replacement of grasslands by mesquite wads along the drainages and a general drying up of the cienegas in the area [Eddy, et al. 1983:6]. Today most streams in this area remain dry throughout the year [Wasley 1983:15]. Likewise, the larger Sonoita valley to the narthwest was better watered in the 1850's than at present, evidenced by historic references that wagons sometimes bogged down in the extensive mid-valley cienegas [Bartlett 1854]. To the east of the San Pedro river valley, the Sulphur Springs valley was largely plains grassland in the mid-19th century [Davis 1973: 202-204].

The changing nature of the southeastern Arizona river valleys indicated by histaric accounts may reflect a natural state of affairs for the region at least as far back as 13,000-15,000 B.P. C.U. Haynes has outlined the major events taking place in the San Pedra valley, based on geomorphological and paleoenvironmental evidence at the locations of Murray Springs [1981] and the Lehner site [1982]. Haynes hypothesized well-watered periods alternating with episodes of arroyo cutting and filling throughout the Holocene. In nearby Sulphur Springs valley, Waters [1986] alsa documented fluctuating enviranmental
conditions over the last 5,000 years, though his sequence of reconstructed conditions is asynchronous with the scheme outlined by Haynes for the San Pedro. Waters suggested that inter-valley correlation of aggradation and degradation events should not be expected to be identical, but rather can be explained by local geomorphological parameters. For Waters, major shifts in the Holocene from a braided stream environment to periods of cienega environments and arroyo cutting were probably climatically induced, while cycles of erosion and deposition within a major cienega or arroyo period could be explained by local geamarphological conditions. It is obvious that both over the shart term and in the lang run, the river valleys in southeastern Arizana can be expected to change.

## PROCEDURES

## Study area selection

A number of objectives were considered in selection of study areas far madern abservations. Twa ungrazed lacatians rich in species of native plants were sought within 100 miles of Tucson to facilitate the frequent visits required. The size of each study area had to be relatively small and manageable for a dissertation, and the owners sympathetic to repeated visits.

Two published resources reviewing natural areas were consulted [Martin 1979; Smith 1974] in the intial stages of site review. Eventually 10 lacations were chosen for visitation and an-site evaluation 〔Appendix I]. Locations in both the Santa Cruz and San Pedra river valleys were represented. All ten sites were visited in the early months of 1983.

At each location a number of observations were made that wauld facilitate later comparisan of sites. Far example, a tally of all plant species recagnized included thase that extended dawn a drainage Eram a higher vegetation zone. Portions of the flora that represented intraduced plants or that were suggestive of severe over-grazing were noted. Species richness was documented. A subjective evaluation was made regarding the presence of a range of age-classes for the dominant species, to perceive community
health. Finally, direct evidence regarding the presence of domestic grazing animals was noted. The 10 locations were then ranked based on the accumulated data.

The top twa sites on the list were Ramsey Canyon Nature Preserve and Canelo Hills Cienega. Both are managed by the Arizona Chapter of The Nature Conservancy, Canelo Hills since 1969 and Ramsey Canyon since 1975. Permission was granted in May of 1983 to make repeated visits to both locations and callect herbarium voucher specimens.

Ramsey Canyon and Canelo Hills are riparian habitats tributary to the San Pedra river [Fig. 1]. A Freshwater stream in the Huachuca mountains drains steep-walled Ramsey Canyon east toward the San Pedra river. Except in time of floods, surface flow stops shortly beyona the canyon mouth. According to local inhabitants, the stream within the canyon often dries up in May and June; later summer rains scour the stream banks. Streamside vegetation falls inta the category of "Interior and Californian Riparian Deciduaus Forests and Waodlands" [Brown 19日2:250], composed of a mixed broadleaf community including Rlatanus. Aceer Ropulus. Eraxiaus. Rinus, Juniperus, Sglix, Queccus, Juglans and Peunus. Such communities are considered relictual of a farmerly widespread Early Tertiary mixed mesophytic Eorest.

Canela Hills cienega is located west-northwest of the Huachuca mauntains, along a permanent stream that gaes underground as it drains north into the Babocamari river, which in turn flows northeast into the San Pedro river. The cienega is maintained by springs, perhaps fault-contralled. The Nature Conservancy has installed a law cancrete dam to help maintain the high water table [Hendrickson and Minckley 1384:1493. The area's permanently saturated, highly organic, axygen-poar sails support a rather limited flora dominated by Scirgus+ Juncus. Elepcharis and same grasses.

Prehistaric activities adjacent to the study sites

Since my aim is to delineate the patential, not the actual, utilization of wetlands plants by humans, it was not essential that archaealogical evidence be near either study site. Especially in the case of Ramsey Canyan, it appeared that the narrow stream terraces flanked by sharply rising slopes or cliffs were not favorable far site preservation.

The archaealogical data bank maintained by the Arizana State Museum was consulted to locate records of sites within a three-mile radius of each study area. Ancient sites are present in the vicinity of both locations [Tables 2 and 3$]$ and a systematic survey wauld daubtless reveal mare.

Of eight sites recorded in the inventory, five were listed as villages by the archaeologists. Apparently these villages were extensive, representing repeated visits or occupations of some duration. For example site EE:E:26 near Canelo Hills spans $900 \times 25$ meters, while less than 1.5 miles away site EE:6:23 covers at least an area $92 \times 92$ meters. Sites EE:11:13 and EE:11:14 in the Ramsey Canyan study region may cover as much as $1 / 4 \times 1 / 4$ miles, including sub-surface pithouses and adobe structures.

The extensive occupation of three of these village sites [EE:11:13, EE:11:14 and EE:11:E] may be partially understood by considering geographic location. All are situated on gentle slapes at a canyon mauth same distance

Table 2. Archaeclogical evidence aithin three miles of Ramsey Canyon Study site.

| Site Manifestation | Arizona State Museur Site No. and Location | Notes |
| :---: | :---: | :---: |
| Rock \& adobe rectangular structures | AZ:EE:11:5 Miller Peak luad, T235, R21E, SH1/4 of Sect. 18, 5100'; 3 ailes SE of Ramsey Canyon study area. | Site located at Broken Arrow Ranch; pottery is Baboconari and Santa Cruz polychroses, brownwares. |
| Village of $10+$ rooas; dates to A.D. $1300-$ 1400 | AZ:EE:11:6 Miller Feak Guad, T22S, R20E, $541 / 4$ of 51 1/4 of 5ect. 35, 5020'; 2 ailes NE of Ramsey Canyon study area. | Constructed of boulders (?); pottery includes Babocomari, Eila and Tucson polychrobes, plainwares. Lithics include full trough eetates, wanos and a quartz erystal. |
| Village consisting of sub-surface pithouses and above-ground adobe structures | AZ:EE:11:13 Miller Peak Guad, T22S, R20E, SM1/4 of NW1/4 of Sect. 28, 5000'; in Garden Canyon, 3 ailes $N W$ of Rassey Canyon study area. | Site covers area 400 \% 400 aeters; pottery includes Babocomari and Gila polychroses, Rincon $\mathrm{k} / \mathrm{br}$, Trincheras P/Rd, plainwares and corrugated sherds. Lithics include trough setates, points and scrapers. |
| Viliage, similar to above | A2:EE:11:14 | A site of very similar nature to A2:EE:11:13, less than 400 eeter 5 from it. |

Table 3. Archaeologital evidence mithin three ailes of Canelo Hills Study site.

| Site Manifestation | Arizona State Huspua Site No. and Location | Notes |
| :---: | :---: | :---: |
| Possible dwellings, plus tho ar aore mestal pits. | AZ:EE:6:2 $0^{2}$ Donnell Canyon Quad T215, R18E, SE $1 / 4$ of NE $1 / 4$ of Sect. 32, $4980^{\prime}$; less than $1 / 4$ aile from Canelo Hills study area. | Site covers 600 meters by 90 eeters on ridge less than 400 aeters from ciensga. Stones outline rooms; pottery includes plain brown, redware, saudged interiors. Lithics include points, scrapers, trough metate. |
| Surface scatter of artifacts | Az:EE:6:3 O'Donnell Canyon Guad, T22S, R18E, Sect. 10, 5100': 2 ailes SE of Canelo Hills study area. | Site covers 4050 square weters along AI highway \$83; pottery includes Trincheras P/Rid and red/broun wares; lithics include manos, hamerstones, drill. |
| Villago/Pithouse (?); little indication of architecture; Babocoaari Phase? A.D. 1300? | Al:EE:6:23 D'Donnel! Canyon Buad, T23S, RIBE, Nili/4 of St $1 / 4$ of Sect. 4, 5030'; less than 1.5 ailes SE of Canelo Hills study area. | Site covers $90 \times 90$ a near Canelo fanger Station; additional sites on adjoining hills. Pottery includes redwares, plain bronnares, fila polychrome; lithics include rhyelite and basalt iteas. |
| Possible village site, Late Hohokam, dates to A.D. 12001700. | AZ:EE:6:26 D'Donnell Canyon Guad, T22S, RIBE, E1/2 of SE 1/4 of Sect. 5, 5025; less than 1.5 miles 5 of Canelo Hills study area. | Site covers $900 \times 25$ a on the west bank of 0'Donnell Canyon, near Al:EE:6:23. Pottery includes redware and plain ware; lithics include heavy flake concentrations and a saa!! steraed paint. |

from steep mountain walls. Broad slapes removed from canyon streamsides would provide sweeping views of the basin beyond, and escape fram cald air drainage.

Twa of the non-village sites might represent more than just casual visitation. Site EE: $6: 2$ consists of mescal pits and a passible dwelling and covers an area at least $3 / B \mathrm{mile}$ long and 100 yards wide. Site EE:11:5 has both rock and adabe structures. Dnly a single site [EE:6:3] was listed as having no below ground features, consisting solely of artifacts scattered on the surface of the ground.

For most of these sites, the ceramic sherds recovered suggest occupation sometime after A.D. 1200-1300. Polychrome pattery types known as Babocamari, Gila, and Tucson are suggestive of the "Classic Period" in southern Arizona. Site EE:G:3 near Canelo Hills might be earlier, perhaps dating to 700-900 A.D. based on the presence of Irincheras sherds. Sites EE:11:13 and EE:11:14 in the Ramsey Canyon area could represent villages lived in first by people making Irincheras and Rincon pattery types, and then later by people that fashioned Gila polychrome wares. Alternatively, these two sites may reflect long-term occupation during the period A.D. 900-1300. The cuitural affiliatian[s] of the inhabitants of these sites derive from a heritage of Hohakam, Mogollon and Trincheras Cultures [see Di Peso 1951, Young 1972, and Eddy and Cooley 1983.J

Permanent callecting stations were designated at each study area. The seven stations selected at Ramsey Canyon [Fig. 2] represented both wet and dry sail in the general vicinity of the stream [Table 4], in the protected area of the reserve that extended from the upper Bledsae cabin to the edge of the preserve in the area known as "The Bax". All seven locations were considered to be either shallow or steep calluvial slapes, underlain by boulders and alluvium, or by granite bedrack. Most locations received less than $25 \%$ exposure to the sun's rays due to the dense canopy of trees that lined the stream.

A variety of locations at Canelo Hills, including the cienega, edges of panded water, streamside, dry stream Elanks, and a spring site were selected as collecting stations [Fig. 3]. The nine statians included water-lagged streamside and relatively dry areas within 30 meters of the cienega and stream [Table 5]; the total distance between the two farthest stations was less than 0.日 km. Most stations were on horizontal terrain underlain by Quaternary alluvium; a few represented shallow slopes underlain by lacal bedrack and calluvium.


Figure 2. Ramsey Canyon Nature Preserve, Nartheast flanks of the Huachuca Mauntains in Cachise County of southeastern Arizana. Miller Peak Quadrangle [7.5' series], T23s, R20E, SE 1/4 of 5w 1/4 of Section 9; 5700-5000 Feet elevation. Numbers refer to collecting/observation stations.

Table 4. Description of Ramsey Canyon Collecting Stations.

| Collecting <br> Station \# 1 | Setting Dry site | Description <br> North-facing shallow colluvial slope abutting granite bedrock; $50 \%$ or more exposure; dry soil. |
| :---: | :---: | :---: |
| 2 | Boulder field near stream | Northeast-facing shallow colluvial slope overlain by boulders and underlain by alluvium; less than $25 \%$ exposure; dry soil. |
| 3 | Stream flanks | North-facing shallow slope overlain by overbank sediments; less than $25 \%$ exposure: wet soil. |
| 4 | Steep ${ }^{\circ}$ colluvial slope | Northwest-facing steep colluvial slope overlying granite bedrock; 25-50\% exposure; dry soil. |
| 5 | Steep granite slope | Northwest-facing steep slope underlain by granite bedrock, with pockets of colluvium; less than $25 \%$ exposure; dry soil. |
| 6 | Very steep granite slopa near stream | Northwest-facing very steep slope underlain by granite bedrock: less than $25 \%$ expossure; dry soil, subject to stream scour. |
| 7 | Eoulder and cobble field near stream | East-facing shallow to steep slope compesed of watercarried boulders and cobbles; less than $25 \%$ exposure; wet soil. |

A mhallow slope deviates between $3-150$ from horizontal.
'A steep slope devietes more than 150 from horizontal.


Figure 3. Canela Hills Nature Pragerve. Uegt-northwest of the Huachuca Mauntains in Santa Cruz County of sautheastern Arizona. $\quad$ D'Donnell Canyon Quadrangle [7.5' geries]; TZis, R1gE, NU $1 / 4$ of $\operatorname{Sw} 1 / 4$ of Section 33 and $N E 1 / 4$ of $\operatorname{SE} 1 / 4$ of Section 32; 4925 feat elevction. Numbers refer to collecting/observation stations.

Table 5. Description of Canelo Hills Collecting Stations.

Collecting Station \#

1 Cienega

2 Decidulus forest

3 Streamside \& drier stream flanks

4
Edges of ponded water

5
5 Dry stream flant:s (east side)

6

> Dry stream flanks (east side)

7

8

9 Cienega

Description
Horizontal surface, underlain by modern and Quaternary alluvium: $100 \%$ exposure: soil fully saturated with water.

Horizontal surface, underlain by modern and Quaternary alluvium; less than $50 \%$ exposure, except winter: wet soil.

Horizontal surface, underlain by modern and Guaternary alluvium; 100 to 1 ess than $50 \%$ exposure: wet to fully saturated soil.

Horizontal surface, underlain by modern and Quaternary alluvium; $100 \%$ exposure: soil fully saturated with water.

West-facing, shallow" colluvial slope underlain by colluvium and volcanic outerops: $100 \%$ exposure; dry soil.

West and northwest-facing steep slope, underlain by volcanic bedrock with pockets of colluvium: 25-50\% exposure: dry soil.

East-facing shallow slope, underlain by Quaternary ailuvium? $100 \%$ exposure: dry soil.

East-facing shallow slopes underlain by Quaternary ailuvium: $75-100 \%$ exposure; soil fully saturated with water.

North-facing shallow slope underlain by Guaternary alluvium: 50-100\% exposure: soil fully saturated with water.

Dver 150 species were chosen that were known from either the ethnographic or archaealogical literature as praviding potential resources for humans. Previous work in Canelo Hills by Yatskievych [1980] and at Ramsey Canyon by Toolin [1980] had produced fairly complete flaras. Effort was made to avaid choosing the same species for study at both study areas although in a few cases [e.g. Rhus tei= lobgta, Salix l묘요미료요] a single species was intentionally selected at both locations to determine intersite differences in phenology. In choosing the plants to be studied, species avaided included those considered "special elements" by the Nature Conservancy, and any plants protected by the Arizona Native Plant Law [AH-N 500-Rev. 7-81-R-D].

For variaus reasons, including Flooding, the ariginal target of over 150 species was reduced ta 127 taxa, representing 50 plant families [Table 6]. They were identified using the taxonomic keys found in Acizong Elqeg [Kearney and
 [Gould 1951], with nomenclature updated by Lehr [1978] and Lehr and Pinkava [1980, 1982]. Synonyms in parentheses can be found in either of the major floral treatments cited above, or in the Supplement to Acizona Elorg CHowell and McClintock 1960].

Table E. List of 127 native plant species studiad, organized alphabetically by plant family. Taxa with an asterisk are considered to be obligate riparian species within the local area.

## ACERACEAE

* Acgex sqgcharum Marsh. ssp. grandidentatum [Nutt.] Desm. [ $=$ E. grandidentatum Nutt.]
AMARANTHACEAE
Brayylinea densa [Humb. \& Banpl.] Small
Gomphrena canespitosa Torr.
G. nitida Rothr.

ANACARDIACEAE
Rhus trilobata Nutt. var. Eqcemulosa [Greene] Barkley APDCYNACEAE

* $\quad$ GRocynum sibicicum Jacq. [mac suksdoceif Greene.〕

ARALIACEAE

* $\quad$ Eralig racemosa L.

ASCLEPIADACEAE
Asclepias subverticillata [Gray] Vail

BERBERIDACEAE
Berberis wilcoxii Kearney
BORAGINACEAE
lithosperimum multielorum Torr.
CAPRIFOLIACEAE
Lonicera qlbifloca Torr. \& Gray. var. dumasa [Gray] Rehd.
CHENOPODIACEAE
Chenopodium qef. negmexicanum Stand.
COMMELINACEAE
Commeling dignthifolig Delile.
Iradesing
conuoluviaceaz
Ipgmaea hederifglig L. [=I, coccineu var.hedexiEgig L. Gray
COMPOSITAE
Beclandienca lyrata Benth. var. macraphulla Gray
Bidens pilosa L.
Grindeliag aumnospermoides [A. Gray] Ruffin
[ = Xanthocephalum gumnospermaides [Gray] Benth. \& Hook J
Gutiegrezia wrightii Gray $[=$ Xanthocephalum wtiahtic Gray]
Helignthus gnouns $L$.
Heliopsis paryifolig Gray
Lactucg graminifolig Michx.
Melgmpgdium longicornu Gray

* Rudbeckig lacinigta $L$.

Yiauiera lonaifolia [Rabins \& Greenm.] Blake

Table 6 [cont]. List of 127 native plant species studied.
CDRNACEAE
Garcug wriphtii Torr.

## CRUCIFERAE

Descurainig pinnata [walt.] Britt. ssp. qceqleuca [woot.] Detling
Rennelliq lonaifoliq [Benth.] Roll. [=Ihelupadium lqnaiEglia Benth.
CUCURBITACEAE
Apadanthera undulata Gray
Cucuabita Eqetidissima H.B.K.
CUPRESSACEAE
Juniperus deppeana Steud. var. pachuphloea [Torr.] Martinez
CYPERACEAE

* Cafex chihuqhuensis Mack.
* C. gecidentalis Bailey
* Es lanuginasa Michx.
C. leucodonta Holm.
* Cupecus Eendiecianus Boeckl.
* C. manimae H.B.K. var, aspectimus [liebm.] Kukenth.
* C. qEE. prinqlei Britt.
* Elepochacis Eastellata [Torr.] Torr.
* Scicaus qmericanus Pers.
* Scirpus validus Vahl. [=Scicpus acutus Muhl.]

EQUISETALEAE

* Equisetum hiemale L. var. aEEine [Engelm.] A.A. Eaton
* Es lagvigatum A. Braun.

ERICACEAE
Gabutus acizonica [Gray] Sarg.
Acctostaphylos pungens H.B.K.
EUPHORBIACEAE
Acalypha lindheimeri Muell. Arg.
Euphocbia rabusta [Engelm.] Small.
FAGACEAE
Quercus qfe. qrizonica Sarg.
Q. emaryi Torr.
Q. hypoleucaides Camus.
Q. Eugasg Nee. [=R. Eeticulata Humb. \& Bonpl.]

GRAMINEAE
Agrapurgn geizonicum Scribn. \& Smith
Andconggen sacchachides Swartz
Bouteloug curtipendula [Michx.] Torr.
B. aracilis [H.B.K.] Lag. ex. Steud.

Bromus caringtus H. \& A.
Elumus canadensis L.
Ecaccostis intecmedia Hitchc.
Erigehlog lemmoni Uasey \& Scribn. var. geacilis
[Fourn.] Gould [-E, gracilis [Fourn.] Hitchc.]
Leptochlog dubig [H.B.K.J Nees

Table 6 [cont]. List of 127 native plant species studied.
GRAMINEAE [continued]
*? Muhlenberain asperifalia [Nees \& Mey.] Paradi
M. emecsleui Vasey
$M_{1}$ pquycatulis Scribn.
M. Eigens [Benth.] Hitchc.
*? M. पtilis [Torr.] A.S. Hitchc.
Eqnicum bulbasum H.B.K.
E. Qbtusum H.B.K.

Rigtochatium Eimbciatum [H.B.K.] Hitchc.
Eqa Eendleriana [Steud.] Uasey
SetaEin $\quad$ genicinlata [Lam.] Beauv.
Sitgnign hustrix [Nutt.J J.G. Smith [=Elymus elymaides [Raf.] Swezey]
Spgrabolus giraides [Torr.J Torr. var. wightii [Munro ex. Scribn.J Gould
Stipg pringlei Scribn.
IRIDACEAE

* Sisucinchium demissum Greene.

JUGLANDACEAE

* Juglans major [Torr.〕 Heller

JUNCACEAE

* Juncus lonaistulis Torr.
* Juncus ensiEalius Wikstr. var.montanus [Engelm.] C. L. Hitche. [-I. saximontanus A. Nels.]
* J_ tenuis Willd.

LABIATAE
Mentha ${ }^{\text {gevensis }}$ L. var. villosa [Benth.] S. R. Stewart Mangrda qustromontand Epling.
Salyia reflexa Hornem.
Stachus coccineq Jacq.
LEGUMINDSAE

* Amargha Enuticasa L. var. pecidentalis [Abrams] K.\&P.

Astragalus nothexus Gray.
Cologania qngustiEaliq H.B.K. [=C. longizoliq Gray]
Desmodium batocaulon Gray
Q. Eosei Schubert

Latus geqbaides [H.B.K.] Ottley var. aummulacis [M.E.Jones] Isely
Phoseglus gcytifolius Gray var. gcutiEgliys
Robinig negmexicgng Gray
LILIACEAE
Aldium cernumm Rath. var. neamexicanum [Rydb.] Macbr. maluaceae

Anoda cristata [L.] Schlecht.
Sidg Eilicqulis T. \& G. [= S. procumbens Sw.]
Sida neamexicang Gray

Table 6 [cont]. List of 127 native plant species studied.
NYCTAGINACEAE
Micabilis coccinea [Torr.] B. \& H. [=0xybaphus cogccineus Iorr.J
di! ACEAE

* Ecaxinus pennsulvanica Marsh. ssp. velutina [Tarr.] G. N. Miller [= E, veluting Torr.]

ONAGRACEAE
Eqilobium qdenocaulon Hausskn. [= E. caliEgenicum Mausskn.J
*? Denothera rosen Ait.
OXALIDACEAE
Qxalis amplifalia [Trel.] Knuth
Q. decgrhylla H.B.K. [-Q. Grayi [Rose] Knuth.]
Q. qlbicans H.B.K. ssp pilosg [Nutt.] Eiten 〔= $\mathrm{Q}_{\perp}$ Diligs모 Nutt.J
Papaueraceam
Cogydalis queea willd.
Pinaceam

* Abies concolor [Gordon \& Glendenning] Hoopes

Rinus discolor Bailey \& Hawksworth [=E. cembraides Zucc.J
Einus engelmannii Carr. [= Rı latiEqiig Sarg]

* P. strobifacmis Engelm. [= R_ EeElexa Engelm.]
* Esexddatsuan Menziesii [Mirb.] Franca var. glauca [Beissn.] Franco [= R. taxiEqlio [Poiret] Britton var. glauga [Beissn.] Sudworth]
plantaginaceam
Elantage patagonica Jacq. [= R. puEshii R. \& S.J
E. virainice $L$.

PLATANACEAE

* Rlatanus wrightii wats.

POLYGONACEAE

* Rumex viglogscens Rech. f.

PORTULACACEAE
Ractulaca umbeaticola H. B. K. [ $=\mathrm{R}_{\mathrm{c}}$ coconata Small]
RANUNCULACEAE

* Ranunculus hudcochacaides Gray
* R. macranthus Schelle.

Thalictrum Eendleci Engelm.
RHAMNACEAE
Ceqnothus Eendlemi Gray
Bhamans betulaefolia Greene. var. qbavata K. \& P.
*? $\mathrm{R}_{2}$ californica Esch. ssp. ucsina [Greene] Wolf.

Table 5 [cant]. List of 127 native plant species studied.
RDSACEAE
Eercocaraus mantanus RaF. var, paugidentatus [S. Uats.] F. L. Martin

* Equaus sergtina Ehrh. ssp. virens [woat. \& Standl.] McUaugh
SALICACEAE
* Populus Ecemontii wats.
* Salix gagdianij Ball
* S. lasiglepis Benth.

SAXIFRAGACEAE
Philadelphus miccophulius Gray

* Ribes quceum Pursh.

SCROPHULAR IACEAE

* Mimulus guttatus D.C.

SOLANACEAE

* Ehusqlis vicainiang Miller var. sonocae [Torr.] WaterEall [= E. longiEalia Nutt.]
IYPHACEAE
* Iupha latitiEolin L.

UMBELLIFERAE
Beyet모 erecta [Huds.] Coville
UITACEAE

* Uitis qEizonico Engelm.

Both Ramsey Eanyon and Canelo Hills study sites were visited fourteen times Eram June 19日3-June 1984, and then less Erequently until July of 1985 [Table 7]. The frequency af visitation declined as my familiarity with the flara improved, and was ultimately determined by the general activity level of vegetation at each study lacation. Because the first months of the study coincided with intense summer plant activity, extensive and frequent callecting was required to establish familiarity with the plants as individual species. For example, Jyncys bglticus was unwittingly collected repeatedly until the range of its morphological expressions became known. After each callecting trip, all plants were identified and verified at the University of Arizona Herbarium, to be added to the grouing list of plants recognized.

Intervals between callecting trips varied according to the seasan. Collecting and observation sessions were less than four weeks apart during the summer and Eall months, since phenological changes were occurring rapidly during this period. As both riparian areas approached the winter dormant season, collecting trips were spaced at longer intervals until the first signs of renewed activity in the spring.

During each visit a suite of phenalogical observations

| Date[s] Uisited | Ramsey Canyon | Canelo Hills |
| :---: | :---: | :---: |
| June 4-5, 1983 | $x$ | $x$ |
| June 25-26 | X | $x$ |
| July 9-10 | X | $x$ |
| Aug E-7 | X | $x$ |
| Aug 20 | $X$ | X |
| Sept 3 | X | $X$ |
| Sept 17 | X | rained out |
| Det 8-9 | X | X |
| Nov 6 | $X$ | $X$ |
| Jan 8, 1984 | $X$ | $X$ |
| Feb 12 | $X$ | $X$ |
| Mar 30 | X | $X$ |
| Apr 29 | $X$ | $x$ |
| May 20 | X | X |
| Aug 19 | X | $x$ |
| Sept 15 | X | X |
| June 1, 1985 | X | $x$ |
| July 20 | $x$ | $x$ |

was made on all piants callected previausly, plus those newly added. Information was kept on $4 \times 6$ index cards; entries included the date and current observations on stem, leaf, flower and fruit condition [Table B]. To insure consistency of observations between visits, parts of each species that pravided important clues to its recognition were taped to the back of the index card carried in the Field. All phenological notations were made on a populatian of individuals to reflect general species activity. Dual conditions, such as presence of both immature and mature Eruit/seeds, were noted only when each was quite obvious and applied to a significant number of individuals. Noting in the field when the different species of grasses resumed active grawth was difficult, since vegetative characters were not always helpful in identification. Herbarium specimens, black and white phatographs, and envelopes of pollen and fruit pravide voucher dacumentation for this study. Standard field callecting techniques and data recording were emplayed to provide a collection of plants to serve as herbarium voucher specimens. These specimens have been deposited in the University of Arizona Herbarium in Tucson. The black and white photographs remain in the files of the author, as do the pollen and seed samples which serve as part of a modern comparative callection useful in identifying fragmented plant parts fram archaealogical sites.

Table 日. Phenological observations made on riparian plant populations. At each visit, a species was observed For all parts listed below.

| Ract | Categocy | Comment |
| :---: | :---: | :---: |
| Leaves | None present |  |
|  | Young, active growth | Leaves toward end of twigs smaller and expanding |
|  | Mature | All full size |
| Stems | No active growth |  |
|  | Active growth | Internodes toward twig \& branch ends short, Elexible; often green and without mature bark |
| Flowers | None present |  |
|  | Buds present |  |
|  | In full bloom |  |
|  | Withering |  |
| Fruit/Seeds | None present |  |
|  | Immature |  |
|  | Mature |  |
|  | Prior season's fruit still clinging |  |

Procedures for acquiring the pollen wash samples were as follows. As fruit, seads or leaves of species came into maturity, variable amounts [averaging fram 1-2 cups] were harvested and immediately washed with a concentrated stream of distilled water into clean plastic containers. The pH of the wash water was then lowered to a range of 2-3 with hydrochloric acid to retard fungal growth. The samples were stared until they could be acetalyzed according to the laboratory procedures outlined in Appendix 2.

At the time of harvest of the parts, predictions were made on whether or not the pollen of the species in question was expected to show up in the wash water. Predictions were based mainly on structural characteristics and timing of flowering in relation to the parts of interest. A need to anticipate sources of pollen transpart into archaedogical sites underlies an interest in plant parts as pollen traps [see Bohrer 1972, 1981b]. This same interest is shared by researchers concerned with different modes of pollen entry into packrat middens $[$ Davis and Anderson 19873.

All three major data bases, including the phenalogical data, ethnographic infarmation, and archaealogical citations, are presented. The field wark to develop the phenological profiles covered one full year, with periodic visits over a second year. This coverage is insufficient to detect potential interannual variability in timing of phemological events.

Phenological profiles were developed for a total of 127 native species, 64 from Canelo Hills and 63 fram Ramsey Canyon. For each species, the profile has been presented in a pictorialized format that precedes each discussion [see Figure 4 for an explanation of the general scheme].

Species are alphabetically arranged, according ta
genus. Full citations [including authorities, subspecies, varieties] are listed at the start of each discussion; thereafter only genus and species names are referred to in the text, tables or appendicies.

Each full species citation is fallowed by a series of explanatary entries. Codes for location of collection are RC $=$ Ramsey Canyon and $\mathrm{CH}=$ Canelo Hills. The number immediately following the location cade, for example RC-1, refers to the actual collecting station within the preserve. A number in parentheses, such as [KA \#62-83] was that assigned by Adams as the field collection number. The


Figure 4. Symbols Ear phenological profiles. [a] Basic positioning of parts monitored. The vertical line represents stem/twig status. The position displaying leaf activity diverges from the lawer right, the location of flower status fram the middle an the left, and Eruit development From the upper right. [b] Stems/twigs inactive. [c] Stems/ twigs elangating. [d] Leaves have emerged directly from ground or water's surface. [e] Leaves on twigs actively expanding. [E] Leaves appear mature. [g] Flower buds swelling. [h] Full Flowering apparent. [i] Flowers withered but still cling to branches. [j] Immature fruit present. [k] Mature fruit available. [1] Mature clinging fruit was formed in the previaus calendar year. Symbols may be cambined, e.g. both immature and mature fruit cauld be present. In any prafile, an $X$ indicates that the plant has died back to ground level or to such an extent that it is difficult to find on the landscape. A blank space represents an annual plant that is overwintering as a disseminule in the sail.
accession number applied by the University of Arizana Herbarium is preceded by the letters UA, for example UA254647.

A sample of the ethnographic and archaealogical literature, largely representing the southwestern United States, has been surveyed Far Native American uses of all native species. Ethnographic data cited in this study has been taken at face value and reparted as written. Yet certain reservations apply to written recards. For example, one cannot assume that ethnographers recorded data on all plants in use by a group; nar can ane be completely certain that their identifications are always correct. Anather potential bias involves plants farmerly in use, but no longer relied upon when the historic observations were made. Even as ethnographers recorded, plants that ance played an important role in subsistence were being replaced by more easily acquired European foadstuffs.

The archaealogical record is also not without bias. Far years anly larger, visible plant remains were recavered; sometimes anly those items actually known by the exaavators were saved. Advent of various flotation methods in the 1970's greatly increased chances of recavering microscopic parts af taxa nat recognized befare. Unfortunately the criteria of identification of prehistoric plant remains are often amitted fram a report, making it difficult to evaluate the basis Eor many identifications.

With these biases in mind, the following section autlines the seasanality af a plant, follawed by a text summary of the historic uses and prehistoric record. Frequently the cumbersome literature citations are summarized in table format. The overall significance of a given species for humans is addressed, as is the likelihood that the various parts sought might survive in the archaealogical recard.

Although the major focus of this study was on mative species, same phenalogical data was alsa gathered on nineteen plants knawn or suspected to have been intraduced into the New world in histaric times [Kearney and Peebles 1960]. These observations have been retained and appear in summarized Eorm in Appendix 3.

Abies concolor [Gordon \& Glendenning] Hoopes RC-1 [KA \#62-B3] UA254547


## HABITAT

Abies concolor grows less than 10 meters from the stream at Ramsey Canyon, on a shallow slope composed of colluvial sediments and granite bedrock. The surface substrate is generally dry and the area receives over 50\% exposure to the sun's rays.

## PhENDLOGY

This evergreen fir resumes active stem elongation and leaf [needle] growth in April, coinciding with the period when male and female reproductive strobili [cones] emerge. Male cones cling to the branches for months, although they most likely shed viable pallen only for a short while. Female cones high in the tree branches appear to ripen in October and November, before they turn brown and come apart. By December the female cones are no longer visible. Active vegetative growth that began in April slows considerably in August, and by September appears to have ceased.

## EIHNDGRAPHIC/ARCHAEOLQGICAL RECDRDS

Fir trees have offered food to historic groups in the form of inner bark [especially the cambium] and seeds [Table 93. When the innar bark of A. balsomeg was analyzed, it was Found to have up to $47 \%$ reducing sugars, depending on the season of the year harvested. It was described os being tasty when eaten raw if peeled off the tree in winter or early spring [Gaertner 1970]. The Kawaiisu of California ate the seeds occasionally, but generally considered them inedible [Zigmund 1981:9]. Perhaps they were mainly sought as a famine food, as both their small size and difficulty in harvesting would require much effort for low return.

Diffarent graups considerad fir neadles useful in medicinal teas, for ceremonial decorations, and as "tobacco" [not to be confused with cultivated tobacco Nicotigna]. Resin was gathered as a chewing gum and medicina. Pipestems have bean fashioned from twigs of apprapriate size. At the Arizona pueblas of Hopi and Hana, the name of a clan was the same name given to Abies concolor.

Fir charcoal has been recovered from faur Anasazi sites of the 11 th century A.D. in the Chimney Rock Mesa area of Colorado [Minnis and Ford 1977: 日3]. The Chacoan period occupants of Salman Ruin [A.D. 1090-1135] in northwestern New Mexico employed beams fashioned from Abies cancaler in their roof construction [Adams 1980b:512]. The Laboratory of Iree Ring Research in Iucson, Arizona undoubtedly has

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. balsamea | inmar bark, enten | Eastern U. S. | Gaertner 1970 |
| A. concolor | ```needles[?], ritually smoked``` | Hopi, Arizona | Whiting 1966:62 |
|  | needles, made into a medicinal tea | Acama and Laguna, New Mexica | Swank 1932:24 |
|  | plant, name af a clan | Hopi, Arizona | Whiting 1966: 62 |
|  | plant, name of the Fir Clan | Hana, Tewa puebla Arizona | $\begin{aligned} & \text { Rabbins et al. } \\ & 1916: 38 \end{aligned}$ |
|  | plant, in decorations | Acoma and Laguna, New Mexico | Suank 1932:24 |
|  | resin, as a medicine | Picuris, New Mexico | Krenetsky 1964:43 |
|  | resin as a medicine | Hano, Tewa puehla of Arizona | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916: } 38 \end{aligned}$ |
|  | seeds, eaten | Kamaiisu, Calif. | Zigmund 1981:9 |
|  | twigs, as pipestems | Hann, Tesa puebla of Arizona | $\begin{aligned} & \text { Rabbins et al. } \\ & \text { 1916:38 } \end{aligned}$ |
| A. grandis | inner bark, eaten | British Calumbia | ```cited in Yanavsky 1936:4``` |
| Abies spp. | resin, chewed | British Calumbia | ```cited in Yanovsky 1936:4``` |

Files on numerous Southwestern United States prehistoric sites where Abies served bath as roof beams and firehearth material.

## SIGNIFICANCE FOR HUMANS

In Ramsey Canyon, the inner bark of Abies concolor might be sweetest in January and February, just prior to resumption af vegetative growth in March. Seeds could be collected from intact Eemale cones high in the tree or from fallen cones in October or November. All other needs served by this species wald be met year round, such as needles sought for medicine, "tobacca" ar as ceremanial paraphernalia, resin as chewing gum or medicine, twigs as pipestems, and wood For roof beams and firehearth fuel. PREDICIIONS FOR THE ARCHAEOLOGICAL RECORD

Parts of gbies exposed to fire, such as hearthfuel or roof beams burned in a catastrophic conflagration, could preserve. Dther parts not normally exposed to fire, such as needles, twigs and seeds, might survive anly if buried in deep deposits or in protected locations. Inner bark is considered to be a highly perishable part. Preserved resin would require a comparative collection of resins and gums for accurate identification.

Acglypha lindheimeri Mull. Arg. CH-3 [KA \#182-83] UA255002



## habitat

At Canelo Hills, Acalupha lindheimeci thrives along the permanent stream in wet to fully saturated soil composed entirely of alluvial deposits. Different gcolygho plants are exposed to varied amounts of sunlight.

## PHENOLOGY

This barely shrubby plant is in full flower in July. Flowering tapers off considerably by September, and mature Fruit capsules can be found in both September and October. The period of active vegetative growth spans the months July through September. In November the plant dies back to ground surface, and remains dormant far a number of months.

## ETHNDGRAPHIC/ARCHAEDLDGICAL RECORDS

In Mexico a number of Acalupha species, including $A_{1}$ lindheimeri, were known as "yerba del cancer" and used for treating cancer, ulcers, sore gums and loose teeth $[$ Altschul 1973:158-159J. People in Honduras, Guatemala, Indochina, the Solomon Islands, the Philippine Islands and Figi all had medicinal uses far Acgluphg [Altschul 1973:15日-159]. Nine
species have served groups in east Africa in medicinal ways; generally a decoction of the roots or leaves has been applied to treat same externcl malady, although sometimes it was drunk [Kakwara 1976: 85-86].

Acalyphg phlegides seems to have been occasionally sought in Mexico. For example, the Tarahumara of Chihuahua considered the leaves as a flavoring for food dishes〔Pennington 1963:76]. Mexicans bundled up leaves and stems of this plant and crushed them to a powder to be applied to sores; they also made a tea from the plant to cure itch [Rose 1899:229]. Apparently a mouth wash for sore gums and loose teeth was alsa decocted $[$ Lewis and Lewis 1977:2613. No archaeological record found.

## SIGNIFICANCE FOR humans

Basically it seems that Acalupha has potential as a medicinal plant, prepared as an external remedy or possibly to be ingested as a tea. Whether or not $A_{\perp}$ lingheimeri can be safely consumed as a medicinal treatment or foad flavoring is unknown.

## PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD

If the plant undergoes extensive alteration in preparation as a medicine, mast likely no recognizable parts would remain in the ancient recard. Incidental introduction of ripe capsules with seeds might bring in a part apt to preserve, provided an accidental burning event or superb preservation conditions prevailed.


## habitat

Gcer saccharum ssp. qcandidentatum is commonly encountered along the stream at Ramsey Canyon. It does well in filtered light as an understory tree.

## Phendlagy

Flower and leaf buds of big-tooth maple begin to swell in March, and flowering follows shortly thereafter since immature fruits are present in April. Leaves continue to enlarge until June, at which time vegetative growth slows considerably. The fruits begin to ripen in August, and by Dctober only mature-appearing samaras cling to branches. Fruits have all dropped off by November. In November mature leaves can still be observed, but by December only dead and withered leaves are retained. Vegetative dormancy spans the period of October to early March.

## ETHNOGRAPHIC/ARCHAEULUGICAL RECDRDS

Big-tooth maple wood makes excellent fuel [Kearney and Peebles 1960:526-527J. In writing on edible plants of
northern Arizona, Bartlett [1951:52] reports that maple sugar was sametimes made from the sap of this species [as A. gegndidentatum].

Other species of maple have also been used by historic groups. The twigs of Acer Degundo were used as prayersticks by the Acoma and Laguna [Swank 1932] and Navajo [Wyman and Harris 1951:313; the Kiowa burned the wood in a peyote ceremany [Vestal and Schultes 1939:41]. Castetter and Opler [1936:44] relate how the Chiricahua and Mescalera Apache graups gathered material far sweetening by boiling $\mathrm{B}_{\mathrm{s}}$ negundg inner bark and cambium just beneath the bark. Ramah Navajo made an infusion of the branches of this species to treat swellings [Uestal 1952:36]. In the New Mexican puebla of Isleta, the supple trunks of straight young specimens of Acer glabrum were the chaice of bows; this species was sought in the Manzano mountains, some distance from the pueblo [Jones 1931:20].

The archaeological record confirms some of the historic uses nated above. Arraw shafts and utilized sticks of Acer negundg were recavered from Puebla III period cliff dwellings in Johnsan Canyon in southwestern Colorado [Nickens 1981:74].

## SIGNIFICANCE FDR HUMANS

Maple wood could be sought year round for fuel needs. Twigs and branches could alsa be acquired at any time as
prayersticks or far medicinal preparations, alang with supple trunks of young trees needed as bows. Tapping the trees for sap and peeling the inner bark to extract sweetening would likely be more productive in the period prior to resumption of vegetative growth in the spring, probably in February. This is the time of year when the trees have initiated internal transport of nutrients ta developing buds, and active cell division which produces soft inner bark tissue. Inner bark acquired in other months might not be as sweet.

## PREDICTIONS FOR THE ARCHAEDLDGICAL RECORD

Parts predicted to show up in the prehistoric record include wood in firepits and twigs and branches fashioned into artifocts. No evidence of sap or inner bark would be expected to survive, especially if the inner bark had been boiled for any period of time to remove the sugars.


Agcapucon acizonicum grows on a steep colluvial slope, in dry sail not far fram the Ramsey Canyon stream. The area is heavily shaded by a higher canopy of trees.

## PHENDLOGY

This perennial wheat grass can be recognized in May by virtue of its wide blue-green leaves. Stem and leaf growth are vigorous through June, continuing through October. Full flowering predominates for July and August. By September the first caryopses are ripe, and mature fruit is available until the end of November. In December the grass generally dies back for a five manth dormant period.

## ETHNDGRAPHIC/ARCHAEDLOGICAL RECORDS

The ethnographic record is quite sparse regarding wheat grass. Dnly the "seeds" [caryapses] of Ageqpuran Eepens, a spacies naturalized in this country From Eurasia CKearney and Peebles 1960:93], were among those formerly eaten by the Gosiute of Nevada and Utah [Chamberlin 1911:360]. Polish,

Hungarian and Roumanian peasants ate flour made from the roots of Ageqpyena, considering it a critical food in famine times [Gunda 1977: 2]. Whether groups in the New World have ever sought any native species of wheat grass is unknown. Perhaps the common occurrence of ergat, a fungus that especially parasitizes $\operatorname{g} g \mathrm{~g}_{\mathrm{g}} \mathrm{g} y \mathrm{~g}_{\mathrm{g}}$ among wild range grasses [Lewis and Lewis 1977:24], discouraged people from seeking this grass for food.

No archaeological record found, but see discussion of "Elymus complex" under Elymus.

## SIGNIFICANCE FOR HUMANS

Unknown.
PREDICTIONS FOR THE ARCHAELLOGICAL RECORD
Data too scanty for predictions.


Allium ceraunm grows in dense shade in wet soil very near the side of the stream at Ramsey Canyon. The underlying substrate is compased of averbank sediments subject to frequent flooding.

## PHENDLOGY

Some wild Aldium species are more typically found in the spring, while others are available in late summer or fall [Kearney and Peebles 1960:179-181]. Ellium cernuym, the nodding onion, is one of the iate summer/early fall species, first recagnized at Ramsey Canyon in August. By September the plants are in Eull Flower and already producing ripe seeds. Shortly thereafter they die back to graund level and are not abvious on the landscape for up to the following ten months.

## EIHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Allium cernuum bulbs have been gathered by groups all over the American Southwest and into the Great Plains area [Table 10]. Peaple have consumed bulbs and leaves of other


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Allium spp. | bulbs, 0 S Foad | Kayenta Navaja, Arizona | Whman and Harris 1951:17 |
|  | bulbs, eaten raw or cooked in ashes | Northarn Arizona groups | Bartlett 1951:50 |
|  | bulbs, as food | Pima, Arizona | Russell 1975:76 |
|  | bulbs, eaten raw ar dried for winter use | Picuris, New Mexica | ```Krenetsky 1964: 4 3``` |
|  | bulbs, eaten ram ar as a Flavoring | Cochiti, New Mexica | Lange 196日: 149 |
|  | bulbs, eaten raw or as a flavoring; dried | Zuni, New Mexica | Cushing 1974:227 |
|  | bulbs, $n s$ Faod | Gosiute, Nevada and Utah | Chamberlin 1911: 360 |
|  | bulbs, as food roasted | Comanche, Okla. | Carlsan and Janes $1940: 520$ |
|  | bulbs, eaten raw or as a Flavaring | Cahuilla, Calif. | Bean and Saubel 1972: 37 |
|  | bulbs, eaten raw or as a Flavaring | Nebraska graups | Gilmore 1977:19 |
|  | bulbs, to Flavor meat | Seri, Sonora | Felger and Moser 1976:25 |

onion species either raw or cooked, often adding them to other faod as a flavoring. The Cahuilla of California gathered wild onion bulbs just prior to full flowering in late spring or early summer [Bean and Saubel 1972:37]. Havard [1895:113] provided some historical insight into the importance of gllium as a foodstuff when he noted that "it was their abundance all over the land which gave them value, rather than their quality". He alsa noted that many early explorers were forced to sustain life by relying on wild onions.

Wild onions have been dried and stored for winter use. They have also provided material for medicinal remedies. For example, warm onions were applied externally as a relief for sare throat by the Isleta of New Mexica, who also thought that application of an onion to infected places would cure them promptly [Jones 1931:20-21].

The archaealogical record of Allidum use is scarce. Small wild onions were occasionally found in Basketmaker deposits in a prehistoric rock shelter in Val Verde County, Texas [Pearce and Jackson 1933:131]. The outer diagnostic bulb scales of Allium macrapetalum were comman in Mesa Verde period [A.D. 1180-1250] trash strata at the Salmon Ruin in northwestern New Mexica, most likely representing a food [Bohrer 1980:243].

## SIGNIFICANCE FOR HUMANS

At Ramsey Canyon the bulbs and leaves of nodding onion
could only be gathered during a relatively shart time in August and September to satisfy both food and medicinal needs. Perhaps bulbs would be preferred in August, before a plant shifted its major store of energy from bulb to developing flowers/fruit. A sharp-eyed observer who nated the exact location of a wild onion stand might be able to dig in the ground at other times of the year to harvest the overwintering bulbs.

## PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD

Unless the diagnostic outer bulb scales are preserved in protected locations, prehistoric acquisition of nodding onions is not likely to be retained in the ancient record. Eating the bulbs raw, cooked, or as a flavoring for other dishes would destroy identifying criteria. Likewise, heating onions to obtain a poultice in medicinal treatment would not provide the best conditions for preservation. Possibly bulbs roasted or cooked in oshes would occasionally preserve as complete charred specimens.


## habitat

Amocpha Exuticosa does well in partial shade along the stream at Ramsey Canyon. It can be faund on steep colluvial slopes or fairly flat land underlain by granite bedrack. The substrate is generally dry, though the roots are undoubtedly in water.

## PHENOLOGY

Indigo-bush is a medium-sized shrub that renews growth in April, signaled by both leaf emergence and stem elongation. The plant is in full flower in May and June, though it is not until September that the fruit pods first appear ripe. This first ripening caincides with cessation of vegetative activity in September. The ripe pads are available until November, at which time the plant loses all its leaves.

## ETHNOGRAPHIC/ARCHAEOLQGICAL RECDRDS

The Kiown of Oklahoma made use of the long stems of indigo-bush as a bedding material; the stems were fashioned
into a faundation for a temporary bed of leaves CUestal and Schultes 1939:31J. The Pawnee felt that by butchering meat onto a thick layer of this plant spread on the ground the meat would be kept clean [Gilmore 1977:41]. Navajo made use of A. microphyllus as a smuff for colds [Elmare 1944:55].

No archamological record faund.

## SIGNIFICANCE FOR hUMANS

In order to be fully effective, it might be better to have the indigo-bush leaves still clinging to stems gathered for bedding foundations, or for holding butchered meat off the ground. At Ramsey Canyon this would be during the months of April through November. Use of the leaves as a snuff for colds wauld span the same period.

## PREDICTIONS FOR THE ARCHAEDLGGICAL RECDRD

If indigo-bush stems and leaves gathered for a domestic purpose also carried ripe pods, perhaps some of the durable tiny seeds would enter the archaealogical record. Since the pods generally dehisce ensily, few seeds might actually be brought into a dwelling. In order for the seeds to preserve, same special condition would be required, such as accidental burning of a dwelling or burial in deep, dry deposits. The very tiny leaves of this plant wauld be difficult to recognize in archaealogical debris unless recovered via a process such as flotation.

## MABITAI

Andcapogon sacchargides does well in dry soil on the west side of the stream at Canelo Hills Cienega, in an area Fully exposed to the sun's rays. The underlying substrate consists mainly of alluvium.

## PHENDLOGY

This rabust perennial blue-stem grass can first be recognized as vegetative in June. By July flowering has commenced, followed shortly by maturity of the first grains. Flowering and grain ripening continue in tandem through the months of August and September, at which time flowering ceases and most grains observed seem mature. Leaf expansion slows in July, much earlier than the cessation of active stem elangation in October. The grass dies back in December, and remains inconspicuous on the landscape until the following June.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECDRDS

Two species of blue-stem grass were used by the Ramah

Navajo of New Mexica [Uestal 1952:15]. Ashes of the stems and leaves of $f_{1}$ scopacius provided blackening for the Enemyway ceremony, while ashes of A. Eutcatus did likewise for Evilway rites. The Omaha-Ponco of the Missouri River Region laid $\theta_{1}$ gecacdi [as $\theta_{2}$ Euccatus] on poles to support the earth covering of lodges. Little boys made play arrows from the stems of this wild grass. A decoction of chopped fine lower blades was used for bathing to treat fevers [Gilmore 1977:16-17].

The archaeological record considerably amplifies the ethnographic record by revealing a number of times when different species of blue-stem were sought in prehistory. A tentative identification of $\theta_{\perp}$ scopgriys was given to some bundled raw material for fashioning baskets, mats, etc. Found in a Basketmaker age rock shelter in Val Verde County, Texas [Pearce and Jackson 1933:115]. Andrgpggon was listed by Yark, et al. [1961:97] as amang plant remains recovered fram a feature at U-Bar Cave, a suspected ceremonial location in the A.D. 1350-1400 period in southwestern New Mexico. Salado peoples living in south-central Arizona in cammunal structures at Tanta National Monument in the A.D. 1300's made pot rests out of coils of Andegegag CBohrer 1962: 日2]. These rests permitted pottery vessels with rounded bottoms to sit upright on either a floor or on someone's head. Andropogon was also described as part of the foundation in coarse coiled basketry at Canyon Creek

Ruin in Arizona CHaury 1934:74]. At least two species of Andrapggon were fashioned into artifacts recovered from the Ozark Bluff-Dweller culture of Arkansas and Missouri
[Gilmore 1931:94]. Pieces of rape had been twisted from the long lower blades of $A_{\text {. E Eucatus, }}$ as well as netted bags, sandals and insoles for moccasins. A fragment of a mat appeared to have been made of O $_{\perp}$ ssopariys.

SIGNIFICANCE FOR HUMANS
It appears that blue-stem can serve a number of daily needs. Stems, leaves and entire plants might be gathered from July through September for basket-making, and the canstruction of pot rests, net bags, sandals, insoles, mats, and other items. Stems sought for play arrows and roof construction might not be collected until they had develaped both length and strengh during the later part of the growing seasan.

PREDICTIONS FOR THE ARCHAELLGGICAL RECDRD
Not much blue-stem evidence is expected to preserve in the archaealogisal record, due to the general perishable nature of the parts. Accidental charring might totally consume grass leaves and stems, leaving no trace of their presence. Only superior conditions of preservation, such as the interior of a dry cave, would be likely to retain evidence of use of this grass; the present archaeological record bears this suggestion out.

Angdg Existatg [L.] Schlecht. CH-5 [KA \#243-83] UA己54657


## habitat

Angda ceistata can be found in dry sail on the east side of the stream at Canelo Hills Cienega. The area is Eully expased to the sun's rays. The underlying substrate is composed of calluvium and valcanic bedrock outaraps.

## PHENDLOGY

This amnual member of the mallow family germinates in the summer months, and comes into Eull Elower in September. The plant continues to Elower profusely until it dies. Ripe fruit are available in both Dctober and November. Ihe plant is no langer abviaus on the landscape by December, but is presumably present as overwintering seeds in the soil for a number of months.

## ETHNOGRAFYIC/ARCHAEOLOGICAL RECORDS

Only two New Warld references to Angog use were located in the literature searched. The leaves of Anodg hastota have been mixed with olive ail and taken for inflammation of the stomach in Mexico [Rose 1899:230]. Anoda triqngularis
was said to be good to eat and a treatment for fever by people in the same country [Altschul 1973:187].

No archaeological record found.

## SIGNIFICANCE FOR HUMANS

The sparse nature of references to Anoda make it difficult to infer potential significance. If gogdg cristatg is not poisonous to humans, perhaps the leaves could serve as both medicinal treatment and food. If sa, they could be gathered in Ramsey Canyon during the months of September thraugh November.

## PREDICIIONS FOR IHE ARCHAEDLOGICAL RECORD

Plants gathered for eating or to be mixed in medicinal preparations are not apt to become part of the archaeological record. It is not considered that much Anodg evidence would routinely preserve in ancient sites.

Gpocynum sibiricum Jacq. [=A. suksdorfij Greene.] CH-1 [KA \#157-83] UA254B9日
 Habitat

ARocunum sibicicum can grow in sail fully saturated with water, with $100 \%$ exposure to the sun. At Canelo Hills it does well in the water-logged soils of the cienega. phendiggy

By April this peremmial Indian-hemp has renewed its growth. Then long flexible stems support rapidly expanding leaves. Vegetative growth continues until July, when the plant reaches full flowering. Mature fruits first present in August have nearly all dispersed by September. Stem elungation slows considerably in Octaber and the plant resumes dormancy from November through March. ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Apparently many members of the dogbane family (Apocynaceaej are poisonaus as well as being important rubber plants〔Kearney and Peebles 1960:651]. Gqgeynum suksdgafij Greene var. angustifoliym wooton was assayed to have 1.69\% rubber, which is a relatively high percentage for a native

Southwestern plant [Buehrer and Benson 1945:19]. This same species was immersed in cold water by the Kayenta Navajo to become an emetic medicine and ceremonial waterway chant lotion. Sometimes it was ground and mixed with frost to be used in a curative way [Wyman and Harris 1951:36]. At least two species of ARocynum were sought by the Ramah Navajo of New Mexico [Uestal 1952:39]. The leaves of A. medium served as an emetic and the plants, after having been placed on hot rocks, were applied to the head of someone with an infection. Leaves of 日. sibificum were used to treat stomach-ache and as an emetic and lotion.

Again and again in literature on historic southwestern groups the Indian-hemp species referenced is Agocunum gannabinum. Peaple in southern Utah, California and Arizona extracted fibers from the stems of this species to make ropes, twine, nets and clothing. The woody stems were first soaked in water, and the bark removed, leaving a soft, silky Eiber which is very strong and durable [Palmer 1678:649]. Southern Paiute groups had many uses for this species whenever strang, flexible fibers were needed [Kelly 1964]. Fourteen northern Paiute groups used the bark fibers to make rope and string; they generally found the plant in the moist rich sail of river bottoms [Stewart 1941:428]. The Luiseno of the California coast made items of clathing from the fibers, fashioning twine by rolling the fibers between a hand and a bare thigh [Sparkman 1908:201-202].

Apgcynum canngbinum has also been sought for needs other than Fibers. Along the upper Rio Grande river drainage in New Mexico, Spanish folks laid the stems of this plant in the sun to dry the milky fluid released, and then chewed the dessicated little balls as chewing gum CCurtin 1965:111J. Also in New Mexica Picuris children made small toys from the stems [Krenetsky 1964:43].

In an attempt to use a property of a plant to treat a human condition, Acoma and Laguna mothers in New Mexico rubbed the crushed milky leaves of spocunum viride on their breasts to give more and richer milk. A tea made from this plant served the same purpose $[$ Swank 1932:27].

The archaealogical recard reveals many identifications of Indian-hemp. Specimens of A. canabinum fibers, threads, twine and cordage were listed by Gilmare [1931:100] as having been used by the Ozark Bluff-Dweller culture of Arkansas and Missouri. Aggeynum fibers fashioned inta a cord net and cordage were recovered from a Basketmaker rockshelter site in Val Verde County, Texas CPearce and Jackson 1933:38, B93. Twine and plant stalks were found in the Pueblo period occupation [A.D. 600-800] of Paiute Cave near Overton, Nevada [Harrington 1930:115, 117]. Nusbaum recovered Gpgcynum fiber string fram Cave Du Pont, a Basketmaker cave in southern Utah [1922:103], and Jennings [1957:228] noted fibers as having been used by the Danger Cave inhabitants of the Great Basin area of Utah. Hewitt
[1980a:6B] listed plant Fibers identified as Agocunum/
Ascledias as forming one of the largest categories of cordage materials faund in Cowbay Cave in central Utah. While the bulk of the evidence suggests prehistoric use of fibers to fill material culture needs, one reference implies ingestion. Roust [1967:56,66] listed an Apocunum twine ring in a human coprolite recovered fram Lavelock Cave in Nevada; likewise he noted a similar item in a coprolite fram Hidden Cave. This limited data may reveal that the Fibers were eaten in famine times.

## SIENIFICANCE FOR HUMANS

Long Indian-hemp stems with flexible bark fibers wauld be available April thraugh October. The Eibers can be fairly easily peeled from the stems in long strands; the accompanying latex serves as a ready "glue" when wrapping the fibers. As for the ingestion of the twine, presumably it could be eaten fresh during the growing season, or at any time of the year, as the material lends itself to indefinite storage. Possibly the latex would have to be leached out prior to human consumption.

## PREDICTIDNS FOR THE ARCHAEOLOGICAL RECORD

Itams constructed of gogeynum fibers could be recovered from well-preserved locations. Evidence of human consumption might show up in human coprolites. Leaves and latex balls used in various ways would probably not preserve.


ARgdantherg undulata grows in dry sail on the flanks of the stream at Canelo Hills Cienega. It can be found among other dense vegetation which provides a good deal of shade for individual plants. The local substrate is composed of colluvium, with volcanic bedrock.

PHENALQGY
This perennial herbaceous plant of the cucurbit family is first noticeable in June, emerging from a large underground raot. It appears to continuously flower far the months of July and August, but by September flowering has ceased and fruit begins to ripen. Active stem and leaf growth seem to have stopped by Dctober, the manth when mature fruit become availabe. The plant resumes darmancy For seven manths, beginning in November.

## ETHNOGRAPHIC/ARCMAEOLQGICAL RECORDS

No historic information on the use of grodantbera was Found. However, archaealogists recovered remains of this
genus in at least two locations in Mexica. Its seeds were Found in several levels of a cave site dating to A.D. 600 near the Rio Zape in Durango, suggesting to researchers the occupants had considered the resource a food [Brooks et al. 1962:3673. Apgdantherg remains were alsa cited by MacNeish [1967:290] as among those recovered from sites spanning a long period of prehistory in the Tehuacan Valley.

SIGNIFICANCE FOR RUMANS
Possibly the seeds and/or fruit of this plant could be eaten, as the cucurbit family has a number of members with edible fruit. If mature fruit were sought, as is suggested in limited prehistoric references, September and October would be the months of harvest. It is quite likely, however, that mature fruit would remain intact for a number of months beyond October, as is the cose with many wild members of the cucurbit family.

## PREDICTIONS FOR THE ARCHAEOLDGICAL RECORD

Chances of finding seeds or fruit would depend on ancient methods of preparation. For example, parching or roasting the seeds increase chances of preservation, while boiling reduces them. The delicate fruit rind might preserve if protected in cave deposits or other dry sites.
 habitat

Acalia Eacemosa grows in deep shade in a boulder and cobble field near the Ramsey Canyon stream. Little sun filters through the dense upper story of trees, and the sail is generally damp.

PHENDLDGY
Although no voucher specimen was secured due to the rare status of this species at Ramsey Canyon, observations on life-cycle events on this member of the ginseng family were routinely made. In July this perennial herb grows robustly from an obviously large underground storage argan. Rapid vegetative and reproductive development occur in July and August, with immature fruit present in September. The plant has died back to ground surface by November, and remains dormant for eight months, until the following July. ETHNOGRAPHIC/ARCHAEOLOGICAL RECDRDS

日rglig is of ethnobotanical interest, for it derives from the same family as Ranax, [true ginsang], a genus
widely used in many parts of the world. Like ginseng, the root of Acalin has been frequently cited as of interest to humans as a Elavoring, medicine and food. According to Kearney and Peebles [1960:605], the underground parts of Acalia are spicy-aramatic, and the root of $\theta_{\mathcal{L}}$ cacemosa has been an ingredient of root-beer. In the Appalachian area of the eastern United States, the root was applied externally to relieve and reduce swellings, and a root decoction was drunk for kidney and liver traubles [Bolyard 19日1:35-37]. Balyard states the Cherokee took the root as a tea for arthritis and backaches, and the Chippewa and Shawnees used it for a variety of other purposes. The roots of this plant, ulone or mixed with the bark of a species of Rinus, formed the basis of a popular 19 th century caugh syrup [Lewis and Lewis 1977:302]. Yanousky [1936:47] reports the Menominees ate the roots with wild onions, gooseberries and maple sugar.

Apparently parts of Acalid other than the root have fulfilled human needs. In the Appalachian area, people used the plant as a carminative [relieves gas in the stamach or intestine] or to ease coughs or other pains [Core 1967:210]. Chumash in sauthern California sought Aralig caliEganicg for medicinal purposes [Timbraok 1984:164]. In China, young shoots and leaves of Acalia chinensis have been eaten, and the flower used in medicine. Two other species of Acalia served medicinal needs [Altschul 1973:211].

No archaeological record found.

## SIGNIFICANCE FOR HUMANS

Young shoots of this plant would be available in July, and flowers could be gathered in August and September. Actively growing leaves are present at least for three of the faur months the plant is active above ground, JulySeptember. Presumably one would not harvest roots during the growing season, when much of the plant's nutrient reserves are located in the visible vegetative and repraductive parts. Once the plant dies completely back to ground level, root harvesting would require recall of plant locations as well as the ability to recagnize any aboveground signals of a plant's presence. The roots would likely vary in chemical make-up at variaus times during the dormant season, offering different properties in the spring as the mechanisms to resume growth are set in motion. Possibly people wauld be aware of these differences, and prefer to harvest in a specific season.

## PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD

It would be quite unlikely that perishable flowers and young shoots of Gralig wauld survive in the ancient record. Roots might preserve if burned or in a location where conditions foster dessication. Recognizing roots would require detailed knowledge of rat anatomy and morphology of a broad range of plants, and even then confusing alternatives might preclude positive identification.

AEbutys grizgnicg [Gray] Sarg.
RC-4 [KA \#7B-83] UA255000


HABITAT
Acbutus arizonica does well in Ramsey Canyon on a steep slope underlain by pockets of colluvium and granite. The area is heavily shaded by trees, with less than $25 \%$ exposure to direct sunlight. The soil is fairly dry.

## PHENDLOGY

This evergreen madrone tree begins stem elongation in March, two months before the leaves start to noticeably enlarge. All vegetative activity ceases in September. Full flowering spans the two months of May and June, and immature fruit can be observed clinging to branches for many succeeding months. Ripe red fruit was first documented in January, fully eight months after flowering, and remained until active growth resumed in March.

EIHNOGRAPMIC/ARCHAEOLOGICAL RECORDS
Acbutus afizonica supplied edible fruit to the Tarahumar of Chihuahua [Pennington 1963:119], as well as to the Tepehuan [Pennington 1969:137]. The Tepehuan made bowls and
spoons from wood of this species [Pennington 1969:220]. The leqves of another species, Arbutus menziesij, were once used by the Cahuilla of southern California as a medicine for stamach ailments [Bean and Saubel 1972:40]. Madrane fruit has been eaten in California [Yanovsky 1936:50]. No archaealogical record found.

## SIGNIFICANCE FOR HLUMANS

Fruit of Acbutus qeizonica can be gathered in January and February, during the harsh part of winter in Ramsey Canyan. As a Food resource clinging ta branches above snow level, it wauld provide a critical food if provisions had run law. Leaves from this evergreen species are available year raund to satisfy medicinal requirements. Likewise the wad cauld be acquired at any time for production of various household utensils.

PREDICTIONS FDR THE ARCHAEOLOGICAL RECORD
Depending on whether madrone fruit is normally eaten raw, or on how it is prepared, the seeds might survive. If the fruit coat, and not the hard seeds, is the object of interest, seeds discarded in a habitation could remain as evidence of madrone use. Wood fashioned into bowls or spoons would presumably be recovered in any context where non-burned wood preservation is Eostered, such as in a dry cave.

habIIAT
Acctostaphulas pungens does well in a site less than 10 meters from the Ramsey Canyon stream. The shallowly sloping substrate in the area is composed of granite and colluvium. Generally the location is quite dry.

## PHENDLOGY

This evergreen point-leaf manzanita shrub flowers in February, after having displayed flower buds for the previous 5 months. Flowering has ceased, and immature fruits are present by March; it takes five months before the first ripe fruits show up in fugust. Stem elongation andor leaf growth span the period from March until September, by which time all vegetative activity has slowed considerably. The dormant season for this shrub seems to be during the months of Dctober through February.

ETHNDGRAPHIC/ARCHAEOLOGICAL RECDRDS
The ethnagraphic recard documents extensive use of a number of species of manzanita, especially for $A_{\perp}$ pungens [Table 11]. For example, people all over the west have

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. glauca | fruit, as food raw or dried and ground into flour | Cahuilla, Calif. | Barrows 1900:64 |
| A. parryi | Eruit, as food graund | Luisena, Calif. | Sparkman 1908:230 |
| A. patula | fruit, as food | Kayenta Navaja, Ariz. | Wyman and Harris 1951:35 |
|  | leaves, as ceremonial emetic and "tobacca" | Kayenta Navajo, Ariz. | Wyman and Marris 1951: 35 |
| A. pungens | flowers, as food | Apache, Arizona | Buskirk 1949:341 |
|  | fruit, as beverage | S. Paiute, Utah and Navada | Bye 1972:94 |
|  | fruit, as beverage | Western Apache, Ariz. | Gallagher 1977: 25 |
|  | fruit, as food or medicinal tea | San Luis Potosi, Mexica | Bye 1979:145 |
|  | fruit, as food | Apache, Arizona | Buskirk 1949:341 |
|  | Fruit, as food | Western Apache, Ariz. | Gallaghar 19\%7:25 |
|  | Eruit, as Fond; mashed with water | NE Yavapai, Ariz. | Giffard 1936 |
|  | fruit, eaten raw or stored | SE Yavapai, Ariz | Gifford 1932:213 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. pungens | Eruit, as Food; sun-dried; stored | Cahuilla, Calif. | Bean and Saubel $1972: 40-41$ |
|  | Fruit, as food | Tarahumara, Chihuahua | $\begin{gathered} \text { Penningtan 1963: } \\ \text { 119, 123, 187 } \end{gathered}$ |
|  | Eruit, as frod | Warihio and Tarahumara, Sanara | Gentry 1942:64 |
|  | fruit, as food, raw or dried; Flour made into mush, bread | S. Paiute, Utah and Nevada | Bye 1972:94 |
|  | Fruit, as food, raw or ground up | Tepehuan, Chihuahua | $\begin{gathered} \text { Pannington 1969: } \\ 137,183-184 \end{gathered}$ |
|  | leaves, mixed with "tabacca" | Cahuilla, Calif. | Bean and Saubel 1972: 40-41 |
|  | leaves, smaked as "tobacca" and as a medicine | 5. Paiute, Utah and Nevada | Bye 1972:94 |
|  | leaves, smoked as "tobacea" | Cochiti, New Mexico | Lange 1968:149 |
|  | leaves, as ceremonial emetic and smaked as "tobacco" | Ramah Navaja, New Mexica | Vestal 1952:38; Wyman and Harris 1941:58 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. pungens | leaves, as a medicinal tea | Iarahumara, Chihuahua | $\begin{gathered} \text { Pennington 1963: } \\ 119,123,187 \end{gathered}$ |
|  | leaves, os a medicinal tea | Cahuilla, Calif. | Bean and Saubel 1972: 40-41 |
|  | leaves, as a medicinal tea | Tepehuan, Chihuahua | Pennington 1969: 137, 183-184 |
|  | seeds, as food ground into a meal | Cahuilla, Calif. | Bean and Saubel 1972: 40-41 |
|  | seads, as Frod roasted and ground | Tarahumara, Chinuahua | $\begin{gathered} \text { Penningtan 1963: } \\ \text { 119, 123, 187 } \end{gathered}$ |
|  | waod, digging sticks | Apache, Arizana | Buskirk 1949:341 |
|  | wood, as fireword | Cahuilla, Calif. | Bean and Saubel 1972: 40-41 |
| A. uva-ursi | leqves, smoked as "tabacca"* | Uarious groups of the Missauri River regian | Gilmore 1977:56 |
|  | leaves, smoked as "tabacca" | Picuris, New Mexico | Krenetsky 1964: 44 |
|  | leaves, smoked as "tobacca" | Santa Ana, New Mexico | White 1945:559 |
|  | leaves, smoked as | Jemez, New Mexico | Cook 1930:20 |


| SPECIES | PART AND USE | GROUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. uva-ursi | ```tanmic acid, as a medicine``` | ```Spanish-Americans, New Mexica``` | Curtin 1965:68-69 |
| Arctostaphylos spp. | Eruit, as Food crushed | Kiliwa, Calif. | Meigs 1939:9 |
|  | Eruit, as Food raw or cooked; dried and ground | Various groups in $5 W$ United States | Yanovsky 1936:50 |
|  | leaves, bailed as a medicine | Kaibab Paiute | Kelly 1939:153 |
|  | leaves, smaked as "tobacco" | Kaibab Paiute and Kaiparowits Paiute, Arizana and Utah | Kelly 1964: 46, 154 |

*species listed as a symonym.
harvested and eaten ripe point-leaf manzanita fruit, as well as made a beverage and medicinal tea out of it. Graups ate the fruit raw, or ground into a flour; frequently it was dried and stored for winter use. Palmer describes in detail the preparation techniques of one species, Arctostophylos tomentosg [197日:599]. Its fruits were dried in quantity, and then used in a fermented beverage, as a mush, or eaten dry. When ground to a fine flour, it was made into a thin cake and then cooked in ashes, providing a sweet meal. In an alternate preparation technique, the Northeastern Yavapai of Arizona pounded the fruit on a metate, then placed the mashed material in a water-tight basket, and drank the mixture; sometimes the hard parts were spit out cGifford 19363. Not only were the fruit frequently eaten in historic times, but a few groups were said to grind the seeds into a meal, sametimes roasting them beforehand (Bean and Saubel 1972:40-41; Pennington 1963:119, 123, 1873.

Hints at timing of manzanita fruit harvest are in the literature. The Cahuilla in southern California customarily gathered the berries from June-September, sun-dried them and stored them for the future. Berries were callected as soon as they ripened, or the birds would devour them; manzanita thickets were known locations for animal diversity, providing a rich hunting opportunity [Bean and Saubel 1972:40-41J. The Kiliwa of California crushed raw berries and ate them when ripe in June and July CMeigs

1939:9]. The Kawaiisu of the same state apparently did not distinguish between different species of manzanita, and were said to gather ripe fruit in August and September [Zigmund 1981:12].

Manzanita leaves have provided many groups with a uild "tabacco" [not to be canfused with cultivated tobacca Nicatianal, either alone or when mixed with other material. The Kaiparowits Paiute considered mixing of the leaves in a smoking mixture an old custr $[K e l l y$ 1964:46, 54]. People also prepared ceremonial emetics and medicinal teas from the leaves; Spanish-Americans living along the Ria Grande River in New Mexico sought them for the medicinal properties of their tannic acid [Curtin 1965:6日-69].

People have alsa brought the wood of manzanita into their firehearths, as well as fashioning digging sticks from it. A single reference to the consumption of flowers [Buskirk 1949:341] reveals yet another part of this plant that has served human needs.

Manzanita remains seem to be rare in Southwestern United States prehistoric sites, but occasionally a record of use is revealed. At Grasshapper Pueblo in central Arizona, occupants in the period A.D. 1300-1400 left fruit pits in three ovens and in seven other room contexts CBohrer 1982:98]. Bohrer [1982:102] pointed out that the seeds of some Grctostaphylos can be scarified to promote germination
via fire, a fact possibly also known ta prehistoric folk. Elsewhere in Arizona, manzanita seeds were recognized in Copper Basin Hohokam sites dating to the period A.D. 7001300 in the Prescott region of the west-central part of the state [Gasser 1977:304-305]. In one of these sites, over 500 seeds were found on a series of ancient floors. In Utah, three fruits were excavated in a Basketmaker IIIPueblo cave in the Zion National Park area [Jones 1955:198]. SIGNIFICANCE FOR HUMANS

The significance of point-leaf manzanita plants for humans seems quite high. Flowers, fruits, seeds, leaves and wood could all be collected. Flowers are present in February, when mast other plant activity is still much reduced, and would perhaps represent an important food at this time. Ripe fruit for food, beverages and medicinal teas is available for at least the three months of August through October; seeds to be ground into flour can be gathered simultaneously with the fruit. Leaves of these evergreen plants intended for medicinal, ceremonial or smoking purposes may be picked off the branches at any time during the year. Likewise, wad sought for firehearth fuel or as raw material for digging sticks or other tools can be acquired during any month.

PREDICTIUNS FOR THE ARCHAEOLDGICAL RECDRD
The practice of roasting manzanita seeds prior to grinding them far a flour might insure that some would enter
the prehistoric record and be recovered centuries later as representative of plant use. Most references to the fruit include drying [not necessarily via fire], grinding to a flour, mashing with water or consumption of the berries raw. None of these practices would foster preservation of recognizable parts, except for the potential of seeds to be recavered in human coprolites, Leaves ground up as tobaceo, or made into various teas, seem unlikely to preserve. Charred hearth fuel, or wooden implements protected in dry deposits cauld presumably be faund by excavators centuries later.


Asclepigs subverticillata is a perennial herb that does well on the dry stream flanks at Canela Hills. The sail is dry and exposure to the sun is partially reduced by the shade of surrounding vegetation.

PhENDLDGY
This milkweed plant begins rapid vegetative growth in June, including the development of flower buds. By July some of the flowers have bloomed and immature fruit is present, but the full period of flowering does not occur until the months of August and September. Ripe fruit can be found in September, and the reproductive structures are no longer obvious by Dctober. During the entire growth period the leaves and stems actively elongate and expand until just prior to dormancy, which occupies the months of Detober through May.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

In general milkweed plants are dangerous plants to both
livestock and humans, due to the cardiac glycosides known to be present in almost all spacies of this genus' Clewis and Lewis 1977:52]. It is with some surprise, then, that the ethnographic literature holds so many references to the use of various species of milkweeds. Eight separate species of Asclezias are listed by Yanovsky [1936:52] as having been utilized by various New World groups. The parts employed include chewing gum from the stem sap, young buds arid blossoms, seeds, roots, leaves and green fruit.

The literature offers a few hints of specific uses of Asclepias subvecticillata. Hough [1898:148] recorded that an infusion of Asclepias vecticiliata was drunk by the Hopi to increase the flow of milk. If Asclepias galigides can be considered a synonym for A. $_{\text {s subyerticillatg }}$ (Kearney and Peebles 1960:661], additional records of milkweed use are available. For example, young Zuni boys sought out A. galioides plants to acquire the first buds to eat [Stevenson 1915:65]; likewise White Mt. Apache children of Arizona ate the first buds [Reagan 1929:155]. These references are supported by Cushing's comment [1974:561] that the Zuni made greens fram the young milkweed pods. Pods that were about two-thirds ripe were gathered for spinning, as fully ripe pods were too dry for this purpose. Some of the beautiful white dance-kilts, women's belts, and other articles were said to have been woven of the fiber of $A_{1}$ goligides, as well as used by the rain priests for making cords to attach
plumes to certain prayer sticks [Stevenson 1915:77,88]. The
Ramah Navajo of New Mexico spun the seed hairs of this species, and used the strings in prayer sticks [Uestal 1952:39]. Swank [1932:30] offers additional uses for the silk from the seed of A $_{\text {g gligides. It seems that when it }}$ became ripe enough ta separate easily, the Acoma and Laguna of New Mexico mixed it with grease and chewed it as a gum. Mothers rubbed the crushed leaves on their breasts to give richer milk, and drank a tea made fram the plant for the same purpose.

Ethnographic references to other species of milkweed are abundant, and have been encapsulated into Table 12. From this data it is clear that numerous parts have served peaple. Clearly the poisonous qualities are either lacking in some of the species referenced, or peaple have learned when to pick or how to render certain parts harmless.

A number of references are to the use of milkweed as food. It seems the young pods have been eaten by more than one group. Dther parts eaten include immature seeds and leaves, either boiled or eaten raw. References to the use of milkweed being cooked with meat can perhaps be explained by a chemical present. According to Bartlett [1951:52] milkweeds cantain a substance called asclepain, which can be used as a substitute for papain for tenderizing meat.

Many milkweed uses appear as medicinal treatments or as everyday non-food needs. The milky sap has been chewed by

| SPECIES | PART AND USE | GRDUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| A．albicans | roots cooked for medicinal shampaa | Seri，Somora | Felger and Maser 1974：419－420 |
|  | plant as medicinal | Seri，Sonora | Felger and Moser 1974 |
| A．日riqcarpa | stems used for fiber | Luisana，California | Sparkman 190日： 230 |
|  | sap from stems for gum | Luiseno，Californio | Sparkman 190日 |
| A．erosa | sap from stems heated and then chewed as gum | Cahuilla，California | Barrows 1900：75 |
| A．hypoleuca | medicina for overeating | Tepehuan，Chihuahua | Pennington 1569 |
| A．invalucrata | plant applied topically for veneral disease | Navajo | Wyman and Harris 1941： 61 |
|  | rant heated and used For toathache | Kayenta Navajo | Wyman and Harris 1951：36－37 |
|  | some part chewed as gum | Hopi | Whiting 196E： 97 |
| A．latifalia | milky Juice Fram stems as chewing gum | Ria Grande Spanish | Curtin 1965：110－111 |
|  | Fresh sap as external medicine | Rio Grande Spanish | Curtin 1965 |
|  | lanves and stams graund as medicinal pouder | Isleta，New Maxica | Jones 1931：23 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| A. latifalia | young plants dried and used as meat flavoring | Picuris, New Mexica | Krenetsky 1964:44 |
| A. Linaria | leaves as medicinal tea | Tepehuan, Chihuahua | Penningtan 1969 |
| A. sordida | tiny Eruits; Food | Tepehuan, Chihuahua | Pennington 1969 |
| A. Speciosa | possible food | Hopi, Arizana | Whiting 1966:87 |
|  | cooked with meat | Hopi, Arizona | Bartlett 1951:52 |
|  | milky fluid mixed with black clay as gum | Chiricahua and Mescalero Apache, New Mexico | ```Castetter and Dpler 1936:45``` |
|  | eaten occasionally | Paiute, Duen's Valley California | Steward 1933: 242 |
| A. strictiFlora | Fruits; food in Sept. | Tepehuan, Chihuahta | Pennington 1969 |
| A. subulata | stem chewed for emetic; dasage carefuliy given | Pima, Arizona | Curtin 1984: 81 |
| Asclepias spp. | gum, fiber; one species as Fand May-June and seeds harvested later | Cahuilla, Califarnia | Bean and Saubel $1972: 43-44$ |
|  | young pods cooked | Kiowa, oklahoma | Vestal and Schultes $1939: 48$ |

Table 12 [cont.] Ethnographic references to the use of Asclegigs

| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Asclepins spp. | leaves boiled and drained or eaten raw | Iarahumara, Chihuahua | Pennington 1963:127 |
|  | leaves dried, crushed and added to water as a medicine | Navajo | Elmore 1944:69 |
|  | plants eaten raw or boiled | Navajo | Elmare 1944:69 |
|  | roats and unripe pods eaten raw | Jemez and ather Ria Grande Pueblos | Castetter 1935:17 |
|  | immature seeds as food | Jemez, New Mexico | Conk 1930:20 |
|  | medicine and additive to an alcoholic | Western Apache, Arizona | Gallagher 1977:63 |

many as a form of gum. It has alsa been applied externally to treat various medical conditions. Leaves have been dried and ground as medicinal powders and for steeping as a tea. Both the roots and stems are recorded as occasionally needed parts.

The archaeological record does not offer extensive evidence of milkweed use. Plant fibers identified as Apocynum<Asclepias formed one of the largest categories of cordage materials recovered from Cowboy Cave in central Utah [Hewitt 1980a:68], Asclepigs fibers were extensively emplcyed during some of the occupation of Danger Cave in the Great Basin area of Utah [Jennings 1957:228]. The stems and pods of some species were found in quantity in Bat Cave stratigraphic deposits, on the shore of ancient Lake San Augustin in south-central New Mexico [Smith 1950:173].

## SIGNIFICANCE FDR HUMANS

Availability of Asclepias subuexticillata at Canelo Hills spans the period June-September. Presumably the milky sap could be obtained at any time during this period. Likewise leaves and stems could be continuously harvested for medicinal or fiber needs. July and August seem prime months to gather the young pods, as by September some of them are mature. Ripe pods and seeds seem restricted to the month of September, possibly a bit longer. Roots might be harvested during the period the plant is actively grawing, or after it has resumed dormancy if its location is known.

## PREDICTIONS FOR THE ARCHAEDLDGICAL RECDRD

The most likely milkweed parts to preserve in archaealogical sites include the stems, stem fibers and mature seeds. Mature pads might alsa survive if canditions of preservation were accomodating. Less likely to preserve in recognizable condition would be the young pods, milky sap, leaves crushed to a powder, roots heated in preparation, young plants cooked with meat, or immature seeds. It seems possible that the prehistoric record might not retain the full complement of evidence of milkweed use.


Asclepias tuberagsa grows on a dry east-facing shallow slope above Canelo Hills cienega. The location receives $100 \%$ exposure to the sun's rays, and the soil seems generally very dry.

PHENOLOGY
This perennial herbaceous milkweed becomes obvious during the manth of June, when active stem and leaf growth resumes, sustained by a large underground root. Plants are in full flower for the two month period of July and August, when a show of flowering attracts swarms of butterflies. By September the leaves have reached full growth patential and flowers have withered. Ripe fruit is available in Dctober and November, when the plants resume darmancy. Above ground parts are not visible between December and May. ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Historic groups have found a variety of uses for parts of $A_{1}$ tubecosa, notably as medicines. For example among people living in the Appalachian area, a decaction of the
raats was given as a tanic and for pleurisy and lung ailments [Balyard 1981:46-47]. A tea made fram the plant served a patient sick with pneumonia. Macerated raats were placed on wounds by Menominees and Omahas, who alsa made leaves into a tea for dropsy, and a poultice af the plant to treat poisonous snakebites. A tea made by Mexicans Eram this species was said to be a cure for all ills [Altschul 1973:230]. The Tarahumara of Chihuahua dried and pulverized the stems, and sniffed the powder to relieve nasal obstruction [Pennington 1963:188]. Ramah Navajo in New Mexico applied a cold infusion of the roots to coyote or dog bites, and drank a decaction of the leaves and stems for influenza [Uestal 1952:39]. Plains Indians groups of the Missauri River region ate the root raw for lung troubles, ar chewed and put it into wounds. In the Omaha tribe, ceremonies connected with digging, preparing and distribution of the root medicine occupied faur days [Gilmare 1977:57].

As듀규률뮨 tuberasa has alsa been eaten. According to Palmer [1870:405], the rather cansiderable undergraund roat was boiled For Food by North American groups. The Sioux of the Upper Platte River gathered the flowers in the morning befare the dew evaporated and derived a crude sugar from them. They also ate the young seed pads after boiling them with buffalo meat. Canadian groups used the tender shoots as asparagus. A similar reference pertains ta the Appalachian mountains, where young shoots have been eaten as
potherbs, and a crude sugar prepared from the flowers cCore 1967]. Yanavsky [1936:53] lists the roots as having been boiled by the Sioux; seed pods boiled with buffalo meat; tender shoots used as greens, boiled like asparagus by the Delaware Indians; and buds dried for winter use.

No archaeological record faund.

## SIGNIFICANCE FOR HUMANS

Asclepias tubecosa could be routinely depended upon, as the large root would provide reserves for the plant to grow and flower under even the harshest of climatic regimes. Young shoots would be available in June, buds and flowers in July and August, and immature pods from July through September. Use of the underground storage root as a boiled foad could occur during the active growing season [JuneNovemberj or at other times, if the location of individual plants were known. Harvest of entire plant, stems, or roots for various medicinal needs would parallel the availability of the parts for food.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD
Likelihood of finding young shoots, flowers, buds or young pads in the ancient recard seems low, due to the perishable nature of these parts. Methods of preparation such as boiling, macerating, and pulverizing would further reduce chances of survival and recognition. Only fortuitous preservation, such as in a catastrophic fire, might reveal the use of this species in a prehistoric setting.

Berberis wilcoxil Kearney
RC-1 [KA \#61-83] UA254985; RC-1 [KA \#276-84] UA254474


Becberis wilcoxil grows in a dry site on a shallow slope in Ramsey Canyon. Surrounding vegetation provides some shade, offering up to $50 \%$ cover from exposure to the sun. Granite bedrock is present in the area.

PHENOLOGY
Barberry is a conspicuous evergreen shrub of the Ramsey Canyon vegetation by virtue of its everpresent spiny leaves. Active elongation of twigs and stems occurs during the months of March though July, after which time vegetative activity declines significantly. The bulk of new leaf development coincides with three of the five months of active stem growth. March is the month of full flowering. Immature fruits, present April through June, are mature by July and were observed to remain clinging on branches for a full eight months, until vegetative growth reactivated in March of the following year.

## ETHNOGRAPHIC/ARCHAEOLQGICAL RECORDS

Although no specific ethnographic citation to Berberis wilcoxii has been located, many references have been made to historic use of barberry parts [Table 13]. It appears that the pollen, fruit, leaves, branches, wood, raots and root bark have all served humans in same way. The fruit has been of prime impartance as a fand, beverage and dye material. The roots have provided a variety of madical treatments as well as a yellow dye. Leaves and branches have been bailed to treat the sick, while tools and ceremonial objects have been fashioned from the wood. Even needs for the callection of pollen and root bark are documented.

The archaeological record retains scant evidence of barberry in prehistaric settings. Berberis repens was listed by Cutler [1952:479] as one of the wild plant remains identified from Mogollon affiliated Tularosa Cave in southwestern New Mexica. Berberis fremontif was also recovered in two of 15 locations examined from Cowboy Cave in central Utah [Barnett and Coulam 1980:130].

## SIGNIFICANCE FOR HUMANS

If it can be assumed that Becbecis wilcoxii might be utilized in ways similar to those suggested by the ethnographic literature, the presence of berries clinging to branches for up to eight months becomes significant. Such a resource might be critical during the dormant winter months when food is difficult to acquire. There might well be

Table 13. Ethnographic references to the use of Berberis.

| SPECIES | PARI AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| B. aquifolium | fruit, steeped for a beverage | Many groups | Havard 1896:45 |
|  | plant, steeped in water as a medicine | California groups | Palmer 1878:650 |
|  | plant, fresh or dried, made inta green dye | Navajo | Bryan and Young 1940: 37 |
|  | plant, chewed in deer hunt magic or as tea | Acama and Laguna New Mexico | Swank 1932:32 |
| B. Fendleri | fruit, eaten | Jemez | Cook 1930:21 |
| B. Fremontii | branches, bailed to treat the sick | Spanish, Rio Grande of New Maxico | Curtin 1965:145 |
|  | Eruit, crushed Ear purple skin dye | Zuni | Stevensan 1915: 88 |
|  | roots, boiled and used to bathe tubereular patients | Spanish, Ria Grande of New Maxica | Curtin 1965:146 |
|  | wood, made into a cross to protect a person | Spanish, Rio Grande of New Mexico | Curtin 1965:146 |
|  | wood, as tools, arraws, spindle shafts, battons | Hopi | Whiting 1966:76 |
|  | wood, for ceremonies because of yellow color | White Mt. Apache, Arizana | Reagan 1929: 155 |


| SPECIES | PART AND USE | GROUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| B．Fremontii | used for dyeing buckskin yellow | Navajo | Matthews 1886：770 |
| B．haemato－ carpa | Fruit，used in September for jelly | Chiricahua and Mescalera Apache | $\begin{aligned} & \text { Castetter and Dpler } \\ & \text { 1936:46 } \end{aligned}$ |
|  | roats，used to dye basket splints yellaw | Western Apache， Arizona | $\begin{aligned} & \text { Gallagher } \\ & \text { 1977:63, 7B, } 110 \end{aligned}$ |
| B．hatera－ phylla | fruit，eaten by children | Argentina | Altschul 1973：70 |
| B．longipes | Fruit，crushed For a beverage | Mexico | Altschul 1973：70 |
| B．repens | Fruit，eaten | Many groups | Havard 1896：45 |
|  | leaves，bailed as a medicine | Spanish，Rio Grande of New Mexico | Curtin 1965：201 |
|  | leaves，Eresh or bailed as a cure－all | Kayenta Navaja | Wyman and Harris 1951：23 |
|  | ```plant, ceremonial emetic``` | Ramah Navaja | Vestal 1952：2B |
|  | plant，used as lotion For scarpion bites | Ramah Navajo | Vestal 1952：2日 |
|  | plant，bailed as a blood tonic tea | Picuris | Krenetsky 1964：44 |

Table 13 [cont.] Ethnographic references to the use of Berbecis

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| B. repens | plant, sprinkled on grass where lightning struck near livestack | Kayenta Navaja | Wyman and Harris 1951:23 |
|  | pollen, used in infusions | Kayenta Navajo | Wyman and Harris 1951: 23 |
|  | roots, for alcohalic beverage | Western Apache, Arizona | $\begin{gathered} \text { Gallagher } 1977 \\ 63 ; 78 ; 110 \end{gathered}$ |
|  | roots, tea made for tuberculosis | Western Apache, Arizona | Gallagher 1977 <br> 17; 63; 110 |
|  | rats, decaction Eor canstipation | Ramah Navajo | Uestal 1952:28 |
|  | woad, for tools, arraws, spindle shafts, battens | Hopi | Whiting 1965:76 |
| B. trifaliata | Fruit, eaten | Mexico | Altschul 1973:70 |
| Berberis spp. | Eruit, eaten | Many groups | Yanousky 1936: 25-26 |
|  |  | Many groups | Standley 1912:457 |
|  |  | Mescalera Apache Jemez | ```Castetter 1935: 19``` |
|  | plant, medicine and emetics | Navajo | Wyman and Harris 1941:56, 58 |

Table 13 [cont.] Ethnagraphic references ta the use of Berberis.
REFERENCE
Kokwaro 1976:35
Kakwara 1976: 35
Kearney and Peebles
1960: 3 20
occasions when the fruit would be clinging to branches above the snow at Ramsey Canyan.

Nearly all other parts of barberry could be acquired year-round. This includes the leaves, branches, wood, roats and root bark, although underground parts might be less likely to be dug from frozen soil in winter months. Pollen could only be gathered in the month of March. pREDICTIONS FOR THE ARCHAEDLOGICAL RECORD

OF all the parts utilized, those likely to preserve in the ancient record would be the fruit, seeds, and wood. Carbonization or protection would play key roles in preservation. Any part subjected to steeping, boiling, or crushing, common preparation tehniques associated with barberry, would be unlikely to survive.

Berlandierg lyrgta Benth. var. macroghyllag Gray CH-6 [KA \#161-日3] لАА254903


## HABITAT

Beclandiera lymata grows in a very sunny location on the dry stream flanks to the east of Canelo Hills Cienega and stream. The substrate is composed of colluvium, underlain by valcanic bedrock. In general the area is very dry. PHENOLGGY

Perennial herbaceous Beflandierg is quite active during May, when vegetative growth and full flowering can be observed. Flowering continues for the months of June, July and August, and ceases by September. Active stem elongation and leaf growth extends throughout the summer months, until the plant becomes dormant in November. Mature fruit is available from June thraugh September.

## ETHNGGRAPHIC/ARCHAEDLDGICAL RECDRDS

Swank [1932:33] recorded that the flowers of B. lumata have been mixed with meat by the Acama and Laguna for the purpose of seasoning. He alsa noted that the roots were collected in the spring and dried; dried roots were either
then sprinkled on hat coals or burned and the smoke inhaled as a remedy for nervousness or to give courage. In

Chihuahua the Tepehuan gathered the roots of a common Beylandieca plant growing along arroyos, which they then crushed and boiled into a decoction to relieve stamach disorders [Pennington 1969:187]. Likewise the Tarahumara of Chihuahua used the roots in preparing a tea used as a purgative [Pennington 1963:192].

No archaealogical record faund.

## SIGNIFICANCE FOR HUMANS

Berlandieng flowers sought for seasaning could be gathered over the period of May through August. The roots cauld be dug up during the six manths the plant is available abave graund, signaling its location far harvest. Perhaps the best times to dig them up would be early in the spring, prior to the time the plant uses root reserves for vegetative growth, or in the Eall just as the plant is gaing dormant and has replenished nutrient supplies.

## PREDICTIDAS FOR THE ARCHAEDLDGICAL RECDRD

Flawers harvested for seasoning would be unlikely to preserve unless same mature achenes were inadvertently gathered as well. These achenes would not be retained in the archaealagical recard if they were added to a meat stew or soup and caaked. Chances of recovering roats crushed and boiled for a tea are low. Perhaps entire raots placed an hot coals could be recovered.


Beryla execta grows not far from the edges of the stream at Canela Hills Cienega, in sail that is fairly damp. The area is underlain by alluvial sediments, and receives full exposure to the sun's rays.

## PHENOLOGY

This perennial, herbaceous species of water-parsnip resumes active growth in June, and is noticeably in flower during July and August. Mature fruit [mericarps] are present in August and September; by October the plant has died back and is no longer obvious on the landscape.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Beryla erecto is said to be extremely poisonous, and in Africa has caused the death of cattle within an hour clewis and Lewis 1977:49, 256]. Yet in the Southwestern United States historic groups have sought it. In New Mexico the Zuni found this species around springs, and gathered the leaves and blossams for an ingredient of one of the
medicinals for a fraternity [Stevensan 1915:44]. They alsa utilized an infusion of the whole plant to help alleviate rashes and athletes foot infection CCamazine and Bye [1980: 378]. Leaves and blossoms of the same species were occasionally eaten by the White Mt. Apache of Arizana, who considered the plant a medicine [Reagan 1929:155]. In South Africa the roat of anather species of water-parsnip was held in the mouth to relieve toothache CLewis and Lewis 1977:49, 2563.

No archaeological record located.

## SIGNIFICANCE FDR HUMANS

Water-parsnip leaves could be gathered as a food and medicine from June through September. Blassoms, collected for the same reasons, are only available in July and August. Roats would provide a potential toothache remedy for as long as the plant is easily located, June to September. predictions for the archaedlogical record

Because of the perishable nature of the leaves and blossoms, and lack of historic information on possible preparation techniques, it is not considered likely that water-parsnip parts would be retained in the prehistoric record. If roots happened to preserve in protected locations, one wauld need a large madern camparative callection of roots to identify them.

## JAN F̄Ē MAR $\overline{A P} \bar{R}$ MAY $\overline{J N E}$ JLY



DED

## HABITAT

At Ramsey Canyon, Bidens pilosa can be Found growing in dry sail on a steep calluvial slope overlying granite bedrock. The area is in partial shade, with an upper canopy of trees blocking much of the sunlight.

## PHENOLOGY

This species of beggars-tick appears to be an annual herb, primarily noticeable in the area in the late summer and fall. In August the plant is actively growing and producing Elower buds. By September Full-Elowering prevails, though flowers are only present in withered condition in Detaber. Immature and mature fruits can be Found clinging to the plant during the three months of September through November, at which time the plant appears to cease all activity. Basically one cannot find this species during the manths of December thraugh July.

ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS
References to the use of species of beggars-tick as

Food or medicines are easily Eound for many parts of the warld [Table 14]. In the American Southwest, Bidens levis was considered a food plant by the Owens Valley Paiute [Steward 1933:244]. In northern Mexica Bidens biqelquij was employed in making a tea [Havard 1896:46]; in Texas an infusion of its flowering tops were used as a beverage [Yanovsky 1936:60]. Leaves of this species provided highly esteemed greens when boiled, drained and fried by the Tarahumara of Chihuahua [Pennington 1963:12日]. Also in Chihuahua, the Tepehuan prepared a tea from a species of Bidens to relieve stomach cramps, and mashed the roats of B. gqugticg to make a tea for stomach disarders [Penningtan 1969: 1873.

No archaealogical record found.

## SIGNIFICANCE FOR HUMANS

Apparently beggars-tick plants can provide a number of usable resaurces. Yaung shoats and leaves cauld be gathered to be eaten as greens or prepared as a tea during the month of August. The leaves, used in so many external medicinal treatments, cauld presumably be gathered from June through November. An infusion of the flawering tops could be made in September. The roats of Bidens would most likely be sought for medicinal needs in August thraugh November, when of some size.

PREDICIIGNS FOR THE ARCHAEOLOGICAL RECORD
The parts chosen and the methods of preparation greatly

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| B. pilosa | leaves, juice as medicine | E. Africa | Kokwaro 1976:61 |
|  | leaves, Juice as medicine | Dominica | $\begin{aligned} & \text { Altschul } 1973 \\ & 323-324 \end{aligned}$ |
|  | leaves, as medicine | Phillipine Islands | ```Altschul 1973 323-324``` |
|  | leaves, as medicine |  | Morton 1962 |
|  | leaves, as medicine | China | ```Altschul 1973: 323-324``` |
|  | leaves, bailed and eaten when young | Mexico | Morton 1962 |
|  | roots, chewed or boiled as medicine | E. Africa | Kokwara 1976:61 |
|  | shoots, as food |  | Martan 1962 |
| B. frondosa | leaves, cooked and eaten when young | Japan | $\begin{aligned} & \text { Altschul } 1973 \\ & 323-324 \end{aligned}$ |
|  | leaves, as medicine | Japan | ```Altschul 1973 323-324``` |
| Bidens spp | used as medicines | E. Africa | Kokwaro 1976:61 |

reduce the chances that evidence of prehistoric use of beggars-tick might enter the archaealogical record. Young shoots and leaves cooked as greens would became unrecognizable. Preparation of the leaves in medicinal treatments have called far crushing and heating, both likely to obliterate identifying criteria. Chewed, mashed or boiled roots would likewise not preserve in recognizable condition.
 habitat

Bantelqua curtipendula does very well in dry soil a short distance from the Ramsey Canyon stream. Plants are partially shaded from the sun, due to the presence of tall trees that grow along the nearby stream. Substrate consists of colluvium and granite bedrock.

## PHENOLOGY

Perennial side-aats grama emerges fram darmancy in the spring and can be recognized in May by actively growing blades. Stem elongation and leaf expansion are apparent for three months; full-flowering occurs in August to September. The first ripe grains are available in September, at which time mast active vegetative growth ceases. Mature grains are present on inactive plants until December, when five months of dormancy resumes.

## ETHNDGRAPHIC/ARCHAEDLOGICAL RECORDS

Side-aats grama has been gathered by a number of historic groups. Among the Tewa of New Mexico, it was
sought in August, tied up in bundles, and dried for later use in making brushes or brooms. When naw, the long soft bundle was used to sweep adobe floars; when worn shorter by use, it made a convenient brush for sweeping the hearth or metutes; the very short butt-end of the broom could alsa be used as a hairbrush [Robbins et al. 1916:64]. The Cochiti, alsa of New Mexica, collected this species in late summer or autumn; they too made hairbrushes and brooms out of the dried stems. Apparently in historic times bundles of this gross were even sold to other pueblos, such os Santo Dominga. Men would gather this grass at the same time they were out harvesting pinyon nuts [Lange 1968:143].

Side-aats grama was much used by the Mescalera and Chiricahua Apache in ceremonial contexts. These people also lined Aggye roasting pits with it CCastetter and Opler 1936:24, 36]. To the Kiowa of Oklahoma, this grass resembled the Indian lance decorated with feathers, and was formerly worn by those who had once killed an enemy with a lance in battle [Uestal and Schultes 1939:14]. This reference dacuments the reproductively mature grass with many evenly-spaced spikelets attached along ane side of a long rachis.

No archaeological record found, but see discussion of prehistoric Bouteloug sp. remains under B_ $_{\text {_ }}$ grgcilis.

## SIGNIFICANCE FOR MUMANS

Side-aats grama grass could be gathered when mature
enough to provide stiff stems far househald needs, certainly by Detober and November. It would presumably be suitable For lining roasting pits at any time during its grawing seasan, but may ie too small in the months of May and June.

## PREDICIIONS FOR THE ARCMAEOLOGICAL RECORD

Side oats grama stems and ather parts might show up in the lining of roasting pits, due to the dehydrating effects of a long slow baking. Bundles of stems would perhaps preserve in dry, protected deposits of caves, or in unprotected but deeply buried deposits if the bundie had been exposed to fire.

Boyteloug gracilis [H.B.K.] Lag, ex. Steud. RC-1 [KA \#21日-83] UA25502日


## HABITAT

This perennial species of Bquteloug grows side by side with Boutelgug curtipendyla, previously discussed.

## PHENDLDGY

Blue grama grass is not obvious on the landscape until July, fully two months after side-oats grama is first recognized. By August blue grama is in full-flower, remaining so through September. Ripe grains are available in October and November, at which time it dies back and remains dormant for seven months.

ETHNDGRAPHIC/ARCHAEDLQGICAL RECORDS
Stems of blue grama grass were sought for comb and broom material by the Apache in Arizona [Buskirk 1949:336; Reagan 1929:155J, in a manner similar to that of side-oots grama. However, unlike side-aats grama, blue grama satisfied other historic needs. For example, it was one of the plants tied to the end of a wand carried by Navajo girls in the Squaw Dance [Elmore 1944:25]. The Ramah Navajo of

New Mexico burned the plants to provide ashes as an Enemyway ceremony blackening, used the inflorescence for prayersticks, and made a decoction of the whole plant as a postpartum beverage. They also chewed the roots and blew them on cuts to heal them, and prepared a cold root infusion as both a drink and lotion to be used as a Life Medicine [Uestal 1952:15-16].

Importantly, blue grama grass has offered food to histaric groups. Apache in Arizona once ground the grains for flour [Buskirk 1949:336; Reagan 1929:155]. The grains are not easily dislodged fram the surrounding palea and lemma, and would have required some processing to remove chaffy parts.

In one of the more unusual uses of this plant, the Blackfoot living on the northwestern Great Plains used blue grama to forecast the winter weather. For example, culms with one fruit were considered to signal a mild winter, while culms with two or more fruits forecast increasingly more severe conditions [Johnston 1970:306].

Blue grama parts were identified in the wild plant remains excavated from the Mogollon site of Tularosa Cave in southwestern New Mexica [Cutler 1952:478]. In a later study Kaplan [1963:352] found spikes of Boyteloyg sp, in the cave debris. Also in southern New Mexica, remains of both blue grama and $B_{\perp}$ hirsuta were common in the strata of Bat Cave on the edge of the San Augustin Plain [Smith 1950].

Two other references document recovery of Bouteloug from sites in New Mexico. Carbonized Boutelgug 〔part not listed] was found in a Basketmaker III [A.D. 700-900] deposit in the Cimarran area CKirkpatrick and Fard 1977:263J. In the south-central area of the state, at archaic age [B.C. 1600-A.D. 13 Fresnal Shelter, Bohrer [1981:44-45] noted the presence of florets and spikelets of Bouteloua throughout strata, and speculated that the plant represented a common prehistaric food.

## SIGNIFICANCE FOR HUMANS

Blue grama raots could be dug at any time from JulyNovember, when the above group parts could alsa be gathered for ceremonial or medicinal requirements. In October and November plants would likely be mature enough to provide stiff stems for bunding inta brushes and brooms, and a mature inflorescence offering food, prayer-stick material and a weather-farecasting device.

## PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD

Depending on preparation techniques, ripe blue grama grains might be retained in the prehistoric record to document food use. Plants or roots chewed or made inta decotions or infusions would be unlikely to preserve. Bundles of stems tied together as brushes or brooms have a higher chance of surviving, if deposited in a dry cave or shelter overhang. In an unprotected site they would most likely disintegrate.

mabitat
Brayulinea densa grows in fairly dry locations at Canelo Hills. It was especially predominant on the dry east flanks of the cienega, with up to $100 \%$ exposure to the sun. As a low-growing plant it can comprise fairly dense mats. PHENOLOGY

This perennial plant resumes growth in May, when active stem and leaf elongation are obviaus. Flowering reaches a peak during August, when immature fruits are alsa developing. During September active vegetative growth is curtailed as the fruits ripen and disperse by October. Dormancy appears to be in full effect during the months of November through April.

## ETHNOGRAPHIC/ARCHAEOLDGICAL RECDRDS

No ethnographic or archaealogical records found.

## SIGNIFICANCE FOR HUMANS

Unknown.
PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD
None.

Bromus caringtus H. \& A. CH-2 [KA \#180-83] UA255220


Bromus caringtus can be found under the canopy of tall trees lining the stream at Canelo Hills Cienega. In the summer months these trees block out much of the sunlight, permitting less than $50 \%$ exposure to plants below. The soil, composed of alluvium, is generally wet. PhENOLOGY

This perennial brame grass emerges from dormancy by June, at which time vegetative growth is quite active. The plant appears to be in full-flower for the three months of July-September; as full-Flowering ceases, so too does noticeable stem elangation and leaf blade expansion. Mature grains are first present in August, remaining so through November. The plant resumes darmancy in December, becaming difficult to locate for six full months.

## ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Only a single historic reference was located for this species. This citation and a number of others document the
general importance of the Bromus genus as a food plant. According to Yanovsky [1936:7] the grains ["seeds"] of Bramus cafingtus and other species of bromegrass were eaten in California. The Gosiute of Utah and Nevada ate the grains of native $B_{\perp}$ margingtus $\left[a s B_{\perp}\right.$ brevigristatus] in former times [Chamberlin 1911:364]. The Tarahumara of Chihuahua, Mexico made a drink of the grains of Bramus arizonicus [Penningtan 1963:156]. More than one species of non-native brame grass was eaten by the Chumash of the southern California coast in historic times [Timbrook 1984: 154]. Their neighbors the Cahuilla gathered the seeds of introduced $B_{2}$ tectorym in quantity when food was short, considering them a famine food [Bean and Saubel 1972:48]. People also collected various species of brome grass for non-food requirements. For example, the stems and plumes of different species were used in green or dry state by the Tepehuan of Chihuahua as a catalyst in preparing a maize drink from corn sprouts and a fermented beverage fram Agque [Pennington 1969:106, 109]. Acama and Laguna living in New Mexico gathered the culms [stems] of B. maraingtus in the mountains after the grains had fallen off, and tied them in bunches; the upper end served as a broam end, and the lawer end as a hair brush [Swank 1932:34]. Likewise, the Isleta of New Mexico tied the stems of brome grass in bunches to make brooms and brushes [Janes 1931:25].

There is at least one prehistoric record of brome
implying its use as food. Carbonized grains were excavated From two house floors, levels of horno [oven] fill and from a trash pit at La Ciudad, a Hahokam site in the city of Phoenix, Arizona [Bohrer 1984].

## SIGNIFICANLE FOR HUMANS

Bromus cacinotus grains could be collected as a food or beverage as early as August, though the percentage of ripe grains is higher in Octaber and November. Stems gathered to manufacture brooms and brushes would likely offer the best material when fully mature, also in October and November. This is supported by the historic reference that in New Mexica stems were sought late in the season after grain maturity. Stems sought green or dry for use as a catalyst in preparing fermented maize or agave drinks could be acquired for some time over the entire June-November growing season of the plant.

PREDICTIONS FOR THE ARCMAEOLOGICAL RECORD
Brone grains gathered and prepared as a faod would have high likelihood of entering the prehistoric record if one of the preparation steps consisted of toasting or parching the resource. At least at one location in New Mexico, this seems to have been the case. Grains made into a beverage wauld probably nat survive, nor would plant parts used as a catalyst in fermenting other plant materials. Stems tied in bundles for brooms or brushes could be recovered, as with Boputelqug stem bundles, from well protected locations.


Carex shihughuensis Mack.
RC-3 [KA \#74-83] UA255041; [KA \#114-83] UA255043




Members of Carex included in this study generally prefer to grow in wet sail. Only $C_{\text {. }}$ leucodonta monitored at Ramsey Canyon grew in dry sail, but the area had less than 25\% expsoure to the sun due to dense surrounding vegetation. The other three species studied flourished in saturated sail of cienegn or streambank. Cacex lonuginasg and $C_{\text {. }}^{\text {. }}$ gccidentalis can be found in alluvial sail in the Canela Hills Cienega proper, fully exposed to the sun. Carex ghihughuensis does well very close to the Ramsey Canyon stream, in overbank sediments heavily shaded by upper story trees.

## PhENOLQGY

These four sedge species behave differently. Corex chihughensis is active vegetatively in February at Ramsey Canyon, but $E_{\perp}$ leucodonta is not noticed in the same area until June. The other two species are intermediate to these extremes in Canela Hills; bath $\mathrm{C}_{\mathrm{A}}$ gccidentglis and C . lanugingsg are quite active in April. Full flowering generally spans a two month period for all species. Achenes ripen in sequential manths in the lacatians. At Ramsey Canyon the mature fruit of c. chihughuensis can be found in June and July, and that of $C_{2}$ leugcodonta in August and September. At Canelo Mills, the fruit of $C_{\text {. }}$ gccidentalis is available in June, while that of C , langingsg is ripe from June through September.

Although the phenological profiles imply that these species are generally not visible above ground level for many months of the year, this may not be the case. Once ripe fruits disperse, it is difficult to recognize the leaves and stems tangled amang other vegetation. Only in the case of $C_{2}$ gccidentalis was it clear that above ground stems and leaves stayed samewhat green and flexible until January. None of the other three species was recognized above ground after the month of Dctober.

## ETHNDGRAPHIC/ARCHAEOLOGICAL RECDRDS

Historic groups have sought various sedge species [Table 15]. Sometimes the entire plant was considered sacred or was decocted into a medicine. Daily neads such as moccasin linings were met by the dried plant.

The literature holds two views on the importance of Carcex as a raw material for basketry. On the one hand, the Kawaiisu of California did not use sedges in "serious" basket-making, although they might have been used for "play" or "practice" baskets [Zigmund 1978:202]. On the other hand the rootstocks of a number of species of farex provided one of the most important basketry elements used by the Pamo of California in historic times [Peri and Pattersan 1976]. A Poma might informally stake a claim to certain areas or "tracks" of sand, dirt or clay where different qualities of rootstocks could be found. Sand root beds were the mast

| SPECIES | PART AND USE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. dauglasii | stem [base], eaten raw | Kamaiisu, Calif. | Zigmund 1981:17 |
| C. Festivella | plant, Halyway emetic | Ramah Navaja, New Mexico | Vestal 1952:19 |
| C. pennsylvanica | plant, infusion as lotion or drink | Ramah Navaja, New Mexico | Vestal 1952:19 |
| C. utriculata | stem bases and roots, as fond | Gasiute, Nevada and Utah | Chamberlin 1911: 365 |
| Carax spp. | plant, dried to line moccasins | Blackfont, Great Plains of U.S. | Johnston 1970:307 |
|  | plant, considered sacred | Jemez, New Mexico | Cook 1930:21 |
|  | rootstocks, as basketry elements | Pomo, Calif. | Peri and Pattersan 1976 |
|  | roots, as medicine | Gosiute, Nevada and Utah | Chamberlin 1911: 365 |
|  | achenes, ground and cooked as mush | Kayenta Navajo, Arizona | Wyman and Marris 1951:16 |
|  | stem [bases], as food | Utah, Nevada, Oregon groups | Yanausky 1936:9 |
|  | stems, sugary juice as Food | Southwest U.S. groups | Yanousky 1936:9 |

preferred and yielded the whitest roots; dirt beds of sand and clay offered vari-colored usable materials, but clay beds had only "kinky" roots harvested as a last resort. The season of collecting sedge roats varied both geographically and according to the composition of the track. Basically sand root beds were best collected from late summer to the first fall rains, while dirt beds were best dug up after the early Fall rains when the soil was loose [Peri and Patterson 1976:24].

As food, sedge stem bases could be eaten raw. Some groups in the American Southwest expressed a sugary juice from the stems, and others ground and cooked the seeds as mush. Underground parts were considered edible by same, and material for a medicine by others.

There are few archaealogical records of Cgrex.
Burned and unburned achenes were recovered in Mesa Verde period trash [A.D.1185-1290] at the Salmon Ruin in northwestern New Mexico [Adams 1980a:296]. In addition, Cyperaceae stems were part of the excavated plant materials. A Corey achene was found in a southern Utah Glen Canyon area human coprolite, representing ancient food of either the Fremont ar Anasazi inhabitants in the period A.D. 1-1350 [Fry 1976]. Carex remains were excavated from Cowboy Cave deposits in central Utah [Barnett and Coulam 1980:130]. They were moderately well represented in human capralites from an early occupation of the cave [B.C. 6000], but became
insignificant thereafter [Hagan 1980:208].

## SIGNIFICANCE FOR humans

Sedges cauld pravide stem bases and stems for food from April through September in bath Ramsey Canyon and Canela Hills. The plants would alsa be available during this period for medicinal, ceremanial or material culture needs, although preferred timing of harvest could span a shorter period. The roots could be gathered any time the plants were active vegetatively, or if the lacation of the resource were known during the dormant period. Achenes could be harvested for food in sequential order in both Ramsey Canyan and Canela Hills from June through September. PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD

Perhaps baskets fashioned of sedge stems or roots would survive in the ancient record, as might the lining of moccasins, if the conditions of preservation were excellent. Stems eaten raw or processed for a sugary juice would not preserve. Achenes ground and cooked to mush would likewise degrade in the archaealogical recard unless they were burned in prehistory.


## HABITAT

Cegnothus Eendleci can be found growing on a steep slope in dry soil less than 10 meters from the stream at Ramsey Canyon. The substrate is composed almost entirely of granite bedrock.

## PHENOLOGY

The spiny, much-branched buck-brush shrub retains mature leaves year-round, even during a four month fully dormant period from October through January. In February and March flower buds swell, and the plants come inta full flower in April. Ripe fruit are available only during June. Active stem and leaf grouth continue through September, at which time all outward signs of growth cease.

## ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Cegnothus plants are goad browse for deer [Kearney and Peebles 1960:532], and animals attracted to them would offer protein resources for humans. That native peoples recognized this fact is suggested in the Navajo name of "deer's

Food or corn" for C. Eendleri [Matthews 1886:771].
Uarious parts of Cegnothus have been gathered in historic times [Table 16]. The twigs have provided arrow shafts, and the woad has been fashioned into digging sticks and burned as fuel. Inner bark strips of E. Eendleri, and possibly the fruit capsules [cited as "berries"], have been eaten. The blossoms are said to lather up well in water and provide a soap.

No archaealogical record located.

## SIGNIFICANCE FOR HUMANS

Most parts of Ceanothus Eendleri could be acquired year round. This includes the wood for fuel and implements, twigs as arrowshafts and kindling, parts needed for medicinal or ceremonial use, and inner bark strips to be eaten. Parts restricted in availability include the blossams, which could be gathered for saap in April, and the passibly edible fruit capsules ["berries"] harvestable in June.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD
Buck-brush wood burned in hearths, or branches employed as kindling in mescal roasting pits, might survive in charred condition, as would implements fashioned of wood and preserved in especially well-protected locations. Blossams, inner bark and parts made into ceremonial emetics or medicines are not expected to be recovered in recognizable condition.

Table 16. Ethnographic references to the use of Ceanothus.

| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. cuneatus | twigs, as arraw foreshafts | Kawaiisu, Calif. | $\begin{aligned} & \text { Zigmund 1981: } \\ & \text { 17-18 } \end{aligned}$ |
|  | Wood, as Fireword | Kamaiisu, Calif. | $\begin{aligned} & \text { Zigmund 1981: } \\ & \text { 17-18 } \end{aligned}$ |
|  | wand, as digging sticks | Duens Valley Paiute, California | Steward 1933: 244 |
| C. Fendleri | bark strips, eaten | Ramah Navaja, New Mexico | Uestal 1952:35 |
|  | berries [sic] eaten | Acama and Laguna, New Mexico | Swank 1932:35 |
|  | plants, as a medicine | Ramah Navaja, New Mexico | Vestal 1952:36 |
|  | plant known as "people's Food" | Navajo | Fransiscan Fathers 1910:197 |
|  | plant, as a medicine | Navajo | Wyman and Harris 1941:58; Elmare 1944:62 |
|  | plant, as a ceremonial emetic | Kayenta Navaja, Arizona | Wyman and Harris 1951: 31 |
| C. greggii | branches, as kindling in mescal roasting pits | NE Yavapai, Arizona | Gifford 1936: 259 |

Table 16 [cont.] Ethnographic references to the use of Ceanothus.
SPECIES PART AND USE GROUP[S] REFERENCE
C. greggii woad, as digging

Ceanothus spp. blossams, lathered well as a soap

GROUP[S]
NE Yavapai, Arizana

Kawaiisu, Calif. Zigmund 1981: 17-1日

Cercgegrpus montanus Raf. var. pgucidentatus [S. Wats.] F. L. Martin [=C. breviflorys Gray] RC-6 [KA \#86-83] UA254628


## habitat

Cexcocarpus montanus var. pqucidentatus does well on a steep slape underlain by granite bedrack, within 10 meters of the Ramsey Canyon stream. The area receives very little of the sun's direct rays, due to a dense overhead tree canopy. Although the soil is generally dry, the soil is subject to occasional stream scouring.

## PHENOLOGY

For the six months of October through March mountain mahogany shrubs appear dormant, though they retain same clinging mature leaves. From April through September the leaves and stems are active, and repraductive events rapid. Flower buds form in June, full flowering occurs in July, and plumose achenes mature in September.

## ETHNOGRAPHIC/ARCHAEQLOGICAL RECORDS

A number of different species of mountain mahogany have been sought by historic groups [Table 17]. They preferred the hard wood for such items as loom tools, digging sticks,

Table 17. Ethnographic references to the use of Ceccocacpus.

| SPECIES | PART AND USE | GROLP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. betulaides | root, boiled as a medicime | Kawaiisu, Calif. | Zigmund 1981:18 |
|  | wood, carved into pipe heads | Kawaiisu, Calif. | Zigmund 1981:18 |
|  | wand, as variaus tools | Chumash, Calif. | ```Timbrook 1984: 160``` |
| C. breviflorus | bark, as a dye | Cochiti, Neus Mexico | Lange 1968: 147 |
|  | bark*, as a dye | Hopi, Arizoma | Whiting 1966:78 |
|  | ronts, mashed for a dye, tanning agent | Cochiti, New Mexico | Lange 1968:147 |
|  | roots, as additive For Fermented corn beverage; also a medicinal tea | Western Apache, Arizana | Gallagher 1977: 64, 79 |
|  | wood, as digging sticks | Cochiti, New Mexico | Lange 1968:147 |
|  | woad , made into weaving tools | Hopi, Arizona | Whiting 1966:78 |
| C. ledifalius | wood, favorite chaice For bows; a charcoal treatment for burns | Gasiute, Nevada and Utah | Chamberlin 1911 365 |

*Spacies listed as a synanym.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. mantanus | Lark, as a medicine | Navaja | Elmore 1944:53 |
|  | bark, os tanning agent | Acoma and Laguna, New Mexico | Swank 1932:35-36 |
|  | leaves, powdered as a medicine | Tewa of New Maxica | ```Robbins et al. 1916:45``` |
|  | leaves, as a medicine | Ramah Navajo, <br> New Mexica | Uestal 1952:30 |
|  | leaves, bailed ns a tea far bathing | Acama and Laguna, New Mexica | Swank 1932:35-36 |
|  | leaves, fashioned into brooms | Acama and Laguna, New Mexico | Swank 1932:35-36 |
|  | pallen, as a medicine | Ramah Navaja, <br> New Mexica | Vestal 1952:30 |
|  | root bark, as a red dye ingredient | Isleta, New Mexico | Jones 1931:21 |
|  | roat bark, as a dye | Ramah Navaja, <br> New Mexica | Uestal 1952:30 |
|  | roats, as a medicine | Navaja | Elmare 1944:53 |
|  | roats, as a tamning agent | Acoma and Laguna, New Mexica | Swank 1932:35-36 |

[^1]Table 17 [cant.] Ethmographic referances ta the use of Ceccocacaug.

| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. mantanus | twigs, to keep away bedbugs | Spanish Americans Naw Mexico | Curtin 1965:147 |
|  | wood, made inta rabbit sticks | Tewa of New Mexica | ```Robbins et al. 1916:45``` |
|  | wood, as laom tan, dice and for sweathouse construction | Navajo | Elmore 1944:53 |
|  | wand, as tanl handles and weaving cambs | Ramah Navaja, <br> New Mexico | Uestal 1952:30 |
|  | wood, as small tools and arraw paints | Acoma and Laguna, New Mexico | Swank 1932:35-36 |
|  | unknown part, made into grooming combs | Mescalera and Chiricahua Apache | $\begin{aligned} & \text { Castetter and Opler } \\ & \text { 1936:19 } \end{aligned}$ |
| C. parvifalius | wat, as bows and as charcoal for burns | White Mt. Apache, Arizona | Reagan 1929: 156 |
| Cercocarpus spp. | plant, as a medicine | Navajo | Wyman and Harris 1941:58 |
|  | ```wood, for digging sticks``` | NE Yavapai, Arizona | Gifford 1936:279 |
|  | ```wood, For digging sticks``` | Quens Ualley Paiute, California | Steward 1933:239 |

pipe heads, rabbit sticks, dice, arrow paints and as charcoal to apply to burns. The Navajo called one species "heavy as a stone" because of its compact, fine-grained structure [Matthews 1886:772].

In addition to the wood, bark provided various medicinal treatments, dyes and tanning agents. Roots and root bark were sought for medicines, dyes, tanning materials, and as an additive to a fermented carn dish. Leaves were fashioned into brooms, boiled as a bathing tea, and used as a medicine. Twigs apparently kept bedbugs away when placed under a mattress. Even the pollen was callected as an ailment remedy. People may have been especially cautious about ingesting medicines that contained mountain mahogany, since the plants have been found to contain harmful cyanogenic glycosides [Lewis and Lewis 1977:1日].

The archaealogical record of mountain mahogany includes records to both fuel use and ancient wooden implements. The presence of charred Cercogcargus remains in hearths and middens at sites in the Dolores River area of southwestern Colorado suggested the resource was a prehistoric fuel [Benz 1984:204, 2053. Cerecocarpus montanys charcoal was excavated From three 11 th century Anasazi sites in the Chimney Rock Mesa area of Colorado [Minnis and Ford 1977:83].

Uarious prehistoric implements have been identified as of mountain mahogany wood. At Cowbay Cave in central Utah, a number of artifacts, including dart, arraw and other
shafts, were made of this wood [Janetski 1980:95].
Agricultural implements, scrapers, and a stirring stick of C. montonus were recovered by excavators in Johnson Canyon Puebla III cliff dwellings in southwestern Colorado [Nickens 1981:79]. Grange [1952:381, 382, 392] described wooden artifacts from the Mogollon sites of Tularosa and Cordava Caves in south-western New Mexico as having been made of Cegccecarcpus. These included atlatl dart foreshafts, the handle of a digging stick, and wooden trowels of various shapes. Kaplan [1963:354] lists four Cercgegrgus achenes as alsa having been faund in this cave.

## SIGNIFICANCE FOR HUMANS

Most parts of mountain mahagany could be acquired at any time during the year. This would include wood for fuel and various implements, bark, roots and raotbark as medicines, dyes and tanning agents, and twigs and leaves to serve various medical and household needs. The only part restricted in availability would be the pollen; if required to treat a medical condition it could be gathered only during the month of July.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD
Wood charred in hearths or fashioned into tools might preserve if protected. Concentrated pollen could possibly be recovered. Because of their uses and typical preparation methods, other Cercgogepys parts are not considered nearly as likely to preserve.

Chengpodium aff, negmexicgnum Stand.
[H-3 [KA \#325-83] UA2554日5
 MABITAT

Chenopodium afe. neomeyicanum appears to be an annual plant that daes well along the streamside and drier stream Flanks at Canela Hills. It grows in alluvial sail that is fully saturated, with partial to full exposure to the sun. PHENDLDGY

Goosefant is recagnizable on the landscape far at least seven months of the year, April through October. Most of that time is spent in vegetative growth and flower bud initiation. By August the leaves appear to be Fully grown, and stem elongation has slowed considerably. August is the month during which full flowering and immature fruit development is observed. Ripe seeds are available in September, possibly into the early part of October. The plant averwinters in the form of dormant seeds during the months of November through March.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

The ethnographic record regarding the use of goosefoot
plants is almost burdensame, and for this reason the data has been encapsulated in Table 1日. The major importance of all the species to groups all over the western United States and elsewhere has been as a food. Mistoric groups even appear to have appartunistically explaited at least two species of goosefoot that are suspected of hoving been naturalized in the United States in historic times.

There are numeraus references to leaves, plants, young shoots and stalks having been boiled as greens, sometimes eaten alone and other times mixed with meal, fat or meat. When abundant, the greens were extensively and even exclusively relied upon. They were eaten raw or boiled, and sametimes dried far winter use. Peaple preferred to pick them when young and tender. Medicinally, the greens have also been applied to burns.

Repeatedtly the literature refers to the use of the seeds as foad. These were gathered in quantity and sometimes stored. Methods of harvest and preparation varied. The Havasupai of north-central Arizona gathered sprays of the plant, dried them for a week, then rubbed the plants between their palms into a basket so the seeds cauld be winnowed. The seeds were then roasted in a parching tray and ground and added to a kettle of boiling water to make mush [Spier 1928:107]. Navajo threshed the seeds by heaping the plants an a sheepskin and beating them with a stick. Preparation could include grinding for a bread, baking as a

Iable 18. Ethnographic references to the use of Chengaddium.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. album* | gramens, anten and applied to burns | Kayenta Navaja | Whman and Harris 1951:20-21 |
|  | greans, large amaunts gathered and eaten | Navaja | Elmore 1944:43-44 |
|  | leaves, extensively bailed as greens | Tarahumara, Chihuahua | Pennington 1963: 125 |
|  | leaves, bailed and eaten with fat | Hopi | Hough 1898: 144 |
|  | leaves, eaten as greens | Luiseno, Calif. | Sparkman 190日: 233 |
|  | plant, cooked For greens | Tetan Dakota, Dmaha | Gilmore 1977: 26 |
|  | plant, cooked far greens in spring or after summer rains | Hapi | Naquatewa 1943: 19 |
|  | plant, bailed then Fried when young | Picuris, New Mexico | Krenetsky 1964: 44 |
|  | plant, dried For winter use | Picuris, New Mexica | Krenetsku 1954: 44 |
|  | plant, eaten | 7 of 7 Northern Paiute groups | Stewart 1941:428 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. album* | plant, as a green paint: Far bows | Paunee | Gilmore 1977: 26 |
|  | seeds, ground and eatern | Navajo, Chaco Canyon of New Mexico | Hocking 1956:149 |
|  | seeds harvested in valleys as food | Kaibab Paiute | Kelly 1964:42 |
|  | seeds, eaten | Navaja | Elmare 1944:43-44 |
| C. ambrosiaides | leaves, extensively bailed as greens | Tarahumara, Chihuahua | Pennington 1963: 125 |
|  | plant, medicinal tea | Chile and Columbia | Altschul 1973:63 |
|  | plant, medicinal tea | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington } \\ & \text { 1969:139, } 179 \end{aligned}$ |
| C. californicum | root, stored and grated For soap | Cahuilla, Calif. | $\begin{aligned} & \text { Bean and Squbel } \\ & 1972: 52-53 \end{aligned}$ |
|  | root, used as saop | Luiseno, Calif. | Sparkman 1908: 233 |
|  | root, shavings used as soap | Cahuilla, Calif. | Barrows 1900:48 |
|  | semds, enten | Luiseno, Calif. | ```Sparkman 190日: 233``` |

* species naturalized fram Europe [Kearney and Peebles 1960].

Table 18 [cont.] Ethnographic references to the use of Chenopodium.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. capitatum | plant as a medicinal lation | Kayenta Navajo | Wyman and Harris 1951: 20-21 |
| C. cornutum | flowers, eaten | Hapi | Hough 1898: 142 |
|  | plant, liniment For ceremonies | Navajo | Elmare 1944:43-44 |
|  | plant, steeped and used medicinally | Zuni | Stevenson 1915: 45 |
|  | plant, considered a medicine with emetic effects | Acoma and Laguna New Mexico | Swank 1932:36 |
|  | seads graund and mixed with meal, baked in corn husks | Hopi | Hough 1998: 142 |
| C. fremontii | sebds harvested fram valleys for food | Kaibab Paiute | Kally 1964:42 |
| C. Fremontii | seads, gathered in quantity; stored | Cahuilla, Calif. | Bean and Saubel 1972:52-53 |
|  | semds, eaten | Duens Valley Paiute, Califarnia | Steward 1933:243 |
|  | young shoots, boiled as greans | Mohave, Cocopa, Maricapa in Arizona | $\begin{aligned} & \text { Castetter and Bell } \\ & \text { 1951:202 } \end{aligned}$ |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. hircinum | plant, medicinal tea | Paraguay | Altschul 1973:63 |
| C. incisum | plant, medicine | Argentina | Altschul 1973:63 |
|  | plant, medicimal tea | Mexico | Rose 1899:228 |
| C. leptaphyllum | plants, gathered when young, boiled | Zuni | Stevensan 1915:66 |
|  | seeds, important foad | Zuni | Stevenson 1915:66 |
|  | seeds, ground and eaten in "old times" | White Mt. Apache, Arizona | Reagan 1929:156 |
|  | young sprauts, boiled and eaten | White Mt. Apache, Arizona | Reagan 1929: 156 |
| C. murale* | seeds gathered For food; early summer | Pima, Arizona | Russel1 1975:73 |
|  | seeds harvested far Food, Dec.-April | Sari, constal Somora | Felger and Maser 1976:16,22 |
|  | young shoots, boiled as greans | Mahave, Cocapa, Maricapa in Arizana | ```Castatter and Bell 1951:202``` |
| C. nuttalliae | plant boiled For food | Puebla, Mexica | Whitaker and Cutler 1966: 10 |
| C. quinoa | leaves, conked | Honduras | Altschul 1973:63 |

* species naturalized from Eurape [Kearney and Peebles 1960].

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Chenopodium spp. | greens, eaten raw or boiled | Apache, Arizona | Buskirk 1949:342 |
|  | greans, bailed and eaten | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington } \\ & \text { 1969:139, } 179 \end{aligned}$ |
|  | gremes, enten | Keresan pueblos af New Mexica | White 1945:560 |
|  | grames, coaked | Sia, New Mexica | White 1962: 107 |
|  | greens, eaten | Cochiti, New Mexico | Lange 1968:149 |
|  | leaves, enten | Isleta, New Mexica | Jones 1931:25 |
|  | leaves, eaten | Graups all aver the Unitad States | Yanavsky 1936:22 |
|  | leaves, bailed then Eried in the spring | Pima, Arizana | Curtin 1984:70 |
|  | leaves and shaots, bailed and eaten | Cahuilla, Calif. | Bean and Saubel 1972:52-53 |
|  | leaves and stams, bailed Ear greens | NE Yavapai, Arizana | Gifford 1935:256 |
|  | plants, gatherad extensively for ford | Gosiute, Nevada ana Utah | $\begin{gathered} \text { Chamber1in } \\ \text { 1911:366 } \end{gathered}$ |
|  | plants, bailed and mixed with ather faod | Mapi | Whiting 1965: 73-74 |


| SPECIES | PART AND USE | GRDUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Chanopodium spp. | plants, packed araund Yuced Fruits being baked in earth ovens | Hopi | Whiting 1966: $73-74$ |
|  | plants, known as a Food resaurce | Wastern Apache, Arizana | $\begin{aligned} & \text { Gallagher 1977: } \\ & \text { 13-14 } \end{aligned}$ |
|  | seads, roasted, ground, then bailed as Food | Havasupai, Arizona | Spier 1928:107 |
|  | seads, purched, graund then bailed as Eand | NE Yavapai, Arizoma | Gifford 1935:256 |
|  | seeds, used for food | Ramah Navaja | Vestal 1952:24-25 |
|  | seads, used for Eaod | Navaja | Eailey 1940:2日7 |
|  | semds, used for fard | Zuni and Navaja | Standley 1912:458 |
|  | seeds, used far fagd | Graups all aver the U. States | Yanousky 1936:22 |
|  | seeds, harvested in abundance; stared | Cahuilla, 5 . Califarnia | Barrows 1900:57 |
|  | seeds, made into flour | Paiute, Arizona | Bye 1972:92 |
|  | stalks, gathered and eaten in summer | Papaga, Arizona | Castetter and Underhill 1935: 14-15 |

cake in a pit aven in the ground, baking as a griddle cake, making into mush, or using as a flavoring in corn cakes [Bailey 1940:2日7]. Northeastern Yavapai in Arizona extracted the seeds by spreading the tops of the plants on a flat surface and beating them with a stick; seeds were then winnowed, parched with coals in a basket, ground on a metate, boiled and eaten [Gifford 1936:256]. The Ramah Navajo [Uestal 1952:24-25] threshed seeds fram dry plants on a blanket, winnowed them in a basket, applied light grinding to loosen perianths, winnowed them again, and washed, dried and graund them with maize. One abserver in 1936 saw a stack of Chenopodium as high as a nogun being threshed and made into bread ar saved for winter. While the previous methods refer to theshing the entire harvested plant, the Zuni had an alternate method of acquiring the seeds. They placed a clasely-woven large shallaw tray near a ripe plant and vigorausly slapped the plant with a wicker Fan or scoop [Cushing 1974:244]. This method differs considerably from that of pulling up an entire plant to be dried and threshed later.

The importance of seeds as food is revealed in oral tradition. For example, the Zuni claim the seeds of Chenopodium leptaphyllum were among the first of their principal Eoods. They ground the seeds, mixed them with corn meal and made a stiff batter which was then formed inta balls and steamed, When the Zuni reached this world for the
first time, however, they prepared the seeds alone, since they had not yet acquired maize [Stevenson 1915:66].

Uses other than food have been made of goosefoot plants. For example, they have been made into green paint, medicinal teas, lotions and liniment, and packed into earth ovens around Yucca fruit to provide steam during cooking. The grated root of $G$. califacnicum makes a type of sap.

The archaealogical record of Chengogdium use in the American Sauthwest is almast as extensive as that detailing historic uses. Because charred and degraded Chengpodium seeds cannot always be clearly segregated fram marphologically similar Amaranthus seeds, Table 19 includes references to both Chenopagikum and Chengpodium/Amaranthus identifications made on ancient material. As with the ethnographic record, mast of the citations suggest a food use for the plant in prehistory, specifically for the seeds.

The majority of ancient seeds have been recovered charred. Some have been faund in human coprolites. Two records of seeds contained within burial vessels suggest food offerings. The words "common", "widely distributed", "most widespread taxa" and "one of most abundant plant foods" hints at the very important role these seeds must have played in prehistoric subsistence.

It seems that the stems were also carried into prehistoric Southwestern dwellings. In Cowboy Cave in Utah,

Table 19. Prehistoric references to Chenogodium or Chenopodium/Amaranthus ramains.

| PART | USE | GRDUP[S] | NDIES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| pallen | on metate and in vessel in high concentrations | Grasshopper Puebla, Arizonn A.D. 13-1400 | From seeds being ground and stored | Bohrer 1982: 102 |
| seeds | burial offering | Rainbow Ridge/ Monument Valley, Arizona | pint of seeds in burial bowl | Jones 1945: 161 |
|  | burial offering | San Cayetano del Tumacacori, Ariz. Upper Pima Uillage | in bawl with a male burial | Cutler 1956a |
|  | Food | Chimney Rock Mesa, Ariz, A.D. 1000's | charred | Minnis and Ford 1977 |
|  | Food | 16 of 17 Arizona Anasazi sites | charred | Gasser 1982: 33 |
|  | Eood | Paint of Pines, Arizona [A.D. 12日0-1300J | cake of charred seed on Floor | Bohrer 1973: 429 |
|  | food | La Ciudad, Arizona Hohokam site | charred; 3rd mast common plant part | $\begin{aligned} & \text { Gasser 1981: } \\ & 351 \end{aligned}$ |
|  | Erod | 6 of B Arizona Hohokam sites | charred | $\begin{aligned} & \text { Gnsser 1981: } \\ & 351 \end{aligned}$ |
|  | Food | Hohakam Site, Arizana [A.D. 1100-1200] | charred seed coats | Bohrer, Cutlar and Squer 1969:6 |

Table 19 [cont]. Prehistoric references to Chenopodium or Chenopodium/Amarantbus remains.

| PART | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| seeds | food | San Cayetano del Tumacacori, Ariz. Upper Pima Uillage | one of most abundant plant Faods | Cutler 1956a |
|  | Food | $\begin{aligned} & \text { Dolores, Colo, } \\ & \text { A.D. } 600-850 \end{aligned}$ | charred | $\begin{aligned} & \text { Benz 1984: } \\ & 204 \end{aligned}$ |
|  | food | Johnsan Canyon, Sw Colo, Pueblo III | in human coprolites and a quid | $\begin{aligned} & \text { Nickens 1981: } \\ & 75 \end{aligned}$ |
|  | food | Chaco Conyon, New Mex. A.D.750-110 | charred, common | Struever 1977:44 |
|  | Food | Cimarron, NE New Mex. A.D.700-900, Basketmaker site | charred | Kirkpatrick and Ford 1977:263 |
|  | food | Salman Ruin, NW New Mexica, A.D.1090-1290 | parched or carbonized; most widespread taxa | Adams 1980a: 265 |
|  | food | Arroyo Hondo, New Mex. A.D.1300-1450 | charred, widely distributed | $\begin{gathered} \text { Wetterstrom } \\ \text { 1976:75 } \end{gathered}$ |
|  | Food | Higgins Flat Pueblo, New Mex. A.D. 1175-1250 | charred | ```Cutler 1956b:``` |
|  | food | Cawbay Cave, Utah B.C.2000-A.ロ. 500 | common in human coprolites | Hagan 1980: 204, 208 |

Table 19 [cant]. Prehistaric references to Chengpodium or Chenopodium AAmargnthus remains.

| PART | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| seeds | Food? | Winona Village and Ridge Ruin, firizona A.D. 1000-1100 |  | McGregor 1941:299 |
|  | Food? | Tularosa Cave, Sw New Mexica |  | ```Cutler 1952: 47B``` |
|  | food? | Cave du Pont, Utah, Basketmaker |  | Nusbaum 1922: 71 |
| stems | awls, scissar snares, spindle whorl shafts | Cowboy Cave, Utah | some twisted and bent | Janetski 19日0: 日0, 81, 95 |
|  |  | Tularasa Cave, SW New Mexico | in all levels of the cave | ```Kaplan 1963: 354``` |
| unknown parts |  | Cowboy Cave, Utah | in 11 of 15 samples; common taxan | $\begin{aligned} & \text { Barnett and } \\ & \text { Coulam 1980: } \\ & 127,130 \end{aligned}$ |

they were apparently fashioned into awls, scissor smares and spindle whorl shafts. In Tularosa Cave in New Mexico, their presence may have resulted from harvest of older plants from which the leaves were stripped and cooked as greens.

The importance of goosefoot as a prehistoric food in the central and eastern area of the United States has been known for some time. In the early 1930's Gilmore reported that sheaves of goosefoot seed heads were recovered with stored foods of the Dzark Bluff-Dueller culture of Arkansas and Missouri [1931:97]. He thought it likely the resource may have been cultivated in prehistory. Chengpadium was one of two foods that formed the bulk of prehistoric plant remains recovered from Salts Cave in Kentucky [Watsan and Yarnell 1966:844] representing an Early lلodland Group dating 1125-290 B.C. When Bryant [1974:207] analyzed human coprolite pollen from Mammoth Cave, very near Salts Cave, he discovered cheno-am pollen [representing both Chenopodiaceae and Amgranthus pollenJ in frequencies greater than 50\% in four samples. He suggested the prehistoric residents may have eaten Chenopgdium seeds; he had noted a correlation between high cheno-am pollen percentages and the presence of Chenogodiym seeds in human feces elsewhere [in Texas].

A flowering stalk and seeds recovered from the azark Bluff Dweller shelter has been recently examined [wilson 1981] and identified as Chenopodium beclandieci ssp. nuttaliige, a Mexican cultivar that was transported to the

Ozarks with other damesticated plants. The characteristics of these remains led wilsan to believe that they represent Eully domesticated Chenopodium in the New World in prehistoric times.

## SIGNIFICANCE FOR HUMANS

Goosefagt greens [leaves] could be gathered throughout a four-six month grouing season, although the entire plant, including young shoots/stems would be most preferred during the earlier period of April and May. At some point as the stems became tough 〔August-October] people would probably pick the plant and strip off only the leaves to boil as Eood. It is quite possible, however, that young plants might be emerging thraughout the summer manths, praviding a continuous supply of the young greens.

At Canela Hills the seeds of Chengpodiym gef.
neomexiconum ripen in September, and may possibly still be available in Dctober. Beyond that time the plant has dispersed its disseminules and can no longer be gathered. Large stands could be harvested in any number of ways such as those suggested by the ethnographic literature.

Use of goasefont plants far ather needs cauld span the entire length of time the plant is recognizable on the landscape. Harvest of the plant for medicinal needs, for paint, and for packing into earth ovens to provide a protective steam-producing layer surrounding Yucca fruits
could occur from April through September.
Limited use of the flowers for food would be confined to late summer, during August. If the roots were harvested for soap, it seems likely it wauld happen late in the grawing seasan [Sept.-Dct.] when they had attained some size.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD
Chances are low that leaves or young goosefoot stalks picked and boiled as greens, Elowers, or roots would preserve, at least in a condition conducive to identification. However, the seeds would in fact have high likelihood of being retained in the archaeological record due to parching or roasting during preparation. Small seeds being processed over a firepit would bounce out of the container and into the pit below or onto the floor. When the hearth was cleaned or the floor swept, their transfer to ancient trash heaps would be insured. Once the seeds had been ground, their chances of recagnition would be quite low. Presence of seeds in earth ovens might confirm the historic practice of using the plants as a steaming material.

Cologonig gnoustiEglig H.B.K. [=C. longiEolig Gray] CH-6 [KA \#185-83] UA己5490日
 habitat

Cologanig qnaustifolig does well in dry sail on the east side of the stream at Canelo Hills Cienega. The area receives only partial exposure to sunlight, due to surraunding tall vegetation. Underlying substrate is composed of pockets of colluvium and valcanic bedrack. PHENDLGGY

This perennial herb emerges sometime prior to July, at which time it can be found in full flower. Flowering continues through August, when immature fruit develops. By Octaber vegetative activity has ceased and fruit pods appear ripe. In November, just prior to resumption of dormancy, only a few mature pods remain clinging to dead branches.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

In Mexico, the roots of Cologanin gngustifolig var. stricta were said to be a purgative [Altschul 1973:124]. The Tepehuan of Chihuahua were reported to boil the leaves and

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                                    195
stems of this species and administer the resulting drink to
someone with a Fever [Pennington 1969:182]. Also in
Chihuahua, the Tarahumara pressed juice From the cooked
leaves of another species, C. bumifusa, and added it to a
common corn dish [Pennington 1963:77].
    No archaeological record faund.
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## SIGNIFICANCE FOR HUMANS

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To treat a fever, leaves and stems of Cologania angustifolig are available in Canelo Hills at least for the four months of July thraugh October. One could also dig at the base of the plant during that time to locate the root for other medicinal use.
PREDICIIONS FOR THE ARCHAEOLOGICAL RECORD
Because of the parts sought and the preparation steps listed in historic literature, it is not expected that Cologanig gngustifglig parts would be retained in the prehistaric record.
```



Commeling dianthifalig grows in a dry site in Ramsey Canyon on a shallow slape in an area of granite bedrock. The plants receive $50 \%$ or mare exposure to the sun.

## PHENOLQGY

The period of active growth for this herbaceous dayflawer species is July-September. In July the taxa displays rapidly elangating stems and enlarging leaves. By August it appears in full flower and by September mature fruit are dispersing. The plants resume dormancy by October.

## ETHNOGRAPHIC/ARCHAEOLDGICAL RECORDS

Uarious species of dayflower have been eaten or sought for medicine the world over. Altschul [1973:20-21] lists medicinal uses of Commeling species in Balivia, China, Japan and the Phillipines. People in China and Japan have been reported to eat young stems and leaves of these plants. Commeling diEfusg, which grows in the ricefields in west Bengal, India, is macerated and applied to burns, boils and itches; the leaves of this species also serve as a
vegetable [Datta and Banerjee 1979:302].
In the New World, references to dayflower seem to be generally medicinal in nature. According to Uestal [1952: 193, the Ramah Navajo gave a cold infusion of dried pulverized raots of $C_{\mathcal{L}}$ dignthifolig to animals in breeding seasons to increase fertility, and to ewes if twin lambs were desired. Other Navajo drank infusions of Commeling sp. as an aphradisiac [Wyman and Harris 1941:61]. Tepehuan living in Chihuahua used the seeds of C . execta as a treatment far badly swallen eyelids [Pennington 1969:178].

No archaeological record found.

## SIGNIFICANCE FOR HUMANS

Young dayflower plants could be gathered in July if sought as edible greens. For medicinal needs, perhaps older plants would alsa suffice, thus extending the period of availability through the manths of August and September. Seeds can be sought for medicinal treatment in September. Roots might be gathered at any time the plant was active vegetatively and visible above graund.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD
Perhaps only the seeds of dayflower would preserve. Their manner of preparation as a medicine would bear upon the chances for finding them centuries later. Any treatment that exposed them directly to fire wauld foster preservation, but other methads such as mixing the seeds in water for an eyewash would not.


## HABITAT

Corydalis qurea does well in a partially shaded area on the east side of the stream at Canelo Hills Cienega. The underlying substrate, composed of colluvium and volcanic bedrock, is dry.

## PHENOLOGY

This biennial or short-lived perennial resumes growth in February and within a month is in full flower. By April the first mature seeds are present in fruit pods. Ripe seeds can be found through May and June on still growing plants; by July the plant has died back and becomes difficult to locate.

## EIHNOGRAPHIC/ARCHAEDLGGICAL RECDRDS

A number of species of weedy Corydalis in North America, including C_ quren are suspected of containing toxic alkalaids, though they may not taste bad to animals. Apparently the tubers of some species have been eaten in Eurape [Lewis and Lewis 1977:32]. In the United States and

Mexica Conydglis gureg has been gathered principally as a medicinal plant. For example, in Mexico a tea of C. $_{\boldsymbol{L}}$ qurea ssp. gccidentalis was considered good for wamen immediately after childbirth [Altschul 1973:92]. In New Mexico the Ramah Navajo made a lation of $\mathrm{C}_{\mathrm{s}}$ gureg to treat sore throats and backache; they also drank a cold infusion of the plant for stomachache and in the treatment of dysmenorrhea [Uestal 1952:283. Kayenta Navajo in Arizona treated "milk leg", diarrhea, snake bite, and sores on the body caused by interaction with a raven's nest with this species [Wyman and Marris 1951:23]. Navaja alsa emplayed it as an arthritis medicine $[W \mathrm{yman}$ and Harris 1941:59, 62].

No archaealogical record located.

## SIGNIFICANCE FOR HUMANS

Conudalis qurea is available for gathering in Canelo Hills February through June for preparation as a medicinal tea or tapical lotion.

PREDICTIONS FOR THE ARCHAEDLGGICAL RECORD
Plants prepared as teas or lotions generally lose all identifying characteristics, precluding chances of recovering them in the prehistoric record. Perhaps only the black shiny seeds, brought in inadvertently in the harvest of the plant, might enter the record and be recovered centuries later.

Cucurbitg foetidissimg H.B.K.
CH-2 [KA \#324-84] UA255014


## habitat

Cucurbita faetidissima flourishes under the canopy of the deciduous forest that lines the stream at Canelo Hills. There is less than $50 \%$ exposure to the sun in this location. The underlying substrate is alluvial, and is often damp due to the shading provided by nearby trees.

## Phenalogy

Buffalo-gourd is a perennial herbaceaus species present above ground at Canela Hills May through October. During the three months of May to July plants put energy inta stem elongation and leaf growth. Flowering begins in August, with immature fruit ripening by October. By November most plants died back to graund level in preparation far a six month dormant period.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Buffala-gourd is another species for which extensive ethnographic literature exists [Table 20]. In the historic period, people have saught blossoms, young and ripe fruit,

| PART | USE | GROUP[S] | NDTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| blassams | dye | Cahuilla, Califarnia | yellow | Bean and <br> Saubel 1972 |
|  | medicinal | Zuni, New Mexico | ```powdered and applied to sores``` | Camazine and Bye 1980:375 |
| Eruit | Goad | Many groups in Sw U.S. | coaked or dried | $\begin{gathered} \text { Yanovsky } \\ \text { 1936:59 } \end{gathered}$ |
|  | Food | Groups in New Mexico | caoked when young | $\begin{aligned} & \text { Standley } \\ & \text { 1912:458 } \end{aligned}$ |
|  | Food | Isleta, New Mexico | Formerly eaten | Jones 1931: 27 |
|  | Food | Zuni, New Mexico | picked while green and cooked | Cushing 1974: 228 |
|  | househald needs | Cahuilla, Califarnia | dried and made into utensils | Bean and Saubel 1972 |
|  | househald needs | Kiowa, Oklahoma | used to clean clothes | Uestal and Schultes 1939:54 |
|  | household needs | Many groups of $S$. California and Arizana | ```pulp of green fruit used to clean clothes``` | Palmar 1878: 651 |
|  | househald needs | Acama and Laguna, New Mexico | made into dance rattles and toys when ripe | Swank 1932: 40 |


| PART | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| fruit | household needs | Hopi, Arizona | Find unsuitable <br> for utensils | Whiting 1966:93 |
|  | hausehold needs | Southern Paiute, Utah | made into a saap | Bye 1972:93 |
|  | household needs | Kawaiisu, California | ```used when ripe Far washing clothes; crushed or bailed``` | $\begin{aligned} & \text { 2igmund } \\ & 1981=\text { e2 } \end{aligned}$ |
|  | household needs | Luisena, California | ripe Fruit used as saap | Sparkman 1908: 229 |
|  | medicinal | Kiowa, Oklahoma | peeled and boiled | Uestal and Schultes 1939:54 |
|  | medicinal | Spanish-Americans of New Mexico | baked in oven | ```Curtin 1965: 45-47``` |
|  | medicinal | Cahuilla, California | pulp applied to sores | Bean and Saubel 1972 |
| fruit and vines | househald needs | Groups in Naw Mexico | mashed and used to wash clothes | $\begin{aligned} & \text { Rose 1899: } \\ & 236 \end{aligned}$ |
| roots | househald miseds | Tarahumara, Chihuahua | crushed and used to sank clothes | $\begin{aligned} & \text { Pennington } \\ & \text { 1963: 212 } \end{aligned}$ |
|  | medicinal* | Plains groups of Missouri River | root resembled human body | Gilmore <br> 1977:54-65 |



| Table 20 [cont]. |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PART | USE | GROUP [5] | NOTES | REFERENCE |
| seeds | Eand | Southern Paiute, utah | made into a mush | Bye 1972:93 |
|  | Food | Pima, Arizona | ransted | Russell 1975 |
|  | food* | Many graups, S. Calif. and Ariz. | ground Fing and made into mush | ```Palmer 1日7日: 651``` |
|  | games | Spanish-Americans of New Mexico |  | ```Curtin 1965: 45-47``` |
|  | medicinal | Zuni, New Mexica | powdered | Camazine and <br> Bye 1980:375 |

* Name listed as a synonym. rants and seeds to serve as food, medicines and as a variety of household needs. The fruit could be cooked when green and eaten, or dried for storage. As an example of how the fruit might be prepared, the Zuni picked it green and cooked it in variaus ways; a principal method was to bail it to a paste, mix liberally with rancid suet and fry it on hot stane slabs [Cushing 1974:228]. When ripe later in the season, the hard rind might be fashioned into children's toys or utensils. Numerous groups in the American Southwest made soap out of the fruit for cleaning clothes. Fruits also provided medicinal treatments, generally undergaing some kind of preparation prior to use.

Sliced, macerated, ground, or bailed raats had medicinal uses that included curing rheumatism CCurtin 1965: 45-47], ulcer relief [Bean and Saubel 1972:57-5日], use as an emetic [Uestal and Schultes 1939:54] and in treating chest pains [Jones 1931:27]. Apparently the roots also provided material for soaking clathes, but not as ofien as the fruits did.

Seeds of buffala-gourd have been eaten. Often they were ground for flour and made into a mush. The Pima of Arizona first raasted them. Spanish-American children have played games with the seeds, and the Zuni ground them to powder for a medicinal need.

The archaeological record of buffalo-gaurd is extensive [Table 21]. According to Cutler and Whitaker [1961:470-471]

| Table 21.PART | Prehistoric references to Cucurbita foetidissima remains. |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | USE | GRDUP[S] | NOTES | REFERENCE |
| fruit pulp | as scauring pads? | Tularasa Cave, New Mexica | Found with rind and roots | Cutler <br> 1952: 470 |
| rind |  | ```Grand Canyon, Ariz. [A.D.1050- 1150J``` | in a rack shelter granary | ```Cutler 1963: 301``` |
|  |  | Tularosa Cave, Neu Mexica | Found with fruit pulp and roots | $\begin{aligned} & \text { Cutler } \\ & \text { 1952: } 470 \end{aligned}$ |
| rind | made into vessels | Uentana Cave, Arizana | fruits halved lengthwise | $\begin{gathered} \text { Haury } 1950: \\ 169,425 \end{gathered}$ |
|  |  | Tanto Nat'l. Monument, Arizona [A.D. 1300's] |  | ```Bohrer 1962: 99-100``` |
|  |  | Montezuma Castle, Arizona |  | Cutler and Kaplan 1956 |
|  |  | Drme Ranch, Ariz. [A.D.1100-1400, historic ageJ | ```many lots in numerous strata``` | Breterinitz 1960: 35 |
| rind and seeds |  | $\begin{aligned} & \text { Tamaulipas, Msx- } \\ & \text { ica [B.C. } 7000- \\ & \text { histaric times] } \end{aligned}$ | thrae caves, in all levels | Whitaker, et al. <br> 1957:356 |
|  |  | Zian Nat'l. Park, Utah [Basketmaker III-Puebla IJ | Fram a cave | Jones 1955: 201 |


this species has the widest distribution among anciert groups of any of the wild Cucurbita species. Wild remains date back to 7000 B.C. in the Dcampo Caves of Tamaulipas, Mexica, and have been recovered from numeraus prehistoric sites in both Arizona and New Mexico. Many of the Southwestern United States remains date to the period A.D. 900-1400. According to Cutler [1955b:182], this plant was one of the most common found in Tularosa and Cordova Caves in New Mexica. Many of the ancient records refer to uncharred parts retained in well-pratected sites.

## SIGNIFICANCE FOR HLMANS

Buffala-gourd blossams cauld be sought for medicinal or dye purposes in August in Canelo Hills Cienega. Young fruit is generally available in September. By October the fruit has ripened, and wauld be ready far harvest then and far some time after the plant has died back. A plant can produce an abundant crop of ripe fruit which contains seed rich in ail and protein $[B e m i s, ~ e t ~ a l . ~ 1978] . ~$

The large underground root would be easily located during the time the plant is obviaus above-graund CMay through October], but if the location of a plant were remembered the root could be dug at any time during the year. The roots can often be quite extensive, with a fresh weight of up to 47 kg ; they also vary in starch content from $20 \%$ [initial flush of growth] to a high of $52 \%$ during dormancy [Bemis, et al. 1978].

## PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD

Highly perishable buffala-gourd blossams would prabably not preserve. Likewise, cooked young fruit would become unrecognizable. Mature fruit fashioned into utensils might be retained in well-protected locations; mature fruit crushed or boiled as soap, or baked, peeled and boiled as a medicine would not. Any macerated or crushed roots that were subsequently mixed with water and/ar bailed cauld lase identifying criteria. The roasted seeds, destined to be eaten, would survive only if they entered the archaealagical record prior to being ground to flour.


All three species of Cuperis graw in a dry, partiallyshaded site, appraximately 10 meters from the stream at Ramsey Canyon. The substrate is composed of colluvium and granite.

PhENOLOGY
Uegetative growth of these perennial flat-sedges resumes in July, though stems cease to elongate a month later. Leaves enlarge for an additional one or two months. By August both Cuperys fendlerignus and $C_{\text {_ }}$ aff. pringlei are in full flower; E. manimae fallows a month later. Mature achenes can be found on all species in September and Detober. It becomes difficult to locate flat-sedge plants in November or December, after they have dispersed their fruit and resumed dormancy.

ETKNGGRAPHIC/ARCHAEDLGGICAL RECORDS
The underground raots of Cyperus Eendlerignus have been listed as food for various Apache graups in the American Southwest [Table 22]. Neither of the other two species listed above were mentioned in the ethnographic literature. However, other species have been sought. The underground tubers and/or rhizames seem to be a preferred food, as well as providing medicinal material. Leaves, culms and achenes have also found their way into a number of medicinal preparations. The achenes of more than one species offered a food resource to peaple in various places.

| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| C. aristatus <br> [as [. inElaxus] | ```tuberous roots, as Food``` | Acoma and Laguna, New Mexica | Castetter 1935:25 |
| C. brevifalius | lenves, 0 m medicine | Philippine Islands | Altschul 1973:12-13 |
| C. cyperaides | semds, n S medicine | Philippine Islands | Altschul 1973:12-13 |
| C. diffusus | roat, as medicine | Philippine Islands | Altschul 1973:12-13 |
| C. esculentus | $\begin{aligned} & \text { seeds, formerly } \\ & \text { enten } \end{aligned}$ | Mahave and Cocapa, Lawer Cala. River | ```Castetter and Bell 1951:192``` |
|  | seads, 05 Food | Cocopa, Lower Colo. River | Kelly 1977:39 |
| C. Eendlerianus | tubers, as Faod | Mescalera and Chiricahua Apache | ```Castetter and Opler 1936:47``` |
|  | tubers, as Eood | Apache, Southwest United States | Bartlett 1951:50 |
| C. Ferax | $\begin{aligned} & \text { seeds, formerly } \\ & \text { eaten } \end{aligned}$ | Mohave and Cocopa, Lawer Cala. River | ```Castetter and Ball 1951:192``` |
| C. muricatus | root, as food and - scent | Tanganyika, Africa | Altschul 1973:12-13 |
|  | unknown part, as medicine | Philippine Islands | Altschul 1973:12-13 |
| Cyperus spp. | culms, ns medicime | West Bengal, India | ```Datta and Banerjee 1979:310``` |


| SPECIES | PART AND USE | GRDUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Cyperus spp. | rhizomes, as medicine | West Bengal, India | Datta and Banerjee $1979: 301$ |
|  | root, as medicine | NE Yavapai, Arizoma | Gifford 1936:261 |
|  | seeds, as frod | $\begin{aligned} & \text { Cocapa, Lower Colo. } \\ & \text { River } \end{aligned}$ | Curtin 1984:99 |
|  | spikes, as medicine | West Bengal, India | Datta and Banerjee 1979: 301 |

No archaeological record found.
SIGNIFICANCE FOR HUMANS
Underground flat-sedge parts might be harvested in July for food or medieine just as the plants are emerging from the ground. These three species may not offer much in the way of nutrient reserves, however, judging from the scanty underground parts on herbarium specimens collected in this study. An alternate time for gathering would be in Octaber or November, when plants have replenished underground storage organs and can still be located via above ground parts. Leaves and culms could be gathered for medicinal needs at any time from July through the beginning of dormancy. Achenes from all three species would be ripe as foad in September and Dctaber.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD
Depending on whether flat-sedge achenes were prepared in some manner that exposed them to fire or heat, they might represent the only part retained in the prehistoric record. Leaves and culms processed into a medicine, and young Fleshy underground parts would be unlikely to survive.
 HABITAT

This species of Qesceurginio can be found on the western side of the stream at Canelo Hills Cienega. The underlying substrate is composed of alluvium and is generally quite dry. The area is fully exposed to the sun's rays.
phendalag
This annual tansy mustard species can only be faund in the spring months of April through June here. It flowers in April and disperses mature seeds in May and June. During the time the seeds are ripe, the leaves have generally dried up. After June the plant has completely broken down, and is present only as seeds in the soil for the next nine months.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

The ethnographic record reveals extensive use of Desseurainig pinngtg [Table 23]. The leaves and young plants have been frequently sought when tender to be cooked and

| Table 2PART | Ethnographic references to the use of Descurginig pinnata. |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | USE | GROUP[S] | NOTES | REFERENCE |
| leaves | food | Cahuilla, Califarnia | as greens, in the spring | Bean and <br> Saubel 1972 |
|  | Eood | Tepehuan, Chihuahua | boiled and fried | Pennington 1969:93 |
|  | Food* | Many graups | boiled or roasted | $\begin{aligned} & \text { Yanousky } \\ & \text { 1936: } 27 \end{aligned}$ |
|  | medicine* | Pima, Arizona | infusion applied to sares | $\begin{aligned} & \text { Russell } \\ & \text { 1975:77 } \end{aligned}$ |
| plants | Food | Mohave and Yuman groups, Lawer Colo. River | boiled as greans | Castetter and Bell 1951:187 |
|  | ford* | Hopi, Arizona | ```as greens in spring``` | Whiting 1966: 77 |
|  | food | Hopi, Arizona | gathered in spring and baked in pit as steamed greens | Nequatewa 1943: 19 |
|  | Eood | S. Paiute, Utah | coaked as pot-herbs | Bye 1972:93 |
|  | medicine | Ramah Navijo, New Mexico | poultice as toothache treatment | ```Uestal 1952: 2B``` |
|  | paint | Mopi, Arizana | for pottery | Whiting 1966: 77 |

[^2]

*Listed under a synonym Sppbig pinnata.
eaten as greens. An alternate need served by this plant has been as an organic pottery paint. For example, the Tewa of New Mexico boiled Derscurainig [as Sophig] until it turned to mush, then squeezed out much of the liquid and molded the mass into a cake to be dried for later use. When needed, a small piece was broken off, dipped in water, and rubied on a stone pallette as a paint [Robbins, et al. 1916:EO].

Perhaps the more important resource provided by tansy mustard was its harvest of tiny red seeds. Hints as to its importance as an early-ripening resource can be found in such statements as "once extensively used for food" and "most common of the seed crops". Typical harvest and preparation techniques have been recorded for the Kawaiisu of Califarnia. These peaple beat the seeds inta a gathering basket, parched them with hot coals on a flat tray, pounded them in a mortar, and after sifting mixed the meal with cold water. Among this group, as with others, the seeds were often stored, as gathered or after pounding [Zigmund 1981:26]. In the 1930's a Ramah Navaja woman in New Mexico was observed making a cake from the ground seeds of this plant [Uestal 1952:28]; perhaps the cake was destined to be stored for future use.

Tansy mustard seeds have been recovered fram ancient sites in the southwestern states of New Mexico, Colorado and Arizona. The repeated occurrence of Descurainia type seeds in 30 of 64 floor and trash strata at Salmon Ruin in north-
western New Mexico suggests that prehistoric occupants of the puebla ate the resource frequently [Adams 1980a:2日22843. Some of the seeds appeared parched or carbonized. Bath the Chacaan [A.D. 1090-1135] and Mesa Verdean [A.D. 1180-1250] accupations of the pueblo harvested this resource. Just to the south of Salmon Ruin burned Descurainig seeds were found in a pueblo site dating to A.D. 750-1100 in the Chaco Canyon area [Struever 1977:52]. Cutler [1952:479] reparted on the presence of Descurginigo ginnatg in the wild plant debris excavated from Tularasa Cave, a Mogallon site in southwestern New Mexico. Twa sites in southern Colorado, dating to the Basketmaker II I and Pueblo I periods, contained a total of four lots of charred Descurginig seeds [Jones and Fonner 1954:94-95].

In Arizona, excavators recovered a number of tansy mustard seeds in a Sacaton Phase [A.D. 1100-1200] pottery vessel ot Snaketown Pueblo in the southern part of the state. An alla [large ceramic vessel] faund in a Rincon Phase Hohokam site [A.D. 1100-1200] just south of Iucson held at least 400 ml of the seeds. An accompanying olla was full of corn, suggesting both vessels contained foodstuffs. An olla in an outdoor hearth area of a nearby site of the same time periad held 890 ml of the same small seeds [Bohrer, Cutler and Sauer 1969:2-3].

SIGNIFICANCE FOR HUMANS
Young tansy mustard plants provide a harvestable green in the spring at Canelo Hills, during April and perhaps earlier. This period of quailability of leaves and tender stems would be rather short, as the plants appear to dry up as the seeds begin to ripen in the pods. Ripe seeds can be Found in May, and may often cling in the pods of the plant until June. Entire stands of what appear to be dead tansy mustard plants can still yield an abundant source of seeds to a harvester walking through with a basket and seed beater.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD
Preservation of young plants and leaves is unlikely, considering that they are most often bailed to prepare either edible greens or pottery paint. Preservation of seeds, on the other hand, is highly likely, especially if they have been parched or roasted in preparation. Chances for entry of the tiny seeds into firepits or trash deposits would be very good.



## HABITAI

The two species of tick-clover monitored in this study ot Ramsey Canyon preferred slightly different settings. Desmadium batocaylan grows in wet sail in a heavily shaded area in overbank deposits near the stream. Q. rosei in be Found in dry sail in an area that receives more exposure to the sun.

## PMENDLOGY

Although D . batacaylon is a perennial herb and $\mathrm{D}_{\text {. }}$ rgsei is an annual, their phenological profiles are similar. Both are in Full flower in Huyust and September, and have
ripe pods in September and October. Both are vegetatively active throughout this period. The major difference between the two species is that the perennial D. batocoulon can be found on the landscape for one month before and one month following the presence of annual $口$. raseit in the area.

## ETHNDGRAPHIC/ARCHAEOLOGICAL RECORDS

No references to New World use of tick-clover were located in the literature searched. This seems samewhat unusual in light of the fact that people in other parts of the world have sought the genus. In east Africa, the roots of a species of Desmodium have been used to treat large sores, while the leaves of another species were pounded and mixed with water and applied to sore eyes [Kokwaro 1976:135]. In West Bengal, India, a paste of the bruised leaves of 1. triflorym provided a topical medicine for itches and sores; fresh leaves were gathered to treat a number of maladies, including diarrhea, abscesses and wounds [Datta and Banerjee 1979:304]. In Haiti, this same species was bailed as a tea for rheumatism, and peaple in Burma ate the leaves as a vegetable [Altschul 1973:121]. Desmodium dunnii beans have been eaten in China, while seeds of $D_{\text {. }}$ Eacemgsum were steamed and eaten in Japan; other species served medicinal needs in Siam, the Solamon Islands and the Philippines [Altschul 1973:121].

Evidence suggesting tick-clover use in prehistory was recovered from a Mesa Uerde [A.D. 1180-1250] trash deposit
at the Salmon Ruin in northwestern New Mexico [Adams 1980a:263]. This sparse evidence hints that tick-clover seeds canstituted an occasionally sought food.

## SIGNIFICANCE FOR HUMANS

With no data fram the New World to support tick-clover use, it is not as likely that prehistoric inhabitants in the area of Ramsey Canyon would have known and saught these species. Nevertheless, in light of Old World references their potential human value may have included use of the leaves in medicines or as a vegetable fram June through November, harvest of the fruit far food September through November, and digging of the roots for external treatment of sores for as lang as the plants were recognizable above graund [June-November].

PREDICTIONS FOR THE ARCHAEOLQGICAL RECDRD
Perhaps only the recovery of burned tick-clover seeds could be reasonably expected to represent prehistoric use of these plants. Preparation techniques applied to other, more perishable, parts would greatly reduce their chances of recovery.

Eleocharis rostellatg [Torr.] Torr. CH-1 [KA \#123-83] UA255224; [KA \#192-83] UA255225


Elegcharis Eastellata grows abundantly in the cienega at Canela Hills. The soil is fully saturated with water, and plants are fully exposed to the sun's rays. The underlying substrate seems to be composed entirely of alluvium. PHENDLOGY

Spike-rush can first be recognized in the cienega in April, at which time the leafless stems are elongating. Full flowering covers the period April through July, and mature fruits are present by September. By Dctaber the plants appear to be dying back to ground level, and they remain dormant for the next five months.

EIHNGGRAPHIC/ARCHAEDLOGICAL RECORDS
Eleqcharis Egstellata was used by the Ramah Navajo of New Mexica as a Holyway emetic [Vestal 1952:19]. The Navajo alsa sought $E$. palustris as a medicinal emetic $[$ Wyman and Harris 1941:5日]. Eight of eight Northern Paiute bands surveyed used this same species in weaving [Stewart 1941:428].

Spike-rush evidence has been recovered in a Few ancient contexts in the American Southwest. At Lavelock Cave, two miles From the shore of Former Humboldt Lake in Nevada, occupants at same time over a 2000 year time span [B.C. 1000-A.D. 1000]J used Es palystris in forming soft, pliable matting. Several bundles of this plant, two of them wrapped with Juncus, were alsa present in the cave deposits Claud and Harrington 1929:60, 93]. EleqchaEis CE. ytahensis achenes were eaten at Lovelock Cave, as they were found in copro-lites dating to the period araund A.D. 740 [Heizer and Napton 1969:567]. At Salmon Ruin in northwestern New Mexica, an Elegcharis mgntang type achene was excavated from the Chacoan occupation [A.D. 1090-1130], yet it was unclear if the item represented prehistaric use of the item or accidental introduction [Adams 1980a:296].

SIGNIFICANCE FOR HLMANS
Spike-rush plants cauld be gathered for pliable stems destined for material culture, medicinal or ceremanial needs at any time between April and Dctaber. Achenes harvested For food could only be acquired in September.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD
Well preserved depasits, such as deeply buried trash ar cave debris, could retain evidence of spike-rush stems gathered in prehistary. Achenes prepared by parching or raasting might preserve as evidence of use of this genus.


## habitat

Elumus canadensis grows in damp soil under a canopy of tall trees near the stream at Canela Hills Cienega. The underlying horizontal substrate is composed entirely of alluvial deposits. Shade provided by surraunding vegetation can filter out over $50 \%$ of the sun's rays in this location.

## PHENDLQGY

This perennial species of wild rye is quite active vegetatively by June. Full flowering seems restricted to July, after which mature grains can be found from August through November. During the four month period when ripe grains are available, stem elongation and leaf expansion appear to have slowed considerably. The plant resumes dormanc:y for the six months of December through May.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

The Gosiute of Nevada and Utah once gathered quantities of Elymus canadensis grains ["seeds"] for food [Chamberlin 1911:368]. Doebley [1984] listed five species of wild rye
that have been harvested far subsistence by nomadic groups in histaric times. Elymus glaugus was known as "mountain wheat" among the Acoma and Laguna of New Mexico [Swank 1932:42]. Elymus sondensatus stalks served as arrowshafts and roof thatching for the Cahuilla of southern California; the stems were fire-hardened in preparation of the arrowshafts [Bean and Saubel 1972:69].

Researchers have listed wild rye remains in prehistoric sites in Nevada, New Mexico and Arizona. Seed [grain] of Elymus triticgides was recovered in a single coprolite specimen fram Lovelock Cave in Nevada, suggesting food use; possibly the fiber was recovered from bath this site and another Great Basin site as well [Roust 1967]. Fruiting material from Elymus salinus was identified in some of the Bat Cave remains in sauth-central New Mexico [Smith 1950: 167]. Carbonized grass grains referred to by Bohrer [1984] as the Elymus Complex Cincluding the genera Elymus, Ggrgpymgn and Sitanign] were preserved in a number of prehistoric contexts in the Hohokam site of La Ciudad in Phoenix, Arizona. Bohrer noted that the recovery of this material from a house floor and trash suggests utilization of the grain os a food, and as such may be the first archaealogical record to clearly document this possibility. An alternate explanation could be the use of the grass as roof thatching, and subsequent incorporation of the grains into the archaealogical record thraugh catastraphic fires.

The historical and prehistoric implications that wild rye provided food to humans is interesting in light of the fact that this grass is particulary susceptible to the
 parasitizing fungus can be ingested by humans in flour milled from contaminated grains [Lewis and Lewis 1977:24]. Humans might have to be especially careful when gathering this grass.

## SIGNIFICANCE FOR HUMANS

Elymus canadensis grains could be gathered for food for the four months of August through November at Canelo Hills. The stalks sought as arrowshaft or roof thatching material might be best callected in the same Eaur month period, when vegetative activity is low and stems are fairly mature. predictions for the archaeliogical record

Both grains and stems of wild rye might enter the archaealagical record. If preparation techniques included parching or tonsting of the grain, daily household accidents would insure that the grain became incorporated in hearth debris or trash deposits. The practice of fire-hardening the stems wauld tend to promote preservation; roof-thatching exposed to normal environmental conditions wauld decay with time.

Egilobium gdengcoulon Hausskn. [-E, sqliEgrnicum Hausskn.] CH-4 [KA \#134-83] UA254653
 habitat

Ebilqbium qdengcqulan grows in sail saturated with water at the edge of a pand below the dam at Canela Hills Cienega. The area is open, with Full exposure to the sun's rays. The underlying substrate is compased of alluvium.

## PHENOLOGY

This perennial herbaceous willow-weed emerges in the spring, becoming obvious in June when in Full flower. Flowering continues for the remainder of the period the plant is above ground. Active vegetative growth spans the period June though October. Mature fruit is available August through Detober. By November dormancy has resumed. ETHNDGRAPHIC/ARCHAEOLOGICAL RECORDS

Generally willaw-weed species have served medicinal needs in historic times [Table 24]. Plants have been prepared as both a tea and a lotion. Peaple sought roots as a styptic. The Kayenta Navaja in Arizona dug mud from around the roats of $E$, adenocaulon and applied it to the

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| E. adenacaulon | mud from roots, as external medicine; infusion as lation and drink | Kayenta Navaja, Arizana | Wyman and Marris 1951: 32 |
| E. angustiFalium | leaves, as a tea | Russia | Lewis and Lewis 1977: 391 |
|  | plants, as a medicine | Kayenta Navaja, Arizona | Wyman and Karris 1951: 32 |
| E. calaratum | plants, pounded as external medicine | Hopi, Arizana | Hough 1899: 149 |
| E. denticulatum | plant, as medicine | Pery | Altschul 1973:210 |
| E. glandulosum | plant, as medicinal tea | Tepehuan, Chihuahua | ```Pennington 1969: 183``` |
| E. hirsutum | roots, as a styptic | E. Africa | Kakware 1976:170 |
| Epilobium spp. | unknown part, eaten as bread | Arizana, Utah and Nevada | Cited in Yanovsky 1936: 46 |
|  | stalks; [gelatinaus] eateri | Northwestern United States graups | ```Cited in Yanousky 1936:46``` |

body far muscular cramps [Wyman and Harris 1951:32]. It is even possible the plants have been eaten.

No archaealogical recard lacated.
SIGNIFICANCE FOR HUMANS
Willow-weed plants and leaves cauld be gathered for medicinal teas and lations from June through Dctaber. Raats and mud in assaciation with the rats wald also be easy to Find during this periad. The stalks of E. gdengogulon do nat seem particularly gelatinous, so perhaps they would not be a gaod food choice.

PREDICIIONS FOR THE ARCHAEDLGGICAL RECORD
Willow-weed plants and leaves braught into a dwelling and prepared as a medicinal tea or lotion would likely lase all identifying characteristics. Recavery of roots in pratected locations would require an extensive modern camparative callection of raots for identification.
 Eguisetum hiemale L. var. qffine [Engelm.] A.A. Eaton RC-4 [KA \#117-83] UA254995


Equisetum lqevigatum A. Braun.
RC-3 [KA \#72-83] UA己54999; RC-3 [KA \#110-83] UA254998

## HABITAT

Both species of Equisetum can be Found growing in Fully saturated sail along the stream at Ramsey Canyon. Exposure to the sun's rays varies from $50-100 \%$. The substrate is composed of alluvium.

PHENOLOGY
In April stem elongation of the two species of horsetail resumes. After this the sequence of developmental events for the twa species diverges. Stem elongation Ear E. hiemgle continues until November, while that of Es logvig믄́ㅇ has slawed considerably by September. Timing
af strobilus development far the twa species is asynchranous. Bath species do, however, have mature spores by August, and both resume dormancy for at least four months. ETHNOGRAPHIC/ARCHAEOLDGICAL RECORDS

Horsetail plants have been made into whistles and crafts, dried and ground as food, prepared as a medicinal decoction and used to polish items such as bows [Table 25]. Underground roots and/or tubers were sought by historic groups as a food, along with the ripe strobili.

The prehistoric record reveals the presence of horsetail stems and possibly the strobili [listed as "seeds"] in ancient contexts [Table 26]. The recovery of stems in wellpreserved human coprolites in Utah and Arizana hints at a foad resource. Horsetail parts were alsa tentatively identified in human fecal material.

## SIGNIFICANCE FOR HUMANS

Although horsetail plants go darmant for three-faur months at Ramsey Canyon, the stems can still be seen above ground, and usually above snow level. Therefare, they could be collected at any time during the year to serve household, food or medicinal needs. Harvest of underground parts, if attempted, would also be a year-round possibility. The only part truly restricted in availability wauld be the conelike strobilus, abtainable Erom August to November from both species.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| E. arvense | roots [swollen], as Fond | Kiowa, 0kla. | Vestal and Schultes 1939: 12 |
| E. hiamale | plants, as whistles | Gosiute, Utah | Chamberlin 1911: 368 |
|  | plants, as whistles | Spanish-Americans of Ria Grande, New Max. | Curtin 1965:51 |
|  | plant, 0 m medicine | Spanish-Americans of Rio Grande, New Mex. | Curtin 1965:51 |
| E. kansanum | plant, as medicine and in Waterway ceremany | Kayerta Navajo, Arizona | Wyman and Harris 1951:15 |
| E. lasvigatum | leqves [sic], as Food mixed with corn | Tarahumara, Chihuahua | ```Pennington 1963: 77, 121, 178``` |
|  | plant, as food dried and ground | San Felipe, New Mexico | Castetter 1935:27 |
|  | plant, as faod driad and ground Eor sacred bread | Hopi, Arizona | Hough 1898: 150 Whiting 1965:99 |
|  | plant, as medicine chewed | Acama and Laguna, New Maxica | Swank 1932:42 |
|  | plant, as medicinal decaction | Ramah Navajo | Uestal 1952:11 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| E. laevigatum | stems, as medicinal tea | Iarahumara, Chihuahua | $\begin{aligned} & \text { Pennington 1963: } \\ & 77,121,178 \end{aligned}$ |
|  | $\begin{aligned} & \text { stems, as medicinal } \\ & \text { tea } \end{aligned}$ | Tepghuan, Chihuahua | Pennington 1969 |
| Equisetum spp. | plants, as medicine | Chumash, Calif. | Timbrook 1984:153 |
|  | plants, as medicine | Cahuilla, Calif. | Bean and Saubel 1972: 70-71 |
|  | plants, as crafts | Chumash, Calif. | Timbrook 1984:153 |
|  | ```plants, as medicinal emetics``` | Navajo | Wyman and Marris 1941 : 58 |
|  | plants, far polishing items | Plains graups | Gilmore 1977:11 |
|  | stems, as whistles | Winnebago | Gilmore 1977:11 |
|  | tubers, as Food | Minnesata | Yanavsky 1936:4 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| E. pratense | plant, for scauring and polishing | Dzark Bluff-Dwellers of Arkansas and Missouri | Gilmore 1931:92 |
| Equisetum spp. | seeds [sic], as food in human coprolites | Lavelock Cave, Nevada | Ambro 1957:38 |
|  | stems, as food in human copralites | Glen Canyon, Utah [A.D.400-1350] | Fry 1976:15 |
|  | stems, as faod in human copralites | Antelope House Ruin, Arizona 〔Pueblo III] | Fry and Hall 1975: 91 |
|  | stems [?] | Tularasa Cave, New Mexica | Cutler 1952:478 |
|  | unknown part | Hoy House, sw Calo. [Puebla III] | Nickens 1981:74 |

## PREDICTIDNS FOR THE ARCHATOLOGICAL RECORD

Dry horsetail plants and stems would preserve if protected in the prehistoric record. Parts ingested by humans, including stralili, might be retained in copralites. Swallen underground roots or tubers could be expected to decay, due to their fleshy nature.

Engarostis intermedig Hitchc. RC-1 [KA \#139-83] UA255023


Eragrostis intermedia can be found on a shallow colluvial slope in dry sail a short distance from the Ramsey Canyon stream. The area is occupied by tall trees that provide a rather dense canapy of shade. The underlying granite bedrock is exposed in a number of locations.

## PHENOLOGY

This perennial species of lave grass becomes noticeable in May, with immature inflarescence units developing by June. Full Elowering occurs in July, followed by rapid maturity of grains. Ripe grains can be found on love grass plants Eor the Eull five month period of July through November. Active vegetative growth has ceased by late September, though the plant is still present through November when it appears to resume complete dormancy.

## EIHNOGRAPHIC/ARCHAEDLOGICAL RECDRDS

Lave grass seeds have been gathered for foad by historic New World groups. In North America, grains of E.
mexicang, a grass native to the Lower Colorado River area, were food for the Cocopa [Castetter and Bell 1951:187-191]. Paiute living in southern Nevada prepared the seeds of love grass in different ways [Bye 1972:91]. Owens Valley Paiute in California considered E. secundiflorg a very important food, gathering it from large patches in wetland areas [Steward 1933:243].

Remains that may represent a species of love grass were reported by Cutler [1952:478] as part of the plant debris in the Mogallon site of Tularosa Cave in southwestern New Mexico. A number of carbonized love grass grains were also recovered from trash pits at the Hohokam site of La Ciudad in Phoenix, Arizona, dating to the period around A.D. 850900 [Bohrer 1984]. At that same site, 14 carbonized grains identified as E. diEEysa type came from trash pits, two hearths and on a floor. Although it is possible the recovery of the grain in oven fill may represent use of the plant foliage in steaming, it may also be that some of the grains are the burned remains of ancient meals. If sa, this record may be the first clear documentation of prehistoric collection of Eragrostis for faod in the American southwest. SIGNIFICANCE FIGR hUMANS

The grain of love grass falls freely from its enclosing chaffy parts. For this reason, a harvester with a beater basket could walk through a dense stand and gather a quantity of ripe grain that needed no extensive chaff removal.

Or, plants cauld be upraated and allawed ta ripen in piles and the mature grain separated later. At Ramsey Canyan the Eive month periad of July through November wauld continuausly offer grain of Eragrastis intecmedia for gathering as a food.

PREDICIIDNS FQR THE ARCHAEOLGGICAL RECORD

Love grass grains prepared by parching or toasting would be likely to become part of the prehistoric record during Food preparation.
 HABITAT

Erigachlog lemmoni grows on the dry east flanks of the stream at Canelo Hills Cienega. The area varies in exposure to the sun's rays, but is generally low due to a dense and high canopy of surraunding vegetation. The substrate is composed of both colluvium and grarite bedrock.

## PHENDLDGY

This diminutive annual cup grass requires that one be on hands and knees to spot it. The months when it can be observed are August through Dctober. The grass germinates and develops in August, flowers in September, and has ripe grains by October. Beyond these three months, evidence of presence is lacking.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Ethnographic literature holds little in the way of references to cup grass. The Cocopa of the Lower Calorado River area ate the seeds of E. aristata, one of many wild plants that provided seeds in their diet [Castetter and Bell

1951:191; Kelly 1977:39]. The archaealogical record is equally sparse. The mature carbonized cup grass florets were recovered from prehistoric oven fill at La Ciudad, a Hohokam village site in Phoenix, Arizona. Bohrer [1984] suggested the villagers may have cut and brought in the foliage to generate steam in cooking.

## SIGNIFICANCE FOR RUMANS

If the grains of Erigchlog gracilis were harvested as a food, they could be gathered only during the month of Dctober. It may be that the small size of this plant and its grains made it an unlikely choice for food, except in times of subsistence stress.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD
Cup grass grains would be retained in the ancient record if prepared in such a way that preservation wauld be promoted, such as parching.

habitat
Euphorbig robusta thrives in a boulder field under heavy shade a short distance from the Ramsey Canyon stream. The underlying dry substrate consists mainly of alluvium, with stream carried boulders.

## PhENOLOGY

This apparently perennial herbaceaus spurge plant is obvious by May, at which time it appears in full flower. Presumably it has been active vegetatively prior ta that time. Full flowering cantinues through August, when ripe capsules become available. Stem elongation and leaf expansion does not cease during the six months this plant is above ground. Beginning in November, a six-month dormant period ensues, when the species dies back to ground level and cannot be located easily.

## EIHNDGRAPHIC/ARCHAEOLOGICAL RECORDS

The milky sap of many species of spurge contain toxic principles that will cause severe poisaning if ingested in
quantity [Lewis and Lewis 1977:37]. This information seems surprising in light of the moderately extensive ethnographic record on spurge use, including occasional ingestion [Table 273. However it is clear that peaple have recognized the patential danger of this genus. East AEricans realized that anly small amounts of spurge could be taken internally; a drop of the juice of one plant was known to induce vomiting [Kakwaro 1976:90-93]. Same United States Plains groups also spoke of the poisonous quality of the genus [Gilmore 1977: 471. Navajo in the Southwestern United States suggested spurge plants caused dermatitis, and were reluctant to use it [Uestal 1952].

The qverwhelming number of historic references pertain to medicinal applications of spurge plants. Ihey were used ta treat fevers, sores in the mouth, rattlesnake bites, earaches and bee stings among the Cahuilla of California [Bean and Saubel 1972:73-74]. Ramah Navajo in New Mexica sought the plants as a remedy for stamach-ache, toothache, warts, cuts, breast inguries and to relieve the itch of poison ivy [Uestal 1952]. Ponca living in the Missauri River Region boiled certain species and gave a decoction to young mothers to increase the flow of milk after childbirth [Gilmore 1977:47]. In this case, the "doctrine of signatures" might apply. Kayenta Navajo living in Arizana treated injuries, pain and bewitchment with Euphorbig Iobustg; later other medicines were used to counteract the

| SPECIES | PART AND LSE |
| :---: | :---: |
| E. Eandleri | plant, as medicine |
| E. glyptosperma | latex, as medicine |
| E. marginata | latex, as chawing gum |
| E. misera | ```roots, as medicinal tea``` |
| E. petrina | leaves, as medicine |
| E. polycarpa | plant, as medicine |
| E. robusta | plant, as medicine |
| E. SerpylliEalia | lanves, as medicine |
|  | plant, as medicine |
|  | plant, as medicine |
|  | plant, as medicine |
| Euphorbia spp. | latex, as medicine |


| GROLP[S] | REFERENCE |
| :---: | :---: |
| Ramah Navajo, New Mexica | Uestal 1952 |
| Picuris, New Mexico | Krenetsky 1964:45 |
| Kiown, Oklahoma | Uestal and Schultes 1939: 36 |
| Seri, Sonora Mexico | Felger and Moser 1974:423 |
| Seri, Sonara Mexica | Felger and Moser 1974: 424 |
| Zuni, New Mexico | Stevenson 1972: 26 |
| Kayenta Navajo, Ariziona | Wyman and Marris 1951: 30 |
| Dmaho, Missouri River Region | Gilmare 1977:47 |
| Navajo | Wyman and Marris 1941:56-57 |
| Zuni, Naw Maxico | Stevenson 1972: 26 |
| Ponca, Missouri River Region | Gilmore 1977:47 |
| East African groups | Kokwaro 1976:90-93 |


| SPECIES | PART AND USE | GROLP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Euphorbia spp. | plant, as fish paisan | Transylvania and S. Eurape | Gundo 1977:17 |
|  | plant, as fish poisan | Mexico and New Guinea | $\begin{aligned} & \text { Altschul 1973: } \\ & 167-169 \end{aligned}$ |
|  | plant, as medicine | Cochiti, New Mexico | Lange 1968:149 |
|  | plant, 0 m medicine | Navajo | Wyman and Harris 1941 : 56-57 |
|  | plant, as medicine, sometimes drunk | Cahuilla, Calif. | Bean and Saubel 1972: 73-74 |
|  | plant, as a medicine | Mexicans | Rose 1899: 229 |
|  | raot bark, as medicine | East African groups | Kokware 1976:90-93 |
|  | stems, 0 a medicine | East African groups | Kokwaro 1976:90-93 |

effects of the Euphorbin treatment [Wyman and Harris 1951:301.

In addition to medicinal treatments, spurge plants have been gathered to serve as fish paisons and for the latex that can be chewed as a gum. Even the roots and root bark have been made inta medicinal teas.

A single reference to passible prehistoric use of Eyphorbia glyptosperma type has been found. At Salman Ruin in northwestern New Mexico, seeds similar to this species were recovered in a variety of ancient strata, including on floors and in trash [Adams 1980a:288-290]. The presence of these seeds in 26 of 64 separate strata suggested they were commonily brought into the pueblo. This interpretation is supported by the parched or carbanized condition of some seeds, as well as by the recovery of over 800 seeds from a mealing bin feature of a ceremonial room. It seems possible that at this location a species of spurge was sought as a food in prehistory.

## SIGNIFICANCE FOR HUMANS

Eupharbig rabusta stems, leaves or entire plants can be collected for medicinal needs, ar ta serve as a fish poison, from May through October. The milky sap would also be available for this period. Roots and root bark, if sought to treat various ailments, could be dug up during the same months; once a plant goes dormant and dies back to ground level, it becomes difficult to harvest underground parts.

## PREDICIIONS FOR THE ARCHAEOLOEICAL RECDRD

Few hints as to prehistoric acquistion of spurge plants might remain in the archaealogical record. Generally the leaves, stems, roots, root bark, and whole plants have been prepared as medicines in ways that wauld abliterate identifying criteria. Brewing the different parts as a tea or making various decoctions wauld preclude recagnition. If ripe capsules were carried into a dwelling incidentally to an intended use, and became charred in a hearth or ram conflagration, the presence of burned seeds would potentially signal an ancient need.

Engxinus pennsylvanicg Marsh. ssp. veluting [Torr.] G.N. Miller [-Eraxinus veluting Torr.] RC-4 [KA \#日1-83] UA254654


HABITAT
Eraxinus pennsulvanica thrives in dry sail less than five meters from the edge of the stream in Ramsey Canyon. The substrate is composed of steeply sloping colluvium and granite bedrock. Dense shading is provided by a high canopy of nearby trees.

PHENDLOGY
At Ramsey Canyon this velvet ash species resumes active plant growth in April, signaled by the presence of both elongating stems and expanding leaves. Flower buds form shortly after vegetative activity begins, and by June ripe single-winged fruit are abscissing from branches. Stem and leaf activity continue through August, at which time obvious growth slows considerably. Fully mature leaves cling to branches through November, at which time the plant resumes outward signs of dormancy.

ETHNOGRAPHIC/ARCHAECLLGGICAL RECORDS
Uarious needs have been satisfied for humans by species
of ash [Table 28]. More than one group sought the wood for making bows, arrawshafts, pipestems and weaving tools. In choosing wood far bows, the Havasupai of Cataract Canyon in north-central Arizona selected an ash tree when young and trimmed the branches sa that the tree would grow straight; after 2 years the tree was ready for cutting ©Spier 1928: 147-148]. Navajo even fashioned stems into arrows and inta saddles in histaric times. Kayenta Navajo gathered the "seeds" [possibly the winged fruit?] and incorporated them into a ceremony praying far rain [Wyman and Harris 1951:35]. Ash has also provided humans with food. Apparently the inner bark [citied as "cambium"] could be cooked and eaten [Yanousky 1936:52], most likely in times of food stress. Leaves were sought by the Tarahumara and Tepehuan of Chihuahua, who ate them as greens after repeated boiling [Pennington 1963:127; 1969:140].

In the archaealogical record, ash wood was listed by Gilmore [1931:100] as having been used for various purposes by the Ozark Bluff-Dweller culture of Arkansas and Missouri. In Arizona, part of a bow fashioned of $\mathrm{E}_{\mathrm{g}}$ gnomala wood was recovered in Orme Ranch Cave; quite likely the item related to historic accupation of the cave by Northeastern Yavapai peoples $[$ Breternitz 1960 .

## SIGNIFICANCE FOR HUMANS

Ash would offer wood for weapons and toals year round, however certain items might require selection of particular

Table 2日. Ethnagraphic references to the use of Enaxiqua .

| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| F. anomala | wood, considered best wand for bows | Havasupai, Arizona | Spier 1928: 147-148 |
|  | seads, used in prayers for rain | Kayenta Navaja, Arizona | Wyman and Marris 1951: 35 |
| F. cuspidata | wrod, as arrawshafte, baws, weaving toals | Ramah Navaja, New Mexico | Usstal 1952:39 |
|  | woad, made into saddles in historic times; stems made into arrams | Navajo | Elmore 1944:68 |
| F. pennsylvanica | inner back cooked and eaten | Ojibway | ```Cited in Yanavsky 1936:52``` |
|  | wood, Eor pipestems. baws, arrawshafts and in ceremanias | Plains graups of the Missouri River Region | Gilmore 1977:5657 |
| F. valutina | leaves, eaten as graens after bailing | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & 140 \end{aligned}$ |
|  | leavas, enten as greans after repeated bailing | Tarahumara, Chihuahua | Pennington 1963: 127 |

parts of a tree or harvest of trees of a certain age. Seeds inside winged fruits wauld anly be available far a. short period in June. Inner bark sought for food, perhaps in times of faod stress, might offer mare nutrition in the early spring manths of March and April when the tree is mobilizing nutrients for a new year's growth. Leaves might be best chasen as greens when they are yaung; such leaves could be faund in abundance in April and May, and then near branch tips during June, July and August.

PREDICIIONS FOR THE ARCHAEDLOGICAL RECORD
Ash wood made into household tools or weapons could survive in pratected lacations such as caves, or if charred. Inner bark and leaves might not preserve, especially if scraped inta tiny pieces ar bailed. Passibly the seeds could be recovered, but their infrequent use in ceremonies might not give them many chances to become part of the prehistoric record.

RC-5 [KA \#日2-83] UA254992


## HABITAT

Garcya wrightii does well on a steep slope in a very shaded area alang the stream at Ramsey Canyon. The underlying sail is dry and composed of colluvium and granite. phendaggy

This large evergreen silk-tassel shrub renews stem and leaf growth in March, and is vegetatively active until Dctober. Actual flowering was not observed, but must take place between March and May, as ripe fruit can be found clinging to the branches during the month of June. By July the fruit disperses. Fully mature leaves cling to branches during the lang dormant season of Dctober thraugh February. ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Only two historic references suggest that humans may use silk-tassel plants. The Tarahumara of Chihuahua fashioned wooden tips for arrows fram the hard wood of Garyyg gugta [Pennington 1963:96]. Tepehuan in the same state of Mexico made both arraws and arrow fareshafts from the wood of this
species and G. lourifolig [Pennington 1969:121].
No archaeological record found.
SIGNIFICANCE FOR HUMANS
The hard wood of silk-tassel could be acquired throughout the year. The evergreen nature of the leaves would be an ever present signal for the species. PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD

Silk-tassel wood fashioned into an arrow tips or foreshafts would oniy remain to signify ancient use if accidentally burned or buried in a sheltered location. Arrows taken on hunts and used away from habitations wauld disintegrate and leave no evidence when lost in open terrain.


## MABITAT

The perennial Gomphena caespitosa appears to be available in the summer months at Canelo Hills. It grows as a dry site species on the east side of the cienega with partial to full exposure to the sun.

PHENOLOGY
There appear to be only twa months when ball-clover is obvious on the landscape. Lying dormant for the period of July until the following April, plants initiate active vegetative growth in May. They are in full flower during the months of May and June, with mature fruits developing in June. Active stem and leaf elongation seems to continue unabated until the plant resumes cormaney in July.

## EIHNDGRAPHIC/ARCHAEOLOGICAL RECORDS

Although Kearney and Peebles [1960:269] have noted that Gomphrena caespitosa plants are eaten freely by cattle and other livestock, no mention of their use has been found in the southwestern United States ethnographic literature
examined. An intriguing reference to the use of the root of a related species, Gomphrena globosa, has been found for east Africa, where a treatment far chest diseases is made from this plant [Kokwaro 1976:19].

York, et al. [1961:97] listed Gompheena caespitosa as among plant remains recovered from a feature in U-Bar Cave in southwestern New Mexica. U-Bar Cave is thought to have served as a ceremanial lacus in the period 1350-1400 A.D. SIGNIFICANCE FOR HUMANS

Current evidence does not strangly support human use of ball-claver, yet there are a few hints that the plant could serve medicinal or ceremonial needs. There would be only a limited period during which the plant and its raots could be gathered in May and June; however once gathered these parts could be dried and stored for an indefinite periad.

PREDICTIONS FDR THE ARCHAEOLOGICAL RECORD
Ball-clover plants would only likely show up if the fruit were accidentally burned in some manner, or preserved in the dry conditions of a cave.

Gomphreng nitidg Rothr. СН-6 [KA \#228-83] UA254896


## HABITAT

Gomphrena nitida does well in dry, full to partially shaded sail to the east of the stream at Canelo Hills.

## PHENOLDGY

The life cycle of Gompheeng nitidg is unlike that of $\mathrm{g}_{\mathrm{c}}$ capspitasa. Gomphreng nitidg appears as an annual plant, in full flower in August. It blooms through November, when mature fruits develop. Active stem and leaf growth span this entire four-month period. The plant cannot be easily found from December-July, present only as seeds in the soil. ETHNGGRAPHIC/ARCHAEDLDGICAL RECDRDS

Gomphreng nitida plants have been reported to provide curative properties in Mexico [Altschul 1973:65].

No archaeological record found.
SIGNIFICANCE FRR HUMANS
If this plant were used in medicinal ways, it could be gathered fram August to November.

## PREDICTIDNS FDR THE ARCHAEDLDGICAL RECDRD

Same predictions as for Gomphreng caespitosa.

## HABITAT

Grindeling gymnospermoides is quite predominant on the east flanks of the stream at Canelo Hills. The area consists of a shallow colluvial slape underlain by colluvium and valcanic outcrops. The soil is quite dry and the plants receive $100 \%$ exposure to the sun.

## PHENCLOGY

This annual species of gum weed first becomes noticeable during June after germination. Rapid stem elongation and leaf expansion occur until August and September, when full flowering occurs. Mature achenes are present during Dctober and November, at which time the plant disperses all fruit for overwintering in the ground.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

The ethnographic record is sparse in regard to gum weed use. A decoction of G. sgugryosg was taken internally by graups in sauthern California as a cure for calds [Bean and Saubel 1972:75]. The Chumash, also of
southern California, used a species of gum weed in medicinal preparations 〔Timbroak 1984:168].

No archaealogical record found.

## SIGNIFICANCE FOR HUMANS

If Grindelia gumnospermaides has any potential for humans, it seems that medicinal needs would be those most likely met. Possibly its presence on the landscape far the months June through November would provide the raw material Far treatments.

PREDICTIDNS FDR THE ARCHAEDLOGICAL RECORD

The rather scarce ethnographic data on gum weed species makes it difficult to predict likelihood of archaeological recovery. If the plants are employed in preparing a decoction, or added to various medicinal preparations, it is unlikely much evidence wauld be retained in the ancient record to reflect such uses.


## HABITAT

Gutiecrezig wrightij does well in overbank sediments along the stream flanks at Ramsey Canyon. Plants grow in moist soil, and receive restricted exposure to the sun's rays.

## PHENDLDGY

As an annual herb, snake-weed has a short period of availability. In August vegetative growth is rapid and flower buds develop. The plant is in full flower in September and achenes mature in Dctober. By November the species becames dormant, remaining sofor a total of nine months.

## ETHNOGRAPHIC/ARCHAEDLOGICAL RECDRDS

Ethnographic references to snake-weed are sparse. The only citation located referred to Gutiecrezig microcepholig, listed as a plant useful to the Cahuilla of sauthern California as a toothache cure [Bean and Saubel 1972:75]. Perhaps the chemical composition of snake-weed plants pre-
cludes their common use by peaple. According to Lewis and Lewis [1977:57], the leaves of many species contain saponins, and are severely toxic to livestack. They may be toxic to humans as well.

No archaeological record found.

## SIGNIFICANCE FOR humans

If snake-weed can be employed in a limited medicinal way, the plant could be gathered during the months of August through Dctober. After that time, it would be nime manths before again becoming available.

## PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD

Since it is unknown which part[s] of snake-weed might have been chosen in historic times to serve medicinal needs, it is difficult to make a prediction whether or not the plant would be recovered in the ancient record. Only if a diagnostic part such as the achenes accidentally burned and preserved would archaealogists have a chance of recovering the evidence.


Helianthus gnnuus can be found growing on dry stream flanks at Canelo Hills Cienega. The plants do well in both dry and damp sail, with total exposure to the sun. PHENDLGGY

This annual sunflower is first noticed in May, after which rapid stem elongation and leaf expansion produce plants over six feet tall by August. Full flowering spans the one month period of September. Mature achenes first become available in October, and may be retained in the heads through November, at which time the plants appear completely dead and often break down. The mature achenes remain dormant in the soil until the following May.

## ETHNDGRAPHIC/ARCHAEOLOGICAL RECDRDS

Historic New World references to acquistion and use of sunflower plants are extensive [Table 29]. The majority of citations are to $H_{2}$ qunus. The flowers of this species have provided yellow coloring as well as a chewing gum.

Table 29. Ethnographic references to the use of Helianthus. The part listed as "seads" mast likely refers to the mature achenes, which are actually specialized fruits containing the seeds inside.

SPECIES
H. annuus

PART AND USE
Flowers, as decaration in ceremonial dances

Flowers, as decoration in ceremonial dances

Elowers, mixed with clay Ear plaster

Flower petals, as chewing gum

Flower petals, for yellaw color in ceremonies

Elawer petals, dried and ground for yellow calor
heads, as medicine
leaves, as food
leaves, as medicine
plant, as a medicine

GROUP[S]
Jemez, New Mexico

Hopi, Arizona

Jemez, New Mexico

Pima, Arizona

Zuni, New Mexico

Hopi, Arizona

Teton, Dakota
Tarahumara, Chihuahua

Pima, Arizona
White Mt. Apache, Arizana

REFERENCE
Cook 1930:23-24

Whiting 1965: 96-97

Cook 1930:23-24

Curtin 1984:103

Stevenson 1915: 93

Whiting 1966 96-97

Gilmore 1977:78
Pennington 1963: 77, 123

Curtin 1984:103
Reagan 1929: 158

Table 29 [cont.] Ethnographic references to the use of Helignthus. The part listad as "seeds" most likely refers to the mature achenes, which are actually specialized Fruits containing the seeds inside.

| SPECIES | PART AND LSE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| H. annues | roat, in medicine | Zuni, New Mexico | Stevensan 1915: <br> 53; Camazine and <br> Bye 1980:375 |
|  | seeds, as Food parched and ground | Apache, Arizona | Buskirk 1949:328 |
|  | seeds, as food highly prized | Gosiute, Nevada/Utah | $\begin{gathered} \text { Chamberlin } \\ \text { 1911:371 } \end{gathered}$ |
|  | semis, as facd | Many groups | Yanovsky 1936:E1; <br> Standley 1912:458 |
|  | seeds, as food | Mescalera and Chiricahua Apache | Castetter and Opler 1936:48 |
|  | seeds, as frod | Kiawa, Oklahoma | Uestal and Schultes 1939: 61 |
|  | seeds, as food | Havasupai, Arizona | Spier 1928:116 |
|  | seeds, as frod | Western Apache, Arizana | Gallagher 1977: 33 |
|  | seeds, as food | White Mt. Apache, Arizana | Reagan 1929: 158 |
|  | seeds, us food | Cahuilla, S. Calif. | Bean and Saubel 1972:76 |

Table 29 [cont.] Ethnographic references to the use of Helignthus. The part listed as "seeds" most likely refers to the mature achenes, which are actually specialized fruits containing the seeds inside.

SPECIES
H. annuus
PARI AND USE
seeds, as Food
seeds, as ford
seeds, as food
seeds, as food
seeds, as food
seeds, as food
seeds, as food
seeds, as food
seeds, as foad
seeds, as food
seeds, as food
seeds, as medicine

| GROUP[S] | REFERENCE |
| :---: | :---: |
| Kawaiisu, Calif. | Zigmund 1981:34 |
| Luisena, Calif. | Sparkman 190日: 228 |
| Tarahumara, Chihuahua | $\begin{aligned} & \text { Pennington } \\ & \text { 1963:77, } 123 \end{aligned}$ |
| Mohave, Lower Colarado River Area | Casteter and Bell 1951: 196 |
| Cochiti, New Mexico | Lange 1968: 150 |
| Zuni, New Mexico | Cushing 1974:243 |
| Kaibab Paiute, Arizana and Utah | Kelly 1964:42 |
| 14 of 14 N. Paiute bands | Stewart 1941:42日 |
| 5. Paiute, Ariz./Utah gathered in quantity | Bye 1972:93 |
| Navaja | Elmore 1944:87 |
| Ramah Navajo | Uestal 1952:51 |
| Pawnee | Gilmore 1977:78 |

Table 29 [cant.] Ethographic references to the use of Helignthus. Ihe part listed as "seeds" mast likely refers ta the mature achenes, which are actually specialized fruits containing the seeds inside.

| SPECIES | PART AND LSE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| H. annuss | seeds, boiled for wash water | Jemez, New Mexico | Cook 1930:23-24 |
|  | stalk, as prayerstick | Navajo | Wyman and Harris 1941:65, 72; <br> Elmare 1944:87 |
|  | stalk, as prayerstick | Ramah Navaja | Uestal 1952:51 |
|  | stalk, as Elute and hirdsnares | Navajo | Elmare 1944: 87 |
|  | stalk, inner pulp as chewing gum or burned as a candia | Pima, Arizona | Curtin 1984: 103 |
|  | stalk, inner pulp dried and used as medicine | Navajo | Wyman and Harris 1941:65, 72 |
|  | stalk, inner pulp as a medicine | Ramah Navajo | Vestal 1952:51 |
|  | stalk, used as a Fire-stick | Tewa, New Mexico | $\begin{aligned} & \text { Robbins, et al. } \\ & \text { 1915:56 } \end{aligned}$ |
|  | stalk, used as a Fire-stick | Isleta, New Mexico | Jones 1931:31 |
|  | stalk, burned in forming scars an arms | Picuris, New Mexico | Krenetsky 1964: 45 |

Table 29 [cont.] Ethnagraphic references to the use of Helignthus. The part listed as "seads" most likely refers ta the mature achenes, which are actually specialized Fruits containing the seeds inside.

| SPECIES | PART AND LSE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| H. annuus | stalk, inner juice as a medicine | Cochiti, New Mexico | Lange 1968:150 |
|  | stalk [?], juice extracted Far medicine | Jemez, New Mexico | Cook 1930:23-24 |
|  | stalk, exudates enjoyed by children | S. Paiute, Arizona and Utah | Bye 1972:93 |
|  | stalk, sap as food when coagulated | Kiowa, Oklahoma | Vestal and Schultes 1939: 61 |
| H. bulanderi | seeds, as food | Duens Valley Paiute, Califarnia | Steward 1933:243 |
| H. canus* | stalks, inner juice as a medicine | Acama and Laguna, New Mexico | Swank 1932:47 |
|  | sbeds, as food | Mescalera and Chiricahua Apache groups | Castetter and Opler 1936: 48 |
| H. lenticularis | ```seeds, as Food a staple gathered in quantity``` | Many groups | ```Palmer 1978:602; 1日70:419``` |
| H. petialaris | seeds, as food | Cochiti, New Mexico | Lange 1968: 150 |
|  | seeds, as a staple Eood | Many graups | $\begin{aligned} & \text { Palmer 1878:602; } \\ & \text { 1870: } 419 \end{aligned}$ |

Table 29 [cont.] Ethnographic references to the use of Helignthus. The part listed as "seeds" mast likely refers to the mature achenes, which are actually specialized fruits containing the seads inside.

| SPECIES | PART AND USE | GROUP[5] | REFERENCE |
| :--- | :--- | :--- | :--- |
| H. petiolaris | seads, as a blue dye | Hopi, Arizana | Haugh 189日:146 |
|  | stalk, inner juice as <br> a medicine | Cochiti, New Mexico | Lange 195日: 150 |

* A possible mis-spelling of $H_{\perp}$ gonuus.

Entire heads were sought far medicinal needs, as were roots and leaves. Leaves have alsa been listed as a food product. The bulk of references list the "seeds" [probably the mature acheneJ as gathered and prepared as a food by graups all over the American Southwest. Dccasionally the literature hints of the importance of this food by suggesting the seeds were harvested "in quantity" or were "highly prized". The stem or stalk also provided material for prayersticks, Flutes, birdsnares and fire-sticks; juice extracted from the stalk was sought by children as a treat and by medical practitioners as a healing substance. Other species of Helignthus seem to have been used in similar ways.

Methods applied to harvest and prepare sunflower achenes have been varied. The Mahave of the Lawer Calorado River area broke off ripe heads and beat them with sticks to release the achenes [Castetter and Bell 1951:196]. Likewise the Gosiute of Nevada and Utah beat the achenes out af the Fipe heads into baskets [Chamberlin 1911: 371], highly prizing this source of ail. The Western Apache of Arizona judged that the heads were ready for harvest when the ray and disk flowers had Eallen off; they would then whack the Flower heads against their hands to discharge the achenes [Gallagher 1977:33].

Preparation often invalved many steps. For example, the Kawaiisu of California removed the achenes from the head with light pounding, followed by winnowing, roosting,
another pounding to remove the shell, and grinding to a meal [Zigmund 1981:34]. Often the ochenes were parched or roasted before being eaten raw or ground for use as a meal [Gallagher 1977:33]. The southeastern Yavapai of central Arizona stored sunflower achenes [no scientific name listed] in pottery ollas in caves [Gifford 1932:203].

The ethnographic literature suggests that wild Southwestern sunflowers have actually been cultivated. Four older Mahave men said that wild sunflower seeds were planted in moist soil at the edges of agricultural fields, in hills much like corn was planted [Castetter and Bell 1951:196]. The Owens Valley Paiute may have irrigated $H_{\perp}$ balanderi in some localities [Steward 1933:243].

The archaealogical record documents a number of instances of Helignthus achenes and some of entire heads recovered from ancient Southwestern sites [Table 30]. The most likely explanations given are that the remains represent prehistoric harvest of the wild plants for food; the charred condition of many of the achenes, and the presence of the fruit in human coprolites, support a food interpretation. The time period represented could be as long as 8000 years, as documented at Cowboy Cave in Utah, up until the A.D. 1400's in a New Mexica context. That the resource may have provided food for the dead is suggested by recovery of achenes in burial boulss at Grasshopper Pueblo;

| PART: | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| heads | unknown | Bat Cave, Neẃ Mexico | scattered throughout deposits | $\begin{aligned} & \text { Smith 1960: } \\ & 164 \end{aligned}$ |
|  | Food use [?] | Tuiarasa Cave, New Mexico | in almost every level; 3 species possible | $\begin{aligned} & \text { Cutler 1952: } \\ & 475 \end{aligned}$ |
| seads | Food | Anasazi, Arizona | charred, in 3 af 17 sites | Gasser 1982: 33 |
|  |  | Carter Ranch, Arizona [A.D. 950-1200] | charred | Cutler 1964: 234 |
|  |  | Grasshopper Pueblo, Arizona [A.D. 13-1400] | Erom an oven, and in two separate burial bowls | ```Bahrer 1982:``` |
|  |  | Johnson Canyon, Colo., Pueblo III | in copralites | Nickens 19日1: 76 |
|  |  | Pueblo I, Colo. <br> Old Ute Trail | charred | Jones and Fonner 1954:94,96 |
|  |  | Arroyo Hondo, New Mex. [A.D. 1300-14 |  | $\begin{aligned} & \text { Wetterstrom } \\ & \text { 1976:97 } \end{aligned}$ |
|  |  | Cimarran, New Mex. BasketMaker III [A.D.700-900] | charred | Kirkpatrick and Fard 1977:263 |


remains of wild Helignthus seeds asociated with burials have also been reported both from Mesa House Ruin in Nevada, and from Hawaikuh near Zuni in New Mexica [cited in Bohrer 1982:993.

A fascinating discovery related to sunflower was made in cliff-dweller age deposits in a cave in northeastern Arizona [Kidder and Guernsey 1919: 34, 145-147]. There, in cave fill, excavators uncovered two corrugated pots covered with stone lids. In one of them 26 painted wooden "sunflowers" and two pieces of tanned skin, cut and painted to represent "sunflowers", were found. The specimens were extramely well preserved and are considered to rapresent ceremonial items. Archaealogists speculated that they were perhaps once attached to the sides of helmet masks like those worn by the Kopi in Kachina ceremonies.

In the sastarn and central part of the United States, it has been known for some time that Helianthus gnaus was heavily relied upon in prahistory. In an early repart on the plant foods associated with the Ozark Bluff-Dwsller culture, Gilmore [1931:102] wrote that quantities of achenes of at least twa cultivated varieties of this species were found, along with sunflower heads. The Early Woodland evidence fram Salts Cave in Kentucky, dating to the period 1125-290 B.C., revealed that $H$ g gnuys achenes were the most abundant plant material found (Watson and Yarnell 1966:844]. Bryant [1974:208] nated a correlation between high

Helignthus type pollen percentages and the presence of sunflower ramains in a number of human capralites from nearby Mammoth Cave.

## SIGNIFICANCE FOR HUMANS

It seems that the annual Helignthus qunus plants have important potential for humans living on wild resources in Canelo Hills and elsewhere. Flowers could be harvested in September for their use in ceremonies and as yellow coloring or chewing gum. Leaves are present for nearly all the seven-month growing season, being available for medicinal or other uses at least from May through October. The highly prized achenes seam to be most abundant in the months of October and November. The many domestic and incidental needs served by the stalk might require a mature stem, with inner pulp Fully developed; this periad most likely would come in the second half of the growing season, from September thraugh November. Even dead stalks could be gathered after the plant had completely ceased activity. Use of the root in medicine might also be restricted to the latter part of the season, when roots had obtained some size.

PREDICTIONS FOR TME ARCMAEDLOGICAL RECDRD
The most likely part of wild sunflower plants to preserve would be the achenes that had not been ground up in preparation. Accidents during parching or roasting, or
devastating household or village fires, might preserve them intact. Achenes stared raw or pulverized, or coaked with other foods, would not be recovered in identifiable condition. Leaves crushed, eaten, or made into a medicinal decoction would likewise not easily lend to recognition. Perhaps stalks would be retained unburned in protected locations; any exposure to fire might burn them completely to ash.

The ability to positively identify Helignthus achenes in the prehistoric recard may not be possible. When carbonized, the achenes of this genus closely mimic achenes of another sunflower type plant, Ulguierg. Distinguishing characteristics may not reveal themselves in prehistaric specimens, making it impossible to say for certain which of the wild sunflower plants were actually used at various ancient habitations. This may not be a problem, if a number of wild sunflower species were harvested and prepared in similar ways by prehistoric folks.

Ingmogg bederifolig L. [=I, coccineg L. var. bederiEolig [L.] Gray]<br>RC-1 [KA \#219-83] UA255933

## habitat

Herbaceous Igomeen hederifalig grows in a dry site in a very sumny area same distance fram the Ramsey Canyon stream. The substrate at this lacation is composed of colluvium, underlain by granite bedrack.

## PHENDLOGY

Specific information on the life-cycle events were not recorded, although it is known this morning-glory species is in full flower with immature fruits during the month of September. The plant is dormant, with no above ground parts visible, for most of the year. According to Kearney and Peebles [1960: 676] the species may be seen on the landscape Fram May to October.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Six separate species of morning-glory are listed as having medicinal uses among groups living in east Africa [Kokwaro 1976:77-78]. Crushed leaves and roots were the parts chosen. In the New World, the small leaves of Ingmeed gurgureg have been bailed and used as a grean by the Tarahumara of Chihuahua [Pennington 1963:127]. At one time, the roots of Ingmoge leptophyllg were gathered and toasted by the Kiowa in times of food shortage [Vestal and Schultes 1939:48J.

No archaeological record faund.

## SIGNIFICANCE FOR HUMANS

Marning-glory leaves could be harvested at any time the plant is available above ground. This wauld encompass the summer months of May through October. The roots would likewise be easily found at this time. After the plant dies back to ground level, root harvest would be difficult. PREDICTIONS FOR THE ARCMAEDLOGICAL RECDRD

Unless morning-glory fruit capsules containing seeds were inadvertently brought into a prehistoric setting and burned, it is unlikely any parts would remain that could be identified. Leaves processed for medicines or greens would enter the ancient record in unrecognizable condition. Possibly a toasted root would preserve, but an adequate modern comparative collection of roots would be required to provide an identification.

Juglans mojor [Torr.] Heller CH-6 [\#323-84] UA254日93


Habitat
Juglans majer grows along bath sides of the stream at Canala Hills Cianega. Although the surface of the soil is generally dry, undoubtedly the deeper roots of this tree are in maister soil. The area is deeply shaded, in part by this species. Underlying substrate ranges from alluvium to colluvium interspersed with volcanic bedrack.

## PHENOLOGY

This large walnut tree resumes vegetative growth in April, when both stem elongation and leaf expansion can be observed. Flowering is marked in May by the presence of long drooping staminate clusters of flowers on lower branches. These catkins remain attached at least through July; it is unlikely they are shedding viable pollen throughout this period. Immature nuts can be sean in the upper branches as early as June, and the first mature nuts fall off in September, coinciding with vegetative growth cessation. After November the tree has dropped most of the
mature fruit and remains in full dormancy until April.

## ETHNOGRAPHIC/ARCHAEDLQGICAL RECORDS

Walnut fruit, leaves, twigs, bark, root and rootbark are parts that have all been sought by different groups [Table 31]. The mast important human use is that of the nutmeats as food. These have been eaten whole, ground, or boiled, sometimes stored and at least considered by a few groups an important resource. The hulled nuts waid be gathered From the ground or by climbing in the trees; the Apache removed the hulls by pounding them with a rock or in a bedrock mortar, and then washing the debris in a rumning stream [Buskirk 1949:332]. Numeraus people stared the hullless muts [Giffard 1932:209; Gifford 1936:256; Pennington 1963:106, 114]. Apparently nutmeats could alsa be applied to the scalp to serve as a dandruff ramedy and hair dye.

Twigs, hulls, nutshells, leaves, and raots all provided dyes, either green, earth-tones, or black. Medicinal preparations were made from leaves, rootbark and the juice of the hulls. Among the Tarahumara in Chihuahua, when the general food supply was scarce in the spring and the walnut trees were just leafing out, the leaves and bark were crushed and thrown into streams or pools to stupify fish. This widespread practice may well have alleviated food stress by making it easy to acquire a protein resource.

The prehistoric record in Arizona, New Mexico, Iexas and

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| J. major | hulls and nutshells, as earthtone dye | Navaja | Bryan and Young 1940:73-74 <br> Elmore 1944:39 |
|  | leaves, as green pigment when crushed | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & 134,135,169 \end{aligned}$ |
|  | leaves, as earthtone dye | Navajo | Bryan and Young $1940: 73-74$ |
|  | leaves, as Fish poison | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & 134,135,169 \end{aligned}$ |
|  | leqves, as body medicine when ground up | Comanche, Oklahoma | Carlson and Janes 1940:531, 534 |
|  | nuts, as food eaten on a large scale | Navajo | Elmore 1944:39 |
|  | nuts, as food eaten whale ar pulverized | NE Yavapai, Arizona | Gifford 1936:256 |
|  | nuts, as food | SE Yavapai, Arizona | GifFord 1932: 209 |
|  | nuts, as Eood, whale or ground | Chiricahua and Mescalero Apache | Castetter and Opler 1936: 42-43 |
|  | nuts, as food or stored without preparation | Comanche, Oklahoma | Carlsan and Jones 1940:531, 534 |

Table 31 [cont.] Ethnographic references to the use of Juglgns.

| SPECIES | PART AND LSE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| J. major | twigs, as dye | Navajo | Elmare 1944:39 |
| J. nigra | nuts, as food | Plains groups of Missauri River Region | Gilmore 1977: 22 |
|  | nuts, as foad | Kiowa, Oklahoma | Uestal and Schultes 1939:21 |
|  | rootbark, decoction as medicine | Kiowa, Oklahoma | Vestal and Schultes 1939:21 |
|  | roots, as dye Eor buffala hides | Kiowa, Oklahoma | Uestal and Schultes 1939: 21 |
|  | roots, as black dye | Plains groups of Missouri River Region | Gilmore 1977: 22 |
|  | nuts, as food eagerly saught | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & 134,135,169 \end{aligned}$ |
| J. ruprestris | leaves and bark, as fish poison [crushed] | Iarahumara, Chihuahua | $\begin{aligned} & \text { Pennington 1963: } \\ & \text { 106, 114 } \end{aligned}$ |
|  | nuts, eaten and stored | Tarahumara, Chihuahua | $\begin{aligned} & \text { Pennington 1963: } \\ & \text { 106, } 114 \end{aligned}$ |
| Juglans spp. | hulls [juice], as medicine | Apache | Buskirk 1949:332 |
|  | muts, as food sometimes boiled | Apache, Arizana | Buskirk 1949:332 |


| SPECIES | PART AND USE | GROUP[S] |  | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Juglans spp. | nuts, as food or as beverage | Western <br> Arizona | Apache, | Gallagher 1977:35 |
|  | ```nuts, as food eaten extensively``` | Navajo, | New Mexico | Castetter 1935:35 |
|  | muts, as dandruff remedy and hair dye | Western Arizona | Apache, | Gallagher 1977:97 |

Calarado reveals ancient acquisition of walnuts, many identified as Jualans majof [Table 32]. In most cases the presence of nutshells, sometimes carbonized, likely represents consumption of the nutmeats. Contexts of recovery also reflect food use. Whole nuts, and nuts with husks are rare in prehistaric deposits. In twa cases, researchers pointed out that lack of modern walnut trees in areas today hinted that prehistoric trade or long distance travel was responsible for presence of the nuts in ancient sites [Nickens 1981:77; Smith 1950:175]. In ane of these examples [Nickens 1981:77] the nutshells had been fashioned into ornaments and beads.

## SIGNIFICANCE FOR HUMANS

Juglans maige nuts would be ripe for harvesting for the three months of September-November. During this period one could acquire Ead [nutmeats], hair treatment [nutmeats], dye [hulls, nutshells], a medicine [hulls] and ornaments/ beads [nutshells]. Newly emerging leaves might be especially important as a fish paisan in April, though they could serve this purpose as well as a dyestuff and medicine from April through November. Acquisition of twigs and roots For dye, bark as a Eish paison, and rootbark as a medicine could continue year raund, as these parts wauld always be available.

PREDICTIONS FOR THE ARCHAEDRDGICAL RECDRD
The prehistoric record would retain tough walnut

Table 32. Prehistoric references ta Jualans remains. Presence of an wiags ramains identified as Iuglans major by researchers.

| PART | USE | GRDUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Nuts with husks | unknown | Hahokam at San Cayetano del Tumacacari, Ariz. | alsa an entire walnut From a house floor | Cutler 1956a |
| Nuts | nutmeats as food* | Higgins Flat Puebla, New Mexica [A.D.1175-1250] | charred, possibly Fram a basket | Cutler 1956b: 1日1 |
|  | nutmeats as food* | Point of Pines, Arizona | carbanized, from a crematian, a Firepit, two corrugated jars | Bahrer 1973: 428 |
| Nutshells | nutmeats as food* | Copper Basin sites, Arizonc [A.D.700-1300] |  | Gasser 1577: 304-30日 |
|  | nutmeats as food* | Tonto Nat'l. Monument, Arizanca [A.D. 1300's] | many broken shells | Bohrer 1962: 99 |
|  | nutmeats as food* | Grasshopper Puebla, Arizana [A.D. 13-1400] | in room fill, Features and quens | Bohrer 1982 |
|  | nutmeats as food | Cave along Rin Zape Mexico [A.D. BOO] |  | $\begin{aligned} & \text { Bráks et al. } \\ & \text { 1962: } 357 \end{aligned}$ |
|  | nutmeats as food | Muriah Cave, Texas rackshelter | most parched, in ash heap | ```Holden 1937: 70``` |

Tabla 32 ［cant．］Prehistaric refarences ta Juglans remains．Presence of an $f l a g s$ remains identified as Juglans major by researchers．

| PARI | USE | GROUP［5］ | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Nutshells | nutmeats as food［？］＊ | Bat Cave， New Maxico | thraughout the deposits | $\begin{aligned} & \text { Smith } \\ & \text { 1950: } 170 \end{aligned}$ |
|  | nutmeats as food［？］ | Caves in Uppar Gila and Hueca areas，New Maxica | part of refuse | Cosgrave 1947： 45 |
|  | nutmeats as Food［？］＊ | Canyon Creak， Arizona［A．D． 1324－134日」 | plentiful in refuse | Haury 1934：59 |
|  | nutmeats as fand［？］＊ | Orme Ranch Cave， Ariz．［A．D．1100－ 1400 and histaric］ | thraughaut strata | $\begin{gathered} \text { Breternitz } \\ \text { 1960:35 } \end{gathered}$ |
|  | nutmeats as Food［？］＊ | Carter Ranch Puebla，Arizana ［A．D．950－1200］ | carbonized | $\begin{aligned} & \text { Cutlar 1964: } \\ & 234 \end{aligned}$ |
|  | mutshells as arnaments／beads＊ | Jahnsan Canuan， Cola． | suggestions of prehistoric trade | ```Nickens 19日1: 7 7``` |
| Unknown |  | Brawstar Ca． Texas，rock－ shelter | Quantities recavered | Coffin 1932： 59 |
|  |  | Caves in SW New Mexico［R．D． 1100－1400J |  | $\begin{aligned} & \text { York et al. } \\ & \text { 1961:96 } \end{aligned}$ |

Table 32 [cont.] Prehistoric references to Juglans remains. Presence of on * flags remains identified as Juglgns majof by researchers.

| PARI | USE | GRDUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Unknown |  | Tularosa Cave, SW New Mexica |  | $\begin{aligned} & \text { Cutler 1952: } \\ & 478 \end{aligned}$ |
|  |  | Pueblo Bonito, New Mexica |  | Judd 1954:61 |

Babocamari Village, Arizama [A.D. 1450+]

Jones 1951:16
nutshells as the residue of food preparation or as ornaments/beads; the hard thick shell is a part predisposed to preserve. Parching or raasting are not methods of preparation cited for walnut nutmeats, therefore any charred specimens recovered likely represent accidents unrelated to use of the resaurce as a faod. All other parts are utilized in ways not conducive to preservation, such as in dyeing, hair treatment, medicinal preparations or as fish poisons. It is intriguing that no histaric or archasological references were found to the use of the wood as firehearth fuel.


CH-1 [KA \#91-83] UA255929; CH-9 [KA \#149-83] UA254622


Juncus tepuis willd.
CH-9 [KA \#150a-83] UA254625; [KA \#150b-83] UA254648

## habital

Two species of rush, Juncus tequis and $\mathcal{L}_{2}$ loggistylis do well in the cienega at Canelo Hills, while $J_{\perp}$ insiEalius can be found on the edges of pounded water just below the
dam. Both locations are fully saturated with water and composed of alluvium. Generally the surrounding vegetation is low, permitting full exposure to sunlight.

## phendlagy

The two cienega rush species seem to have a growing season roughly half that of $\mathrm{J}_{\mathrm{A}}$ ensifolius. The cienega plants are first observed to flower in June, have ripe capsules in July and August, and resume nime months of dormancy by September. They are noticeable for a tatal of anly three months, being vegetatively active only during June. On the other hand, Juncus ensiEolius is recognizable on the edge of a pond below the dam for seven full manths, beginning in May and continuing through November. Full flowering of this species spans a three month period from June through August, and ripe fruit are available from July through October. This species is most vegetatively active during the months of May, June and July.

## ETHNOGRAPHIC/ARCMAEOLOGICAL RECORDS

The ethnographic record of rush use is obscured in part by the fact that same graups, such as the Hapi, classed together all "grass-like" plants growing near water, especially those with round stems [Whiting 1956:70]. In the references that do exist, one of the most frequent needs served Juncus was that of basketry material. Among the Chumash of California, this genus comprised virtually the
only material used in basket-making [Timbrook 1984:145]. Rush plants were a source of several colors that could be warked into elaborate basket designs by the Cahuilla [Barraws 1900:42; Bean and Saubel 1972:80-81], Kawaiisu [Zigmund 1981:35; 1978:202], and Luisena [Sparkman 1908: 234], also of California. The baskets made by the Luiseno included openwark containers for gathering acorns and cactus, and ather baskets used to cook acorn meal and as a sieve; they also fashioned Juncus stems into mats [Sparkman 1908:234].

Other needs have been served by rush plants in modern times. Although the size of an individual rush seed is minute, the Paiute in the Owans Valley of Califarnia collected the seeds of $\mathrm{I}_{\mathrm{L}}$ balticus for food (Steward 1933: 243]. This citation may reflect a more widespread practice in North America before people began to rely heavily on cultigens.

In other uses, the Isleta of New Mexico gathered rush plants as thatching for houses [Jones 1931:32]. The Navajo made an emetic out of an introduced species Juncus balticus〔Wyman and Harris 1941:5日], and Kopi in Arizona may have collected rushes for use in ceremonies, because of their assaciation with water [Whiting 1966:70].

In the archaealogical literature surveyed for this study a single reference to rush was located. Juncus, including J. cogegri typa seads, ware recavered in 6 of 64
floor and trash strata examined from the Salmon Ruin in northwestern New Mexico [Adams 1980a:263]. These remains possibly represented a food for both the Chacoan [A.D. 10901150 ] and Mesa Verdean [A.D. 1180-1250] accupations of the puebla.

SIGNIFICANCE FOR HUMANS
Rushes could be harvested for basketry material, mats, roof thatching or medicinal/ceremonial uses at Canelo Hills at least Eram May thraugh November. All three species would offer ripe seeds as a food during July and August, with I. ensifolius seeds available for the additional twa months of September and October.

PREDICIIDNS FOR THE ARCHAEOLOGICAL RECORD
Since the Paiute reference gives no clue as to haw the rush seeds might be prepared for consumption, predicting the likelihood of survival in the ancient record is difficult. Any preparation step that would require parching or application of heat might ensure some seeds would preserve. Perhaps the Salman Ruin data represent ancient toosted meals. In situations of outstanding preservation, such as the interior of a cave or shelter, it is expected that baskets and mats would alsa be recovered.


HABITAT
Juniperus deppeana grows in both dry and damp sail along the stream at Ramsey Canyon. Exposure of the trees to the sun varies from very little to $100 \%$. Substrate is composed of overbank sediments of colluvium with rocks. PHENOLGGY

Evergreen alligator juniper trees are obvious on the landscape year round. Active twig and leaf growth begins in May and continues until September, at which time vegetative activity ceases. Cone development occurs in April, and a Full six months is required before they ripen in September. These ripe cones can remain tightly clinging to branches for up to nine months, and may still be available in the following calendar year when the tree has resumed another year's growth.

ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS
The cones [often called "berries"] of alligator juniper [as J_ gacbuphlgeg] was gathered by a number of Southwestern
groups [Table 33]. The berries were said by same to be sweet, and without a strong juniper taste. Often they were collected and stored for the winter, to be ground and made into bread [Palmer 1878:593]. The Southeastern Yavapai of Arizona collected them from the ground in October, pulverized them in a bedrock mortar, saaked them in water, put a handful of the mass into the mouth and sucked out the juice; the dry solid matter was then spit out [Gifford 1932:212]. The Ramah Navajo of New Mexico gathered the fallen berries inta sacks, usually at the same time acorns were harvested. They wauld bail and grind the berries to remove the seeds, and eat the sweetish pulp, or eat the berries raw without preparation [Uestal 1952:12].

If enough alligator juniper berries could be gathered, they would be stored. The Northeastern Yavapai of Arizona pounded and ground the berries on a metate and winnowed out and discarded the seeds. Some of the resulting meal might be kept in tight burden baskets, or made into a cake by dampening and gradually adding meal to build up a heavy cake up to one foot thick [Gifford 1936:257]. Such a cake could keep far several manths, often cached in a burden basket under a rock.

Two opposing views can be found regarding the dependability of alligatar juniper as a resource. Palmer [187日: 593) suggests it provided a staple article of food for many groups. On the other hand, Vestal [1952:12] recounts that

| PART | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| berries | Food | Sauthwest U.S. groups | considered a staple by same; eaten raw or ground | $\begin{aligned} & \text { Palmer } \\ & \text { 1878:593 } \end{aligned}$ |
|  | Food, or crushed as a beverage | Tarahumara, Chihuahua |  | Pennington 1963: <br> 112-113 |
|  | Food | Isleta and San Felipe Puebloes, Mescalera Apache, New Mexico | boiled | ```Castetter 1935: 32; Jones 1931: 33``` |
|  | Food | Ramah Navaja, New Mexico | eaten raw or bailed and graund; sametimes stared | $\begin{aligned} & \text { Uestal } \\ & 1952: 12 \end{aligned}$ |
|  | Food | SE Yavapai, Arizona | pulverized | $\begin{aligned} & \text { GiFFard } \\ & 1932: 212 \end{aligned}$ |
| needles | medicine | Tarahumara, Chihuahua | bailed | $\begin{aligned} & \text { Pennington } \\ & 1963: 178- \\ & 179 \end{aligned}$ |

some Ramah Navajo individuals considered the production of the berries erratic, much like the crops of pinyon nuts, and that juniper berrias ware only gatherad in good years.

When faod was not scarce, the matter of taste was considered. For example, the Kaibab Paiute of Arizana and Utah considered the berries of another species, $\mathrm{J}_{\mathrm{L}}$ wtahennsis, to be sweet on some trees, but not on others [Kelly 1964: 22-23]. The peaple would go about tasting them until they found some to suit their needs. According to Nequatewa [1943:18] the Hopi picked the berries of this same species in the winter after they were frost-bitten, because the frost "made them sweet".

To gain a broader perspective on the potential uses for a juniper tree, the ethnographic literature has been summarized for species other than alligator juniper 〔Table 34], highlighting the wide range of parts sought. Diverse needs have been satisfied by juniper bark in historic times. For example, it has been chewed when food was scarce, used as a medicine, rubbed fine for baby clothes and served as a slow match/fire tinder and as a dye for clath. Branches were sought for basket frames, bows and ceremonial dances. People have gathered needles and twigs for dye mordants, medicine, and ritual purification. Wood has provided building material, tipi poles, love flutes and fuel. Charred wood has been made into a ceremonial body paint.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| J. manasperma | bark, chewed in times of food shortage | Navajo | Castetter 1935:32 |
|  | bark, rubbed fine for baby clathes | Acoma and Laguna, New Mexica | Swank 1932:48-51 |
|  | bark, chewed as a medicine | Acama and Laguna, New Mexica | Swank 1932:48-51 |
|  | bark, used in dyeing wool | Navaja | Bryan and Yaung 1940:6, 17, 39 |
|  | branches, used in ceremanial dances | Jemez, New Mexica | Stevensan 1915:93 |
|  | branches, used in ceremonial dances | Acoma and Laguna, New Mexica | Swank 1932:48-51 |
|  | branches, as basket Frames and bows | Acoma and Laguna, New Mexica | Swank 1932:48-51 |
|  | berries, roasted and cooked for food | Chiricahua and Mescalera Apache | ```Castetter and Opler 1936:37, 45``` |
|  | berries, roasted and quantities eaten in fall or when fand scarce | Acama and Laguna, New Mexica | Swank 1932:4日-51 |
|  | berries, eaten raw or sum-dried; ance a very important food | Western Apache, Arizona | Gallagher 1977: 28 |


| Table 34 [co | t.J Ethmographic refere Juniper노. | nces to the use of | ional species of |
| :---: | :---: | :---: | :---: |
| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| J. monosperma | berries, used in dyeing wool | Navajo | Bryan and Young 1940:6, 17, 39 |
|  | needles, burned and used as a dye mordant | Navajo | Bryan and Young 1940:6, 17, 39 |
|  | twigs, medicine For childbirth; roasted and bailed | Zuni, New Mexica | ```Stevansan 1915:55; Camazine and Bye 1980: 373``` |
|  | twigs, staminate canes, as medicine | Acoma and Laguna, New Mexica | Swank 1932:48-51 |
|  | ```twigs [green], rubbed on maccosins for calor``` | Acama and Laguna, New Mexico | Swank 1932:48-51 |
|  | woad, as building material | Jemez, New Mexica | Cook 1930:24-25 |
|  | wood, as fence posts | Acoma and Laguna, New Mexica | Swank 1932:48-51 |
|  | wood, as fuel | Western Apache, Arizana | Gallagher 1977:113 |
|  | wood, as Euel | Jemez, New Mexico | Cook 1930:24-25 |
| Juniperus virginiana | berries, chewed as medicine | Kiowa, Oklahoma | Uestal and Schultes 1939: 13 |



| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Juniperus spp. | twigs, as Flavoring For boiled bread | Zuni, New Mexica | Cushing 1974:255 |
|  | twigs, mediaimal tea | Westarn Apache, Arizana | Gallaghar 1977:8日 |
|  | twigs, scarched and used as medicine | White Mt. Apache, Arizana | Reagan 1929:158 |
|  | wand, as Firemora | Zuni, New Mexica | Stevenson 1915:93 |
|  | wood, as firewood | Hopi, Arizona | Whiting 1966:62-63 |
|  | woon, in ceramonies | Zuni, Naw Mexico | Stevensan 1915:93 |

Although the literature repeatedly recards gathering the fruit of various juniper species for food, it also reveals other uses For the berries. For example, the Navajo considered them useful in dyeing wool [Bryan and Young 1940: 6, 17, 393. Kiowa in Oklahoma chewed them as a medicine CUestal and Schultes 1939:13]. In New Mexico the Zuni kneaded berries inta jerked meat as a flavoring agent [Cushing 1974:255], and the Hopi of Arizona pierced and strung them on necklaces [Whiting 1966:62-53].

The archasalogical record reveals that many modern needs far juniper were also prehistoric needs [Table 35]. Berries and seeds, charred and uncharred, appear to represent faod in a number of lacations in ancient times. The seeds were also pierced and strung as beads. Possibly the branches were made inta a tea, or eaten, as high percentages of pollen recovered in two human coprolites suggest. The presence of juniper fiber in human feces in a Glen Canyon site hint that the bark was ingested, in all likelihood in times of food shortoge.

Shredded bark of Juniperys ostegsperma or $I_{2}$ mongspermg was fashioned into pot rests, torches, and bags. At Orme Ranche Cave in the Prescett National Forest of Arizona, strips of $\mathcal{L}_{2}$ Qstegsperma bark and a grass formed the lining of a storage pit. All the strips were burned on the outside [bottom], possibly to dry them out thoroughly and facilitate shaping. According to the excavator [Breternitz 1960:26]

Table 35. Prehistaric references ta Juniperus remains.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| J. deppeana | berries and seeds* | Bat Cave, New Mexico | Smith 1950:166 |
|  | berries and seeds* | Tularasa Cave, New Mexico | Kaplan 1963:352 |
|  | berries and twigs* | Bat Cave, New Mexica | Smith 1950:165 |
|  | 5eeds | Hohokam, Prescatt, Arizana [A.D. 7-1300] | $\begin{aligned} & \text { Gasser } 1977: \\ & 304-305 \end{aligned}$ |
| J. manasperma | seeds | Heltagito Rackshelter, Arizana [A.D. 600-1200] | Breternitz 1957:5 |
| J. monosperma/ <br> J. osteosperma | hark, shredded as household needs | Salman Ruin, NW New Mexico [A.D. 1090-1280J | Adams 1980b |
| J. osteosperma | bark, as ceramic pot rests | Johnsan Canyon, SW Calarada [Puebla III] | Nickens 1981:74 |
|  | bark, shredded as a starage pit lining | Orme Ranch Cave, Arizana | Breternitz 1960:26 |
|  | berries and seeds, as Food | Salmon Ruin, NW New Mexica [A.D. 1090-1280] | $\begin{aligned} & \text { Lentz 1984:191- } \\ & \text { 200 } \end{aligned}$ |
|  | ```berries and seeds, as Eood``` | Tularesa Cave, New Mexica | Kaplan 1963:352 |

*Listed as synonym I. pochyphloga.

| SPECIES | PART AND USE | GRIUP [5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| J. osteosperma | seeds, as head necklace in animal skin bag | Cowbay Cave, Utah | Hull 1980:139 |
|  | seeds, as beads | Salmon Ruin, NW New Mexico [A.D. 1090-1280J | Adams 1980b |
|  | wood, as construction beams and tools | Johnsan Canyon, sw Colorado [Puebla III] | Nickens 1981:74 |
| J. scapulorum | seeds, charred | Basketmakar I I and III, NE New Mexico [A.D. 400-900] | Kirkpatrick and Ford 1977: 263-26! |
| J. utahensis | berries, charred | Higgins Flat Puebla, New Mexico [A.D. 1175-1250 | Cutler 1956b:181 |
| Juniperus spp. | bark, bundles as torches | Cowboy Cave, Utah | Hewitt 1980a:71 |
|  | bark, bundle as torch and brush | Tanta Natianal Hanument, Arizama [A.D. 1300's] | Bohrer 1962: 83 |
|  | bark, bundles fashioned into a bag | Painted Cave, Arizana | Haury 1945:41 |
|  | Fiber, as faod [?] in human copralite | Glen Canyon, Utah [A.D. 400-1350] | Fry 1976:15 |


| SPECIES | PART AND USE | GROUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Juniperus spp. | berries, as food | Ria Zape, Durango, Mexica [A.ロ. EOO] | Brooks, et al. 1962: 357 |
|  | berries [charred] | Paint of Pimes, Ariz. [A.D. 1280-1300] | Bahrer 1973:427 |
|  | pollen, as food [?] in human capralite | Glen Canyon, Utah | Martin and Sharrack 1964: 173 |
|  | pollen, as medicinal tea [?], in human coprolite | Antelape Hause, Arizona | Williams-Dean and Bryant 1975:103 |
|  | seeds, representing Food | Fresmal Shelter, New Mexica [B.C. 1600-A.D. 1 J | Bohrer 1981:44 |
|  | seeds | Grasshopper Pueblo, Arizana [A.D. 13001400J | $\begin{aligned} & \text { Bohrer 1982: } \\ & 98-99 \end{aligned}$ |
|  | seeds [charred] | Carter Ranch Puebla, Arizond [A.D. 950-1200 | Cutler 1964:234 |
|  | ```twigs [charred], as Euel``` | Chaco Canyon, New Mexico [A.D. 750-11003 | Struever 1977:71 |
|  | wand | Bat Cave, Neu Mexico | Smith 1950:166 |
|  | wood, as knife handle | Danger Cave, Utah | Jemnings 1957:191 |

Table 35 [cant.] Prehistaric references ta Juniperus remains.

| SPECIES | PART AND LUSE | GROLP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Jumiperus spp. | Wand, as Euel | Dolares Rivar Area, Calarada [A.D. 6OO1200] | Benz 1984: 205 |
|  | woad, as fuel and construction materials | Chimney Rock Mesa, Colo. [A.D. 1000's] | Minnis and Ford 1977: 83 |
|  | wood, as Euel | Salmon Ruin, NW New Mexica [A.D. 1090-1280J | Adams 1980b |

such juniper bark/grass lined starage bins have been found at a number of Sauthwestern archaealagical locatians. At Salmon Ruin such hausehold requirements as cordage, pot rests/burden rings and toilet paper were all satisfied by Elexible juniper bark [Adams 1980:b]. At this site juniper remains were found in burned store rooms, burials, trash, and potential food processing areas [Lentz 1984:191-200]. Juniper wood provided dwelling construction materials and fuel to ancient folks. They also chose the wood in the manufacture of variaus tagls, including a knife handle.

## SIGNIFICANCE FOR HUMANS

Obviously juniper cauld serve a wealth of human needs. At Ramsey Canyon, alligator juniper could offer all parts cited in the ethnographic and archaealogical literature except for the shredded bark. The bark of this species occurs in hard plates, rather than as loose, easily detached shreds. It still seems possible that alligatar junipar bark could be used as fire tinder, as a medicine, or the inner bark eaten if Food were scarce.

It alsa seems that this species might provide fairly dependable fruit harvests in a riparian location. Ripe berries clinging to branches for up to nine months would offer a long-term food, stored right on the plant. Acquisition of the twigs with pollinating cones as a medicinal tea or food would be limited to the month of March.

Twigs and branches could be gathered throughout the
year, although for certain purposes such as the construction of bows there might be a preferred time for collecting. Wood for fuel, dwelling construction or tools would be always available.


Since sa many af the parts af juniper can became charred during use, it is quite likely that the archaealogical record would retain a fair representation of this plant. The nabits of people to roast the berries prior to further preparation increases the chances burned Eruit or seeds would enter the ancient recard. Wood employed as fuel, or as part of a dwelling that catastraphically burned, cauld be recavered as charred waad fragments. Bark used as tinder, alang with twigs ar branches burned far variaus needs, wauld again have a goad chance of being retained in an ancient site.

Charred parts might not be the anly anes to survive. Wooden tools could preserve for centuries in a dry cave shelter. Seeds pierced for beads in a necklace and buried in deep trash deposits might not decay, due to their very hard and thick seed coat.


Lactuca graminiEalia grows in a shady area in a substrate of boulders and alluvium. Although the plant can be found not too far from the stream in Ramsey Canyon, the sail where it graws is relatively dry.

## Phendigey

This perennial wild lettuce remains visible above ground in vegetative state throughout the year. During the months of October through March short stems with inactive leaves are always available. In April noticeable vegetative growth begins. For the period of April through September the plant is in full flower, with both immature and mature achenes present simultaneously. Leaves and stems continue to grow and elongate as well. In sum, the phenology of this wild lettuce can be characterized as having six months of inactivity, with seemingly dormant above ground vegetative parts, and six manths of active vegetative grawth and continuous reproduction.

ETHNDGRAPHIC/ARCHAEOLOGICAL RECORDS
A number of Southwestern groups have utilized different species of wild iettuce in historic times. The Gosiute of Utah and Nevada ate the leaves [Chamberlin 1911:373]. The young tender plants of L_ inteacata were chosen by the Acoma and Laguna of New Mexico as greens [Swank 1932:51]. The leaves of the same species were eaten fresh as a relief for stomach ache by the Isleta, also of New Mexico [Jones 1931:33]. The Navajo of the Chaco Canyon region employed $\mathrm{L}_{\mathrm{s}}$ virgsa in the treatment of "sick stomach" (Hocking 1956:152]. Lactuca pulchella was called "female milk plant" by a member of the Ramah Navajo of New Mexica, and was said to be used like other milky plants (Uestal 1952:52].

In addition to the leaves, the root of various wild lettuce plants have been considered a chewing gum. The White Mt. Apache chewed the roots of $L_{+}$pulchella [Reagan 1929:158]. The Zuni extracted a gummy substance from the root of this same species; they also hung the roots to dry and collected the gum as needed [Stevenson 1915:68].

No archaeological record found.

## SIGNIFICANLE FOR HLMANS:

The cultivated variety of lettuce grown all over the warld is the related species Lactugg satiyg CKearney and Peebles 1960:96E]. It is therefore not surprising that groups eat leaves of related wild species. Although the plants wauld perhaps be most tender and desirable during the
period of April-September, when leaves and stems are rapidly growing, at Ramsey Canyon the leaves could still be harvested during the remainder of the year. Likewise the roots would be easily found at any time, as above ground parts are always present marking their location. predictions far the archaedlogical record

Unless the small achenes became inadvertently charred in a household catastrophe, it is unlikely that any recognizable part of wild lettuce would survive in the ancient record. The practice of cooking the leaves as greens, or eating them raw, would preclude their recovery. Roots chewed for gum wauld likewise become unrecognizable.

habitat

This plant does well in dry sail a shart distance Eram the stream at Ramsey Canyon. Lack of dense nearby vegetation permits the area to receive more than $50 \%$ exposure to sunlight. The substrate is composed of colluvium and granite bedrack.

PHENDLDGY
The slender perennial sprangle-top grass is not obvious in the Ramsey Canyon area until late summer, first signaled by the presence of immature inflorescence units in July. The grass flowers thraugh August and September, and grains mature in Dctaber. By Navember the plants have died back, resuming a dormant period that lasts for up to eight months. ETHNOGRAPHIC/ARCHAEOLDGICAL RECDRDS

Grains of Leptochloa viscida were once gathered and eaten by the Mohave of the Lower Colorada River region [Castetter and Bell 1951:187, 192]. In East Africa, grains of Le chinensis L. were considered a famine food [Datta and

Banerjee 1979:2993. Beyond these two references, there are no hints in the historic literature examined as to posible uses of sprangle-top.

No archaedlogical record found.

## SIGNIFICANCE FOR HURTAS

Possibly the grains of sprangle-top could be harvested for food. At Ramsey Canyon this would be restricted to the month of October.

PREDICTIONS FQR THE ARCHAEDLQGICAL RECDRD
Like other grasses, grains would be retained in the ancient reccrs if harvested and then prepared in such a way that fastered preservation, such as parching.


Lithospermum multiflocum does well on the east side of the stream at Canela Hills cienega. The sail is dry, underlain by volcanic bedrack, and partially exposed to the sun. PhENDLOGY

Gramwell is a perennial, possibly biennial, plant noticeable only for the summer months of June through September. In June vegetative growth resumes, with the plant coming inta full flower in July. Immature fruits are visible in August, ripening to maturity in September. Leaf growth and stem elongation seem to continue throughout the period the plant is visible above ground. Evidence of the plant's presence in the area is difficult to detect during the months of Dctober through May.

## ETHNDGRAPHIC/ARCMAEOLOGICAL RECORDS

The roots and seeds of Lithospermum mutiflorym are noted in historic literature for different reasons. The seeds of this species of gromwell were formerly eaten by the

Gosiute of Nevada and Utah; these same people alsa made a remedy fram the raots far kidney traubles CChamberlin 1911:373]. The Ramah Navajo of New Mexica used the roat as a Life Medicine, employed in treating a host of internal and external complaints CUestal 1952:41; Uyman and Harris 1941: 67-68]. This plant was known as "great red body medicine" among certain Navajo [Mathews 1885:774]; perhaps this is in reference to the observation that many gramwell species contain a purple dye in their roots $\mathbb{C K e a r n e y ~ a n d ~ P e e b l e s ~}$ 1960:723].

Other species of gromwell are referenced as serving human needs [Table 36]. Dften they were chosen for their coloring properties. For example the flowers were ground or chewed with gum for a yellow hue, roots produced a purple, vialet or red dye, and the plant itself offered a "red bady medicine" to the Navajo. These references are understanable when one examines herbarium specimens that leave various blue and red stains on the paper near the roots. As a food, leaves have been eaten Fresh or steeped into a tea. Medicinal meeds have been met by both plant and roots. Seeds provided incense and eyewash powder.

A medicine man's bag from Tularasa Cave in southwestern New Mexica, dating after A.D. 700, contained a number of Lithospermum multiflogym seeds. These seeds had all been pierced and inserted anto cactus spines [Martin 1952:454]. At this same cave, Cutler [1952:479] identified the remains


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| L. incisum | taps and seeds, dried for incense | Blackfoot, Nw Great Plains | $\begin{aligned} & \text { Johnston 1970: } \\ & 318 \end{aligned}$ |
| L. longiflorum | roots, yield a purple dye | United States | Palmer 1878:654 |
| Lithospermum spp. | Elowers, chewed with gum by children Eor yellow color | Plains | Gilmore 1977:59 |
|  | Flawers, ground to make a yallow paint | Acama and Laguna, New Mexica | Swank 1932:52 |
|  | leaves, eaten fresh | Pima of Arizona | $\begin{aligned} \text { Yanavsky 1936:54; } \\ \text { Russell 1975:77 } \end{aligned}$ |
|  | leaves, in a tea | Europe | Lewis and Lewis 1977: 389 |
|  | plants as medicines | Navaja | ```Fransiscan Fathers 1910:183``` |

of $k_{\mu}$ incisym among the general wild plant debris. SIGNIFICANCE FOR HLIMANS

The ability to acquire hithaspermum multiflocum would be generally restricted to the four month period of above ground availability, unless locations of specific plants were remembered. Entire plants, leaves, and roots could be gathered from June through September. The flowars could only be sought in July and August, and the seeds in September.

PREDICTIONS FOR TME ARCHAEOLOGICAL RECORD
Due to the preparation techniques applied to most gromwell parts, including bailing, grinding, chewing, and soaking, it would be unlikely that much would remain in the ancient record to signal use. Perhaps only the seeds, if incompletely burned for incense, would preserve.

Lonicerg albiflorg Torr, \& Gray var, dumgsg [Gray] Rehd. [H-6 [KA \#312-84] UA254902


## HABITAT

Shrubby Lonicera glbiElofa grows along the dry east flanks of the stream at Canela Hills, tangled up among other dense vegetation. Partial shading is provided by nearby trees.

## PHENDLOGY

The phenalogical record for this species of honeysuckle is incomplete, and blank spaces in the phenological profile of this shrub represent missing data. The species is reproductively active during the spring and early summer of the year, at least in the months of March thraugh June. Full flowering can be observed in April, and immature fruit develops in April and May. The entire period of mature fruit availability was not observed, nar was the timing af the period of dormancy.

## ETHNDGRAPHIC/ARCHAEOLDGICAL RECDRDS

The ethnographic record refers to a number of species of honeysuckle but not to be qubiEloca specifically. There
are few refarences to use of the plants as food, perhaps because the fruits are said to contain saponin, responsible far emetic and cathartic effects CKearney and Peebles 1960: 816]. In China the black fruit of Loaicea aEfinis and the yellow fragrant flowers of $\mathrm{L}_{\mathrm{c}}$ Eeticulgtg were both said to be edible [Altschul 1973:292]. Closer to home, the Ramah Navajo of New Mexica used two species of Lquicera; they ate the berries of $k$ geizonicg and made an emetic from its leaves. Likewise they made an emetic from the leaves of $L_{1}$ inyolucrgta [Uestal 1952:45]. Apparently Navajo also used t. arizonica in preparing an "eye wash" to treat various eye diseases and afflictions [Wyman and Harris 1941:54, 583. Two separate species served the Chumash of the southern California coast as material for crafts, tools and in medicines [Timbraok 1984:167].

No archaealogical record found.

## SIGNIFICANCE FOR HUMANS

As potential food resources, honeysuckle would offer flowers in April and May and ripe fruit during June and possibly later. Leaves could be harvested for emetic and other medicinal uses from March until the plant went dormant. Craft and tool needs could be satisfied for perhaps the entire year if the location of dormant plants were known.

## PREDICTIDNS FOR THE ARCKAEOLGGICAL RECORD

One would not expect to find the highly perishable
honeysuckle flowers in the recard, except in the form of their insect-carried pollen. The chances would be better at recovering seeds or fruits that had been accidentally carbonized or preserved in a highly protected location. The use of leaves in medicines might require their maceration or cooking, two processes that would render them unlikely to be recognized. Perhaps tools or craft items fashioned from twigs or wood might preserve.

# $\frac{X}{\operatorname{JAN}} \underset{\frac{X}{\text { FEB }}}{ } \quad \frac{X}{\text { MAR }}$ <br> $\frac{X}{A P R} \frac{X}{M A Y}$ <br>  <br> $\frac{X}{D E C}$ mabitat 

Lotus quaboides can be faund on the dry anst flanks of the stream at Canelo Hills Cienega．The area is fully exposed to sunlight．Local substrate is compased of collu－ vium with valcanic bedrack outcrops．

## PHENOLOGY

This herbaceous perennial deer vetch can be observed in June and July in vegetative state．By August flowers are present，and the plant continues to flower through Septem－ ber．Mature pods are available in October；by November mast clues to the taxon＇s presence in the area are gone．

## ETHNOGRAPHIC／ARCHAEOLDGICAL RECORDS

Most species of deer vatch are grazed or browsed by domestic animals and deer［Kearney and Peables 1960：425］． Isleta sheepherders considered $L_{\text {e wrightii an excellent }}$ grazing plant［Jones 1931：34］．Peaple have gathered this same species to satisfy medicinal needs．For example，the Navajo made a diuretic out of it as a treatment in a whole
suite of genito-urinary problems [Wyman and Harris 1941:6061], while Ramah Navaja used its leaves in a decoction as a cathartic and in treatment of stomach-aches CUestal

1952:32]. In east Africa another species, be qaetzei, has been drunk three times a day for the treatment of warms [Kokwaro 1976:140]. A single reference hints that Lotus has also been eaten in historic times. At least one California group considered a species of Latus to provide edible greens [Yanovsky 1936:37].

No archaealogical record located.
SIGNIFICANCE FOR HUMANS
At Canela Hills, deer vetch could be valuable as a faod preferred by game in the period of June through October, thus increasing chances for humans to acquire animals. The plant itself might provide edible greens in June and July; beyond that time leaves and stems might be less palatable. Plants sought far medicinal purposes could be gathered during the entire period of above-graund availability, JuneDctaber.

PREDICTIONS FOR THE ARCMAEDLOGICAL RECDRD
None of the uses listed above would suggest that recognizable parts of deer vetch wauld routinely enter ancient deposits with high likelihood of preservation. Plants cooked down to greens or prepared as a decoction for a medicinal treatment are not likely to survive.

## habitat

The dry stream Elanks of Canelo Hills Cienega provide suitable growing conditions for Melampgdium longicornu. Underlying soil is dry, and the plants receive up to $50 \%$ exposure to the sun's rays in this location. PHENOLOGY

This annual-looking plant appears in late summer and is present at least through November at Canelo Hills. Full flowering spans the months of Septamber through November, and mature fruit first became available in Octaber. Stem elongation and leaf expansion continue throughout the entire period the plant is visible. Dormancy begins in December, with the seeds overwintering in the ground.

## EIHNDGRAPHIC/ARCHAEOLGGICAL RECDRDS

Only two historic references have been located for Melompadium. The Navajo in the Southwestern United States used $M_{\text {. }}$ leucanthum in some way as an eye wash CWyman and Harris 1941:54]. Elsewhere in the world, $M_{\perp}$ camphoratum has No archaealogical record found.

## SIGNIFICANCE FOR HUMANS

The significance of this plant for humans seems low. Possibly it could serve as an externally applied medicine, available for gathering August through November. Whether or not it is actually safe as a tea is questionable, since only one historic reference suggested this use.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD
Plants saught for medicines are generally used much less frequently than those sought for food. Low frequency of use might result in a low rate of loss inta the archaealogical record. In any event, if this plant were prepared by soaking or heating in water, it is unlikely any part would preserve in recagnizable form.

Mentha gryensis L. var. villosg Benth. S.R. Stewart CH-3 [KA \#193-83] UA254892

habitat
Mentha acyensis can be found along the stream at Canelo Hills Cienega, in wet to fully saturated alluvial sail. The surraunding canapy of trees and shrubs provides a fair amount of shading.

## PHENDLOGY

This perennial aromatic mint is first noticeable at Canela Hills in June by virtue of rapid vegetative growth. In August the plants begin to flower, and continue to do so until they resume dormancy in November. Ripe nutlets can be found in both September and October. Stem elongation and leaf expansion never esase during the five months the plants are visible on the landscape.

## ETHNDGRAPHIC/ARCHAEOLQEICAL RECORDS

Mentha aryensis leaves, stems and flowering tops have been selected for internal consumption and external application by numerous historic groups [Table 37]. Steaping the leaves as a beverage tea and medicinal tea is commonly


cited, as is use of the leaves as a flavaring for ather foods. External application includes preparation of eye paultices and lotions far skin problems and swellings. Western Shoshoneans living in Nevada and Idaho picked the leaves of tops of Mentho gryengis in late spring or early summer when the plant was still in bloom, formed this material in tight cails and dried it in a closed container for later medicinal use. People have also eaten the plant as a pot herb, packed it around dried meat, and occasionally smaked the leaves as "tabacca".

No archaealogical record of Mentha was located, but Labiatae pollen, comprising $25 \%$ of a pollen spectrum, was noted in one coprolite from Hoy House in Johnson Canyon in southwestern Colorado [Scott 1979:271], implying ingestion of some sort of mint flowers.

SIGNIFICANCE FOR RUMANS
At Canela Hills mint leaves and stems could be gathered for flavaring, teas, pot herbs, "tobacco", packing around meat and as medicinal remedies during the months of June through October. Flowering tops, intended for some of the same purposes, are available August through Dctober.

PREDICIIONS FOR THE ARCHAEOLOGICAL RECORD
Unless mutlets of Menthg gryensis were incidentally carried into a dwelling to became incorporated in burned deposits, perhaps only pollen from Elowering tops would remain to signal use of this plant in prehistory.


Mimulus quttatus thrives in wet to fully saturated soil beside and in the stream at Canela Hills. The amount of sunlight that reaches the plants is variable, being partially obscured by tall trees a short distance from the stream. The underlying substrate is composed of alluvial sediments.

## PHENDLIGY

Herbaceous perennial monkey-flower plants are first noticeable as actively growing leaves in February and March. By April the stems have begun to elongate, and the plants are in full flower May through July. Capsules disperse ripe seeds in July and August, and by September all active vegetative growth has ceased. The plant is still visible on the landscape until November, when it then basically dies back for a three manth dormant periad.

## ETHNDGRAPHIC/ARCMAEDLDGICAL RECDRDS

Mimulus quttatus satisfied needs for both California and Chihuahua, Mexico groups. The Kawaisu of California
ate the tender stalks of this plant raw, and boiled the leaves and stems to inhale the steaming vapor for relief of sore chests and backs [Zigmund 1981:41]. Tepehuan in Chihuahua cooked the leaves of this species as food, and made a tea to treat fevers by boiling the entire plant in a small amount of water [Pennington 1969:140, 186]. The Iarahumar of Chihuahua also cooked the leaves, and often ate them with beans [Pennington 1969:1273.

Other species of monkey-flower were also sought. The Kayenta Navajo of Arizona chewed the seeds of $M_{\mathcal{L}}$ enstwondiae and sprinkled them on an Enemyway rattlestick; possibly they also ate the capsules [as "berries"] raw or stewed, and used the plant in some manner to relieve hiccoughs cwlyman and Harris 1951:423. The inhabitants of Isleta puebla in New Mexico salted and ate the tender young leaves of $\mathrm{M}_{2}$ geyeri as a salad [Jones 1931:35].

No archaeological record located.

## SIGNIFICANCE FOR HUMANS

At Canelo Hills Mimulus guttatus leaves would provide a tender food resource especially in February and March, but alsa April through August as new leaves continually Formed. Tender stalks would be more likely restricted to April, when rapid stem elongation preceded reproductive events. Leaves and stems could be callected for medicinal requirements April through October. Seeds would be mature in July and August for use in ceremonies. If the capsular fruit Clisted
in the historic literature as "berries"] provided a food, it wauld be restricted ta the months of July and August. PREDICIIONS FOR IHE ARCMAEOLOGICAL RECORD

QE the monkey-Elower parts potentially utilized in prehistary, perhaps anly the seeds or Fruit capsules would preserve, and these anly in very pratected lacations. Since the seeds were chewed, nat many of them would survive in recognizable condition. Ancient use of young leaves, stalks, and plants as medicines would reduce chances that such mankey-Elower parts wauld be recovered.

Mingbilis goceinag [Torr.] B. \& H.
[-0xubophus coccineys Torr.]
[H-5 [KA \#162-83] LA254655; [KA \#189-83] LA25554日3]


Micabilis coccinea can be found growing in dry soil on the eastern flanks of the stream at Canelo Hills. Some shading is provided by nearby vegetation. The underlying substrate is composed of colluvium and volcanic bedrock. phendlogy

This showy red-flowered perennial plant is obvious only for the three month period of Jume through August. Reproductive maturity is rapid, with flower buds present in June and full flowering by July. Mature fruit begins to disperse in August. By September the plant has died back to graund level and is difficult to find.

ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS
Various four-o'clock species related to Mirabilis coccineg [as Qxybaphys] have been gathered by Navajo and Zuni groups in the Southwestern United States. The root of Qxubgohus linearis was ingested by the Zuni to induce vomiting and urination [Camazine and Bye 1980:377]. The

Kayenta Navaja considerd this species a "Life Medicine". They also used the root to treat stomach disorders and postpartum problems, and raasted and ate the seads CWyman and Harris 1951:21]. Ramah Navajo of New Mexico split and soaked the root of $\mathrm{D}_{\mathrm{s}}$ comatus as a burn treatment, and treated coughs with a species [ 0 , linearis] that was also a good luck drink or lotion [Uestal 1952:26].

No archaeological record located.

## SIGNIFICANCE FDR RUMANS

It appears that the root is the part of Qxubaphus most sought by histaric groups. At Canelo Hills raots could be dug for the three months the plant is present above ground, June thraugh August. Beyand that, ane would have ta recall the location of the plants, and perhaps search in the sail to find them. If seeds can be harvested as a food, as the Kayenta Navajo apparently did of $Q$. linearis, they could be gothered only in August at Canelo Hills.

PREDICIIONS FOR THE ARCHAEOLOGICAL RECORD
Roasted faur-o'clock seeds would be apt to enter the archaealogical recard if they were harvested either in quantity or repeatedly. Roots prepared in medicinal ways would not be nearly as likely to survive.

## HABITAT

Monarda qustramontana does well ot Canela Hills is an area of partial shade, on the east side of the stream. The dry underlying soil in the location is composed of underlying volcanic bedrock and pockets of colluvium.

## PHENDLOGY

This annual bee-balm becomes obvious in July, when it is active vegetatively and developing flower buds. Vegetative activity ceases and full flowering begins in August, continuing through September. Ripe mint nutlets are present in October and November. The plant overwinters as nutlets in the soil from December through June.

ETHNDGRAPHIC/ARCHAEOLQGICAL RECORDS
Various species of bee-balm have been used in ways similar to Mentho $[$ Table 383 . Leaves and plants are frequently cited as imparting flavoring to food and providing beverage and medicinal teas. Dccasionally groups ate beebalm as a potherb. Externally applied lations, insect bite treatments and hair perfume have all been made up from

Table 38. Ethnographic references to the use of Manarda.

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Manarda austromontana | plant, as seasoning for food and as medicinal tea | Mexican groups | $\begin{aligned} & \text { Altschul 1973: } \\ & \text { 255-256 } \end{aligned}$ |
| Monarda menthaefolia | leaves, as seasaning for stews/soups | Isleta, New Mexico | Jones 1931:35 |
|  | leaves, as Flavaring and beverage | Chiricahua and Mescalera Apache | Castetter and Dpler 1936:47, 53 |
|  | plant, fresh or dried as Flavaring | Picuris, New Mexico | Krenetsky 1964: 46-47 |
|  | plants, as a potherb, dried for winter use; possibly cultivated? | Hopi, Arizana | Bartlett 1951: 50; Whiting 1966:91 |
|  | plants, as a potherb, | Tewa of Hano, Arizana | $\begin{aligned} & \text { Rabbins et al. } \\ & \text { 1916:57-58 } \end{aligned}$ |
|  | plants, chewed while hunting | Acama and Laguna, New Mexica | Swank 1932:55 |
|  | plants, as medicinal tea | Spanish-Americans, Rio Grande River of New Mexico | Curtin 1965:138 |
|  | plant, as medicinal tea or lotion For gun/arrow wounds | Ramah Navaja, <br> New Mexica | Vestal 1952:41 |


| SPECIES | PARI AND USE | GROUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Manarda menthaefalia | plant*, as medicine | Navajo | Elmare 1944:73 Matthews 18日E: 775 |
| M. pactinata | leaves, graund and mixed with sausage | Acoma and Laguna, New Maxica | Swank 1932:55 |
|  | plants, as flavoring | Spanish-Americans, Ria Grande River of New Mexico | Curtin 1965:138 |
|  | plants, as flavaring and medicinal tea | Picuris, New Mexico | ```Kremetsky 1964: 46-47``` |
|  | plants, as medicine | Kayenta Navaja, Arizana | Wyman and Harris 1951:41 |
|  | plants, as medicine | Navaja, Chaco Canyan area of New Mexica | Hacking 1956: 153 |
|  | plants, as medicine | Ramah Navaja, <br> New Mexica | Vestal 1952:41 |
|  | plants, as medicine and "chant latian" | Navaja | Wyman and Harris 1941:53, 67 |
| Monarda spp. | Flowering hears [immature] as hair perfume | Kiowa, Ok lahoma | Vestal and Schultes 1939:49 |

*species listed as a synanym.

Table 38 [cant.] Ethnographic references to the use of Manacda.

| species | Part and use | GROUP[S] | Reference |
| :---: | :---: | :---: | :---: |
| Monarda spp. | leaves, rubbed on insect bites | Kiowa, Oklahoma | Vestal and Schultes 1939:49 |
|  | plant, as medicinal tea | Winnebago and Dakota groups | $\begin{aligned} & \text { Lewis and Lewis } \\ & \text { 1977:194 } \end{aligned}$ |
|  | plant, to make hagans smell nice | Navaja | Elmore 1944:73 |

bee-balm leaves and plants. The Navajo appreciated its ability to make a hogan "smell nice" [Elmore 1944:73]. A single citation [Whiting 1965:91] suggests that great demand for $M_{1}$ menthaefolia by the Hopi and Tewo at Hano in Arizona may have lead to occasional cultivation of this plant.

In the archaeological record, several Eruiting heads of some species of bee-balm were listed by Smith [1950:173] as among the plant remains fram Bat Cave in south-central New Mexica. Labiatae pollen [up to 25\% of the pollen spectrum] from a human coprolite at Hoy House in Johnsan Canyon, 5 w Colorado, implies ingestion of some sort of mint flowers [Scott 1979:271].

## SIGNIFICANCE FOR HLMANS

At Canelo Hills Monardg qustromontana might serve the same needs as Mentha acyensis. Leaves and stems could provide flavoring for other foods, a beverage tea, pot herbs, hair perfume, home deadorizers and material for medicinal preparations and teas. All these needs could be met by bee-balm plants between the months of July-November. priedictions for the archaeological record

As with Mentha evidence, unless mature nutlets of
 or pollen fram flowering heads enters the record, it is not likely that bee-balm evidence would survive, due to perishable parts selected and the destructive nature of preparatian steps applied.



The five species of muhly grass monitored grow in diverse habitats. Both M. utilis and M. osperifolig thrive in the fully saturated soil of the Canelo Hills Cienega, exposed to the full force of the sun's rays. The other species generally prefer to grow in drier sail. $M_{\alpha}$ poly= caulis and $M_{2}$ emersleyi are in heavily shaded locations at Ramsey Canyon, while $M_{\perp}$ cigens and $M_{\text {_ }}$ emersleui receive full sunlight at Canelo Hills.

PHENDLOGY
Although all five species of muhly grass studied here are perennials, three are rather diminutive [M. asperifglig, $M_{2}$ polyggulis and $M_{1}$ utilis] in comparison to the two extremely robust species, $M_{\perp}$ emersleyi and $M_{\perp}$ rigens. The plants have been grouped according to this size distinction for presentation of the phenological profile data.

At Canelo Hills M. asperifolig becames naticeable in the cienega in June. It continues vegetative growth until flowering in September. By Dctober its grains are ripe. For three additional months, even though vegetative growth appears to have ceased, the plant remains visible above ground, priar to resuming darmancy in February.

Alsa in the Canelo Hills Cienega, $M_{\perp}$ utilis is recognizable nearly the year raund. A weak-stemmed grass that supports itself on the dense cienega vegetation, this grass resumes stem elangation and leaf expansion in April. No
reproductive activity is apparent for a full six months; by Dctaber the grass flowers, and produces mature grains in November. Inactive stems and leaves can still be faund until February, prior to a one-month period when any evidence of this species is difficult to Find.

At Ramsey Canyon, $M_{\perp}$ pquycaulis reveals yet a different phenalogical profile. The stems and leaves of this species are present in April, followed by four months of vegetative growth. Full flowering spans the three months of August through Octaber; ripe grains can be found September through November. A four month dormant period ensues, when it is hard to find visual evidence of the plant's presence above ground.

The robust $M_{2}$ emersleyi seems to follow similar phenological patterning in Ramsey Canyon and Canelo Hills; this was one of the few plants monitored simultaneously at both study areas. The plants follow basically the same sequence of events, with the exception that active stem and leaf growth begin two months earlier in Canelo Hills, commencing in April instead of June as in Ramsey Canyon. Flawering, presence of ripe grains, cessation of leaf and stem growth and resumption of dormancy are synchronous in timing in both areas. Large dried clumps of the grass are present from December until growth resumes.

Robust $M_{2}$ Eigens is first observed at Canelo Hills in

May in the form of leaves growing from the center of large clumps of dead stems/leaves representing previous years grawth. Bu August inflorescence units are present, and full flowering commences in Qctober. Ripe grains are available only in November, after which time the plant loses all green color for five months.

## EIHNDGRAPHIC/ARCHAEOLOGICAL RECORDS

Different species of muhly grass are discussed in the histaric literature of bath the Unitad States and Mexica [Table 39]. Three of the species examined for this study have documented uses. $M_{\perp}$ gsperiEqlig and $M_{\perp}$ rigens grains have been eaten, $M_{2}$ emersleyi stems were sought to make brooms, bows for shooting fish, and to serve as baking pit lining, and $M_{\perp}$ Ligens plants and stems were fashioned into coiled baskets by various Califarnia graups. The Kawaiisu even inserted a stem of this species into a newly-pierced ear hole to keep the hole from growing shut [Zigmund 1981:43]. References to other species of muhly grass reflect these same sorts of human needs.

The prehistoric record reveals a few references to muhly grass. $M_{2}$ Eigens specimens were recovered in strata at Bat Cave in south-central Naw Mexico [Smith 1950:168]. Not too far away in U-Bar Cave, a suspected ceremonial locus in the period A.D. 1350-1400, Muhlenbergia sp. was excavated from a feature [York et al 1961:97]. The recovery of burned muhly grain in a Mesa Verde occupation kiva [A.D.1180-1250]

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Muhlenbergia asperifalia | grains*, as food parched and ground | Paiute, Utah | Palmer 1878:603 |
|  | grains, as Food prepared in variaus ways | Paiute, Nevada | Bye 1972:91 |
| M. emersleyi | stems, as broom | Tepehuan, Chihuahua | Pennington <br> 1969:231 |
|  | stems, as tiny baw For shooting fish; pit lining when baking Aqaye; broom for sweeping metate | Tarahumara, Chihuahua | ```Pennington 1963:111,130,221``` |
| M. microsperma | grains, as food toasted and ground; cooked as a gruel | Seri, Sonora | Felger and Maser 1976: 25 |
| M. neomexicana | plants, as lining for Aggye baking pits | Mescalera and Chiricahua Apache | ```Castetter and Opler 1936: 35, 48``` |
| M. pungens | stems, hairbrushes and as roof thatching | Hopi, Arizona | Hough 1989:144; Whiting 1966:65 |
| M. rigens | grains*, as faod ground for flour | Apache, Arizona | Buskirk 1949:336 |


| SPECIES | PART AND USE | GROUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| M．rigens | grains＊，as frod | Kaibab Paiute，NW Arizona and SWl Utah | Kelly 1964：42 |
|  | plant，in craft preparations | Chumash，California | Timbrank 1984： 154 |
|  | stems，in basketry and ear－piercing | Kamaiisu，California | Zigmund 1981： <br> 43；197日：192 |
|  | stems＊，in basket－ making | Luiseno，Calif． | Sparkman 1908：204 |
|  | stems，in basket－ making；picked in summer | Cahuilla，California | Bean and Saubel 1972：89－90； Kroeber 190日： 41－42 |
| Muhlenbergia spp． | grains，as Faod threshed，winnawed and ground to flour | Mescalera and Chiri－ cahua Apache | $\begin{aligned} & \text { Castetter and Dpler } \\ & 1936: 36,48 \end{aligned}$ |
|  | stems，hairbrushes | Ramah Navajo | Uestal 1952：16 |
|  | stems，brushes and brooms | Navajo | Elmore 1944：25 |
|  | stems，hairbrushes and braams | Cochiti，New Mexico | Lange 196日： $149-1$ 150 |

[^3]at Salmon Ruin in northwestern New Mexico hints at the use of this taxon in prehistory [Adams 1980a:278]. Finally, excavators faund $M_{\perp}$ dymosg in Uentana Cave in southern Arizona, speculating that this grass possibly provided raw material for arrow shafts for the Hohokam occupants who visited the cave repeatedly during the period A.D. 500-1400 [Haury 1950:169].

## SIGNIFICANCE FOR HUMANS

If grains of Mublenbecaig osperiEolia and M. rigens are gathered as food in Canelo Hills, they could be had in the two months of October and November. These grasses do not have grains tightly enclosed in surrounding chaffy bracts, and would require little effort in harvesting and preparation, as they fall freely from enclosing palea and lemma. This might be a distinct advantage in the eyes of a prehistoric harvester.

Stems of $M_{\perp}$ emersleyi would provide raw material for fish bows, brooms and hairbrushes most likely in October and November, after active vegetative growth had ceased and fully mature stems were available. Possibly these parts could be collected for some time beyond October. Gathering the green leaves and stems for steam-producing fleshy material in roasting would span the manths of May through September at Canelo Hills and July-September at Ramsey Canyon. Beyand September the leaves and stems slowly dry out and become brittle.

## PREDICIIONS FOR THE ARCHAEOLOGICAL RECORD

Presence of muhly grass grains is expected in the prehistoric record, especially in light of historic references to parching or toasting this food resource. Stems laid in baking pits and slowly steamed might preserve, though could be hard to recognize and identify. Stems gathered into bundles as broams or hairbrushes can be expected to survive only in the best of preservation situations.


Qengtherg coseg can be found under the canopy of the deciduous forest that lines the stream at Canelo Hills Cienega. The plants grow in generally wet sail composed of alluvium. The area is shaded extensively by the trees in the area.
phenology
This perennial evening primrose cames up in the spring and is clearly recognizable by June, when it is in full flower. Flowering continues through July and August, with ripe fruit available in August. Uegetative growth occurs throughout the period the plant is above ground.

## ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Qenotherg rgseg leaves have been eaten by the Iepehuan of Chihuahua as a condiment, bailed as greens and made into a medicinal tea [Table 40]. At least six other species of evening primrose have been sought by groups living in the Southwestern United States and Mexico. Reproductive parts such as blossoms, fruits and seeds provided food; roots

| SPECIES | PART AND USE | GROUP [5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| D. albicaulis | Eruit* eaten | Mescalero Apache | Castetter 1935:17 |
|  | Fruit* eaten as a delicacy without treatment | Mescalero and Chiricahua Apache | Castetter and Opler 1936:45 |
|  | blassoms* eaten in ceremonies | Acama and Laguna New Mexica | Stevenson 1915: <br> 日7; Whiting 1966: B6 |
|  | plant*, as medicine | New Mexica | Swank 1932:27 |
|  | seeds*, ground and made into a gravy or boiled in soup | Mescalero and Chiricahua Apache | Castetter and Opler 1936:45 |
| O. biennis | ```seeds, occosionally eaten``` | Gosiute, Nevada and Utah | Chamberlin 1911: 375 |
| D. brevipes | seeds, as food | Mohave, Lawer Colorada River | ```Castetter and Bell 1951:187, 195``` |
| 0. caespitosa | raots, as a medicine | Gasiute, Nevada and Utah | Chamberlin 1911: 375 |
| 0. <br> clavaeformis | plant, once gatherad and eaten; it alsa harbared a soughtafter caterpillar as Food | Cahuilla, CaliE. | Bean and Saubel 1972:94 |
| *Species listed | as the symanym Anageg | bicaulis. |  |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| D. hoakeri | Flowers, powdered as a medicine | Zuni, New Mexico | Camazine and Bye 1980: 377 |
|  | root, carried as a charm in hunting | Jemez, New Mexico | Cook 1930:25 |
| D. rosea | leaves, as condiment in corn dishes; as greens after bailing; as a medicinal tea | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington } \\ & \text { 1969: } 100-102, \\ & 140,183 \end{aligned}$ |
|  | plant, as medicinal infusion | Ecuador | Altschul 1973:210 |
| Denothera spp. | leaves, bailed and eaten as greens | Tarahumara, Chihuahua | ```Pennington 1963: 126``` |
|  | plant, named as medicines | Navaja | Fransiscan <br> Fathers 1910:195 |
|  | plants, as medicinal and ceremanial needs; flowers, roats, leaves, ashes of seed pads as paultices, drinks and tobacco mixtures | Ramah Navaja, <br> New Mexica | $\begin{aligned} & \text { Uestal 1952: } \\ & 37-38 \end{aligned}$ |

offered medicine and charms in hunting, and plants provided medicines and food. The list is impressive fram the standpoint of the variety of species sought as well as the diversity of parts used.

The presence of evening primrose pollen in a rock shelter in the Hualapai Mts. in Arizona led researchers to speculate it was a prehistoric economic resource CHevly , Heuett and Olsen 197日:72]. The site was occupied infrequently during the period A.D. 900-1150 by a group of people associated with the prehistoric Patoyan culture. SIGNIFICANCE FOR HUMANS

Qenotheca coseg is certainly available in the Canelo Hills area for the three months of June through August. Perhaps the plant can also be acquired earlier in the spring. The parts that could be gathered thraugh this three month period include leaves, blossoms and roats, to satisfy food and medicinal requirements. Harvesting ripe pads and seads for food wauld be restricted to the month of August. PREDICTIONS FOR THE ARCHAEDLDGICAL RECDRD

Evening primrase leaves and plants made inta medicines or boiled as greens are not likely to became part of the archaealogical record, nor would fruit pods eaten without treatment. Ground up seeds would have low chances of surviving in recognizable condition. Burned fruit or seeds, and the pallen from blossams, could canceivably be recovered from well-protected locations.


## HABITAT

All three species of wood-sorrel monitored in this study can be found growing throughout Ramsey Canyon. However, observations were made in an area of dry soil, with 50\% or more exposure to sunlight. The underlying shallawly sloping substrate was camposed of colluvium and granite bedrack.

PHENDLIGY
The three species of wood-sorrel differ in more than ane way. The twa that have scaly underground bulbs, gxalis amplifolig and $\underline{Q}_{\text {. }}$ decaphylla, share similar phenalogical profiles. They are active far a very short period in July and August, flawering, fruiting and dying back to graund level over a 2-3 month period. On the other hand, the species with no undergraund bulb, Qxalis albicans, can be found for a full nine months, six of these in reproductive state. In addition, the flowering and fruiting regime of $Q_{\text {. }}$ albigans is not synchranaus with that of the other twa species, as it is undergoing reproductive activity both prior to and following that of the other two species.

## ETHNQGRAPHIC/ARCHAEDLOGICAL RECORDS

Dxalic acid, an organic acid of plants that is taxic to animals under natural canditions, accurs as both soluble and insoluble axalates; while axalates rarely reach dangeraus levels in most plants, they do so in a number of species of
woad-sarrel [Lewis and Lewis 1977:20]. Yet humans have harvested and eaten the leaves and bulbs of a number of Qxalis species in historic times [Table 41]. Same graups preferred them for their sour taste [Gilmore 1977:46; Krenetsky 1964:47]. The leaves and entire plants have been consumed raw, or boiled as potherbs. Likewise, bulbs were eaten raw or boiled. The plants served other needs, including thase of medicinal tea, thirst reliever, and agent For curdling cheese.

No archaealogical record located.
SIGNIFICANCE FOR HUMANS

At Ramsey Canyan the leaves and bulbs of Qxalis ampliEglig and ㅁ. deconghyllg could be gathered for the three month period of July through September for foad, medicine, etc. Leaves of $\mathrm{g}_{\mathrm{L}}$ glطicans wauld be available far the much longer nine month period of May thraugh January. PREDICTIONS FOR THE ARCMAEOLOGICAL RECORD

The perishable nature of wood-sorrel plants, coupled with the typical preparation methods Cboiling or no preparationl combine to reduce chances that the archaealogical record would reveal use af these plants.

| SPECIES | PART AND USE | GRDUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Q. albicans | leaves, boiled as a potherb | Tepehuan, Chihuahua | ```Pennington 1969: 139, 1日2``` |
|  | plant, as a medicinal tea | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & \text { 139, 182 } \end{aligned}$ |
|  | plants, Eaten as greens | Rio May groups, Sonora | Gentry 1942:68 |
| Oxalis carniculata | leaves, crushed Eor medicines | East Africa | Kakwara 1976:170 |
| ロ. decaphylla | bulbs, eaten raw [much esteemed]; used in curdling cheese | Tarahumara, Chihuahua | $\begin{gathered} \text { Pennington 1963: } \\ \text { 126, 131, 146 } \end{gathered}$ |
|  | leaves [young], eaten raw; alder leaves bailed as greens; used in curdling cheese | Tarahumara, Chihuahua | $\begin{aligned} & \text { Pennington 1963: } \\ & \text { 126, 131, } 146 \end{aligned}$ |
|  | leaves*, eaten raw | Picuris, New Mexico | Krenetsky 1964:47 |
| O. stricta | leaves, chewed to relieve thirst | Kiowa, Oklahama | Westal and Schultes 1939: 35 |
| 0. tuberosa | ```tubers, eaten raw or boiled [a historic intro- duction from Peru?J``` | Puebla, Mexico | Whitaker and Cutler 1966: 10 |

*species listed as a synonym.



## HABITAT

Both species of Ranicum can be found in a dry site less than 10 meters fram the Ramsey Canyon stream. They graw in partial shade provided by nearby trees. The underlying substrate is composed of colluvium and granite bedrock. phendiggy

The phenological profiles of these two perennial grasses are similar. Both are first recagnized in May by active leaf expansion; stems and leaves elongate and enlarge for up to four months. Full flowering takes place in August, with bulb panicum [Pgnicum bulbasimal flowaring for the additional month of September. Mature grains are
present on bulb panicum fram August through November, but on vine mesquite [Ranicum gbtusum] they can only be had during September and October. Both species resume a five month period of dormancy in December.

## ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Different species of Ranicum have been sought for food by historic New World groups $\{T a b l e ~ 42] . ~ K e l l y ~ l i s t e d ~$ Ronicum as fourth in order of importance among the major wild plants harvested for food in the Colorado River delta [1977:32, 37]. Palmer [1970:419] suggested this grass was actually planted near peaple's homes, sa they wouldn't have to go out and hunt for it. They would scatter the seeds over bare ground along the river banks in June as the water level receded, blowing the seeds from their mouths and harvesting them later in the year when ripe. In an attempt to identify which species of Rgnicum were invalved in this practice, Castetter and Bell [1951:177, 243] argued the R. hirticaule was cultivated by the Cocopa, Yuma and Mahave groups, and that $\mathrm{R}_{2}$ sanacum was cultivated by the Cocopa. Nabhan and Dewet [1984] suggest $R_{\perp}$ sgnacum was mast likely the species harvested, sown, and culturally selected in historic times.

Food was not the only resource offered by Ronicum, though undoubtedly it was the most important. Tewa women made a small broom for sweeping metate and metate boxes from the plant. They alsa held a leaf blade between the lips and

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. bulbosum | grains, for food threshed, winnowed and graund into Elour | Mescalero and Chiricahua Apache | Castetter and Dpler 1936:4日 |
| P. obtusum | ashes, in ceremony | Ramah Navajo, N. Max. | Vestal 1952:17 |
|  | grains, as Food | Mescalera and Chiricahua Apache | Castetter and Opler 1936:4B |
|  | grains, as food | Hopi, Arizana | Hough 1898: 142 |
|  | stalons, as hair wash, graund and mixed with Yucce root | Islata, New Mexica | Janes 1931:36 |
| P. scribnerianum | part unknown, used medicinally | Ramah Navajo, <br> New Mexica | Vestal 1952:17 |
| Panicum spp. | grains, as Faod singed and boiled | Cahuilla, California | $\begin{aligned} & \text { Bean and Saubel } \\ & 1972: 98-99 \end{aligned}$ |
|  | grains, as flour | Lower Calarada River | Palmer 1970:419 |
|  | grains, as Food | Paiute, Nevada | Bye 1972:91 |
|  | grains, as Fomd | Northern Arizona | Bartlett 1951:51 |
|  | leaf, as whistle | Tewa | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:64 } \end{aligned}$ |
|  | plant, as small brooms | Tewa | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:64 } \end{aligned}$ |

sucked; the resulting sound was said to be like that of a chirping mountain bird [Robbins et al. 1916:64]. As a tonic For rapid hair growth, the Islata of New Mexico ground the stalons of vine mesquite [R. obtusum] into a powder and mixed it with the root of Yucce glauca for a hair wash [Jones 1931:36].

A small number of ancient sites have yielded Ranicum remains [Table 43]. One of the mare outstanding finds came from the Trigo Mts., 18 miles north of Yuma, Arizona in a cave alang the Colorada River (Kaemlein 1963). Here, approximately 1.5 pounds of Panicum [possibly $\mathrm{E}_{2}$ sonorym] was found in a stitched-shut woven bag; the grains were radiocarban dated ta 603 B.P. +- 140 years, placing their origin in the 14 th century A.D. These seemingly authentic prehistaric grains were accompanied by the seeds of two ancient cultivars, Cucupbita and Ehasegilus. In spite of this association, Nabhan and Dellet [1984] do not consider Ranicum to have also been domesticated in prehistory. SIGNIFICANCE FOR HUMANS

Both vine mesquite and bulb panicum offer large grains that could provide a valuable food resouce. Because each floret has a tightly enclosing palea and lemma, grinding is required to release the nutrient rich grain inside. However, it seems that historic groups were aware of this preparation step. At Ramsey Canyon the grains of Ronicum plants could be harvested over the four month period of

| SPECIES | PART AND USE | GRQUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| Panicum cF． copillare | grains，as food in human coprolites | Lavelack Cave and Hidden Cave，Great Bosin Area | Roust 1967： <br> 56，66 |
| Panicum cf． somorum | grains，as Eood or for planting | Cave in Trigo Mts． Arizona［A．D．1340］ | Kaemlein 1963 |
| Panicum sp． or Panicum／ Setaria | grains | Snaketawn，Arizana ［A．D．200－700］ | Bohrer 1970：415 |
| Panicum spp． | grains | Wadi Beadmaker and other sites on ancient Lake Cahuilla， Patayan／Yuman Camplex ［A．D．1050－1500］ | In Nabhan and Dewat 1984 |
| Panicean tribe | Florets／spikelets， represent comman food | Fresnal Shelter， New Mexica［B．C． 1600－A．ロ． 1 〕 | Bohrer 1981：44 |
| $\begin{aligned} & \text { Paniceae } \\ & \text { tribe plus } \\ & \text { Panicum type } \end{aligned}$ | 日rains，Eram Flaor and trash contexts | Salmon Ruin， New Mexica［A．D． 1180－1280］ | Adams 1980a：279 |

August through November, with both species simultaneausly producing ripe Eruit in September and Dctaber.

Stalans of vine mesquite sought for a hair-growth treatment cauld be had from May-November, when the plants are easily visible above graund. Likewise, ashes required far ceremonial use or leaves picked as whistles cauld be had in the same period.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD
If parching Eanicum grains was a common preparation step in prehistary, their retention in the ancient record wauld be expected. Perhaps small brooms Eashioned of the stems would preserve in a pratected lacatian. It is unlikely that stolons prepared as a hair tonic, or leaves made into whistles, would remain in recognizable condition.

## 



## habitat

Rennellig lengifgliig grows along dry stream flanks in Canelo Hills Cienega. The area is quite dry, though protected by an overhead canopy of trees and shrubs from the full effects af the sun's rays. Underlying substrate is composed of colluvium, with volcanic bedrock.

## Phendiogy

Pennellia is a late summer/early fall apparently annual plant on the landscape. First appearing in July, it is in full flower in August and September. Seeds begin to mature in October, and can still be found clinging to plants in November. The plants display active vegetative growth far the first three months, although later when the seeds are ripening little new stem elongation or leaf expansion occurs.

## ethnagraphic/archaedlogical records

Generally historic references to Penaellia or Thelypadiym concern medicinal or ceremonial needs. For
example, heated crushed roots of Pennellig microntho were applied to toothaches by the Ramah Navajo of New Mexica; a decoction of the roots was given to a woman to expedite chidbirth [Uestal 1952:29]. The Navajo employed Ihelypodium wrightij in some way as a treatment for swellings cMatthews 1886:770]. Zuni women of the Sandhill Crane Clan crushed and mixed the seeds of this same species with beans to be planted; the procedure was said to cause the bean crop to be as abundant as the seeds from the pods [Stevenson 1915:85].

Citations to food use of this or similar plants are rare. Ihelypodidum lidacinum plants were occasianally used as greens by the Mohave of the Lower Calorado River Region, but generally considered to be a famine food. The young shoots would be prepared by roasting on hot ashes CCastetter and Bell 1951:201-202].

No archaealogical record Found.

## SIGNIFICANCE FDR HLIMANS

If Pennellig lqngifoliq can be used in ways similar to those suggested in the ethnographic literature for related specias, the plant might pravide young shoats far greens in July and possibly August. Medicinal needs served by the plant would span July to November; this plant retains Eullgrown leqves during the period of seed ripening. Seeds cauld be gathered in Octaber and November; it is likely they could be eaten. Since Rennellig lonaifolia seems to be an
annual plant, the roots might nat be saught in medicinal treatments as actively as the raots of related, perennial, species. If sought, the most likely time of harvest might be October and November, the period of maximum plant size. PREDICTIONS FOR IHE ARCHAEOLOGICAL RECORD

As with other plants whose leaves or young shoots are collected for greens, it is unlikely the parts would survive in the ancient record. Likwise if the roots were collected and heated, crushed or made into a decoction, their recovery wauld be precluded. The seeds, if planted with beans and given no preparation steps, would alsc be missing. Only seeds that were parched or roasted, in the same manner as Desscucainig prepared as a foodstuff, might remain as evidence of prehistoric interaction with this plant.

Phoseglus gcutifolius Gray var．gcytifolius RC－1［KA \＃209－日3］UA254日日1；［KA\＃22こ－日3］UA254日B2


Rhaseglus acutiEalius grows well in dry soil less than 10 meters from the stream at Ramsey Canyon．The location receives some shading from nearby taller trees and shrubs． Underlying substrate is composed of colluvial sediments abuting local granite bedrock．

## PHENOLOGY

This difficult－to－find annual legume may be present as small seedlings as early as April at Ramsey Canyon，growing hidden among nearby grasses．For four months only vegeta－ tive activity occurs．The plants are in full flower for the months of August through October，with mature fruit avail－ able October and November．Stem elongation and leaf expan－ sion never appear to cease during the entire eight month period the plant is present on the landscape．Seeds overwinter in the sail for four months．

## ETHNDGRAPHIC／ARCHAEDLOGICAL RECDRDS

Sonoran Desert groups harvested wild tepary beans in
historic times. Papago in Arizona gathered this Eood resource until after Warld War II, occasionally selling them at trading posts [Nabhan and Felger 1978:7]. The Seri af Sonora, Mexica considered the seeds of wild Ehasealus a very impartant food, which ripened at the end of the summer rainy season [August-September]. Seri would gother the pods in early morning when cool and damp to decrease chances of their shattering and subsequent seed loss. Pods taken back to camp were dried, then rubbed between the hands to free the seeds, which might be coaked with mule deer meat or bones [Felger and Moser 1976:23]. In a non-food use af wild Phasequys quatifolius beans, the Papago held one of the tiny stone-like beans between their teeth and bit down; this maneuver served as a toothache remedy [Castetter and Underhill 1935:54].

Wild tepary beans Eas Phaseginus gcytifglius var. latifali낸구], were among the plant remains identified from the Babocomari Uillage Site in the San Pedro River Valley of Arizana [Jones 1951:16]. This site has been dated to A.D. 1450, and possibly was occupied up until Spanish contact times. As far the presence of tepary beans in earlier archaealogical sites, Nabhan and Felger [1978:7] repart no clear evidence in the Sauthwestern United States. This is perhaps partly due to the fact that the tiny seed is gravellike in appearance and would be hard to recognize. It is difficult ta evaluate the significance of McGregor's report

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[1941:297] of finding four lots of charred R_ gcutiEglius
beans [from 5-9 mm in length] in the Winona Uillage-Ridge
Ruin area east of Flagstaff, Arizona. These beans, along
with others noted by McGregor as having been found in a
Pueblo III site north of Flagstaff, bear re-examination to
verify their identity.
SIGNIFICANCE FOR HUMANS
The part of Ehasealus acutifolius most valuable to humans in Ramsey Canyon would be the tiny gravel-like beans, available for harvest in October and November. PREDICTIONS FOR THE ARCHAEDLGGICAL RECORD
It wald seem that at least a few of the hard, tiny beans would be retained in the prehistoric record if they were frequently carried into ancient dwellings. However, the common historic method of boiling beans, if also practiced in prehistory, would wark against finding many beans in recognizable condition.
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## habitat

Rhiladelphus miccophullus grows in wet soil on a shallow to steep slope next to the stream at Ramsey Canyon. The area is primarily composed of water-carried boulders, and receives very little direct sunlight due to a dense canopy of tall trees.

## PMENDLOGY

Negetative growth of this much-branched mock-arange shrub resumes in April, continuing until September. Full flowering occurs in June, and mature fruit can be gathered July through September. By Octaber the shrub has ceased outward signs of growth and becomes dormant for up to six manths.

## ETHNDGRAPHIC/ARCHAEOLDGICAL RECORDS

Only a single historic reference was located for mockorange. Jones [1931:36] reported that the Isleta of New Mexico formerly ate the fruit of P. microphulius. The prehistoric record is equally as sparse, in that a single
utilized twig of P . microphylys was recovered from a Johnsan Canyon Pueblo III period cliff dwelling in southwestern Colorado [Nickens 1981:80].

## SIGNIFICANCE FOR HUMANS

The modern and ancient records do not reveal much potential value of $R$. microphylus to humans. If the fruit can, in fact, be eaten without ill effect, it would be ripe in Ramsey Canyon July through September. Twigs could be sought year round for general purposes where certain qualities [such as flexibility] would not be required. pREDICIIONS FOR THE ARCHAEOLOGICAL RECORD

If mock-arange fruit were prepared in a method that required exposure to fire, possibly some charred parts would enter the archaealogical record. Dtherwise, only in dry, protected locations might they or the twigs survive.

Phusglis virginigng Miller var. sonorae [Tarr.] Waterfall [=Physalis longiEglig Nutt.] CH-6 [KA \#185-83] UA254610; CH-3 [\#326-84] UA254611


Phusalis yicgigigag can be found in more than one location at Canelo Hills. Generally it prefers to grow fairly near the stream, in moist alluvial sediments that receive a moderate amount of shading from nearby taller vegetation.

## PHENDLOGY

This herbaceaus perennial groundcherry or husk-tomato can be recognized in vegetative condition in June. Far the following four months the plant is in full bloom, continuously developing immature fruits of varying sizes. In October and November the fruits appear mature, surrounded by the inflated papery calyx. The plants more or less abruptly resume darmancy in Derember, and remain inconspicuaus on the landscape for up to six manths. ETHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Fruits of various species of groundcherry have been gathered and eaten by modern graups [Table 44]. People

Table 44 . Ethnagraphic references to the use of Physglis.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Physalis crassifolia | fruits, eaten fresh | Seri, Sonora | Felger and Moser 1976:24 |
| P. Fendleri | Fruits, eaten Fresh by children | Mohave and Yuma, Lawer Colo. River | ```Castetter and Bell 1951:207``` |
|  | fruits, bailed as a condiment | Zuni, New Mexico | $\begin{gathered} \text { Stevenson } \\ \text { 1915:70 } \end{gathered}$ |
|  | Fruits, Formerly eaten Fresh or cooked | White Mt. Apache, Arizana | Reagan 1929: 159 |
| Physalis heterophylla | calices, used by children in play | Graups of Missauri River Region | Gilmore 1977:61 |
|  | fruits, eaten and dried for winter | Groups of Missouri River Region | Gilmore 1977:61 |
| P. longifalia | fruits, eaten | Acama and Laguna, New Mexica | Swank 1932:59 |
|  | Eruits, boiled as a relish; possibly cultivated the plants | Zuni, New Mexica | $\begin{gathered} \text { Stevenson } \\ \text { 1915: } 70 \end{gathered}$ |
|  | Fruits, eaten in former times | Hopi, Arizona | Whiting 1956:90; Hough 1898: 143 |
|  | Eruits, enten | Navajo, Chaco | Hocking 1956:154 |


either ate them fresh or boiled them with other foods as a condiment. The fruit was occasionally dried for winter use. Sametimes the fruit, dried leaves or roots provided an ingredient in medicinal preparations. The inflated calyx did not escape the notice of children living in the Missouri River Region, who popped them against their foreheads in play [Gilmore 1977:G1]. A reference to modern Zuni women cultivating Ehusalis longifalia in their gardens [Stevenson 1915:70] may refer to a historic practice, since some of the ingredients they cooked with this species [chili, coriander] were introduced into the Southwest in historic times.

Charred groundcherry seeds, including $\mathrm{P}_{\mathrm{g}}$ longifolig type, have been recavered from ancient contexts in New Mexica, Arizona and Calorado $\{T a b l e ~ 45\}$. For example, the fruit of these plants seems to have been a common food item at Salmon Ruin in Northwestern New Mexico in the period A.D. 1080-1250 [Adams 1980a:291]. Parched or charred seads were thought to represent either food offerings to deities or accidental inclusion of the parts in firepits; the presence of groundcherry seads in human fecal remains provides strong evidence of Food use. In a summary of Mexican subsistence in the Tehuacan Ualley, MacNeish [1967:290-294] cites evidence that Physglis was found both in general plant debris and in human fecal samples representing thousands of years of deposition.

| Table 45. | Prehistoric re longiEqliq typ an asterisk]. | ces to Rhusalis rem synonym of $R, \underline{v i}$ gai | ns, including Phus <br>  | 1is <br> ted by |
| :---: | :---: | :---: | :---: | :---: |
| PART | USE | GRDUP[5] | NOTES | REFERENCE |
| seeds | fruit as foad | Chaca Canyon, <br> New Mexico [A.B. 7501100 J | charred; same in bell-shaped storage cist may represent trash | Struever 1977;55 |
| seeds | Eruit as food | Arroya Handa, New Mexico [A.D. 1300-14503 |  | ```Watterstram 1976:96``` |
| seeds | fruit as food | Antelope House, Arizana, Puebla II and III | Erom human coprolites | Fry and Hall 1975:91 |
| seeds |  | 3 of 8 Hahakam sites in Arizona | charred | $\begin{aligned} & \text { Gasser } \\ & 1981: 364 \end{aligned}$ |
| seeds | - | Cochiti Dam, New Mexica, Puebla II, III | uncharred, from storage pit fill | $\begin{aligned} & \text { Ford 196日: } \\ & 243 \end{aligned}$ |
| seeds* |  | Guadalupe Ruin, New Mexica [A.D. 900-1200] | parched, from an adobe-lined hearth | $\begin{aligned} & \text { Pippin } \\ & \text { 1979:236 } \end{aligned}$ |
| seeds* | Fruit as frad | Salman Ruin, New Mexico [A.D. 1080-1250] | charred or parched; same in human coprolites | Adams 1980a; 291 |
| $\begin{aligned} & \text { seeds } \\ & \text { and poller } \end{aligned}$ | Fruit as fand | Jahnson Canyon, Cala., Puebla III | from human capralites | $\begin{aligned} & \text { Nickens } \\ & \text { 1981: } \end{aligned}$ |

At Canela Hills the fruit of Phusalis longiealig would be ripe in October and November. At the same time the inflated papery calyx could be gathered for play. Leaves and roots wauld be available far medicinal uses from June through November.

PREDICTIONS FOR THE ARCMAEDLGGICAL RECDRD
Since ripe groundcherry fruit are generally eaten Fresh or boiled, they are not processed in a manner which would normally foster preservation. Perhaps the most likely avenues that charred seeds might preserve wauld be via cooking mishaps or accidental conflagrations. Thus the ancient record of graundcherry use may be highly underrepresented. The appearance of the seeds in human copralites helps counteract this under-representation. Leaves and roots, if recavered, would require much effort in identification thraugh use of an adequate madern comparative collection.


HABITAT
Rinus discolof can be found on a shallow slope in a field of boulders near the stream at Ramsey Canyon. The underlying substrate is composed of dry alluvium. In this location heavy shading is provided by an upper story of larger trees. However, this species does well in open, sunny nearby areas as well.

## PHENOLOGY

The first sign of needle growth on the Mexican pinyon can be observed in April. By May stems become active and cones form in June. Pollen is shed from male strobili thereafter, but the separate female cones will not bear mature seeds for up to two years hence. A set of larger, older cones that have been develaping for a number of months will be the ones that produce mature seeds in October; these mature pinyan "nuts" are available for at least four weeks. The female cones on Mexican nut-pines represent distinct age-classes initiated aver a period of at least twa years.

Vegetative activity has ceased by Databer, remaining sa until April.

## ETHNDGRAPHIC/ARCHAEDLDGICAL RECDRDS

The Southwestern pinyon or nut pines include Rinus discolor, $P_{\perp}$ edylis, and $P_{\text {. mongpylla }}$ [Kearney and Peebles 1960:51], as well as locally available Rinus leiophulla [Chihuahua pine]. The histaric literature reveals extensive use of pinyons [Table 46]. Seeds and inner bark/cambium have been sought for food, while pitch, wood, leaves [needles] and pollen pravided a variety of needed materials. Many groups considered the seeds, commonly referred to as "nuts", a very important Food resource CBarrows 1900:63; Reagan 1929:147; Jones 1931:37]. The Northern Paiute considered them so important that different bands actually held proprietary rights to certain tracts of trees, and nuts were often hidden in piles until transport could be accamplished [Loud 1929:59]. In good years a person could collect up to 50 [Gallagher 1977:37] or 70 [Uestal 1952:12133 pounds of clean nuts a day. Some acknowledged, however, that the trees would not always bear abundantly. For example, the Western Apache of the Clarkdale, Arizana region generally knew by August or September if the crop would be a good one, even though it would not be ready for a couple of months [Gallagher 1977:37]; they undoubtedly planned their collecting strategy accordingly.

Groups that traveled long distances to harvest the

| SPECIES | PART AND LSE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. discalor | seeds*, eaten raw and sald in markets | San Luis Potosi, Mexica | Bye 1979:139 |
|  | seeds*, important food, gathered in quantity | Cahuilla, California | ```Barraws 1900:``` |
|  | seeds*, eaten | Tarahumara, Chihuahua | ```Penmington 1963: 113``` |
|  | seeds*, eaten | Cacopa, Lower Colorado River | $\begin{aligned} & \text { Kelly } 1977: \\ & 22,40 \end{aligned}$ |
| P. edulis | inner bark [cambium], eaten or dried as a beverage | Apache, Arizana | ```Buskirk 1949: 330-332``` |
|  | inner bark, eaten in famine times | Ramah Navajo, New Mexica | ```Uestal 1952:12- 13``` |
|  | inner bark, as food | S. Paiute, Utah and Arizana | Bye 1972:90 |
|  | leaves [needles] chewed as a medicine | White Mt. Apache, Arizona | Reagan 1929: 147 |
|  | pitch, as chewing gum, water-proafing Eor baskets, facial hair remover; gathered in June | Apache, Arizana | Buskirk 1949: 330-332 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. edulis | pitch, warmed far sealing water jugs | White Mt. Apache, Arizona | Reagan 1929:147 |
|  | pitch, warmed to seal Bhus tixlㅁํ믐ㅁ twig water jars | Western Apache, Arizona | ```Gallagher 1977: 106``` |
|  | pitch [gum], waterproofing vessels, in dyeing, cement For jewelry, to coat thrawing sticks | Hopi, Arizana | Whiting 1966:63 |
|  | pitch, as a carrier For paint, external medicine, and in making paper bread | Acama and Laguna, New Mexica | Suank 1932:61 |
|  | pitch, for making a black dye and waterprabing material | Navajo | Bryan and Young 1940:5; Elmore 1944: 20-23 |
|  | pitch, as a chewing gum, basket sealant, ingradiant in black dye and medicine | $\begin{aligned} & \text { Ramah Navaja, } \\ & \text { New Mexico } \end{aligned}$ | $\begin{aligned} & \text { Uestal 1952:12- } \\ & 13 \end{aligned}$ |
| $\cdot$ | pitch, as chawing gum, mending gum and water sealant | S. Paiute, Utah and Arizona | Bye 1972:90 |

Table 46 [cont.] Ethnographic references to the use of nut-pines Rinus.
P. edulis
pitch, as a medicine
pitch, as external
medicine
pitch, as a chewing
gum
pitch, as a glua
pollen, for various
needs
seeds, eaten raw or
roasted
seeds, eaten raw or
roasted
seeds, important food,
raasted more than once
seeds, parched and
graund as food
seeds, eaten
roasted
seeds, eaten raw or
raasted

| GROUP[S] | REFERENCE |
| :---: | :---: |
| Zuni, New Mexico | ```Camazine and Bye 1980:373``` |
| Isleta, New Mexico | Jones 1931:37 |
| Picuris, New Mexica | Krenetsky 1964: 47 |
| Cachiti, Naw Mexica | Lange 1968:145 |
| Apache, Arizona | $\begin{aligned} & \text { Buskirk 1949: } \\ & 330-332 \end{aligned}$ |
| Apache, Arizona | ```Buskirk 1949: 330-332``` |
| Mescalera and Chiricahua Apache | Castetter and Opler 1936:43 |
| White Mt. Apache, Arizana | Reagan 1929:147 |
| Western Apache, Arizona | Gallagher 1977: 37 |
| Hopi, Arizana | Whiting 1956:63; Nequatewa 1943:18 |
| Acoma and Laguna, New Mexica | Swank 1932:61 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. edulis | seeds, maten roasted | Cochiti, New Mexico | Lange 196日: 145 |
|  | seads, ance an impartant staple Food | Isleta, New Mexica | Jones 1931:37 |
|  | seeds, eaten ranster and graund | Navajo | Bailey 1940: 285-287; Elmora 1944:20-23 |
|  | seeds, eaten and stored | Ramah Navaja, New Mexica | Uestal 1952:1213 |
|  | seeds, gathered in large quantities and stored for fond | Shoshane, Nevada | Carter 1964: 3 |
|  | seads, very important food, eaten raw, roasted or cooked | 5. Paiuta, Utah and Arizana | Bye 1972:90 |
|  | seeds, very important Food | Gosiute, Nevada and Utah | ```Chamberlin 1911: 377``` |
|  | wrad, as fuel | Cochiti, New Mexico | Lange 1968:145 |
|  | wood, as logs for construction, looms, cradles and Firemord | Navaja | Elmore 1944:20-23 |
|  | wand, as Euel | Ramah Navaja, <br> New Mexica | $\begin{aligned} & \text { Uestal 1952:12- } \\ & 13 \end{aligned}$ |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. edulis | wood, as fuel | S. Paiute, Utah and Arizona | Bye 1972:90 |
| P. monophylla | inner bark, as food | S. Paiute, Utah and Arizona | Bye 1972:90 |
|  | pitch [gum], as chewing gum and cemant for jewelry | Hopi, Arizona | $\begin{aligned} & \text { Hough 1989: } \\ & 143,145 \end{aligned}$ |
|  | pitch, warmed as waterpraofing material and extenal medicine | Kawaiisu, California | $\begin{aligned} & \text { Zigmund 1981: } \\ & 50-51 \end{aligned}$ |
|  | pitch, as chewing gum, mending gum and water sealant | S. Paiute, Utah and Arizona | Bye 1972:90 |
|  | seeds, maten | Lower Colorado River Groups | $\begin{aligned} & \text { Castetter and Bell } \\ & \text { 1951:197-198 } \end{aligned}$ |
|  | seeds, eaten | Hopi, Arizono | $\begin{gathered} \text { Hough } 1898: \\ 143,145 \end{gathered}$ |
|  | seeds, very important Fond | Gosiute, Nevada and Utah | Chamberlin 1911: 377 |
|  | seeds, very important Food, enten raw, roasted or cooked | S. Paiute, Utah and Arizana | Bye 1972:90 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. monophylla | seeds, very important food | N. Paiute, Nevada | Loud 1929:159 |
|  | seeds, very important food | Dwens Ualley Paiute, California | ```Steward 1933: 241-242``` |
|  | seeds, a favarite Eood | Kawaiisu, California | $\begin{aligned} & \text { Zigmund 19日1: } \\ & 50-51 \end{aligned}$ |
|  | wood, as fuel | Hopi, Arizona | Hough 1898: 143, 145 |
|  | wood, as fuel | S. Paiute, Utah and Arizona | Bye 1972:90 |
|  | wood, as possible portable wood mortars | Kawaiisu, California | $\begin{aligned} & \text { Zigmund 1981: } \\ & 50-51 \end{aligned}$ |
| Pinus [pinyon] spp. | seeds, eaten parched and/ar ground | Havasupai, Arizana | $\begin{aligned} & \text { Spier 192e: } \\ & 107-108 \end{aligned}$ |
|  | seeds, eaten ronsted and ground | Navaja | ```Fransiscan Fathers 1910:211``` |
|  | seeds, considered an outstanding food; ground | SE Yavapai, Arizona | Gifford 1932:205 |

seeds include the Apache [Buskirk 1949:330-332], Cahuilla [Barrows 1900:63], and Gosiute, who looked upon the pine nut harvest as one of the great fixed events of the year CChamberlin 1911:337]. Cocopa living in the Lower Colorado River Valley sametimes traveled 5-6 days one way to mountains where pinyon trees grew; the trip was long and involved a climb of over 4000 feet in six miles [Castetter and Bell 1951:18日,197-198; Kelly 1977:22,403. The people would gather and eat pine nuts until they tired of them, then head hame carrying all they could. Such a trip might be interrupted while the gathering party collected agave, wild dates and wild honey [Castetter and Bell 1951:18B, 1971983.

One group actually moved to the mountains for an extended periad, rather than just gather the muts and return home. When the harvest was good, the Dwans Valley Paiute in Califormia lived in the mountains fram fall until spring, relying on nut pines for food [Steward 1933:241-242].

Harvesting methods were quite varied. They included: [a] picking the unopened green cones and drying or roasting them to release the seeds [Buskirk 1949:330-332; Barrows 1900:63; Pennington 1963:113; Gifford 1932:205]; [b] shaking the trees to dislodge the seeds from the cones [Buskirk 1949:330-332; Castetter and Dpler 1936:43], [c] picking up seeds from the ground [Buskirk 1949:330-332; Pennington 1963:113; Gallagher 1977:37], and [d] raiding woodrat nests
[Gifford 1936:257; Elmore 1944:20-23]. The Kawaiisu of California gathered the seeds in two seasons. In August they saught nearly mature cones and raasted them to both open them up and toast the seeds. Later in September, they collected the seeds which had fallen from the cones [Zigmund 1981:50-51].

Preparation methods were almost as varied as collecting techniques. Seeds were eaten raw, roasted or parched, ground, and sometimes mixed with other foods. Western Apache in Arizona shelled the seeds individually with the teeth, or lightly ground them on a metate and winnowed the hulls out [Gallagher 1977:37]. Mast groups, however, prepared the seeds both with and without the thin hulls [Buskirk 1949:330-332; Reagan 1929:147; Gifford 1936:257]. When ground up, the seeds made a type of butter that could be spread on bread or added to boiling water as a gruel [Spier 1928:107-108].

Methods of storage differed. While mast groups carried the seeds back to their dwellings, Shoshanes in Nevada stored the nuts in large circles of stones, covered with sticks, leaves and earth to keep out rodents and birds [Carter 1964:3]. The Southeastern Yavapai always stared the seeds in their shells [Gifford 1932:205], as did the White Mt. Apache [Reagan 1929:147] and Cochiti [Lange 1968:145]. Navaja, on the other hand, roasted then ground the winnowed
seeds, which they molded into small cakes to be dried in the sun and then stored far winter [Bailey 1940:286-287].

Inner bark [especially the cambium] of at least twa of the nut pines has been eaten in famine times. Apache [Buskirk 1949:343], Ramah Navaja [Uestal 1952:12-13] and Southern Paiute [Bye 1972:90] ate the inner bark of Rinus edulis, and Southern Paiute sought Pinus monophylla as well. The Apache even made a drink from green or dried inner bark [Buskirk 1949:343].

Household uses for the pitch or resin were varied. Different groups considered it a mending gum, jewelry glue, water sealant, facial hair remover, black dye mordant, and chewing gum. Pinyon pitch was also chosen to rub on the flat stone in preparation of cooking paper bread ©Swank 1932:61]. As a medicine it could be rubbed on open sores [Swank 1932:61; Jones 1931:37; Zigmund 1981:50-51], or heated and the fumes inhaled as a cure for head colds [Uestal 1952:12-13].

Pinyon wood served as fuel for a number of groups [Uestal 1952:12-13; Bye 1972:90; Lange 1968:145; Elmore 1944: 20-23; Hough 1898:143, 1453. Ramah Navajo preferred it in an open fire because it threw few sparks CUestal 1952:1213]. Navajo found other reasons to collect it, gathering it for logs in hogan construction, loom supports, and cradles [Elmore 1944:20-23]. The Kawaiisu in California may have even used wood of a nut pine in fashioning portable wooden
mortars [Zigmund 1981:50-51].
Leaves [needles] and pollen have been occasionally collected in historic times. The White Mt. Apache in Arizana chewed the leaves as a remedy for venereal disease [Reagan 1929:147]. Buskirk [1949:330-332] hints that pollen from these trees was gathered for various reasons.

The prehistoric record of pinyon use in the Southwestern United States contains many references to Rinus edulis [Table 47]. The seeds occur charred in many locations, likely representing accidents during removal from the cones or raasting. Shell fragments are alsa commonly recovered. The presence of Rinus edylis female cones and cone scales, twigs and hearth fuel imply nearby access to this tree at same sites, such as Salman Ruin CAdams 19B0b: 512], Bat Cave [Smith 1950:165], and Guadalupe ruin [Pippin 1979:2673. Although the presence of charred female cones and cone scales suggests an anciant method of loosening the nuts fram immature cones, it is also possible the cones were brought in for fire tinder.

Pinyon or nut pine resources from species other than Pinus edulis may have been gathered prehistorically. Pinyon nut remains most likely from Rinus manophulla were found in one of 50 well-preserved coprolites in Lovelock Cave in Nevada (Cowan 1967:24). A number of references in the literature are simply to the use of pinyon [Pinus sp.], and



supplement the record given above. The presence of nutshells in human coprolites suggests ancient peaple ote the thin hulls, just as modern groups do. In northern Utah, Einus seed occurred in Fremont period [A.D. 400-1350] coprolites from Danger Cave; in the Glen Canyon area of southern Utah Rinus seeds and pitch were also recovered from Anasazi period [A.D. 1-1300] coprolites [Fry 1976:13, 15]. Coprolites excavated fram Pueblo II and III deposits in Antelope House, northeastern Arizona, also contained Rinus sp. nutshell fragments [Fry and Hall 1975:91].

Pinyon has also been recovered from caves in the Southwest, including Mexica. For example, evidence of pinyon pine is axtensive in Cowboy Cave in central Utah, including nuts, leaves [needles], chunks of pitch, and artifacts cavered with pitch, all dating from a period after 3500 B.C. (Hewitt 1980b:135]. Pinyon nuts were excavated from prehistorically occupied caves of both Basketmaker and Pueblo affiliation in the Upper Gila and Hueco areas of southwestern New Mexico [Cosgrove 1947:45]. Nutshells, thought to represent ancient food, were found in various deposits in a cave in the Rio Zape area of Duranga, Mexico, dating ta A.D. 600 [Brooks, et al. 1962:357].

## SIGNIFICANCE FOR HUMANS

In Ramsey Canyon the seeds of Mexican pinyon could be gathered for Food in October and November. Inner bark might
be sought in the months of February through April, just as the trees resume growth in the spring. The period during which pollen could be gathered for various needs seams limited to a short while in late June or early July. Pitch For household needs and as a medicine would be available year round, as would wood for fuel, househald implements [including passibly wooden martars], and construction timbers. Needles needed for medicine could likewise be had at any time of the year.

PREDICTIONS FOR THE ARCHAEOLDGICAL RECDRD
Ancient roasting of pinyon female cones and nuts would increase chances that parts wald enter the archaealogical record. If the hulls were frequently ground, as in historic times, heavy reliance on pinyon might be obscured; if the roasted hulls were winnowed out and locally discarded a mare accurate reflection of prehistoric use might occur. Wellpreserved coprolites from caves hint that one ancient habit included eating the nutmeat with the nutshell on.

Whether or not female cones or cone scales would be recovered from roasting episades might depend on whether pinyon grew close to an ancient dwelling, making it convenient to bring the material in for preparation, or whether people had to travel long distances and perform some of the [debris producing] preparation steps elsewhere. If people had to walk long distances carrying a harvest on their backs, one would not expect them to bring the bulky,
unopened cones to their dwelling. Rather, raosting wauld take place at the gathering place, and evidence in the form of charred parts would only enter the archaealagical record at the processing site.

Pinyon nut harvests stored roasted in their shells would be likely to survive, iF a storage area accidentally burned. On the other hand, nuts stored in the form of dried nut-meat cakes would not preserve in recagnizable condition.

Pinyon wood carried in for hearth fuel, used as roof timbers, and fashioned into various implements has a fairly good chance of surviving, either charred in open sites or uncharred in protected locations. The rather sturdy needles would be likely to survive in the same situations as wood.

A pinyon part not likely to preserve is the inner bark, a saft, perishable material that would become unrecanizable if scraped or chewed. If pollen were gathered for a special need, one might have a difficult time singling out such an event, as high percentages of pinyon pallen can fill the air during pollination. Pitch might only survive in protected locations, such as caves, for it might tend to burn up in any conflagration that occurred in an open site.


## habitat

Both these species of Rinus grow fairly near the stream in Ramsey Canyon. Apache pine \{Rinus encelmanaii] does well on a very steep slope underlain by granite bedrock, in dry soil subject to stream scour. The area receives few direct rays from the sun. Southwestern white pine CPinus strobi= Egrmis] is found in wet sail composed of overbank sediments, alsa in an area of intense shading.
phendidgy
These two non-nut pines grow into very robust trees at Ramsey Canyon. Their phenological profiles overlap in matters relating to vegetative growth. Both resume active
stem elangation and leaf expansian in May, remaining naticeably active thraugh August. By September, this grauth is no longer obviaus and the trees resume an eight-month period of vegetative dormancu.

Where the two species differ is in reproductive regimes. Apache pine is the first to develop new cones in March, shedding pollen by April. Southwestern white pine, on the other hand, developes new cones in May and sheds pollen in June, fully two months after apache pine. These differences became less apparent later, as the first mature seeds of apache pine ara noticeable in August, and those of squthwestern white pine follow in September. Both species retain mature cones until the end of November.

## ETHNOGRAPHIC/ARCHAEDLUGICAL RECDRDS

Rinus species that don't produce the large seeds [nuts] of the nut-pines have still been cited as having pravided edible seeds in historic times [Table 4日]. For example, the Mescalera and Chiricahua Apache utilized the thin, small seeds of $P_{\perp}$ scopylorum and $P_{\perp} E l e x i l i s, ~ c o n s i d e r i n g ~ t h e m ~ a ~$ Eamine Eood.

In addition to the seeds, groups alsa ate the "sweet and palatable" inner bark, especially when other foads were scarce. They would cut large squares of bark with a lang pointed stick, scrape the inner bark off with o smaller, sharpened piece of wood, and boil the pulp to make it

| SPECIES | PARI AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. Engelmannii | cones, in making combs | Tarahumara, Chihuahua | Pennington 1963: 213 |
|  | seeds, as food | Tepehuan, Chihuahua | ```Pennington 1969: 135, 177``` |
|  | stems, as a medicinal tea | Tepehuan, Chihuahua | Pennington 1959: 135, 177 |
| P. Flexilis | seeds, as Eamine Erod | Mescalera and Chiricahua Apache | Castetter and Opler 193E:43 |
| P. ponderosa | inner bark, eaten raw or coaked | Zuni, New Mexico | ```Standley 1912:448; Cushing 1974: 2е4-225``` |
|  | inner bark, eaten in summer | Navajo | Bailey 1940:2日6287 |
|  | pitch, chewed like gum | Pacific Narthwest Groups | French 1965 |
|  | waod, as roof timbers | Jemez, New Mexico | Coak 1930:26 |
| P. scapulorum | inner bark, eaten when ather foads scarce | Mescalerg and Chiricahua Apache | Castetter and Opler 1.936:43 |
|  | seeds, as famine food | Mescalera and Chiricahua Apache | Castetter and Opler 1936:43 |


digestible [Castetter and Dpler 1936:43]. The Zuni in New Mexico ate the inner bark of yellow pine [as $P_{\perp}$ pondecasa]. Thousands of these trees were annually whitened on southern sides by Zuni scrapers. Dftentimes only the pulp was eaten raw and the stringy fiber wrapped into bundles and carried home for cooking. The well-pounded bark strings could be coaked with joints of dried meat [Cushing 1974:224-225].

Historic evidence of the use of pine bark as a human food is also documented by the presence of surviving trees with peeling scars in various locations in the western United States. Swetnam [1984] summarized some of the ethnographic literature on use of inner bark, and found differences in patterns of utilization. Same groups peeled pine trees every spring, seeking the sweetest ones for an annually sought treat; others suggested the practice of eating bark was reserved for famine times anly. Although peeling the trees may have been easier in the spring when the sap was moving up the trunk, some secords suggest that trees were also peeled at other times of the year.

A high frequency of inner bark eating has been documented in a circum-palar area including Russia, Canada, Alaska and Scandinavian countries [Swetnam 1984]. The nutritive value and digestibility of pine bark both seem low, and the amount of effort required to obtain and prepare it seem high; therefore in areas where other foodstuffs might be available, such as the American Sauthwest, utilization of
pine bark might be restricted to times of food shortage.
In addition to the nut-pines previously discussed, the major species of pine recovered in the prehistoric record in the American Southwest is Rinus ponderasa [Table 49]. Parts found include wood as construction beams and firehearth fuel, leaves [needles] as a hairbrush, a branch as a tarch, and bark as variaus items.

A rather detailed loak at ancient Riaus sp. evidence comes from the Point of Pines site in east-central Arizona where excavators found pine pitch, needles and carbonized degraded cones [Bohrer 1973:426]. The occupants of this area in the period A.D.1280-1300 apparently made a covering for a left thumb from pine pitch, and used pine nebdles as a matting for foodstuffs and possibly pottery jars. In one case, pine needles were spread on the floor of a stareraom prior to stacking an corn. Iwo carbonized pine cones could not be identified to species as most of the scales were missing.

## SIGNIFICANCE FOR humans

Apache pine and southwestern white pine produce tiny seeds from August through November; these seeds could be eaten in times of food stress. Inner bark gathered as a Food might be sweetest in March and April, prior to resumption of vegetative growth, although it could be collected throughout the year. Fuel and construction needs would be


Table 49 [cant.] Prahistaric references to Rinus ponderosa remains.

| PART | USE | GRDUP[S] | NOTES | REFERENLE |
| :---: | :---: | :---: | :---: | :---: |
| moad | atlatl [unEinished] | Tularosa Cave, New Mexica |  | $\begin{aligned} & \text { Grange } \\ & \text { 1952: } 376, \\ & 394,411,441 \end{aligned}$ |
|  | as fuel | Tularasa Cave, New Mexica | abundant | $\begin{aligned} & \text { Kaplan } \\ & \text { 1963: } 351 \end{aligned}$ |
|  | construction beams | ```Salmon Ruin, New Mexico [A.D. 1090-1250J``` |  | Adams <br> 1980b:512 |
|  | construction beams, Firewood, lap boards | Jahnsan Canyon, Sw Calo. [Puebla IIIJ |  | Nickens 1981: 74 |

met year round by the woad of these species, as would any requirement for branches, twigs or leaves for the household. PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD

The part with the highest likelihood of survival would be the wood, charred in firehearths or preserved as roof timbers. Inner bark is not expected to survive, nor are the infrequently gathered seeds of these species. Branches, twigs or leaves might be recovered, if charred or preserved in a well-protected location.


HABITAT
Both species of Indian-wheat monitored for this study can be faund in the same habitat at Canelo Hills. They grow in dry sail, fully exposed to the sun's rays on an eastfacing shallow slope composed of alluvial sediments. PhENOLGGY

These two species are active during the months af March through June, although they do not have identical reproductive cycles. The annual or biennial Rlantaga virginjeg has a short period of flowering [April] in comparison to perennial $E_{\perp}$ patggonica, which flowers for a
full three months [April through June]. Stem elongation for the two species occurs in March and April, but leaf growth differs, extending for two additional months for $\mathrm{E}_{\perp}$ patagonicg. By August neither species can be easily located.

## EIHNDGRAPHIC/ARCHAEDLOGICAL RECDRDS

Various parts of Indian-wheat have bean gathered in historic times [Table 50]. Leaves were preferred as greens by groups living in Chihuahua. The entire plant was callected for preparing medicinal treatments or for use in dances. The seeds, which become mucilaginous when wet [Kearney and Peables 1960:B03], were saught and sametimes stored as a valuable food source, as well as providing a medicine to treat obesity [Uestal 1952:45], diarrhea [Curtin 1984:96-97] and stomachache [Felger and Moser 1974:427]. Cold or boiled infusions of the roots reduced one's appetite [Uestal 1952:45] or treated fevers and stomach cramps [Pennington 1969:140, 186].

Sparse evidence for the prehistaric use of Indian-wheat was recovered from a floor dating to the Mesa Verde occupation [A.D. 1180-1250] of Salman Puebla [Adams 1980a:263]. Gasser [1981:364] reported that charred Elantago remains were recovered in 3 of 8 Hahakam sites along the Salt and Gila river drainages in central Arizona.

SIGNIFICANCE FOR HUMANS
At Canelo Hills, Indian-wheat leaves could be harvested

Table 50. Ethnographic references to the use of Elantaga.

| SPECIES | PART AND USE: | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. Eastigata | seeds, as a medicine | Pima, Arizona | ```Curtin 1984: 96-97``` |
| P. insularis | seeds, impartant foad item often stored; also a medicine | Seri, Somora | ```Felger and Moser 1974:16, 24, 427``` |
| P. purshii | plant, given to make a person "mare agreeable" | Hapi, Arizona | Whiting 1966:92 |
|  | plant, as a medicinal tea | Acoma and Laguna, New Mexico | Swank 1932:61 |
|  | seeds, eaten as a mush | Kayenta Navaja, Arizona | Wyman and Harris 1951: 43 |
|  | root, leaves and seeds, as a medicine | Ramah Navaja, <br> New Mexico | Uestal 1952:45 |
|  | unknown part, as a medicine | Navaja in Chaco Canyan, New Mexico | Hocking 1956:154 |
| P. virginica | plants, used in dances; an ancient symbalic plant | Kiowa, Oklahoma | Vestal and Schultes 1939:51 |
| Plantaga spp. | leaves, eaten raw ar boiled | Iarahumara, Chihuahua | Pennington 1963: 128 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Plantaga spp. | leaves, much favared as greens | Tepehuan, Chihuahua | ```Penningtan 1969: 140, 186``` |
|  | plant, as a medicine | Navajo | Wyman and Harris 1941:56 |
|  | roots, crushed and bailed as a medicine | Tepehuan, Chihuahua | Pennington 1969: 140, 186 |

from both species in March and April, and during May and June fram $R_{1}$ gataqoaica. The plants are available for ceremony or medicine March through June, though $\mathrm{E}_{\mathrm{p}}$ virainicg can only be found as leafless stems with mature fruit capsules. Seeds can be gathered to be eaten May through July, being ripe on both species in June. Roots could be dug up as a medicinal treatment at any time from March through July; after that the plants are difficult to locate. PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD

The Indian-wheat part with the best chances of survival in the prehistoric record is the seed, especially if prepared by parching or roasting. Seeds cooked to mush, plants made into medicinal infusions, leaves bailed as greens, and roots boiled to treat various ailments are not expected to leave evidence of such uses.

Rlatgnus wrightii wats. RC-6 [KA \#E5-83] UA254641; [KA \#113-83] UA254640


Rlatanus wriahtii graws very near the stream at Ramsey Canyon, in try sail composed of a mixture of colluvium and volcanic bedrack.

## PHENDLDGY

As a large, deciduaus tree, Arizona sycamore daminates the vegetation along the stream. Vegetative growth appears to resume in March, one month prior to flowering in April, and cantinues through August. Fruit development takes at least five months, with the fruiting heads appearing ripe in Dctober and November. The tree resumes outward appearances of dormancy for the months of December through February. ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

A number of historic groups have made a medicinal tea out of Arizona sycamore bark $\left[\right.$ sometimes listed as $\mathrm{R}_{\mathrm{L}}$ [agcepgosa], including the Kawaiisu of Califarnia [Zigmund 1981:53], the Tarahumara (Pennington 1963:181] and Tepehuan [Pennington 1969:111] of Chihuahua, and the Apache of the

Clarkdale region of Arizona [Gallagher 1977:37, 93, 1103.
The Apache also produced a reddish color for dyeing deerskin from the bark [Gallagher 1977], and the Chumash of California used some part of the tree in craft preprations [Timbrook 1984:160].

No archaedlagical recora located.

## SIGNIFICANCE FOR HUMANS

The outer, flaky bark and inner white bark of Arizona sycamare is available year round at Ramsey Canyon and could be gathered at any time to decoct a medicinal tea or a dyestuff.

PREDICTIUNS FOR THE ARCHAEOLDGICAL RECDRD
Thin flakes of Arizona sycamare bark made into a medicinal tea or used to prepare a red dye are not expected to preserve in recognizable condition in the archaeological record.
 habitat

At Ramsey Canyon Rog Eendlerigna grows on a dry steep slape underlain by granite bedrock. The area receives a significant amount of shading fram a tall farest canopy of nearby trees.

PHENDLOGY
This perennial blue grass resumes active growth in the spring. By May it seems to be in full flower. Grains begin to mature in June, and by July all evidence of reproductive activity ceases. The grass dies back and is not particularly obviaus for a full seven month period of dormancy.

## ETHNDGRAPHIC/ARCMAEOLOGICAL RECORDS

Although a hardy, vigoraus plant, Ega Eendlerigng praduces relatively small amounts of viable seed [Gauld 1951:703. Nevertheless, three species of blue grass, including $R$. Eendlerigng [as $\mathrm{P}_{\mathrm{s}}$ colifornicg], were an important source of food to the Gosiute of Utah and Nevada〔Chamberlin 1911: 377]. People would need to be cautious in
harvesting blue grass, as amang wild range grasses it is especially susceptible to ergot, a fungus that can be ingested in flaur milled from contaminated plants [Lewis and Lewis 1977:24].

A number of references to prehistoric use of Rog Eendlerigng are present in the archaealogical literature of New Mexico and Colorada. Both R. Egndlerigna and P. secunda were found throughout strata at Bat Cave in south-central New Mexica [Smith 1950:167]. Also in New Mexica, P. Eendlerigng may have been an impartant foad resource to the Mogollon occupants of Tularosa Cave [Cutler 1952:478]. Large amounts of the chaff, numerous knotted bundles with up to 24 stems, and several piles of ripe stalks missing the grains were recavered.

In Colorado charred $\mathrm{R}_{2}$ Eendlefiana grains were assaciated with bedrack metates at a site called Cattanwood Pueblo in the western part of the state [Crane 1977:36]. The site was considered to be a faod processing area dating to the period of A.D. 900-1150; parching and grinding of the meal were the inferred activites. A grain representing this species was faund in a human copralite from a Puebla III occupation [A.D. 1050-1150] in a Johnsan Canyon cliffdwelling in southwestern Colorado [Nickens 1981:77].

Blue grass remains have also been recovered in two Utah sites. They were identified from Cowboy Cave in the central part of the state [Barnett and Coulam 1980:131], and a

Shoshane period [A.D. 1350-1B50] coprolite from the Glen Canyon area in southerni Utah contained evidence of blue grass grain [Fry 1976:35].

## SIGNIFICANCE FOR HUMANS

It seems likely that ripe blue grass grains wauld offer a food resaurce in the Ramsey Canyon area at least during the manths of June and July.

PREDICTIONS FOR THE ARCHAEOLOGICAL RECORD
One might expect to Eind blue grass remains in locations of excellent preservation and in human caprolites, if they represent prehistaric food acquistion. IF the grains were parched at same point in preparation they wauld also be likely to show up in prehistoric Eirehearths, trash deposits, and perhaps in floor debris.


## HABITAT

Populus Exemontif grows along the stream at Canelo Hills, in soil that is generally wet, at least below the surface. The substrate in the area consists almost entirely of alluvium. This species receives full exposure to the sun's rays.

## PHENDLQGY

Flower buds of the large Fremont cottonwoods at Canelo Hills begin to swell in February, and the trees are in full bloom during March. Vegetative growth has alsa resumed in February. The trees profusely disperse downy seeds in April. For the next five months stem elongation and leaf growth can be observed. By October these activities have ceased and the plant resumes Dctaber-January darmancy. ETHNOGRAPHIC/ARCHAEOLOGICAL RECDRDS

Parts of cottonwoods sought in historic times include the wood, wood knots, branches/young shoots, leaves and leaf buds, bark, inner bark, catkins, buds [flower?], fruit, and
roots [Table 51]. People appear to have utilized whatever species grew locally, and same, such as the Hopi, even transplanted seedlings nearer the villages CWhiting 1966: 723. Wood was gathered in the form of sound wood, driftwood or rotten logs. The ratten logs were preferred in drummaking, because they were already partially hallowed aut. Although some groups did not consider cottonwood very strang [Zigmund 1981:53], still it was collected for use in house construction, or for making shelters, sunshades, snake figurines., shovels, paddles, handles, fenceposts, cradles, prayersticks, loom frames, tinder boxes, firedrills, dice, clubs and small boats or rafts. Various people, including the Pima, Papaga, W. Yavapai, Cocopa and Cahuilla fashioned wooden mortars from cottonwood logs. Curtin [1984:121] observed a large thick-walled cottonwood mortar with a stone pestle in use by the Pima in the mid 1900's. The wood, which burns rapidly and produces an intense heat of short duration [Standley 1912:462], was gathered as firewood.

Branches and young shoots provided material for basketmaking, thatching, bows, arrows, prayersticks and other ceremanial paraphernalia. The Western Apache in Arizona were said to have pruned Fremont cottonwood trees in the fall so that they would produce long, straight shoots the following year [Gallagher 1977:103, 116].

Bark and inner bark have been cited as providing resources for humans. Bark was collected as a fuel and for

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. acuminata | branches*, used in ceremanies | Zuni, New Mexica | Stevanson 1915: 97 |
|  | honey-dew formed by aphids on leaves* gathered as sugar | Gasiute, Nevada and Utah | Chamberlin 1911: 378 |
|  | shoots*, for basketmaking | Gasiute, Nevada and Utah | ```Chamberlin 1911:``` |
|  | ```mond;' callected ns driftwood; saplings made inta sunshades; dend treas made inta dr``` | Cachiti, <br> New Mexico <br> ms | Lange 1968: 147 |
|  | wood, as fire drills and smake Figurines | Ramah Navajo, New Mexica | Vestal 1952:22 |
| P. balsamifera | inner bark, as antiscorbutic [scurvy] | Kiowa, Oklahoma | Uestal and Schultes 1939:20 |
|  | wood, for canstruction, as Firewand and far use in ceremonies | Kiowa, Oklahoma | Vestal and Schultes 1939:20 |
| P. deltaides | bark*, as fuel to ranst clay far skin painting | Tetan Dakata, Missouri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 20-21 } \end{aligned}$ |
|  | branches, for basketmaking | Pima, Arizona | Russel1 1975:134 |
| *species listed as a synonym |  |  |  |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. deltaides | catkins, gathered Feb. and March and eaten raw | Pima, Arizona | Russell 1975:69 |
|  | Eruits*, as chewing gum when ripe, as beads and pendants when green | Teton Dakota, <br> Missouri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 20-21 } \end{aligned}$ |
|  | inner bark*, eaten | Teton Dakota, Missouri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 20-21 } \end{aligned}$ |
|  | inner bark, as a lining along with Syageda in pits Eor baking Atciplex Fruit | Pima, Arizona | Russell 1975: 78 |
|  | leaf buds*, as yellaw dye in early spring | Teton Dakata, Missouri River Regian | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 20-21 } \end{aligned}$ |
|  | leaves*, made inta toy tepees and toy moccasins: made music when vibrated between lips | Teton Dakata, Missauri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 20-21 } \end{aligned}$ |
|  | wood, for shovels, paddles, handles, house construction | Pima, Arizana | $\begin{gathered} \text { Russel1 1975:97, } \\ 101,120,154 \end{gathered}$ |
| P. Eremantii | bark [fibraus] For many uses, including medicinal | Cahuilla, California | Bean and Saubel 1972: 106-107 |


| SPECIES | PART AND USE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. Eremontii | Eruit, chawed as gum when green | Pima, Arizona | Curtin 1994: 109, 111-112,119, 121 |
|  | inner bark, stripped to make cradles | Pima, Arizona | $\begin{aligned} & \text { Curtin 1984:109, } \\ & \text { 111-112,119,121 } \end{aligned}$ |
|  | inner bark, boiled or used Fresh as a medicine | Kawaiisu, Califarnia | Zigmund 1981:53 |
|  | inner bark, worn as an apron-like garment | Luiseno, California | Sparkman 1908:233 |
|  | leaves, boiled as a medicine; as a hair dye | Pima, Arizona | Curtin 1984:109, 111-112,119,121 |
|  | shoots, as white splints in basketmaking | W. Apache, Arizona | $\begin{aligned} & \text { Gallagher 1977: } \\ & \text { 103;11G } \end{aligned}$ |
|  | wood, as tools including a woaden mortar; as Firewoad | Cahuilla, Califarnia | Bean and Saubel 1972: 106-107 |
|  | wood, as Fuel and Fence-posts, house construction, cradles, wooden mortars and sho | Pima, Arizana ls | $\begin{aligned} & \text { Curtin 1984:109, } \\ & 111-112,119, \\ & 121 \end{aligned}$ |
| P. tremulaides | bark, as a medicinal tea | Western Shashone, Nevada and Idaho | Smith 1972: 82 |

Table 51 [cont.] Ethnographic references to the use of Ropulus.

| SPECIES | PART AND USE | GRDUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. tremulaides | bark, pounded and made into a medicinal tea | White Mt. Apache, Arizona | ```Reagan 1929:154,``` |
|  | inner bark, as a Eamine Food | Ramah Navaja, <br> New Mexica | Uestal 1952: 22 |
|  | knots, made inta cups | Ramah Navaja, <br> New Mexico | Uestal 1952:22 |
| P. wislizenii | bark, burned to ash Far a medicirie; bailed as a medicine | Spamish-Americans, Rio Grande River, New Mexico | $\begin{aligned} & \text { Curtin 1965: } \\ & 19-20 \end{aligned}$ |
|  | branches and leaves, as thatching; branches as small bows and arrows | Isleta, New Mexico | Jones 1931:39 |
|  | branches, in building ceremanial structures | Acama and Laguna, New Mexico | Swank 1932:62 |
|  | buds [flower?] knoun as "cottonwood kernels" | Tewa, New Mexica | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:42 } \end{aligned}$ |
|  | burs, chewed as chewing gum | Chiricahua and Mescalera Apache | Castetter and Opler 1936:45 |
|  | leaves, bailed as as medicine | Spanish-Americans, Rin Grande River, New Mexica | $\begin{aligned} & \text { Curtin 1965: } \\ & 19-20 \end{aligned}$ |
|  | Fruit, chewed as chewing gum | Isleta, New Mexico | Jones 1931:39 |


| SPECIES | PARI AND LSE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. wislizanii | Fruit, chewed as chewing gum | Acoma and Laguna, New Mexica | Swank 1932:62 |
|  | mood, callected as driEtwood; saplings made into sunshades; dead trees sought for | Cochiti, New Mexico ums | Lange 1968:147 |
|  | wood, made into small baats and rafts and ceremonial drums | Isleta, New Mexico | Jones 1931:39 |
|  | wood, made into variaus implements | Tewa, New Mexico | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916: } 42 \end{aligned}$ |
|  | moad, as fuel | Acoma and Laguma, New Mexica | Sunak 1932:62 |
| Populus pas. | branches, used in ceremonies; shoots peeled as prayersticks | Hopi, Arizono | Whiting 1965:72 |
|  | buds, eaten as food and chewing gum | White Mt. Apache, Arizana | ```Reagan 1929:154, 157``` |
|  | roots, made into rafts for short voyages | Cocopa, Lawer Colorada River | ```Gifford 1933: 270-272``` |
|  | roots, carved inta dolls, gaming cups and boxes | Hopi, Arizona | Whiting 1966:72 |

Table 51 [cont.] Ethnographic references to the use of Popudus.

| SPECIES | PART AND LSE | GROUP[G] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Papulus spp. | wood, for house construction and firemaking apparatus; ratten logs for drums | Hopi, Arizona | Whiting 1966:72 |
|  | wood, made inta deep mortars, structural timbers | Cocopa, Lawer Colorado River | ```Gifford 1933: 270-272``` |
|  | wood, as mortars | Papaga, Arizona | Castetter and Underhill 1935:6 |
|  | mood, as mortars | W. Yavapai, Arizona | Gifford 1936: 259 |
|  | wood, as prayersticks, laom frames, tinder boxes, dice, shelters, game pieces and clubs | Navaja | Elmore 1944:37 |

medicinal preparations. A thick syrup extracted from having boiled a large quantity of $\mathrm{E}_{\mathrm{f}}$ wislizenii bark for many hours was used in setting braken bones; it made a remarkable cast that remained in place for up to two months [Curtin 1965:19203. Inner bark could be eaten as a famine food, made into a treatment for scurvy, used as a lining in a baking pit, and strips employed in making cradles and loose apran-like clothing.

Still other parts of cottonwood trees were collected by people. Cups were made out of waod knots, and leaf buds provided a substance from which a dye could be obtained. Children made toy tepees, moccasins and temporary musical devices from the leaves; adults used them for hair dyes, medicines and scraped a sweet "haney-dew" substance off the leaves where aphids had chewed. Roots provided the raw material for making rafts, dolls, gameing cups and boxes.

Reproductive parts have been eaten by numeraus groups. Catkins offered both food and chewing gum. Buds [Elower?] did likewise, Unripe fruit was preferred by same as chewing gum; others gathered it ripe, when the cottony seeds were dispersing. Unripe fruit could also be made into beads and pendants.

Cottonwood wood and root material has been identified in ancient sites in Colorado and Utah. For example, charred woad was recovered thoughout deposits at sites in the Dolores River valley of southwestern Colorado dating to the
period A.D. 600-1200, suggesting this resource was heavily utilized by the Anasazi occupants of the region cBenz 1984:205]. Also in southwestern Calorada, variaus wooden cottonwood implements and construction material, including scrapers, bars, boards and roof beams, were found in Pueblo III cliff dwellings in Johnson Canyon [Nickens 19日1:79]. Cottanwood was preferred far dart, arraw and ather shafts by the occupants of Cowboy Cave in central Utah; the root of this taxan was also roughly hacked off at one end and hollowed out at the other to form a crude cup $[J a n e t s k i$ 1980:83, 953.

A variety of parts of Eappulus deltaides were found in Ozark Bluff-Dweller cantexts in the Arkansas and Missouri region. The wad had apparently been used for a number of purposes, and bundles of the dry, shredded inner bark might have served as tinder for a fire. Numerous knots of twigs with attached leaves were faund, possibly representing children's toys. One specimen comprised a bundle of cottonwood leaves secured with a grass string [Gilmore 1931:95].

Two records of cottonwood pollen imply ingestion of the male catkins. In the Glen Canyon region of southern Utah, Ropulus pallen accounted for $92 \%$ of the pollen recognized in a human coprolite from a Pueblo II-III site CMartin and Sharrock 1964:174]. Five human copralites fram Antelape

House in the Canyon de Chelley region of northeastern Arizona contained percentages of Pqpulus pallen ranging from 23-93\%, causing researchers to speculate they represented consumption of the catkins as Eaod or medicine [WilliamsDean and Bryant 1975:1043.

## SIGNIFICANEE FRR HLMANS

Fremont cottonwad could offer a wide range of resaurces at Canelo Hills. In February peaple could gather flower buds for foad and chewing gum, and callect leaf buds for dye. By March the catkins have develaped and could also provide food or gum. Unripe and ripe fruit are available as potential chewing gum and beads/pendants in March and April. Young shoots might be most appropriately gathered for basketry material in April and May, when flexible and actively elongating. Leaves are present on branches from March thraugh November to suit variaus hausehold and medicinal needs. All other parts, including wood, wood knots, branches, bark, inner bark and roots could be collected year raund.

## PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD

Depending on preservation conditions, the parts of cottonwood have varying chances of preserving. Charred wood representing firewood may be the most likely part to survive in open sites. In protected locations, wooden artifacts and construction timbers, baskets fashianed of branches, and waad knot and root implements would have a higher likelihood of


#### Abstract

remaining in the archaealogical record than the mare perishable bark, inner bark, leaves, leaf buds and fruit. However, some of these delicate parts cauld preserve under the best of conditions. Pollen would probably have a good chance of being recovered in human coprolites from cave or overhang deposits.


 habitat

Roctulacg umbraticala thrives in dry soil on the stream flanks at Canelo Hills. The area receives partial shading from nearby vegetation. Underlying substrate is composed of both volcanic bedrack and pockets of colluvium. phendiogy

This annual purslane is difficult to spot as a prostrate succulent hidden among other plants. It can be first observed in July, though possibly seedlings are present priar to that month. The plant appears vegetatively active for at least five months. For the three months of September thraugh November it simultaneausly flowers and produces mature seeds. By December the plant has died, and for the next seven months is present as seeds in the soil. ETHNOGRAPHIC/ARCHAEDLQGICAL RECDRDS

At least two species of purslane are listed in the histaric literature as having provided graups with potherbs and medicines [Table 52]. The leaves and stems might be

Table 52. Ethnographic references to the use of Portulgca.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. Oleracea | leaves and stems, as medicine | East African groups | Kokwaro 1976:180 |
|  | leaves and stems, cooked as greens | Paiute | Palmer 1870:422 |
|  | leaves and stems, boiled or Fried | Cochiti, <br> New Mexica | Lange 1968: 150 |
|  | leaves and stems, gathered in quantity and dried for winter | Isleta, New Mexica | Jones 1931:39 |
|  | leaves and stems, bailed and eaten as greens, alsa dried For winter use | Picuris, New Mexica | Krenetsky 1964: 47 |
|  | leaves and stams, eaten | Tewa of New Mexico | $\begin{gathered} \text { Robbins et al. } \\ 1916: 59-60 \end{gathered}$ |
|  | leaves and stams, eaten | Mescalera and Chiricahua Apache | Castetter and Opler 1936:46 |
|  | leaves and stems, eaten and made inta a medicinal tea | Acoma and Laguna, New Mexica | Swank 1932:62-63 |
|  | leaves and stems, cooked as a gravy | Hopi, Arizona | Whiting 1966:75 |


| SPECIES | PART AND USE | GRDUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| P．ロleracen | leaves and stems， eaten raw ar canked | Apache | Palmer 1日7日： 42 2 |
|  | leaves and stems， bailed as greens or dried and stared | Tarahumara，Chihuahua | Pennington 1963： 125 |
|  | leaves and stems， boiled as greens | Tepehunn，Chihuahua | ```Pennington 1969: 139``` |
|  | leaves and stems， eaten as greens | Luiseno，California | Sparkman 1908： 232 |
|  | leaves and stems， boiled as greens | Ramah Navaja， New Mexico | Vestal 1952：26 |
|  | leaves and stems， as a medicinal lotion | Kayenta Navaja， Arizona | Wlyman and Harris 1951：22 |
|  | leaves and stems，as a medicine | Navaja | Elmore 1944：47 |
|  | Segds，as food | Navajo | Elmore 1944：47 |
|  | seeds，as food ground to flour | Uariaus SW United States graups | Palmer 1878：602 |
| P．retusa | leaves and stems， coaked as greens | S．Paiute，Arizona | Bye 1972：95 |
|  | leaves and stems， as greens | San Felipe， New Mexica | Castetter 1935：43 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. retusa | leaves and stems, eaten | Tewa of New Mexico | $\begin{aligned} & \text { Robbins et al. } \\ & 1916: 59-60 \end{aligned}$ |
|  | leaves and stems, eaten | Hopi, Arizona | Hough 1898: 143 |
|  | leaves and stems, eaten as potherbs | Navajo, Chaca Canyon area of New Mexica | Hocking 1956: 154 |
|  | seads, ground into <br> flour and eaten as mush | S. Paiute, Arizona | Bye 1972:95 |
|  | seeds, enten | Navajo | Elmore 1944:47 |
| Portulaca spp. | seeds, as food | Zuni, New Mexica and Navajo | Standley 1912:458 |

eaten raw, caaked in variaus ways, or even dried and stared For winter use. The fact that the frequently cited $\mathrm{E}_{\mathrm{A}}$ glegaceg has been found to contain high levels of soluble axalates [Lewis and Lewis 1977:20] suggests people either ingest small amounts of the raw leaves and stems, or render the oxalates harmless by a preparation step which leaches them out.

Purslane seeds have also been gathered and ground into Elour, Plants bear tiny black seeds in abundance, and ane method of harvest has been described for the Zuni. Gatherers pulled the plants up just before the seed had ripened then dried and threshed them either by agitation or by pounding them over mats or screens. Sametimes the plants were far too mature for this method, so the Zuni swept up the sandy sail at the base of the plants and later carefully winnowed the seeds from the soil [Cushing 1974:244]. Harvest of these plants continued into the eOth century, especially after a rainy season when the seeds became abundant. The Zuni considered it important to nourish themselves with seeds of their forefathers [Cushing 1974: 258].

Both pollen and seeds have been recovered in ancient New World sites [Table 53]. Pallen in human coprolites suggests that the flowers have been eaten, most likely when the plant was prepared as a potherb. Charred seeds have been quite cammon in some sites, and their uhiquitous presence in trash depasits at same locations CAdams 1980a:

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. retusa type | seeds [charred] as camman Foad | Salman Ruin New Mexica [A.D. 1090-1250] | Adams 1980a:272276 |
|  | seeds, $\quad$ as common foad | Arraya Honda, Naw Mex. [A.D. 1300-1450] | Watterstram 1975: BO |
|  | seads, as Food [Fram a pottery vessel] | Tularasa Basin site, New Mexica [A.D. 1200-1425] | Phelps 1968 |
| Portulaca spp. | pallen [in copralite], consumption of Elawers | Frightful Cave, Coahuila, Mexico [B.ट.2000-A.ロ.300] | Bryant 1975:98 |
|  | pallen [in caprolites], cansumption of Elawers with greans | Antelape Hause, Arizona | Wiliams-Dean and Bryant 1975:105 |
|  | pallen [in capralites], consumption of Elowers with greans | Hay House, Sw Cala. [Puebla III] | $\begin{aligned} & \text { Scott 1979:270- } \\ & .271 \end{aligned}$ |
|  | seeds [charred] as fard | Dalares River, SW Cala. [A.D. 600-975] | Benz 1984:202 |
|  | seeds [charred] as camman Faod | Chaca Canyon, Naw Marica [A.D. 750-1100] | Struever 1977:49 |
|  | seads [charred] as fand | 7 of 17 NE Arizana Anasazi sites | Gasser 1982:33 |


| SPECIES | PARI AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Partulaca spp. | ```seeds [charred] as Food``` | 3 of 8 Arizona Hohakam sites | Gasser 1981:364 |
|  | ```seeds [in coprolites] as Eood``` | Glen Canyon sites, Utah [A.D.400-1350] | Fry 1976:15 |
|  | ```seeds [in copralites] as Food``` | Antelape House, Arizona [Puebla I and IIJ | Fry and Hall 1975: 91 |

272-276; Wetterstrom 1976:76] suggests frequent discard of a regularly eaten resource. One of the more intriguing Finds of purslane seeds was made near the western boundary of the Tularosa bosin in New Mexico [Phelps 1968]. There, over 345 cubic centimeters of $\mathrm{P}_{\mathrm{f}}$ retusg seeds were recovered From a Cupadera pottery pitcher in a site near Coe Lake belonging to the El Paso Phase of the Jornada branch of the Magollon Cultural Tradition. The seeds partially filled the vessel, with no evidence of accompanying leaves or stems, and represents one of the largest Pgrtulacg caches found in a prehistoric context.

## SIGNIFICANCE FOR HUMANS

At Canelo Hills, the fleshy leaves and stems of Partulacg ymbraticalo are available as a potherb from July through November. Seeds can be gathered from September through November, as the plants continuously produce maturing capsules.

PREDICTIONS FDR THE ARCHAEQLQGICAL RECORD
Since the fleshy purslane plants flower throughout much of their growing season, pollen would be gathered at the same time leaves and stems are sought for greens. This pollen, along with mature seeds, could well show up in human coprolites. If ancient seeds were routinely parched or roasted prior to consumption, their presence in ancient firehearths and trash areas would be anticipated.


## habitat

Reunus secoting can be found on a shallow colluvial slope receiving $50 \%$ or more exposure to the sun, less than 10 meters from the stream at Ramsey Canyan. The underlying substrate is dry and composed primarily of granite bedrock.

## PHENDLGGY

Southwestern choke-cherry is a large shrub that resumes active growth in March, evident by the formation of flower buds and by stem and leaf expansion. After full flowering in April immature fruits cling to branches for three manths, until ripening in August. By August the vegetative growth has slowed considerably, and by October the plant appears to have become dormant.

## ETHNOGRAPMIC/ARCHAEOLDGICAL RECORDS

This and other species of Rrunus have not only provided fruit for mumeraus historic groups, but alsa leaves, bark, branches and roots to satisfy various needs [Table 54]. Many people ate the fruit, either fresh or dried, and often

| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. serotina | bark, as a medicine | Southern Mexico | Bye 1979:147 |
|  | bark and leaves, crushed as Eish poison | Tepehuan, Chihuahua | ```Pennington 1969: 134, 136``` |
|  | inner bark, as a tonic and medicine | Appalachian groups | Core 1967 |
|  | fruit, eaten | Sauthern Mexico | Bye 1979: 147 |
|  | fruit, eaten | Tepehuan, Chihuahua | ```Pemnington 1969: 134, 136``` |
|  | fruit, eaten fresh or dried | Iroquois and other groups in Minn. and Wiscansin | cited in Yanovsky $1936: 33$ $1936: 33$ |
|  | Fruit, eaten | Appalachian groups | Care 19E7 |
|  | plant, valued for its shade | Southern Mexico | Bye 1979:147 |
|  | twigs, 0 a a beverage | Iraquais and ather groups in Minn. and Wisconsin | ```cited in Yanousky 1936:33``` |
| P. virginiana | bark*, as a green dye in the spring | Spanish-Americans, Rio Grande river, New Mexica | $\begin{aligned} & \text { Curtin 1965: } \\ & 51-52 \end{aligned}$ |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| P. virginiana | bark, as a medicine | Gosiute, Nevada and Utah | Chamberlin 1911: 378 |
|  | branches*, for bows | Isleta, New Mexico | Jones 1931:40 |
|  | Eruit, eaten | Cahuilla, California | Bean and Saubel 1972: 119-120 |
|  | fruit*, eaten | Kaibab Paiute | Kelly 1964:43 |
|  | Fruit*, Eaten and dried for winter | Gosiute, Nevada and Utah | ```Chamberlin 1911: 37B``` |
|  | Eruit*, eaten Eresh or made into jam ar meal cakes | Cochiti, New Mexico | Lange 1968:150 |
|  | fruit, cooked and eaten | Picuris, New Mexica | Krenetsky 1964: 47 |
|  | fruit*, prized food | Isleta, New Mexico | Jones 1931:40 |
|  | Fruit, eaten Eresh or ground into cakes; also dried for winter; infusion as a medicine | Ramah Navaja, <br> New Mexica | Vestal 1952:31 |
|  | Fruit, eaten fresh or large quantities dried for winter | Kiowa, Oklahoma | Uestal and Schultes 1939:31 |

Table 54 Ccont.J Ethnographic references to the use of Exunus.

| SPECIES | PART AND USE | GROUP[S] |
| :--- | :--- | :--- |
| P. virginiana fruit, eaten Eresh | Plains groups, |  |

Vestal 1952:31
Bean and Saubel
1972:119-120
Curtin 1965:
51-52
Gilmare 1977:
35-37
Elmore 1944:54
Buskirk 1949: 340
Elmare 1944:54
Elmore 1944:54
gathered large quantities to be stored for winter. Bath the Cahuilla of California [Bean and Saubel 1972:119-120] and Isleta in New Mexico [Jomes 1931:40] acknowledged the astringent quality of the fresh fruit, suspecting that it cauld cause stamach trauble. Hawever, peaple still traveled miles to harvest Reunus along streams, where they were
 pits to be too small to be easily removed, and often pounded the entire fruit to a pulp [pits and all], and made the resulting mass into small cakes to be dried in the sun [Gilmore 1977]. Numerous California groups actually sought the pits of Rrunus ilicifglig instead of the fleshy pulp; they develaped preparation methods that rendered this potentially poisonous foodstuff harmless [Timbrook 1982].

Reynus twigs and branches have been fashioned into bows, prayersticks and ceremonial staffs. They have also been sought as a dye, to provide shading, and to prepare a beverage infusion. People gathered bark for dyeing, medicinal needs and as a fish poison. The leaves were also sought as a fish poison and for use as a ceremonial emetic. A purple dye and a medicine cauld be made from the roots.

Same Reynus remains have been recovered from southwestern prehistoric sites. In the Cimarron area of New Mexico carbonized remains of P . virginigng were listed by Kirkpatrick and Ford [1977:263-264.] as present in Basketmaker II and III [A.D. 400-900] deposits. A low frequency of

Prynus pits in Salmon Ruin strata suggested their use as a food in the period A.D. 1180-1250 [Bohrer 1980:247].

Presence of a wooden planting stick and the pits and pollen of $\mathrm{E}_{2}$ virginigna suggested that prehistoric Pueblo III residents of Johnson Canyon in southwestern Colorado utilized this plant [Nickens 1981:79]. The species is locally common today in mesic, shaded side canyons of the area. Over 100 Reynus pits were recovered from the 11th century Anasazi occupation of the Chimney Rock Mesa area in Colorado [Minnis and Ford 1977:84].

## SIGNIFICANCE FDR HUMANS

At Ramsey Canyon the presence of Southwestern Chokecherry would have offered a variety of resources. Ripe fruit, available in August, could be gathered for food. Leaves could be had for ceremonial purposes and as a Eish poison at least in the months of March through September. Bark, branches/twigs, and roots could all be collected throughout the year.

## PREDICIIONS FOR IHE ARCHAEOLOGICAL RECORD

The fact that choke-cherry fruit are generally eaten Fresh or ground to a pulpy mass with the pits still inside would decrease chances of picking up evidence of use in the ancient record. Branches fashioned into bows or ceremonial implements might survive in well protected locations. More perishable parts such as leaves, bark and roots are considered to have relatively low chances of preservation.
habitat
Pseㅛudgtsmag menziesid does well in odry soil less than 10 meters from the Ramsey Canyon stream. The underlying shallow slope is camposed of colluvium and granite bedrack. The area generally receives $50 \%$ or greater exposure to sunlight.

## PHENDLOGY

This evergreen coniferous Douglas-fir tree is observed to flower profusely in March, one month prior to resumption of vegetative activity. By May immature green cones have formed, which turn brown and open up in September. Although these mature looking cones cling to branches until February of the following year, it is not certain that ripe seeds are retained inside. Stem elongation and leaf growth are confined to the four month period of April through July. ETHNOGRAPHIC/ARCHAEOLDGICAL RECDRDS

Douglas-fir has been sought by historic groups as food
[inner bark, especially the cambium], medicinal ingredient [leaves, bud tips], fumigant and water jar sealant [pitch], and for other needs such as hoaps, garments, bows and arrows [branches]. However, again and again it is referred to as the tree of choice when branches or poles have been needed for ceremonies or dances [Table 55]. For example, among the Tewa of New Mexico Douglas-fir branches were carried in almost all of their dances and the failage used in all manner of bady decorations, even though a long journey to the mountains was required to obtain the needed materials [Robbins et al. 1916:43]. When the ceremonies were over, any branches worn or carried were thrown into the nearby Santa Clara River. The Hopi of Arizona also traveled as much as 35 miles to obtain branches; they predicted whether a summmer ahead was to be a good or bad one, depending on the glossiness or dullness of the needles [Whiting 1966:63]. The Zuni of New Mexica felt the breath from gods of the undermost world ascended through the trunks of Douglas-fir trees and Formed clouds behind which the rain-makers could work [Stevenson 1915:97].

The archaealogical record reveals use of Douglas-fir roof beams. For example, roof baams were used throughout the A.D. 1090-1250 occupations of Salmon Pueblo in northwestern New Mexico [Adams 1980b:512]. Johnson Canyon inhabitants in southwestern Colorado during Pueblo III times employed the wood in room and kiva construction [Nickens



1981:743. Apparently a male adult burial at that site was interred with a pillow made of some part of Douglas-fir. Also, the presence of Douglas-fir beams in a number of sites in the Winona Uillage-Ridge Ruin area east of Flagstaff, Arizona led the investigator to speculate that environmental conditions had changed significantly from the Hohokam/ Magallon accupation of the area in the A.D. 1000-1100's [McGregor 1941:277]. None of these trees grow anywhere in the area today. In support of this hypothesis, McGregor cites a variety of bird remains and fish vertebrae faund in the trash mounds that suggest a relatively abundant and nearby permanent water source not currently present. Certain land snail shells normally faund "in damp places in dry country" were also found in the ancient strata.

Dougias-fir has also been recovered as firehearth charcoal. Charcoal was identified in four sites of 11 th century A. D. Anasazi affiliation in the area of Chimney Rock Mesa in Colorado [Minnis and Ford 1977:83].

SIGNIFICANCE FOR HUMANS
In the Ramsey Canyon area Dauglas-fir inner bark would perhaps be sweetest as a food resource in February and March, before vegetative growth begins in earnest. Bud tips [both flowering and vegetative] needed for medicine would alsa be swelling in these twa months, though are alsa available fram September until January. All other parts could be acquired year raund, including leaves as a
medicine, pitch for hausehold uses, branches for ceremonies and daily requirements, and waod for construction beams and Euel.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD

The most likely part of Douglas-fir to preserve would be the woad, as charcoal in Eirepits or remaining Eram construction beams of raofs that have burned. Ancient rituals that required discarding the branches in a special place away from a dwelling or village wauld decrease chances of recovering them. Parts that don't normally encounter fire would not be expected ta survive unless affarded a high degree of protection. Perishable parts, such as bud tips and inner bark would also have a low likelihood of recovery.


## HABITAT

All three species of oak monitored at Ramsey Canyon grow in relatively dry sail, as part of the mid-level canopy of trees. These trees are rooted in fairly dry soil in an
area subject to stream scour in heavy rains. The amount of sunlight they receive varies from less than $25 \%$ to over $50 \%$, depending on the presence of nearby averstory species.

## PHENOLDGY

These three oaks are all evergreen trees, prominent and recognizable the year round. By April they are either in flower bud or full flower; full flowering lasts only a very short period of time, no longer than one month. Immature acorns can cling to branches for up to six months prior to becoming mature. These oaks seem to follow one another in regard to developing ripe fruit. Net-leaf [Queccus rugqsa] acorns are fully develaped in August and remain on the trees for at least two manths. Following along are the acorns of silverleaf aak [q. bupgleycgides], which ripen in September. Fully two months later in November the fruit of Arizona white oak [ $\mathrm{Q}_{\mathrm{c}}$ q[izgonica] matures, and is available through December.

The period of leaf expansion varies considerably among the three species. Both Arizona white oak and silverleaf oak exhibit leaf activity only for the manths of April and May. Net-leaf oak, on the other hand, has expanding leaves evident for the full six month period of April through September. These differences could be partly explained by inferred relatedness between the species; net-leaf oak may not be closely related to any other species in the United States [Kearney and Peebles 1960:217]. Stem elongation
coincides for all three species over the period April through August/ September. Why stem activity is so similar, yet leaf growth so variable, is unclear.

## ETHNOGRAPHIC/ARCHAEDLDGICAL RECDRDS

Daks have been an important resource to peaple in historic times $\{T a b l e$ 56]. Many groups have eaten the acorns, some considering them a staple food to be gathered in quantity [Jones 1931:41; Sparkman 1908:103; Cushing 1974:2433. Acorn meal has also been used as a material to mend clay pots, as well as a medicine. Children made toy tops out of the caps.

Acorns differ in the amount of tannic acid they contain, ranging from very little to quantities that make them very bitter to human taste. Both sweet and bitter acorns grow in the New World. Two areas in the United States, California and the Eastern U.S. Waodlands, have been known to be the centers of acorn-leaching activities [Gifford 1967]. Acorneating has been a very characteristic feature of the domestic economy of California groups, and the crux of acorn preparation involved removal of the objectionable tannic acid from the nuts. The discovery of the process to rapidly leach pulverized acorns increased access to a food of high nutritive content.

Unlike the California groups, however, people living in Arizona and Mexico generally did not leach acorn meal, even

| SPECIES | PARI AND USE | GROLP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Q. arizonica | acarns, as Food [?] | Mexicans, Ria Maya Sanara | Gentry 1942:67 |
|  | acorns, as food | Tepehuan, Chihuahua | ```Mennington 1969:``` |
| Q. gambelii | acorns, as food | Kaibab Paiute, Arizana and Utah | Kelly 1964:44 |
|  | acorns, as food | White Mt. Apache, Arizona | Reagan 1929:160 |
|  | bark, as dye | Navaja | Bryan and Yaung $1940: 49-50$ |
|  | bark af raot, as a medicine | Navajo | Uestal 1952: 22 |
|  | woad, for handles and implements | Isleta, New Mexico | Jones 1931:41 |
|  | wood, made into ladders | Picuris, New Maxico | Krenetsky 1964:47 |
|  | woad, as clubs | Jemez, New Mexico | Cook 1930:27 |
| Q. grisan | acorns, $0 s$ ford Favored of all oaks, raw ar ranstad and ground | Mescalera and Chiricahua Apache | Castetter and Opler 1936:42 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Quercus <br> hypoleucaides | acarns, as food | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & 136 \end{aligned}$ |
|  | gall, white pith as Food | Tarahumara, Chihuahua | Pennington 1963: $114-115,124$ |
|  | laaves [yaung] as famine Food | Tarahumara, Chihuahua | Penningtan 1963: 114-115, 124 |
| Duercus oblongifalia | acorns, as Food staple in past | Isleta, New Mexica | Jones 1931:41 |
|  | acorns, $0 s$ Food hulled and ground | Pima, Arizona | Russel1 1975:7日 |
| Q. palmeri | acorns, as food preferred of all aaks | Western Apache, Arizana | $\begin{aligned} & \text { Gallagher 1977: } \\ & 43-44 \end{aligned}$ |
| Q. pungens | galls, as dye | Navajo | Bryan and Young $1940: 49-50$ |
|  | gum, as chewing gum, dye and paint | Navajo | $\begin{aligned} & \text { Elmore 1944: } \\ & 40-41 \end{aligned}$ |
|  | twigs, as weaving toal | Acoma and Laguna, New Mexico | $\begin{aligned} & \text { Swank 1932: } \\ & 64-65 \end{aligned}$ |
|  | wood, as tool handles | Acoma and Laguna, New Mexico | Susank 1932: $64-65$ |
| Q. rubra | acarns, as Faod after leaching | Plains graups of the Missouri River Region | Gilmore 1977:23 |


| SPECIES | PART AND USE | GROLP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Q. rubra | bark of root, bailed as medicine | Plains groups of the Missouri River Region | Gilmore 1977: 23 |
| Q. rugasa | acorns, as Food | Tepehuan, Chihuahua | Pennington 1969:61 |
|  | wood, tool handles | Tepehuan, Chihuahua | Penningtan 1965: 61 |
| Q. turbinella | acorns, as food | Kaibab Paiute, Arizana and Utah | Kelly 1964:44 |
|  | acorns, as Food stared and ground | Lawer Colorado River graups | ```Castetter and Bell 1951:187-197``` |
| Q. undulata | acorns, as food | White Mt. Apache, Arizona | Reagan 1929:160 |
| Q. utahensis | acorns, as Food staple in past | Isleta, New Mexica | Jones 1931:41 |
|  | acarns, as Food bailed ar ground | Acama and Laguna, New Mexica | Smank 1932:54-65 |
|  | acorns, as Foad | Cochiti, Naw Mexica | Lange 196日: 150 |
|  | moad, a saurce of implement handles | Cochiti, New Mexica | Lange 1968: 150 |
| Quercus spp. | acorns, as Foad boiled or roasted | Navaja | Fransiscan <br> Fathers 1910:211 |


| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Quercus spp. | acorns, as Food ground | Navaja | Bailey 1940:287 |
|  | acorns, as Foad staple | Luisena, California | Sparkman 190日: 103 |
|  | acorns, as Food | SE Yavapai, Arizona | Gifford 1932:205 |
|  | acorns, as food | Kiliwa, California | Meigs 1939:9, 11 |
|  | acorns, as food | Kawaiisu, Californin | Zigmund 1981:56-57 |
|  | acarns, as fond gathered in quantity | Zuni, New Maxico | Cushing 1974:243 |
|  | acorns, os food | Papaga, Arizana | Underhill 1935:13 |
|  | acarns, as foad | Tewa, New Mexico | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:44 } \end{aligned}$ |
|  | acorns, as Eood | Uariaus North American graups | ```Yanousky 1936:18- 19``` |
|  | acorns, as Food toaster | Tarahumara, Chihuahua | ```Penningtan 1963: 114``` |
|  | acorn, meal to mend clay pats and as medicine | Kawaiisu, California | ```Zigmund 1981: 56-57``` |
|  | acorns, to confer sexual potency | Isleta, New Mexico | Jones 1931:41 |


| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Quercus spp. | acorn caps, as childrens toy top | Kawaiisu, California | Zigmund 1981:56-57 |
|  | bark, ground and leached as a famine ford | Great Hungarian Plain, Hungary | Gunda 1977: 2 |
|  | bark, as medicine | Philippine Islands | Altschul 1973:49 |
|  | branches, as throwing sticks | Kiliwa, California | Meigs 1939:9, 11 |
|  | branches, notched to keep track of time | Navajo | Uestal 1952:22 |
|  | galls, as dye | Navajo | Vestal 1952: 22 |
|  | galls, as medicine for external application | San Luis Potosi, Mexico | Bye 1979:145 |
|  | galls, as medicine | Acoma and Laguna, New Mexico | Swank 1932:64-65 |
|  | galls, as medicine | Kawaiisu, Califarnia | 2igmund 1981:56-57 |
|  | leaves, as cigarette wrappers | Kiowa, Oklahoma | Uestal and Schultes 1939:21-22 |
|  | twigs, as carrying baskets | Navajo | $\underset{41}{\text { Elmore } 1944: 40-}$ |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Quercus spp. | wood, as tools and utensils | Hopi, Arizona | Whiting 1966:72 |
|  | wood, as various implements | Tewa, New Mexico | $\begin{aligned} & \text { Rabbins et al. } \\ & \text { 1916:44 } \end{aligned}$ |
|  | woad, as toals and utensils | Kowaiisu, California | Zigmund 1981:56-57 |
|  | wood, as clubs, bows, hoes, etc. | Navajo | ```Elmore 1944:40- 41``` |
|  | wood, as fuel in ceremonies | Kiowa, Oklahoma | $\begin{aligned} & \text { Uestal and } \\ & \text { Schultes 1939: } \\ & \text { 21-22 } \end{aligned}$ |

though the pracess was understoad by same. Far example, the southeastern Yavapai of Arizona leached the seeds of iranwood trees [glneyg tespta], but apparently did not apply the same process to acorn meal [Gifford 1932:20B]. People inthe Southwest simply saught trees with sweeter acorns, rather than apply a leaching technique. Apache groups in Arizana gathered nuts from several species but definitely had a preference order [Buskirk 1949:307-311]. Ramah Navaja in New Mexica considered acorns of Quercus gambelij edible, While those of g. griseg and Q. undylotg were not as good [Uestal 1952:2ᄅ]. The sautheastern Yavapai in Arizona considered the nuts of Arizona white ak bitter and preferred those of q. empryi; people would sample fallen nuts of other species on the ground until they found a tree which bore the sweetest ones [Gifford 1932:205, 20日].

Some groups went on lang expeditions to harvest the nuts, e.g. the Apache [Buskirk 1949:307-311], Papago [Castetter and Underhill 1935:13] and southeastern Yavapai [Gifford 1932:208]. Harvest methods cansisted of gathering the nuts from the ground or knocking them out of the trees〔Buskirk 1949:307-311; Gifford 1936:257]. Sometimes people would pound the trunk of a tall tree with a stone to knock the acorns loose [Gifford 1932:208]. Dnce harvested, the nuts might be prepared in several different ways which included grinding, boiling, roasting, and drying.

Storage practices were quite varied. The Apache in

Arizona stored acarns both hulled and unhulled [Buskirk 1949:307-311]. Mohave of the Lower Colorado River stored them in baskets under ramadas CCastetter and Bell 1951:1日7, 197]. Northeastern Yavapai of Arizona stored hulled nutmeats in conical burden baskets set into the ground and covered with stones and grass [Gifford 1936:257]; southeastern Yavapai stared hulled acorns in pattery vessels [Gifford 1932:205]. In California the Kawaiisu stored the unshelled nuts in elevated granaries or stone-lined pits or caves [Zigmund 1981:56-57]. The Mescalera and Chiricahua Apache pounded up slightly raasted acarns and mixed the meal with dried meat or fat and stored this mixture in hide containers [Castetter and Dpler 1936:42].

Althaugh the nuts have been the part mast sought after as a food, people have also eaten oak gall pith, leaves, and bark. The Tarahumara of Chihuahua ate the white pith inside silverleaf oak galls, discarding the bitter interiar; they alsa considered the young leaves of this species a famine food to be prepared by boiling twice and washing in flowing water [Pennington 1963:114-115, 124]. Poverty-stricken peaple on the Great Hungarian Plain ate the ground bark of oak instead of flour, leaching the bitterness out of it by pouring hot water over it several times [Gunda 1977:2]. Dther human needs served by oaks in historic times include use of the galls and trunk bark in dyeing cloth and

For medicine, preparation of medicine from the root bark, fashioning tools and household implements from the wood, twigs and branches, burning of the wood as hearth fuel, and use of the leaves as cigarette papers.

The archaeological record reveals prehistoric oak use [Table 57]. Most of the references to "acorns" in ancient sites may be to nutshells only, rather than complete fruits. Wooden implements recovered include digging sticks, awls, fire drills, fire tangs, scrapers, twig knots and cails, a snowshae, and baws [Nickens 1981:77] as well as atlatl parts and a scoop [Cutler 1952:47日].

SIGNIFICANCE FDR HUMANS
Oaks can obviously satisfy a whole range of human requirements. At Ramsey Canyon acorns could be harvested in sequential order from August through December. All have been listed as providing a food to historic groups. Young leaves could be gathered and prepared as a famine food in April and May, and for the following four months from netleaf oak only. Other famine food parts, i.e. the bark and galls, are present year round. These parts, along with the root bark, could also be collected at any time for use in dying cloth and in medicinal preparations. Twigs, branches and wood are always present to satisfy wooden tool and hearth fuel nesds. Likewise, leaves made inta cigarette wrappers could be had at any time.


Table 57 icont.J Prehistoric references to Quercus remains.

| PART | USE | GROUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Acorns [?] |  | Ual Verde Co., Texas, rackshelter [Basketmaker] |  | Pearce and Jacksan 1933: 130131 |
| Cotyledon Fragments | Food | Point of Pines, Arizana [A.D. 1280-1300J | carbonized, from possible ancient trash | $\begin{aligned} & \text { Bahrer } \\ & 1973: 429 \end{aligned}$ |
| Leaves |  | Bat Cave, New Mexico | fram a number of locations | $\begin{gathered} \text { Smith 1950: } \\ 170-171 \end{gathered}$ |
| Nutshells | Eaod | Tularasa Cave, New Mexica | not an important food | $\begin{aligned} & \text { Kaplan } \\ & \text { 1963: } 354 \end{aligned}$ |
| Woad |  | Bat Cave, New Mexico |  | $\begin{aligned} & \text { Smith } 1950: \\ & 170-171 \end{aligned}$ |
| Wood and twigs | ```implements, house canstruc- tion, basketry material``` | Johnsan Canyon, Calarado [Pueblo III] |  | $\begin{aligned} & \text { Nickens } \\ & \text { 1981:77 } \end{aligned}$ |
| Wood | artifacts | Tularasa and Cardava Caves, New Mexico | - | Grange 1952: 373-394; Cutler 1952:47日 |

PREDICTIONS FOR THE ARCHAEDLGGICAL RECORD
The rare references to roasting of the acorns by
histaric groups hints at why the archaeological record may retain little evidence of oak use. Preparation techniques that emphasize hulling the nutmeats and then grinding and/or boiling them wauld preclude the recognition of the parts centuries later. The fact that the majority of the archaealogical records of acorns come fram caves, rack ar bluff shelters supports this notion; only where conditions of preservation are superb does the evidence of acorns as a Food seem to be retained.

Wood brought in for hearth Fuel has a very high chance of preserving, as do wooden implements or utensils in wellprotected locations. If ank galls, bark or roat bark happen to be alsa faund in protected places, ane wald need extensive comparative collections of modern species to identify them. Young bailed leaves or oider leaves used in smaking likely have low probability of surviving.


## MABITAT

Both species of Ranunculus monitored for this study grow in soil that is wet to completely saturated with water. They do well on a horizontal surface underlain by alluvial sediments, receiving partial to full exposure to the sun's rays.

## PHENDLDGY

These twa herbaceaus perennial buttercups develop basal leaves in January, displaying the basal rasette form for four months. In May their phenological profiles diverge. The diminutive R. hudrochargides flowers in May and June,
produces the first mature achenes in June, and ceases most outward signs of vegetative growth by August. For the three months of Octaber through December this spacies is nat sasily located. Bqnunculus maccanthus, on the other inand, is a much more visible and showy plant that flowers continuously from June through October, producing mature achenes from August until the plant resumes darmancy at the end of Dctober. Stem elongation and leaf expansion do not seem to slow for this species; it remains vegetatively active until dying back to ground level for November and December .

## ETHNDGRAPHIC/ARCHAEDLOGICAL RECDRDS

Sparse historical documentation for buttercup suggests the plants, achenes, and roots have been eaten. Groups in Utah and Nevada boiled entire buttercup plants to remove the acrid principle, and then consumed them [Yanovsky 1936: 25]. The achenes of $B_{\perp}$ eglifornicus were ground to a meal and used for baking in Califarnia [Yanovsky 1936]. The roots of $R$. ingmoenus were eaten by the Acoma and Laguna of New Mexico [Swank 1932:65], and people apparently had to be careful not to confuse this edible species with certain poisonous buttercup plants. At least one species of buttercup was eaten by Hungarian peasantry in Transylvania, as both a vegetable and a salad [Gunda 1977:11].

People also saught buttercups for medicinal/ceremonial needs. The Kayenta Navajo in Arizona used B. cumbalaria as
a "life medicine" [byman and Harris 1951:22]. The Ramah Navajo of New Mexcia made emetics from this species, and used R. ingmoenus to prepare a cold infusion that served as bath drink and lotion far protection from dangeraus animals CVastal 1952:27]. Chinesa collectad Ronuncylus sclergtus for a medicine [Altschul 1973:70].

No archaealogical record located.

## SIGNIFICANCE FOR HLMANS

It is not known if the two Canelo Hills buttercup species are poisonous to humans. However, if they can be eaten and made into medicinal decoctions, the plants could be gathered from January through Octaber, first as young leaves and then as mature individuals. Achenes could be collected in June From R. hydrochargides, and from August through Dctober fram $\mathbb{R}_{\perp}$ mgeranthus. Roots of both species would be available for food during all months except November and December, easily located via above ground parts.

## PREDICTIDNS FOR THE ARCHAEDLDGICAL RECDRD

Possibly buttercup achenes would become part of the ancient record if prepared in a manner that exposed them to charring. Plants eaten raw, boiled as a potherb, or made into a medicinal decoction would not be likely to survive. If roots were prepared for consumption by some method other than roasting, they would likewise probably not preserve in recognizable condition.


Rhomnus betulgefolig Greene. var. gboyota K. \& P. RC-5 [KA \#144-83] UA254E30


Rhamnus californica Esch. ssp. ursing [Greene] Walf.
CH-9 [KA \#151-日3] LAㄹ54E29

## HABITAT

Rhamnus betulaeEgliqu does well in dry sail less than Five meters from the stream at Ramsey Canyon. The location is heavily shaded by nearby tall trees. Rhamnus colifornico can be found grawing on a shallow slope composed of alluvial sediments at Canelo Hills. Fully-saturated sail in the area receives Erom 50-100\% of the sun's rays.

## PHENDLOGY

The vegetative regimes of these two species of bucktharn are not at all alike. California buck-thorn $\mathbb{C R}$ californicg] did not cease active stem elongation or leaf
growth during all months monitored; it was the only plant in this study that seemed to grow year round. On the other hand, birch-leaf buck-thorn [R. betulgefolig] lost all leaves in the fall after five months of growth, and then went dormant for a number of months.

In contrast to vegetative activity, the sequence of reproductive events of these two species are similar. Both appear to have flower buds by May, and are in Eull flower for anly the month of June. The fleshy drupes of birch-leaf buck-thorn are mature in August and September, while those of Califarnia buck-thorn are ripe in September and Dctaber. ETHNOGRAPMIC/ARCMAEOLOGICAL RECDRDS

Fruits of buck-thorn have been eaten by modern groups [Table 58]. Same, such as the Cahuilla [Bean and Saubel 1972:131] and Kawaiisu [Zigmund 1981:58] of California, acknowledged potential laxative effects. Bhamnus fruit have been found to contain purgative glycosides which can cause violent purgation and collapse, especially dangerous to children [Lewis and Lewis 1977:40, 284]. Apparently people in Eurape have been paisaned by eating the fruits of these plants (Bean and Saubel 1972:131).

Other parts of buck-thorn sought in historic times include the bark, ground up to treat constipation (Bean and Saubel 1972:131], and the roots used to stop the flow of blood, stop infections and counteract poisoning [Zigmund 1981:5日]. Leaves, buds and immature berries were also

Table 58. Ethnographic references to the use of Rhomnus.

| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Rhammus betulaefalia | Eruit, ground and used in ceremonies | Kayenta Navaja, Arizona | Wyman and Harris 1951: 31 |
| Rhammus califarnica | bark, ground to pousder as a cure for constipation | Cahuilla, California | Bean and Saubel $\text { 1972 : } 131$ |
|  | fruit, steeped and drunk as a tanic | Cahuilla, California | Bean and Saubel $1972 \text { : } 131$ |
|  | Fruit, aaten as a laxative | Cahuilla, California | 2igmund 1991:58 |
|  | Fruit, eaten fresh or bailed | Dwens Valley Paiute, Califarnia | Steward 1933:245 |
|  | leaves, buds and immature berries, as a medicine | Cahuilla, California | Zigmund 1981:58 |
|  | plant, 05 a medicine | Chumash, California | ```Timbroak 1984: 1G2``` |
|  | roots, as a medicine | Cahuilla, California | Zigmund 1981:58 |
| R. croced | Eruit, eaten | Uarious groups in North America | ```citad in Yanovsky 1936:42``` |
| Rhammus spp. | Fruit, eaten | Tepehuan, Chihuahua | Pennington 1969:136 |
|  | fruit and seeds, enten crushed | Kiliwn, Californio | Meigs 1939:9 |

crushed and rubbed into burns [Zigmund 1981].
A single archaeaiogical reference reveals that buckthorn wood was recovered from a deposit at Bat Cave, a site on the Plains of San Augustin in west central New Mexico [Smith 1950:179]. There is no clue as to the possible use DF this material, or whether it could have been inadvertently intraduced into ancient deposits.

SIGNIFICANEE FDR HUMANS
It seems prudent to speculate that buck-thorn fruit at both Ramsey Canyon and Canela Hills would have served as a medicine, rather than a food, given the information in the ethnographic literature. Fruit could also be gathered for ceremonial needs. Basically the months of August through Octaber would provide this resource. Bark and roots sought for medicinal preparations could be acquired at any time during the year. Leaves of California buck-thorn could be picked year round for medicine, but those of birch-leaf buck-thorn are only present April through November.

PREDICTIONS FDR THE ARCHAEDLOGICAL RECDRD
No methods that would routinely expose buck-tharn fruit to fire were mentioned in the ethnographic literature. If these habits prevailed in prehistory, chances of seeds preservation are low. Likelihood of highly perhishable parts such as buds, immature berries, bark or leaves surviving is also low. It is not thought that much in the way of Rhamnus evidence wauld remain to signal ancient use.


## HABITAT

Rhus trilgbata occurs in dry sail ot both Canelo Hills and Ramsey Canyon. At Canelo Hills it daes well on a westfacing steep slope in partial shade. At Ramsey Canyon it grows in a boulder field adjacent to the stream, again in an understory situation of filtered light.

## PHENDLDGY

Skunk-bush or squaw-bush is one of the few plants for which phenalogical observations were made in both locations. The sequence of life-cycle events is not synchronous, with the Ramsey Canyon plants appearing to follow those at Canelo
by about one month. Also of interest, the period of plant activity is up to two months longer at Canelo Hills, encompassing both May and November; at Ramsey Canyon skunkbush appears outwardly inactive during these two months. Dormancy seems braken in Canela Hills in May, follawed by a month of active vegetative growth and flower bud development. By July the plants are in full flower, with immature fruits present. Flowers have withered by August and fruits are mature and still clinging to the plants during the months of Dctober-January. Leaves seem fullgrown and stem elongation ceases by Dctaber. This same sequence is basically repeated at Ramsey Canyan, althaugh the events all occur within the five months of June to Dctaber, at which time dormancy is apparent.

## EIHNOGRAPHIC/ARCHAEDLOGICAL RECORDS

Both the ethnagraphic and archaealogical records on Rhus trilgobata use are extensive. Because of this, the available data has been summarized in Iables 59 and 60. All parts of skunk-bush seem to have been utilized in historic times, including berries, bark, leaves, twigs, roats, buds, pollen and wood. Primary emphasis seems to have been on the value of the berries as a food, either eaten raw or dried for later use, and as a beverage flavaring. Berries also served as a mordant for dyeing, a body paint and a medicine. Dil bailed from them provided a hair tonic. Seeds and fruit recovered in the archaealogical record suggest a lang

| PART | USE | GRDUP［S］ | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| Bark | Ceremonial | Camanche， Oklahoma | Used in sweat lodge | Carlson and Jones 1940： 527－53日 |
|  | Food | Navaja | Eaten with salt or ground up | Bailey 1940： 2日日 |
|  | Food | Ramah Navajo | Inner bark eaten | $\begin{aligned} & \text { Uestal 1952: } \\ & 35-36 \end{aligned}$ |
|  | Medicinal［Ear sore mouth］ | Spanish along Rin Grande | Ground into a pawder | Curtin 1965： $113$ |
|  | Medicinal | Acama and Laguna | Ted as a douche after childbirth | $\begin{aligned} & \text { Swank 1932: } \\ & 66 \end{aligned}$ |
|  | Medicinal | Jemez | Chewed far sore gums | $\begin{aligned} & \text { Cook 1930: } \\ & \text { 27 } \end{aligned}$ |
|  | Medicinal | Comanche， Oklahoma | Chewed For cold remedy | ```Carlsan and Jones 1940: 527-538``` |
| ＂Berries＂ | Beverage | Cahuilla | Harvested May－ July | Bean and Saubel 1972： 132；Barraws 1900 |
|  | Beverage | Kiowa，Oklahoma | Boiled as a tea | Uestal and Schultes 1939：39－40 |




| PARI | USE | GRDUP[S] | NOTES | REFERENCE |
| :---: | :---: | :---: | :---: | :---: |
| "Berries" | Food | NE Yavapai | Picked red fruit in Jume | $\begin{aligned} & \text { Giffard } \\ & \text { 1936:257 } \end{aligned}$ |
|  | Food | Gosiute | Ate fruit | $\begin{gathered} \text { Chamberlin } \\ \text { 1911: } 379 \end{gathered}$ |
|  | Food | Luisenos | Graund into a meal | $\begin{aligned} & \text { Sparkman } \\ & 1908 \end{aligned}$ |
|  | Food | Cahuilla | Ate Fresh or dried | $\begin{aligned} & \text { Barrows } \\ & 1900: 16,42 \end{aligned}$ |
|  | Hair tonic | Ramah Navajo | Obtained by boiling | $\begin{aligned} & \text { Vestal 1952: } \\ & 35-36 \end{aligned}$ |
|  | Medicine | Kiowa, Oklahoma | Whale berries as a cure for stomach trouble | Vestal and Schultes 1939: 39-40 |
|  | Medicine | Acoma and Laguna | As a mauth wash | Swank 1932: 66 |
|  | Mardant in dyeing | Hopi | Far wal | Whiting 1966: 84 |
| Branches | Hae handles | Jemez |  | $\begin{aligned} & \text { Cork 1930: } \\ & 27 \end{aligned}$ |
| Buds | Medicimal | Hopi | Alsa as perFume | Whiting 1966: 84 ; Haugh 1898: 143-150 |



| Table 59 [cont.] Ethnographic references to the use of Rhus trilobotg. |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PART | USE | GRDUP[S] | NOTES | REFERENCE |
| Stams | Basket-making | Southwest U.S. | Baskets used For caaking | ```Palmer 1日7B: 597-598``` |
|  | Basket-moking | Navajo |  | Matthews 18B6:771 |
|  | Basket-making | Kayenta Navaja |  | Wyman and Marris 1951: 31 |
|  | Basket-making | Ramah Navajo |  | $\begin{aligned} & \text { Uestal 1952: } \\ & 35-36 \end{aligned}$ |
|  | Basket-making | Acama and Laguna |  | Swank 1932: 66 |
|  | Basket-making | Jemez |  | $\begin{aligned} & \text { Cook 1930: } \\ & \text { 27 } \end{aligned}$ |
|  | Basket-making | Zuni | Used with and without bark | Stevensan 1915: 81 |
|  | Basket-making | Hapi |  | Whiting 1965: 84 |
|  | Basket-making | White Mt. Apache |  | $\begin{aligned} & \text { Reagan 1929: } \\ & 150,150 \end{aligned}$ |
|  | Basket-making | Western Apache | ```Collected in Fall; ton "sappy" in spring``` | Gallagher 1977: ᄅ2, 59, 103 |



| Table 59 [cont.]PART USE |  | references to the use of Rhus trilobata. |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | GRQUP[S] | notes | REFERENCE |
| Stems | Cradles | Hopi |  | Whiting 1966: 84 |
|  | Water bottles, spear shafts, sun shades | Ramah Navajo |  | $\begin{aligned} & \text { Uestal 1952: } \\ & 35-35 \end{aligned}$ |
|  | Water jugs | White Mt. Apache |  | $\begin{aligned} & \text { Reagan 1929: } \\ & 150,160 \end{aligned}$ |
| Unknown part | Medicinal | Kayenta Navajo | Lotion for poisan ivy and dermatitis | Wyman and Harris 1951: 31 |
| Wood | Ceremonial | Hapi | Kiva fuel and prayer sticks | Whiting 1966: 84 |


histary of berry use in the southwestern United States. At Salmon Ruin in northwestern New Mexico Bohrer [19日2] suggested possible storage of this food resaurce.

The pliable stems of this plant have apparently served numeraus graups as basketry material. Dccasianally the Finished containers were water-proafed with pinyon pitch. Other items Fashianed Eram slender withes included baws, cradles, water battles, spear shafts, and sun shades. The larger branches made hoe handles. The prehistoric record contains references to various objects fashioned of Rhus trilgbatg twigs, including coiled basketry, roofing material, an axe handle and a number of split-twig Figurines.

Dther parts af the skunk-bush plant filled additional needs in historic times. Far example, the Hapi collected buds far medicinal and perfume use and the Navaja gathered pallen for a ceremonial need. Roats were prepared as both a medicine and a hair rinse. The Hapi made prayer sticks and used the wood as a kiva fuel. Bark served a number of Eunctions. When ground to a powder it provided a mouth rinse. Navaja graups ate the inner bark. Others chewed the bark for sore gums or as a cold remedy. Ceremonially it was emplayed in the sweat lodge. A tea made Erom bark served as a dauche after childbirth. Leaves were mixed witiר tobacco and smaked, used in preparation $0 f$ a black dye, and considered a medicine.

## SIGNIFICANCE FOR MUMANS

Humans have abviously discovered a very broad patential For the Rhus trilobato plant. At Ramsey Canyon and Canela Hills the mature fruit appears to cling to the plant for at least a two-month period in the fall, ripening as early as September and sametimes remaining on the plants until January of the fallowing year. This rather long period of availability would provide continued opportunities for harvest. Fresh fruits might be consumed as is, or crushed and mixed with water for a tart beverage. Thoroughly dried fruits could be stored indefinitely, Either whale or ground. The seasan of harvest would vary by geographic location, as apparently the Cahuilla of southern California sought the berries in May-July, the northeastern Yavapai in Arizona found them in June, and the Jemez of New Mexico ate them "in the spring".

The nation that Rhus teilabata might provide material to construct baskets or other needed items seems contradictory when one looks at the mature plant. Stiff, breakable, short twigs abound in a camplex branching habit. However, Bohrer [1983] has pointed out that it is possible to acquire long flexible wands by burning or cutting back the plant in the fall to encourage springtime "sucker" growth. Apparently one of the split-twig figurines recavered Fram the Grand Canyon was Eashioned from a skunk-
bush wand over six feet long; this figure still had petiole and leaf evidence which pravided a secure identification. Some of these items date to the Archaic period [3500 B.P.]. The months of May-July may have provided the supple wands in southeastern Arizona settings. However, the Western Apache in Arizana seem to have alsa gathered twigs in the fall, considering those available in the spring too "sappy".

Buds and pallen would have a season of availability from June through August. Leaves could be gathered during most of the time of active plant growth and reproduction. Wood, roots, branches and bark would presumably be accessible year-round, as aven though the plant goes dormant, above-ground parts remain as an indicatar af presence.

## PREDICTIONS FDR THE ARCMAEDLOGICAL RECDRD

The archaealogical record is likely to reveal evidence of whole skunk-bush berry use, although perhaps not extensively due to the habits of people to eat the fruit raw or grind it with other foodstuffs. Preserved human fecal material could easily retain the seeds. Fruit prepared as a beverage would be unlikely to preserve. Since historic groups employed no preparation technique that exposed whole fruit to fire, cooking accidents would not yield evidence of skunk-bush.

Baskets and other items fashioned of skunk-bush twigs would provide a record of this plant if the items were
burned or retained in a well-protected location. Items water-proofed with pinyon pitch might last longer due to a preserving coating. Woad burned in a firepit or a branch made into a digging implement could be identified on the basis of anatomy.

Parts less likely to be preserved and identified include the very perishable buds, and raots and bark whose anatomies might overlap many other plant species in appearance. Possibly the pollen could be recovered. The typical three-lobed leaves would be easily identified, provided they had not been ground up ar boiled, as most historic references suggest.

Ribes gureum Pursh. CH-2 [KA \#96-83] UA254607; [KA \#275-84] UA254606


MABITAT
Ribes qureum thrives throughout the area of Canela Hills Cienega. The species was monitored within 10 meters of both the cienega and the permanent stream, in wet sail composed mainly of alluvial sediments. The area receives less than $50 \%$ exposure to sunlight in summer months, more in the winter dormant seasan.

## PHENOLOGY

Golden currant was among the very first species to produce young new leaf growth, naticed initially in January. For twa months the leaves of these shrubs continued to be practically the only green growth obvious in the cienega area. Full flowering began in March, and immature green berries formed shortly thereafter. This fruit matured by July and remained clinging to the branches through October. Dctaber was also the month in which active stem growth was no longer apparent; leaf expansion had slowed considerably in June, same months earlier. The period of full dormancy
for golden currant spanned only the months of November and December.

## EIHNOGRAPHIC/ARCHAEDLOGICAL RECDRDS

It is clear that the most important resource offered by various currant or gooseberry species, including $\mathbb{R}_{\perp}$ qureum, has been the fruit as food [Table 51]. The berries were picked and eaten fresh, or dried for winter use. Sometimes they were ground up and made into small cakes. More than one group found them "to have a very pleasant taste" [Jones 1931:42], be "highly relished" [Stevenson 1915:70] or "much gathered" for food [Hough 1898:143]. When the bushes bore abundantly the fruit was "dried in quantity" [Chamberlin 1911:379]. Apparently one could overindulge in Ribes fruit, for the Hapi felt eating too many would make them sick [Nequatewa 1943:18; Whiting 1966:78].

In addition to the ripe fruit, other parts such as leaves, stems, wood and possibly the entire plant offered resources to humans. The Zuni ate the fresh leaves of $R$. inebrions in the spring, because they were some of the first leaves to be available [Stevenson 1915:70]. In fact, their name for the plant meant "first to leaf out" CCushing 1974: 2423. As an indicator of season, the Ramah Navajo timed the plowing of fields to when this same species began to green up, and the planting of maize to when it leafed out [Uestal 1952:301.

Currant stems and wood were fashioned into various

| SPECIES | PART AND USE | GRQUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. aureum | fruit, eaten | Pacific Northeast. groups | French 1965 |
|  | fruit, eaten | NE Yavapai, Arizona | Gifford 1936:258 |
|  | fruit, eaten | Kaibab Paiute, Utah and Arizona | Kelly 1964:43 |
|  | fruit, eaten | Qwens Ualley Paiute, Califarnia | Steward 1933:245 |
|  | Fruit, eaten Fresh or dried in quantity for winter | Gosiute, Nevada and Utah | Chamberlin 1911: 379 |
| R. cereum | Fruit, eaten | Hopi, Arizona | Hough 1998: 143 |
|  | fruit, eaten | Acama and Laguna, New Mexico | Swank 1932:66 |
| R. inebrians | fruit, eaten fresh | Navajo | Bailey 1940:288; Elmore 1944:52 |
|  | Fruit, eaten | $\begin{aligned} & \text { Ramah Navaja, } \\ & \text { New Mexica } \end{aligned}$ | Uestal 1952:30 |
|  | Eruit, eaten | Tewa of New Mexica | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:48 } \end{aligned}$ |
|  | Eruit, eaten | Zuni, New Mexico | Stevenson 1915:70 |

Table 61 [cont.] Ethmographic references to the use of Ribes.

SPECIES
R. ingbrians

Eruit, eaten

Eruit, eaten

Fruit, cooked or graund with carn meal

Fruit, eaten Eresh or coaked
leaves, eaten Fresh with uncooked mutton ar deer Eat
stems, made into arrawshafts
unknawn part[s], as a medicine and ceremanial emetic
wood, made into spinning tools
wood, used in arraw making

GROUP[S]
Isleta, Neu Mexica

Cachiti,
New Mexica
Hopi, Arizona

Kayenta Navaja, Arizona

White Mt. Apache, Arizana

Zuni, New Mexico

Ramah Navaja,
New Mexica

Kayenta Navajo, Arizana

Navaja

Hopi, Arizona

REFERENCE
Jones 1931:42

Lange 1968:150

Whiting 1966:78; Nequatewa 1943:18

Wyman and Harris 1951:26

Reagan 19로: 160

Stevenson 1915:70

Vestal 1952:30

Wyman and Harris 1951: 26

Elmore 1944:52

Whiting 1966:78

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. inebrians | wood, made inta bows | Tewn of New Mexicor | $\begin{aligned} & \text { Rabbins et al. } \\ & \text { 1915:48 } \end{aligned}$ |
|  | wood, made into bows and other articles | Cochiti, New Mexico | Lange 1968: 150 |
| R. inerme | fruit, eaten | Mescalera Apache and many Ria Grande Ualley groups, New Mexica | Castetter 1935:49 |
|  | Eruit, eaten | Navajo in Chaco Canyan region of New Mexica | Hocking 1956: 155 |
| R. leptanthum | fruit, eaten fresh or made inta cakes far winter use | Mescalera and Chiricahua Apache | $\begin{aligned} & \text { Castetter and Dpler } \\ & \text { 1936:44 } \end{aligned}$ |
| R. montigenum | fruit, eaten | Acama and Laguna, New Mexica | Swank 1932:66 |
| R. odaratum | fruits, eaten fresh or made into jelly | Kiowa, Oklahoma | Vestal and Schultes 1939:29 |
|  | plants, used in treating snakebite | Kiown, aklahoma | Uestal and Schultes 1939: 29 |
| R. pinetorum | Fruit, cooked and eaten | Picuris, New Mexico | Krenetsky 1964: 48 |


| SPECIES | PART AND USE | GRDUP(S) | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. pinetorum | Eruit, graund and compressed into cakes For winter use | Mescalera and Chiricahua Apache | $\begin{aligned} & \text { Castetter and Dpler } \\ & \text { 1936: } 44 \end{aligned}$ |
|  | unknown part, used as an emetic | Navajo | Wyman and Marris 1941:58 |
| Ribes spp. | fruit, eaten Eresh or dried and stored; stored Eruit was saaked in water ar boiled | Kamaiisu, California | ```61\mp@code{Zigmund 1981:60-}``` |
| - | root, used to cure toothache | Luisena, California | Sparkman 1908: 232 |

artifacts, perhaps because it was cansidered "very hard" 479 some [Elmore 1944:52]. Arrowshafts were made from stems and wood, and spinning tools, bows and other articles from the wood. Some part[s] of currant plants were gathered and used as a medicine, ceremonial emetic and in treating snakebites.

A single charred seed of Ribes from a Dolores River valley site in southwestern Colorado dating to A.D. B50-900 hints that the resource may have been utilized in prehistory [Benz 1984:205]. Ribes wood, perhaps that of golden currant, was listed as coming from a number of strata at Bat Cave in southcentral New Mexico [Smith 1950:172].

## SIGNIFICANCE FDR HUMANS

At Canelo Hills, some of the first leaves to emerge in the spring are those of golden currant in January and February. When young they could possibly be eaten, as the Zuni did in historic times. The ripe berries would provide another dependable resource, possibly clinging to branches for the four manths of July through Dctober. Wood and stems for various tools could presumably be collected throughout the year. Part[s] gathered Ear medicinal needs and ceremonial emetics cannot be clearly given a period of availability, since it j.s nat known precisely what they are. PREDICTIDNS FOR THE ARCHAEDLOGICAL RECDRD

Since so many of the histaric references are to consumption of the fresh, cooked or ground Ribes fruit, it is not considered likely that many wauld survive in the
archaealogical recard unless accidentally burned. Tender young leaves picked in the early part of the year may be too delicate to preserve. Perhaps only the wood might be retained to signal ancient use of this species, if the canditions of preservation were excellent.

Robinig neomexicgng Gray
RC-2 [KA \#70-B3] UA254880


## HABITAT

One can find Robinia neqmexicang growing in dry soil in partially shaded areas along the stream at Ramsey Canyon. The species does well in overbank sediments or in a mixture of colluvium and granite bedrock.

## PHENDLDGY

The medium-sized New Mexican locust tree emerges from dormancy in April, when both stem elongation and leaf growth become obvious. Full-flowering begins immediately thereafter in May. By June, not only flowering, but the first ripe pods, are seen. Ripe fruit can be found throughout the four manth period of June through September. Vegetative grouth slows considerably in October, when only fully mature leaves are noticeable on branches. By December these leaves have dehisced from the trees, and a four manth dormancy period resumes.

## EIHNDGRAPHIC/ARCHAEDLDGICAL RECDRDS

The bark, roots and seeds of New Mexican locust are
reported to be poisonous (Kearney and Peebles 1960:442]. Likewise, R_ pseudo=acacig apparently contains poisonous substances in the inner bark, yaung leaves and seeds, causing human paisaning, especially of children [Lewis and Lewis 1977:45]. Thus it is interesting to view the range of historic references to use of these two species [Table 62]. Young pods of both species appear to have been cooked and eaten, and seeds of $R \mathcal{A}$ gseudg=acgeig were nated as consumed. A number of authors note that the bright pink clusters of New Mexican locust flowers provide sweet "vegetables" in the spring. The inedible branches have been fashioned into bows and arrow shafts.

The prehistoric record revealed a single reference to acquisition of Robinig. Wood identified as this genus was listed by Wetterstrom [1976:121] as one of the types sought as firewoad at Arrayo Hando Puebla, an A.D. 1300-1450 adabe structure in the Santa Fe area of New Mexico.

## SIGNIFICANCE FOR hUMANS

Flower clusters of New Mexican locust could be gathered and eaten raw or cooked in May and June. Yaung pods are available in both June and July; mature seeds cauld be callected from pads June through September. Branches far fashioning bows or arrow shafts are present year-round, though they may have been preferred in a specific seasan. PREDICTIONS FOR THE ARCHAEOLOGICAL RECDRD

Due to their perishable nature, New Mexican locust

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. neomexicana | branches, for bows | Jemez, New Mexico | Cook 1930:27 |
|  | branches, for bows | Tewa, New Mexica | $\begin{aligned} & \text { Robbins et al. } \\ & \text { 1916:48 } \end{aligned}$ |
|  | branches, for arraw shafts | Acoma and Laguna, New Mexico | Swank 1932:67 |
|  | Flowers, eaten without preparation | Jemez, New Mexico | Coak 1930:27 |
|  | flowers, eaten after bailing | Kaibab Paiute, Utah and Arizana | Kelly 1964:46 |
|  | flowers, eaten after boiling; sometimes stared | Mescalera and Chiricahua Apache | Castetter and Opler 1936:42 |
|  | pods, eaten raw or cooked; sametimes stored | Mescalero and Chiricahua Apache | $\begin{aligned} & \text { Castetter and Opler } \\ & \text { 1936:42 } \end{aligned}$ |
| Robinia <br> pseuda-acacia | pods [young], as food | Appalachin Area, Enstern U.S. | Care 1967 |
|  | ```seeds, cooked with meat``` | Appalachin Area, Enstern U.S. | Core 1967 |

flower clusters and young pods do not have high likelihood of surviving in the ancient record. Seeds [beans], on the other hand, might preserve if in a protected location or if they became charred through some means. The historic practice of "cooking" the beans, if olso a prehistoric preparation technique, would reduce chances of recovering this genus in prehistoric deposits.


## HABITAI

Rudbeckia laciniata can be found grawing in dry or moist sail under the canopy of vegetation along the stream at Ramsey Canyon. It does well in a substrate of colluvium and granite boulders. Exposure to the sun is fairly low, ranging up to $50 \%$.

## PHENDLDGY

The phenology of cut-leaf coneflower at Ramsey Canyon is not completely known because floods in both the summers of 1983 and 1984 devastated the population under observation. It is not certain exactly what the normal sequence of phenological events for October and November would be for this species.

This perennial remains dormant until April, when it is first seen rapidly elongating and with much new leaf expansian. Flowering begins in June, and continues in Eull farce thraugh August. Immature achanes Earmed in Juna and July appear ripe in August. What happens after this is
unclear; after July floods in 1983 the plant was observed in recovering vegetative condition in September, however this is probably not the narmal course of events. It is known that the plant is dormant from December through March.

## EIHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Uses listed for this large perennial plant are limited. Cut-leaf coneflower is reported to be poisonous to cattle, sheep and swine CKearney and Peebles 1960:898; Lewis and Lewis 1977:58]. The ethnagraphic literature hints, however, that the plant may not be poisomaus to humans. SpanishAmericans living along the upper Rio Grande river in Naw Mexico used this species as a remedy for gonorrhea in historic times. They boiled the dry green leaves in water, and drank a cup of the resulting tea every morning CCurtin 1965:74-75]. Castetter [1935:50] mentions that the young stems of this plant have been used at San Felipe puebla in New Mexico in the same way as celery, having been considered Ĺelicious.

No archaealogical record found.

## SIGNIFICANCE FOR RUMANS

If people are actually able to eat cut-leaf coneflower, the young shoots could be harvested in April and May, and again later in the seasan if for some reason the plant had been damaged and was in the process of recovering. Leaves are available for tea preparation at least from April through September, and likely beyand.

## PREDICIIONS FOR THE ARCKAEQLOGICAL RECORD

Young shoats eaten as a celery, and leaves brewed inta a tea are not parts that are normally preserved in the ancient record. It is unlikely that prehistoric use of these parts wauld survive to reveal choice of this species by humans.


Rumex videlascens does very well in wet to fully saturated sail along the streamside at Canelo Hills. The species graws on a flat surface underlain by alluvium, and exposure to sunlight varies, depending on closeness of taller shrubs and trees.

## PHENDLDGY

This apparently annual dock CKearney and Peebles 1960: 2443 is present for eleven months at Canelo Hills, absent only during tine manth of Octaber. Presumably a seed germinates in November, and the plant remains in vegetative state with only leaves present through the fallowing winter and spring. Rapidly the plant sends up a flowering stalk on a stem in June. Mature fruit are available in August and September, and by October the plant has turned brawn and dispersed the winged reproductive units.

ETHNOGRAPHIC/ARCMAEOLOGICAL RECDRDS
A number of dock species, including $\mathbb{R}_{2}$ yiglascens, are
noted in the ethnographic literature as having a variety of uses in historic times [Table 63]. The most Erequently sought part seems to have been the roats. They were gathered to be eaten, boiled as a medicine, dried and powdered as a remedy for sores, used to tan buckskins, prepared as a body and cloth dye, made inta a dandruff shampaa, and burned as tinder or fuel for a hot fire. Leaves of many species have been aaten raw, bailed ar fried as greens, or made into a medicine. Young stems provided a boiled, baked or raasted rhubarb substitute. That these vegetative parts [raats, leaves, stems] affered a foad is interesting in light of some of their chemical components. Dack plants contain soluble axalates, accarding to Lewis and Lewis [1977:34], and R. humenosepalus has a high tannin content [Kearney and Peebles 1960:245]. Peaple perhaps rendered these chemical harmless by different preparation methods.

Two reproductive parts were alsa callected. Uarious groups cansidered the seeds edible; generally they wauld be parched or roasted, ground, and cooked into a mush. Even the pollen was gathered for use in ceremanies.

A single reference to a prehistoric occurrence of dack was found in the literature searched. The seeds of Rumex cF. 山tghensis were reported in two coprolite specimens dating to $\quad$ A.D. 740 occupation $0 f$ Lavelack Cave in westcentral Nevada [Heizer and Naptan 1969:567].

Table 63. Ethnographic references to the use of Rumex.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. altissimus | leaves as greans, boiled or Fried | Iepehuan, Chihuahua | ```Pennington 1969: 13日``` |
| R. crispus* | leqves, as a food and medicine | Dmaha and Teton Dakata, Missauri River Region | Gilmore 1977:25 |
|  | leaves, eaten as greens | Isleta, New Mexico | Jones 1931:42 |
|  | leaves and plant as a medicine | Ramah Navaja, <br> New Mexico | Uestal 1952:24 |
|  | ronts, as a medicine boiled or dried | NE Yavapai, Arizona | Gifford 1936: 258 |
|  | roots, peeled and eaten raw or bailed as a medicine | Owens Valley Paiute, Califarnia | Steward 1933: 317 |
|  | ```roots, dried, pounded, and made inta a medicinal decoction``` | Western Shoshome, Nevada and Idaha | Smith 1972:82 |
|  | roots, powdered and applied as a medicine | Zuni, New Mexico | Camazine and Bye 1980: 378. |

*Rumex cringㄹus is a native of Eurasia [Kearney and Peebles 1960:245].


| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Rumex hymenosepalus | raots, chapped and bailed as a medicinal taa; or dried and powdered as a medicine | Western Apache, Arizona | Gallagher 1977: 95, 110 |
|  | roots, pounded and swallowed dry as a medicine | Papaga, Arizona | Castetter and Underhill 1935:14 |
|  | roots, chewed 05 a medicine; alsa dried | Pima, Arizona | Curtin 1984:51-52 |
|  | roots, as a sonp and powdered medicine | Pima, Arizona | ```Russell 1975:76, 80``` |
|  | roots, as a dye and medicine | Hopi, Arizona | Whiting 1966:73 |
|  | roots, to tan buckskins and in dyeing brown or mahogany | Groups in Utah | Palmar 187日:653 |
|  | roats, as a dye or medicine | Ramah Navajo | Uestal 1952:24 |
|  | roats, as a dye both Fresh and dried | Navajo | Elmore 1944:43 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Rumex hymenosepalus | roots, to tan buckskins, as a body dye and Euel for a hot Eire | S. Paiute, Utah | Bye 1972:95 |
|  | roots, boiled to dye deerskin, ar as a dandruFf remedy | Western Apache, Arizona | ```Gallagher 1977: 95, 110``` |
|  | roots, soaked to tan hides, willow withes and yarn | Pima, Arizona | Curtin 1984:51-52 Russell 1975:76, BO |
|  | seeds, roasted and ground far faod | Pima, Arizoma | Curtin 1984:51-52 |
|  | stems, eaten as rhubarb | Graups in Utah | Folmer 187日: 653 |
|  | stems, eaten as rhubarb | Pima, Arizona | Curtin 1984:51-5id |
|  | stems, eaten as rhubarb after baking | Navajo | Elmore 1944:43 |
|  | stems, eaten ofter ruasting | Pima, Arizona | ```Russel1 1975:75, BO``` |
| R. mexicanus | leaves, as a medicinal tea | White Mt. Apache, Arizona | Reagan 1929:160 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| R. mexicanus | plant, as a <br> "Halyway" emetic | Ramah Navajo, New Mexica | Vestal 1952: 24 |
|  | ```roots, boiled as a medicine, or powdered For purification rites``` | Zuni, New Mexico | Stevenson 1915: 59, 85, 98 |
|  | roats, crushed and dried Ear tinder; burned For a medicinal paste | Acoma and Laguna, New Mexica | Swank 1932:76 |
|  | roots, used as a "Life Medicine" | Ramah Navajo, <br> New Mexica | Vestal 1952: 24 |
| Rumex occidentalis | leaves, as food | Mescalera and Chiricahua Apache | ```Castetter and Opler 1936:46``` |
| ```Rumex salicifalius``` | roots, crushed as a medicine | Kawaiisu, California | 2igmund 1991:60 |
| R. vialacens | entire plant, including roots; as various medicines | Seri, Sonora | Felger and Moser 1974: 427-428 |
| Rumex spp. | leaves, as a medicine | Enst African graups | ```kokwaro 1976: 179-180``` |
|  | leaves, eaten raw and coaked | Transylvania, Hungary | Eiunda 1977:11 |


| SPECIES | PART AND USE | GROUP [5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Rumex spp. | leaves, eaten as greens when young | Cochiti, New Mexico | Lange 1968:151 |
|  | roots, as a medicinal decaction | East African groups | Kokwara 1976: $179-180$ |
|  | roats, as a medicinal decaction | Luiseno, California | Sparkman 1908:233 |
|  | roats, used to tan hides | Cochiti, New Mexico | Lange 1968: 151 |
|  | sap fram stems and leaves, as a medicine | East African groups | ```Kakwaro 1976: 179-180``` |
|  | seeds, is food parched, ground and cooked to mush | Kawaiisu, California | Zigmund 1981:60 |
|  | stems, eaten when young as rhubarb | Cachiti, Neus Mexico | Lange 1968:151 |
|  | stems, boiled or raasted For Foad when green | Kawaiisu, California | Zigmund 1981:60 |

## SIGNIFICANCE FOR HUMANS

At Canelo Hills dack roots could be dug up For most of the year, except perhaps for the first few months after germination. This would mean they were generally available Fram January through September for such diverse needs as food, medicine, dye and tanning agents, dandruff shampoo, and tinder or fuel. Young leaves can be harvested for food or medicine from November through the following August. Stems sought for food would perhaps be the most tender in June, as the plant sends up a stalk that rapidly becomes reproductive. Pollen is available for ceremonies only during June, and seeds can be harvested and eaten later in August and September.

PREDICTIONS FDR THE ARCHAEDLDGICAL RECDRD
Preparation steps such as boiling, crushing, chapping, chewing, and powdering would lessen the chances that parts such as roots and leaves would be retained in the prehistoric record. Roasting of stalks or seeds, or burning of roots would increase chances that a few of these parts would become part of the record. Seeds might also preserve in coprolites that survive in protected locations.


## habItat

At Ramsey Canyon Salix gooddiagii grows in dry or wet soil on a steep colluvial slope overlying granite bedrock, within 2 meters of the stream. Salix losiolepis prefers
wet soil, growing in overbank sediments at Ramsey Canyan and in alluvium at Canela Hills. These two species of willow do well in fairly shaded locations at both study sites.

## PHENDLDGY

The phenalogical profiles of arroyo willow [Salix lasiglepiss at both Ramsey Canyon and Canelo Hills are essentially identical. Flower buds develop in January, flowering occurs in February, and fruit capsules are ripe in March. Active vegetative growth resumes in March and extends through August at Canela Hills and through September at Ramsey Canyon. All signs of stem Elongation and leaf expansion are absent until the fallowing March.

Goodding's willow [Salix gogaddingii] develops flower buds in January in Ramsey Canyon, but does not flower until April, fully two manths after the arrayo willow. Ripe capsules disperse cottony seeds in May. Stem elangation and leaf expansion occur March through September, and then the species ceases vegetative activity until the following March.

## ETHNDGRAPHIC/ARCHAEDLDGICAL RECDRDS

The record of willow use by historic groups [Table 64] is equally as extensive as is the record for cottonwod [Populys] already discussed. For example, the Chumash of California were known to have at least eight separate kinds of uses for arrayo willow that satisfied medicinal, ceremonial and material culture needs [Timbrook 1984:156].

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. exigua | bark, made into a medicinal tea | Zuni, New Mexico | Camazine and Bye 1980:378 |
|  | branches, in roof construction | Jemez, New Mexico | Cook 1930:270 |
|  | branches, for basketmaking and mats | Acoma and Laguna, New Mexico | $\begin{aligned} & \text { Swank 1932: } \\ & 67-68 \end{aligned}$ |
|  | branches, chewed as a Farm of toothbrush | Spanish-Americans, Rio Grande River, New Mexico | Curtin 1965:105 |
|  | leaves, chewed to harden gums | Spanish-Americans, Rio Grande River, New Mexica | Curtin 1965:105 |
|  | leaves, made into "tobacca" | Kayenta Navaja, Arizona | Wyman and Marris 1951: 1日 |
|  | leaves, used as an emetic | Ramah Navajo, New Mexica | Uestal 1952:22 |
|  | stems, made into ceremonial hoops | Ramah Navaja, New Mexica | Uestal 1952:22 |
| S. groddingii | bark of seedlings, eaten raus or coaked in hot ashes | Yuma, Lawer Calorado River | ```Castetter and Bell 1951:201-203``` |

Table 64 [cont.] Ethnographic reference to the use of Sglix.

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. gooddingii | ```bark, as binding in lashing construction timbers together``` | Pima, Arizana | $\begin{aligned} & \text { Curtin 1984: } \\ & 111-119 \end{aligned}$ |
|  | branches, used extensively in basketmaking | Tepehuan, Chihuahua | Penningtan 1969: 195 |
|  | branches, used in cailed basketry, for cradleboards, and as framework for houses | W. Apache, Arizona | Gallagher 1977: 103, 109, 112 |
|  | branches and mood, as bows', as warf in basketry, cradle boards | Cahuilla, California | Bean and Saubel $\text { 1972: } 135$ |
|  | cotkins, eaten | Pima, Arizana | Curtin 1984:108 |
|  | leaves and twig bark, steeped as a ten | Yuma, Lower Colorado River | $\begin{aligned} & \text { Castetter and Bell } \\ & \text { 1951:201-203 } \end{aligned}$ |
|  | shoats [young] as hinding in lashing construction timbers together | Pima, Arizana | $\begin{aligned} & \text { Curtin 1984: } \\ & 111-119 \end{aligned}$ |
|  | stems, in basketmaking | Pima, Arizana | Curtin 1984: 111-119 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. gooddingii | wood, as construction timbers, hunting bows and cradles | Pima, Arizona | $\begin{aligned} & \text { Curtin 1984: } \\ & \text { 111-119 } \end{aligned}$ |
| S. interior | poles, used in construction | Plains groups of the Missauri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 21-22 } \end{aligned}$ |
|  | stems, peeled for basketmaking | Plains groups of the Missouri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 21-22 } \end{aligned}$ |
|  | twigs, used in Euneral rites | Dmaha, Missauri River Region | $\begin{aligned} & \text { Gilmore 1977: } \\ & \text { 21-こ2 } \end{aligned}$ |
| S. irrorata | branches, as prayersticks | Acama and Laguna, New Mexica | Swank 1932: 67-68 |
|  | branches, tied together as stirring rods; made into baskets | Zuni, New Mexico | Stevenson 1915:81 |
| 5. lasiandra | wood, used in hogan and hobby horse construction | Ramah Navajo, <br> New Mexica | Vestal 1952:22 |
| S. lasiolepis | branches, used extensively in basket-making | Kawais | $\begin{aligned} & \text { 2igmund 1981:61; } \\ & \text { 1978:200 } \end{aligned}$ |
|  | catkins, eaten ground with corn | Tarahumara, Chihuahua | Pennington 1963: 77, 125 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. Iasiolepis | leaves [young], bailed and eaten | Tarahumara, Chihuahua | ```Penningtan 1963: 77, 125``` |
|  | plant, used in various medicinal ways | Aztecs of Mexico | Montellano 1975: 219 |
|  | wood, as Euel | Chumash, Califarnia | Timbrook 1984:156 |
| S. nigra | branches, as a layer in roof construction | Hopi, Arizona | Whiting 1965:72 |
|  | twigs, gathered before the leaves appeared for basketmak | Pima, Arizona | Russell 1975:131 |
| Salix spp. | bark, made into rings to support roundbottomed water jars | Pima, Arizana | Russell 1975:113 |
|  | bark, made into baskets | Pima, Arizona | Russell 1975:132 |
|  | bark, chewed to relieve toothache | Kiowa, Oklahoma | Uestal and Schultes 1939: 19 |
|  | bark, made into soft bedding | W. Yavapai, Arizana | Gifford 1935: 272 |
| - | branches, used in basket-making | Kawaiisu, Califarnia | $\begin{aligned} & \text { 2igmund 1981:61; } \\ & \text { 1978:200 } \end{aligned}$ |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Salix spp. | branches, used in basket-making and making sieves for straining juice pulp | Pima, Arizana | $\begin{aligned} & \text { Russel1 1975:144; } \\ & 145 \end{aligned}$ |
|  | branches, used for baskets, cradle canopies, plumed wands, prayersticks, arrawshaf | Navaja cs, etc. | Elmore 1944:39 |
|  | branches, for house thatching and basketry | Isleta, New Mexico | Jones 1931:42-43 |
|  | branches, for basketry and fish weirs | Gosiute, Nevadia and Utah | ```Chamberlin 1911:``` |
|  | branches, for basketry | N. Paiute, Nevada | Laud 1929: 158 |
|  | branches, For water jugs, stirring rods, poles and hoaps in games, and roof thatching | White Mt. Apache, Arizona | $\begin{aligned} & \text { Reagan 1929: } 150, \\ & 160 \end{aligned}$ |
|  | flowers [catkins] made into a tea | Colorado Graups | $\begin{aligned} & \text { Castetter and Bell } \\ & \text { 1951:201-203 } \end{aligned}$ |
|  | inner bark, made into garments and $2-p l y$ cordage | Cocopa, Lawer Calorada River | ```Gifford 1933: 272, 275``` |


| SPECIES | PARI AND LSE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Salix Spp. | inner bark, made into clothing | Pima, Arizana | Russell 1975:157 |
|  | laqves, made into a beverage | Navajo, Chaco Canyon area of New Mexica | Hocking 1956:155 |
|  | leaves, as a medicinal infusian | Kiowa, Oklahoma | Vestal and Schultes 1939: 19 |
|  | leaves, bailed as liquid for bathing | Isleta, New Hiexico | Jones 1931:42-43 |
|  | leafy stems, as a sunshade | Kiowa, Oklahoma | Vestal and Schultes 1939:19 |
|  | roots, made into rafts | Cocopa, Lower Colorado River | Gifford 1933: 272, 275 |
|  | shoots [young] made into a tea | Colorado Groups | $\begin{aligned} & \text { Castetter and Bell } \\ & \text { 1951:201-203 } \end{aligned}$ |
|  | stems, as construction material | Kiawa, Oklahoma | Vestal and Schultes 1939: 19 |
|  | stems, as a calendar stick | Pima, Arizona | Russell 1975:104 |
|  | twigs, for making large baskets | Papaga, Arizana | Castetter and Underhill 1935: 6, 53, 56 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Salix spp. | twigs, used in ceremonies, and for making baskets | Tewa of New Mexica | $\begin{aligned} & \text { Rabbins et al. } \\ & \text { 1916:48-49 } \end{aligned}$ |
|  | twigs, as prayersticks | Keresan groups, New Mexico | White 1945:564 |
|  | woad, made into charcanl far body paint | Tewn of New Mexico | $\begin{gathered} \text { Robbins et al. } \\ 1916: 48-49 \end{gathered}$ |
|  | mood, in roof construction, as prayer sticks and in ceremonies | Hopi, Arizona | Whiting 1966:72 |
|  | wood, for bows | Luiseno, California | Sparkman 1908:233 |
|  | wood, Far hause | Kiliwa, Califarnia | Meigs 1939:11 |

People sought all parts, including the woad, branches/ stems/twigs, bark and inner bark, young shoots, leaves, catkins and roots. As Far cattonwood, the Hopi once transplanted willows inta washes nearer ta their villages sa the trees wauld be conveniently located [Whiting 1966:72]. Woad of different willow species was sought by many groups for construction timbers, fuel, body paint [as charcaal] and for making bows, cradles, prayersticks and children's toys.

Ferhaps the most extensively collected part[s] included the branches/stems/twigs, for the primary purpase of basketmaking. The Papago of Arizana illustrate the importance of willow basketry. They used large willow baskets for starage, winnowing, parching seed, and for eating and drinking. Tightly waven and water-tight when wet, these baskets took the place of dishes [Castetter and Underhill 1935:63. In addition to basketry needs people gathered willow branches for house and roof construction and thatching, sunshades, and far making innumerable items such as mats, cradleboards, bows, arrowshafts, sieves, stirring rods, water jugs, game and ceremonial hoops, calendar sticks, proyersticks and Eish weirs. It is likely that some species of willow were not preferred as much as others; this is hinted at when the Kawaiisu reported the stems and twigs of Goodding's willow "broke easily" [Zigmund 19日1:61; 197日: 200]. It also seems reasanable that the branches/ stems/twigs were more appropriately gathered in certain
times of the year, as the Pima sought Salix nigra twigs "before the leaves appeared" [Russell 1908:131]. Branches were also chewed as a toothbrush and used in funeral rites. Young shoots newly emerging in the spring provided strong but flexible strips for lashing construction beams together.

Long strips of willaw bark could be easily pulled off of dead trees with the hands [no tools needed] at any time of the year; the Western Apache in Arizona then worked it into soft bedding material [Gifford 1936:272]. Others used it to make baskets and rings to support round-bottomed water jars. Bark and inner bark have also provided material for binding, garments, 2-ply cordage, medicines and food fwhen stripped from seedlings].

Even willow leaves had a number of uses in madern times. They were eaten after boiling, made into a beverage, used in medicinal treatments including as an emetic, chewed to harden gums, smoked as "tobacco", and when boiled in water provided a liquid for skin baths.

Two additional parts were sought on occasion. Apparently willow roots are large enough to provide material for constructing rafts. Catkins available in the spring offered both a food resource and material for making tea.

The prehistoric record of willow use covers the states of Colorado, New Mexico and Utah, as well as a group east of the Mississippi River. A wide variety of artifacts
excavated from Puebla III cliff dwellings from Johnson Canyon in southwestern Colorado were identified as having been made from willow [Nickens 19日1:79]. These included sewn mats, arraws, a bow, bark and twig knots and cails, bound branches, prayer stick fragments, a stirring stick, a drill handle and a split-twig wand. Wooden atlatl foreshaft sections fashioned of willow were recovered from the two Mogollon sites of Tularosa and Cordova Caves in southwestern New Mexico [Grange 1952:376, 377]. Willow remains were also reparted by Cutler [1952:478] in the Iularosa Cave plant debris. Much of the basketry remains faund in Danger Cave in the Great Basin area of Utah were made of the slender twigs of S. nigeg [Jennings 1957:257]. Apparently this species was chosen throughout the 9000 year occupation of the cave. A bundle of $\mathrm{S}_{\mathrm{L}}$ nigig leaves were reparted from the Dzark Bluff-Dweller culture of Arkansas and Missauri [Gilmore 1931:96].

## SIGNIFICANCE FOR HUMANS

Both species of willow can be found in Ramsey Canyon and Canelo Hills. It is expected that people in both locations would have year-round access to the wood, branches/stems/twigs, bark, inner bark, seedlings, and roots. It might well be that for certain needs where Flexibility was critical, stems would best be gathered in a certain seasan, such as before the leaves appeared in January and February. Leaves and catkins are the parts
mainly restricted in their period of availability. Leaves of both species could be collected fram March through November. Catkins of arrayo willow are abundant in February, while those of Goodding's willaw can be collected in April.

## PREDICIIONS FOR THE ARCMAEDLDGICAL RECDRD

Unless a willow part is sturdy, such as wood, branches or roots, it is unlikely it would survive in an open archaealogical site. Dnly in caves or pratected averhangs might leaves, bark, and unburned wood and branches preserve, depending on what type of prehistoric preparation steps had been applied to them. Easily degraded catkins or seediing bark would not be expected to be recavered.

Salyig reflexg Hornem. CH-6 [KA \#230-83] UA254890


## HABI TAI

Salvig EeElexg does well in very dry soil on the eastern flanks of the stream at Canela Hills. The area receives up to $50 \%$ exposure to the sun's rays, due to the blocking effects of nearby trees and shrubs. The underlying substrate is composed of colluvium and pockets of valcanic bedrock.

## PHENOLOGY

The annual Rocky Mauntain sage is a small herbaceous mint, often hidden among dense surrounding vegetation. It is in full flower for the Eour months of August-November, producing mature nutlets throughout this period. Active stem elangation and leaf expansion continue until the plant dies from the effects of the first heavy frost in the fall. The species overwinters as nutlets in the ground for up to eight months.

## ETHNDGRAPHIC/ARCHAEDLOGICAL RECDRDS

Apparently the leaves of this mint were nat as

Erequently gathered by modern groups for flavoring as Menthg and Mongrdg. Rather Rocky Mountain sage and other species of this genus provided nutlets ["seeds"] that were made into refreshing beverages [Table 65]. Peaple also used the nutlets to remove foreign objects from eyes; the nutlet coat becomes mucilaginous when wet and would adhere to the offending particle. Historic groups gathered Salvia leaves or plants to prepare a medicinal tea, or simply chewed the leaves to relieve various ailments. The entire plant, when placed around a bed, was considered by the Spanish-Americans living along the Rio Grande River in New Mexico to keep bedbugs away [Curtin 1965:59].

A trosh deposit representing the A.D. 1180-1250 time period at the Salmon Ruin in northwestern New Mexico contained two Rocky Mountain sage type nutlets [Adams 1980a:263]. At Grasshoper Puebla in central Arizana, a Salvia ceflexa type nutlet was recovered from the A.D. 13001400 occupation [Bohrer 1982:98]. The width and size of this nutlet did not match the smaller measurements of modern wild $S_{\perp}$ feelexa nutlets, and one possible explanation wauld be that Salvig was a cultivated plant in prehistory. According to Bohrer [1982:98] a number of central and northern Mexican groups cultivated a species of Salyig in historic times. The suggestion that Rocky Mountain sage was a prehistaric cultivated plant bears investigation.

| SPECIES | PART AND USE | GRDUP［5］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| Salvia columbariae | ```seeds [nutlets], steeped as a beverage``` | Papago，Arizona | ```Castetter and Underhill 1935:27``` |
|  | seads［rutlets］，日round and made inta beverage | Mahave，Lawer Colorado River | $\begin{aligned} & \text { Castatter and Bell } \\ & \text { 1951:187, } 195 \end{aligned}$ |
| 5．Teflexa | leaves，green ar dry，as medicinal tea | Spanish－Americans， Ria Grande River of New Mexico | Curtin 1965：59 |
|  | leqves，chawed as medicine | Cochiti，New Mexica | Lange 196日： 151 |
|  | plant，to keep bedbugs away | Spanish－Americans， Ria Grande River of New Mexico | Curtin 1965：59 |
|  | seed［nutlet］，to remave particles Eram the eye | Picuris，New Mexica | Kranetsky 1964：4日 |
|  | sead［nutlet］，to remave particles from the eye | Spanish－Americans， Ria Grande River af New Mexica | Curtin 1965：59 |
|  | seeds［nutlets］，known as＂white chia＂，far beverage | Mexican groups | Altschul 1973： 251－252 |
| Salvia spp． | seeds［nutlets］，as a heverage | Mexican graups | Rose 1899：225 |

Table 65. Ethmagraphic refarences to the use of Sqlyig, including Se EeElexa.

SPECIES
Salvia spp.
plant, as "chant
lotion" in
ceremonies
plant, eaten raw or bailed as a medicine

GRDUP[S]
Navaja

Jemez, New Maxico

REFERENCE
Wyman and Harris 1941: 57

Cook 1930:27

## SIGNIFICANCE FOR HUMANS

At Canelo Hills Rocky Mountain sage nutlets are available for making a beverage or removing Foreign objects from eyes for the four months of August through November. During the same period one could harvest the leaves/plants for use in medicinal preparations or as a bedbug repellant. PREDICIIONS FOR THE ARCMAEDLOGICAL RECORD

Since the nutlets are actively sought for different needs, they could become incorparated in the archaealogical record. However, their typical preparation as a beverage would do little to promote preservation. Only if the nutlets were accidentally charred, or prepared by exposure to fire, would their likelihood of survival increase. Preservation of leaves or plants as recognizable entities is not expected, due to their use in medicines or eventual disintegration as bedbug repellants.


CH-1 [KA \#121-83] UA255035; CH-9 [KA \#152-83] UA255036

habitat
Both perennial species of bulrush growing at Canelo Hills prefer sail saturated with water, either in the actual cienega or along the immediate edges of the stream. Generally the plants are fully exposed to the sun. The substrate in which they grow is composed of alluvial deposits.

## PHENDLOGY

Although the phenological profiles of these twa species seem to reflect life-cycles out of synchroneity with each other, this might not be the case. Sciepus yalidus looks to have begun active growth two to three months ahead of $\$$.
gmericgnus, yet full flowering in June and July and timing of fruit set in August coincide between the two species. It seems likely that Scirgus gmericanus may have actually been present vegetatively on the landscape somewhat earlier than its sudden full-flowering presence in June suggests. Both species resume dormancy in September, being visible as inactive above ground stems for up to four subsequent months. ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

In historic times bulrush plants have served the needs of many people [Table 66]. Perhaps one of the more striking references is to the construction of large floating islands of S. californica by inhabitants of Lake Iiticaca in Peru [Heiser 1979]. As the material rots from beneath and the island sinks, new plants are piled on top and the balance restored. Not oniy are the plants made into floating islands and dwellings but the basal sections of the stems provide food.

Both species of bulrush that grow in Canelo Hills have been sought by historic groups in the American Sauthwest. Scirpus qmericrans plants offered material for housing, cordage, footgear and weaving to Northern Paiute bands [Stewart 1941:428], while the achenes and roots both provided food resources. From Seicpus validus Calso listed as S. acutus] people gathered pollen for bread, achenes, roots and stem bases for food, and the stems and entire plants for food, household, ceremonial and medicinal requirements.

Table 6E. Ethnographic references to the use of Scirpus.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. americanus | achenes, as faod | 12 of 14 N. Paiute bands | ```Stewart 1941: 428``` |
|  | plant, many household needs | 12 af 14 N. Paiute bands | ```St:ewart 1941: 428``` |
|  | roots, as food | 12 of 14 N. Paiute bands | ```Stemmart 1941: 4こВ``` |
| 5. californica | plant, for mats and house construction | Uros, Peru | Heiser 1979 |
|  | stem base, as food | Uras, Perv | Heiser 1979 |
| S. lacustris | achenes, as Eood | Various groups, 5w United States | Yanovsky 1936:10 |
|  | pollen, as food | Uariaus Narth American graups | Havard 1895: 115 |
|  | roots, as food raw or in bread | Various groups, SW Unitad States | Yanousky 1935:10 |
|  | roots, as food | Various North American groups | Havard 1895: 115 |
|  | shoots, as food when young in spring | Various groups, SW United States | Yanovsky 1936: 10 |
|  | stem, base eaten | Gosiute, Nevada/Utah | ```Chamberlin 1911:``` |


| SPECIES | PART AND USE | GRQUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. lacustris | stalks and lenves, as basketry material | Uarious North American groups | Havard 1895:115 |
| 5. nevadensis | achenes, as food | N. Paiute, Nevada | $\begin{aligned} & \text { Laud 1929: 157, } \\ & 159 \end{aligned}$ |
| Scirpus aff. paludasus | achenes, as Eaod | S. Paiute, Nevada | Bye 1972:91 |
| S. rabusta | ```roots, as basketry material``` | Kawaiisu, Califarnia | 2igmund 1981:63 |
| S. validus | achenes, as food | 12 of 14 N . Paiute bands | Stewart 1941:428 |
|  | plant*, as Food both raw and cooked | Blackfont, NW Great Plains | Johnston 1970:308 |
|  | plant*, many household needs | 12 of 14 N. Paiute bands | Stewart 1941:428 |
|  | plant, many household needs | California groups | Palmer 1878:604 |
|  | ```plant*, as ceremonial emetic``` | Ramah Navaja, New Mexica | Vestal 1952:19 |
|  | plant*, as life medicine | Navajo, Chaco Canyan New Mexica | ```Elmore 1344:79-``` |

*Listed as Scirpus ncutus

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. validus | pallen, eaten as bread | Califarnia graups | Palmer 1878:604 |
|  | roots*, as food | 12 of 14 N. Paiute bands | Stewart 1941:428 |
|  | roats, eaten raw or cooked | California graups | Palmer 1878:604 |
|  | stems, as mats | Kawaiisu, California | Zigmund 1981:63 |
|  | stems, base as Food | Kawaiisu, California | Zigmund 1981:63 |
| Scirpus spp. | achenes, as food raw or ground for mush | Cahuilla, California | Bean and Saubel 1972:139 |
|  | plant, as thatching material | Kiliwa, California | Meigs 1939:11 |
|  | pallen, as Eood | Cahuilla, California | Bean and Saubel 1972:139 |
|  | pollen, as foad | Uarious groups, SW United States | Yanousky 1936:10 |
|  | rhizomes, as food | Chumash, California | Timbroak 1984:145 |
|  | roots, as food | Cahuilla, California | Bean and Saubel $1972: 139$ |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Scirpus spp. | shoots, as Eood when tender | Luiseno, California | Sparkman 1908:234 |
|  | shoots, as food when tender | Acoma/Laguna, <br> New Mexico | Swank 1932:6日 |
|  | stalks, many household needs | Cahuilla, Califarnia | Bean and Saubel 1972: 139 |
|  | stems, base as food | Dakota | Gilmore 1977:17 |
|  | stems, base as food | Hopi, Arizana | Bartlett 1951:50 |
|  | stems, for mats | Many graups of Missouri River region | Gilmore 1977:17 |
|  | stems, as mats and house thatching | Chumash, California | Timbrook 1984:145 |

Dther species of bulrush reveal basically the same set of historic uses, with the following additions. Sometimes young tender shoots would be dug up and eaten as they resumed grawth, and raats gathered far basketry material.

The archaealogical recard suggests that bulrush has a long history of satisfying human needs [Table E7]. The
 and cardage, as well as having been chewed alang with the rhizames, either to extract food value or to prepare fiber for cordage. Scirpus validus plants were made into mats and bags by various ancient groups in New Mexico and elsewhere. A fruiting head of this species was recovered at Bat Cave in New Mexica; its significance is unknown. Sciepus leaves and stems were fashioned into rings, braids, mats, thongs and cordage at a number of ancient Southwestern sites.

At other locatians, burned and unburned achenes could represent prehistoric food, medicines or ceremonial goods. The presence of achenes in human caprolites in Utah and Nevada caves strangly argue the resaurce was saught as a subsistence item. At Lavelock Cave in Nevada Scirpus achenes, along with seeds of Iuphg [cattail], comprised over $90 \%$ [by weight] of the seed remains in 50 well-preserved human coprolites; the presence of entire and slightly parched achenes, along with charocal pieces, implied the achenes had been parched with live coals priar to consumption [Cowan 1967: 2ᄅ-23]. A similar long term history of

| SPECIES | PART AND USE | GRDUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| S．americanus | leaves，as torches or fuel | Danger Cave，Utah ［B．C．9000－A．D．1］ | Jennings 1957： 185，224，22日 |
|  | plant，as cordage | Danger Cave，Utah ［B．C．9000～A．ロ．1］ | Jennings 1957 185，224，229 |
|  | rhizomes and leaves， chewed far Faod value | Danger Cave，Utah ［B．C．9000－A．ロ．1］ | Jennings 1957： 185，224，224 |
| S．validus | ochenes，as parched Erod | Cahuilla，California ［A．D．900－1500］ | Wilke 1978：67－68 |
|  | achenes＊，as parched food | Cahuilla，California ［A．D．900－1500］ | Wilke 1978：67－6日 |
|  | fruiting head | Bat Cave，New Mexica | Smith 1950：169 |
|  | plant，as mats and bags | Qzark Bluff－Dwellers， Arkansas and Missauri | Gilmore 1931：95 |
|  | plant＊，as burial mats | Pueblo Bonito，Chaco Canyon，New Mex．［A．D． 1000－1100J | Judd 1954：50 |
|  | plant，as mats | Tularosa and Cordava Caves，New Mexica ［B．C．300－A．D．1100］ | Bluhm and Grange 1952：ᄅ19 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Scirpus spp. | achenes [unburned]; incidental to stam harvest? | Chaco Canyon, New Mexica [A.D. 750-1100] | Struever 1977:64 |
|  | achenes [burned and unburnedl, as fand and medicinal/ ceremonial need | Salmon Ruin, New Mexica [A.D. 1180-1250] | Adams 1980a:294295 |
|  | achenes [some burned] as Ead from coprolites | Lovelock Cave, Nevada | Cowan 1967:22-23 |
|  | achenes, as food fram copralites | Glen Canyon sites, Utah [A.D. 1-1300] | Fry 1976:15 |
|  | leaves | Bat Cave, New Mexica | Smith 1950:169 |
|  | plant, as rings and braids | Zion Nat'1. Park, Utah [Basketmaker II I-PueblaI | ```Jones 1955:200-``` |
|  | plant, as woven mats | Johnsan Canyon, SW Colorado | Nickens 1981:76 |
|  | plant, as woven mats | Chaco Canyon, New Mexico [A.D. 750-1100] | Struever 1977:148 |
|  | stems, as twined mats, thongs or cordage | South Shelter, <br> SW Calorada <br> [Basketmaker III] | Jones and Fanner $1954: 104$ |

parched Scirpus achenes was revealed in human coprolites fram ancient Lake Cahuilla in California [Wilke 197日: 67].

One of the most complete archaeolagical records of Scirpus is that of Lavelock Cave . Many sandals, mats, carrying cases, ropes, spherical balls and bulrush bundles of various nature were faund in deposits covering at least 2000 years. A common food of the occupants seems to have been the shoots of Scirpus logustris, os evidenced by the quantity of chewed stalks of this species [haud and Harrington 1929:54-93]. A number of masticated quids of Scirpus preserved intact dental impressions, which were used to ascertain age and the dental condition of prehistaric individuals $[$ Turner 1967:117].

## SIGNIFICANCE FOR HUMANS

It seems that all parts of bulrush plants may provide valuable raw materials far humans. At Canela Hills, the general agreement in life-cycle events between the two species permit evaluating their potential simultaneausly.

Bulrush plants and stems are visible above ground from March through December, and could be gathered to satisfy a whale range of material culture, medicinal and ceremonial desires. Likewise, as lang as the plants are visible above graund, roots can be dug up to be eaten ar employed in basketmaking. Although stem bases are alsa subject to eollection for the lang period of March through December, sameane intending to eat tham might prefer their taste and
texture earlier in the growing season. Young shoots sought for food would most likely alsa be preferred in March and April, when tender. Pallen could be harvested over the rather long period of full flowering, April thraugh August; mature achenes, on the other hand, cauld only be acquired far foad during August.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD
Depending on prehistoric preparation techniques and conditions of preservation, bulrush achenes and vegetative parts made into artifacts or remaining as Eood debris [i.e. stems above the basel cauld be retained in the prehistoric record. Roats might also preserve. Young shoots would be expected to decay. Pollen might remain as evidence of ancient meals.

Setarig genicylata [Lam.] Beauv.
CH-1 [KA \#177-83] UA255207


## habitat

Setacia geniculata grows in a dense stand on the edge of the cienega at Canelo Hills. The area receives the full force of the sun's rays. The underlying soil is often wet, due to the proximity of fully-saturated alluvial deposits. PMENOLOGY

This perennial bristle grass resumes active vegetative growth in the summer, and is not obvious much earlier than July. The grass flowers in August and September, and there is actually a rather short periad of mature grain availability in Sept, and October. After the grains have Fallen from the plant, stems and leaves remain visible above ground for three months, until the following February. A five-month period of dormancy ensues.

## ETHNQGRAPHIC/ARCHAEOLQGICAL RECORDS

The ethnographic record examined revealed little in the way of data on bristle grass use. Apparently the fruits [grains?] of Setarig lutescens were rubbed on open pimples
as a curative by the Ramah Navaja of New Mexica [Uestal 1952:17J. Along the Gulf of California in Somara, Mexica, the Seri toasted, ground and mixed grains of $\boldsymbol{S}_{\perp}$ mgergstochyg with water to be eaten as a gruel. It was alsa cooked with sed turtle oil [Felger and Maser 1976:25].

In China a species of bristle grass was apparently one of the early cereal crops [Harlan 1971:47]; the prehistaric recara disa holds a EEu hints as ta the patiential value af Setaria for New Warld groups in ancient times. Setacia maceastachug was among the taxa recovered from U-Bar Cave in southwestern New Mexica; this cave was thought to represent a ceremonial locus in the period A.D. 1350-1400 [York et al. 1961:97]. Inflorescence units of this same species were Found in the Upper Ruin at Tonto Natianal Monument, a Salada Pueblo dating to the A.D. 1300 's in south-central Arizona [Bohrer 1962:98]. At this location bristle grass could have represented either a food resource or roof thatching.

Prehistoric evidence of the bristle grass use is more extensive in Mexica than in the United States. This grass grain occurs in abundance in human coprolites found in caves in the Iehuacan Valley of Mexico [Callen 1967:285]. Basically the time period covered is B.C. 5000-A.D. 1500, and except for a brief span, SetaEig remains are present throughout all strata. The oldest coprolites recovered suggest that this grass was an important component of the diet early 0 . Callen [1967:2日7] suggests the grass was
alsa eaten in northern Mexica, based on copralites recavered Erom Tamaulipas. The question of whether or not Setacia underwent damestication in this part of the world was addressed by MacNeish [1967:291], who felt that there was no morphological evidence to suppart the idea.

## SIGNIFICANCE FOR HUMANS

Bristle grass grains ripen and disperse rather rapidly From the plant, therefore harvesting of this resource would have to be carefully monitared in the general period of September to Dctaber. If the plant were selected for a household need, such as roof thatching, it could be gathered July through January, when it is obvious on the landscape. PREDICIIONS FOR THE ARCMAEDLDGICAL RECDRD

Bristle grass grains gathered as food would be most likely to show up in the prehistaric record if preparation invalved exposure to fire in some manner. Accidents would increase chances that some charred representatives would become incorporated with ancient debris. Human consumption would be documented by retention in copralites recovered in protected locations. Use of the plants Ear roof thatching might nat be revealed, except under the best of preservatian conditions.


## HABITAT

Both species of Sidg included in this study grow in dry soil on the eastern flanks of the stream at Canelo Hills Cienega. Generally the area is sloping, with an underlying substrate of volcanic bedrock. The amount of exposure to sumlight varies from $100 \%$ to less than $50 \%$ under a canopy of nearby trees.

## PHENDLOGY

These two perennial herbaceous species reveal similar phenological profiles at Canelo Hills. Both are first noted in June at the beginning of a two manth period of active
growth. By August both species are in full flawer. Sidg Eidicgulis continues to flower thraugh November althaugh Sida negmexicang does not. Mature fruit is available on $S_{2}$ filicalisis September through November, and on S. negmexicana for only the month of October. Both species continue active stem elongation and leaf expansion until resuming dormancy in October or November.

## EIHNDGRAPHIC/ARCHAEDLCGICAL RECORDS

New World groups have not sought Sidg for many reasons. The Tepehuan of Chihuahua valued S. cordifolig as purgative tea [Pennington 1969:183], and along the west coast of Mexico branches of Sida gcuta carpinifolia were ance commonly tied together and used as a broam for sweeping yards [Rose 1899:253].

Sida species have been gathered by peaples in many other parts of the warld to serve a variety of purposes. In east Africa six separate species have been used in medicinal treatments [Kokwaro 1976:135-136]. For example, crushed leaves were applied to swallen limbs and snakebites. Roots, when pounded, provided an external cure for lumbaga. The bark also served as a remedy for waunds. In West Bengal, India, the stems of $S_{\perp}$ qeuta yielded both cordage fibre and medicines [Datta and Banerjee 1979:305]. In Guatamela Sidd geytg has been used to treat coughing, and in Nicaragua the entire plant [including roots] has offered a liquid remedy for bladder and urethra traubles. Others in the world use
this species, along with $\mathbf{S}_{\perp}$ cordifolig and S. Eetusg in medicinal treatments [Altschul 1973:187].

No archaealogical recard located.

## SIGNIFICANCE FOR HUMANS

The significance of the the two species of Sidg for humans living in the Canelo Hills area may be low. Perhaps the plants would provide material for medicinal teas. If so, harvesting would be restricted to the period of June thraugh November. It seems unlikely that these low-growing herbaceous plants would offer cordage or raw material far brooms.

PREDICTIDNS FOR THE ARCHAEDLDGICAL RECDRD
Preparation of Sida plants in a medicinal tea is not expected to leave any recognizable parts in the prehistaric record.

Sisurinchium demissum Greene.
CH-1 [KA \#88-83] UA254894


Sisurinchium demissum grows in the cienega at Canela Hills. The location is flat, fully exposed to the sun's rays, and the substrate composed of alluvial sediments. phenalqgy

The perennial blue-eye-grass is first noticeable in the cienega in April, although it has probably come up prior to this time since full-flowering begins in April. Mature fruits are present in June, and continue to be available through September. Active vegetative growth is concentrated in the months of April though June, at which time stem elongation and leaf expansion slow considerably. The plant can no longer easily be found in the period of October through March, when it has resumed dormancy.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

Species of blue-eyed-grass have been used as fish poisons and in medicinal treatments. The Tarahumara in Mexico crushed and dumped the roots of $5_{\text {. grizonicum into }}$
pools of water to stun fish [Pennington 1963:106]. The Luisena of southern California made a purgative from the roots of S. bellym [Sparkman 190日:233]. Navaja dried and pulverized S. $_{\text {m }}$ mucranatum plants and mixed them with other herbs to treat nase and throat troubles [Elmore 1944:37].

No archaealogical recard found.

## SIGNIFICANCE FOR HUMANS

Blue-eyed-grass plants could be picked for medicines at any time from April through September. The roots would also be available as fish poisans during this period when above graund parts signal their precise location.
predictions for the archaedlogical record
Evidence of blue-eyed-grass might not show up in the prehistoric record due to the manner of preparation of parts. Crushed roots, or dried and pulverized plants would not preserve in recagnizable condition. Seeds carried in unintentionally with harvested plants, and accidentally burned in a household fire, would perhaps be the anly evidence that might signal an ancient need for this plant.

Sitgnign hustirix [Nutt.] J.G. Smith
[-Elymus elymoides [Raf.] Swezey]
CH-7 [KA \#147-83] UA255201; [KA \#31日-84] UAこ55017

habitat
Sitanion bustrix does well in dry sail on the west side of the Canelo Hills Cienega. The underlying substrate is composed af alluvium, and the plants receive full sumight.

## PHENDLGGY

This perennial squirrel tail grass has renewed growth by April. Full flowering occurs in May, continuing well into July. Mature grains are present and dispersing in July and August. By September activity has ceased, and the grass resumes dormancy for up to seven months.

## ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

No ethnographic records were located regarding this
species. A single archaeological reference listed Sitanion bustrix as present in Bat Cave deposits in south-central New Mexico [Smith 1950:167].

SIGNIFICANCE FOR HUMANS
Unknown.
PREDICTIONS FOR THE ARCHAEGLOGICAL RECDRD None.

Spgeobolus giroides [Torr.] Torr. var. wrighti.i [Munra ex. Scribn.] Gould CH-5 [KA 184-83] UA25501日


HABITAT
Sparabalus giraides var. wrightiif thrives on the dry western flanks of the stream at Canelo Hills Cienega. The plants grow on a shallow slope underlain by alluvial deposits. They receive fully $100 \%$ of the sun's rays.

PHENDLOGY
This large, coarse, perennial dropseed grass is always present on the landscape, but appears to be dormant for the months of November through March. In April leaf grouth initiates and, along with stem elongation, represents the only obvious plant activity until July. The origination of flower buds in July precedes full flowering in August. Ripe grain is present only during part of the month of September. The plant loses all green color and resumes dormancy by November.

## EIHNQGRAPHIC/ARCHAEOLQGICAL RECDRDS

The ethnographic record of dropseed use is rather extensive [Table 68]. When Daebley [1984] listed six

Table 6B. Ethnagraphic references to the use of Sporgbolus.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. airaides | grains, as Food gathered in quantity; parched and graund | Groups in Utah | Palmer 1878:603 |
|  | grains, as Food | Paiute, Arizana and Utah | Bye 1972:91 |
|  | grains, as Food, especially in famine times | Hopi, Arizona | Whiting 1966:66 |
|  | ```plants, as lining For Aggye raasting pits``` | Chiricahua and Mescalero Apache | $\begin{aligned} & \text { Castetter and Dpler } \\ & 1936: 36,40,48 \end{aligned}$ |
| S. airaides var. wrightii | grains*, 05 food | Ramah Navajo | Uestal 1952:17 |
|  | raats*, as a hair brush | Pima, Arizama | Russell 1975:116 |
|  | grains*, as Food | Papaga, Arizana | Castetter and Underhill 1935:24 |
|  | plants, as ash in ceremonies, and brushes far metates | Ramah Navaja | Vestal 1952:17 |
|  | stems*, as stiff brush to remove 5pines Fram Dguntin fruits | Chiricahua and Mescalero Apache | Castetter and Opler 1936: 36, 40, 48 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| S. Eryptandrus | grains, as food | Paiute, Arizona and Utah | Bye 1972:91 |
|  | grains, as food or beverage; ground | Navajo | Hailey 1940:286 |
|  | grains, ground as food | Ramah Navajo | Uestal 1952:17 |
|  | grains, as food | Kaibab Paiute, Utah and Arizana | Kelly 1964:42 |
|  | grains, as food ground or bailed | Chiricahua and Mescalera Apache | $\begin{aligned} & \text { Castetter and Opler } \\ & 1936: 36,40,48 \end{aligned}$ |
| 5. cuspidatus | plants, as brushes | Navajo | Matthews 1886:777 |
| 5. giganteus | grains, as Food threshed and ground | Hapi, Arizona | Nequatama 1943:20 |
|  | stems, as prayersticks | Hopi, Arizona | Whiting 1965:66 |
| S. strictus | grains, for food ground into Elour | Apache, Arizona | Buskirk 1949:336 |
|  | plants, as mats for covering hatchuays/ <br> house openings; also made inta Field shelters | Zuni, New Mexico | Stevenson 1915:日1 |
| 5. virginicus | shoots [young], as food | Seri, Sonora | Felger and Moser 1976: 25 |

separate Sporgbalys species known in historic times to Southwestern United States groups, four of these citations were to "much used" or "staple" foods. For the Ramah Navajo of New Mexico, the grains of Sporgbolus were one of the "First foods" given them by supernaturals, according to an origin myth [Uestal 1952:17].

There were various ways one could collect the freefalling grains from the plants. For example, in Arizona the Papago harvested Spcobolous airoides var. wrightif [as S. wrightii] in September by burning an entire patch of the grass and then sweeping the grains off the ground later [Castetter and Underhill 1935:24]. The Ramah Navaja in New Mexica gathered the plants, then beat the grains out on a blanket; or they would rub the living plant over a basket with their hands to loosen and harvest the food [Uestal 1952:17]. Once gathered, the grains were often parched and ground to be eaten alone or with other foodstuffs.

The archaeological record suggests that drapseed grains have been a sought after subsistence item for some time [Table 69]. Their recovery in human coprolites, occasionally in parched or charred condition, reflect direct consumption and preparation techniques. The presence of chaff at Fresnal Shelter in New Mexico suggests that either winnowing or processing of entire plants was carried out in that location, rather than only the cleanly threshed grain being carried to the shelter.

| SPECIES | PART AND USE | GRDUP［S］ | REFERENCE |
| :---: | :---: | :---: | :---: |
| S．airaides | unknown | Bat Cave，New Mexica | Smith 1950：168 |
| S．airaides var．wrightii | stems and Fruiting heads＊ | Bat Cave，New Mexica | Smith 1950：16日 |
| S．cantractus | unknown | Tularasa Cave， New Mexico | Cutler 1952：478 |
| S．cryptandrus | plant，Eashioned into a mat，inside an animal skin bag | Couboy Cave，Utah ［B．C．3300］ | Hull 1980：139 |
| S．giganteus | unknown | SW New Mexica Caves ［A．D．1100－1400］ | York et al． 1961：96－97 |
| Sporabolus spp． | chaff，representing a Food | Fresnal Shelter， New Mexico［B．C．1600－ A．D．1J | Bohrer 1981：44 |
|  | grains［charred］ | Chaca Canyon， New Mexica ［A．D．750－1100］ | Struever 1977：70 |
|  | grains，as food， same parched or carbonized | Salmon Ruin，New Mex． in 10／64 trash and floor strata ［A．D．1180－1250］ | Adams 1980a：280－ 2日2 |
|  | grains，comman in human capralites | Cowboy Cave，Utah ［8000 year occupation］ | $\begin{aligned} & \text { Hogan 1980:204, } \\ & \text { 208 } \end{aligned}$ |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Sporabolus spp. | unknown, as cordage | Cowboy Cave, Utah | Hewitt 1980a: 68 |
|  | unknown | Basketmaker III site, Cimarron, New Mexica [A.D. 700-900] | Kirkpatrick and Ford 1977:263 |
|  | unknown | in B of 15 samples in Cowbay Cave, Utah | Barnett and Caulam 1980:130 |
| cf. Sporabalus spp. | pollen, representing Food ground on a metate | Hay Hallow Site, Arizona | Bohrer 1966:5 |
|  | grains [charred] | in 6 of 17 Anasazi sites in NE Arizona | Gasser 1982: 33 |

SIGNIFICANCE FOR BUMANS
The easily harvested grain resource of Spacabalus girgides var. wrightii ripens in September in Ramsey Canyan. Yaung vegetative shoots wauld be most appropriately gathered for food in April and May when the new saason's vegetative growth has newly resumed. Callecting the plant or stems for manufacture of mats, brushes ar prayer-sticks, as well as their use as ash in ceremonies or as lining for raasting pits, could span the entire year. Likewise, roots could be gathered at any time for fashioning into items such as hairbrushes.

PREDICTIDNS FDR THE ARCHAEQLOGICAL RECDRD̄
Dropseed grains harvested and parched for food would have a good chance of entering the archaeological record. Young vegetative shoots would decay, leaving no trace of their presence. Plants and stems might preserve if accidentally charred, or protected in cave or shelter deposits. Possibly an item fashioned of Sporgbolus roots would also survive; ane wald need an adequate comparative collection of roots to attempt identification.


Stachus coccineq thrives in a boulder and cobble field near the Ramsey Canyon stream. The area is heavily shaded by the upper canopy of trees, and sail is frequently damp.

## PHENDLOGY

This perennial herbceaus betony is visible year-raund at Ramsey Canyon. Even while the plant has the previous season's fruit capsules with nutlets still clinging to stems, in January new shoots emerge. Leaf growth continues until May, when stem elongation becames very vigorous. For the three months of August through October flowering is profuse, and capsules develop mature nutlets shortly after flowering begins. These ripe nutlets are available for up to seven months, from August through the following February. ETHNOGRAPHIC/ARCHAEOLOGICAL RECORDS

In historic times the Gosiute of Nevada and Utah gathered the "seeds" [nutlets] of $\mathrm{S}_{\mathrm{p}}$ palustris for food [Chamberlin 1911:383]. The dried leaves of S. rothrockif
were used by Ramah Navajo of New Mexico as a medicine and as a deodorant for the feet [Uestal 1952:42]. Dutside of the American Southwest, S. Eloridgng is reputed to have been eaten in the eastern United States for its white, fleshy rhizomes [Altschul 1973:251]. The entire plant of $\mathrm{S}_{\perp}$ gEficinalis has served as a tea in Europe Clewis and Lewis 1977:390] and a nerve tonic in Denmark [altschul 1973:251]. No archaeological record found.

## SIGNIFICANCE FOR HUMANS

Since no direct references to Stachys coccineg have been found in historic or archaeolagical literature, inferences as to its significance for humans are tentative. Possibly the nutlets could be eaten in a manner similar ta those of another species of Stachus. These nutlets could be harvested for the seven month period of August-February, providing a valuable foodstuff in the difficult winter months. Use of leaves/plant as a medicine, tea or deodorant could occur year-round. Since the underground parts of Stachus cogcineg do not give the appearance of a fleshy rhizome, it is not considered likely this part would be eaten.

## PREDICTIDNS FOR THE ARCHAEDLOGICAL RECDRD

Betony nutlets prepared by parching prior to consumption might be retained in the prehistoric record. Leaves dried and used in medicines, teas, or crushed and put into footwear would not.

Sting pringlej Scribn. RC-2 [KA \#204-83] UA255019


## HABITAT

Sting pringlei grows in dry sail on a shallow colluvial slope a short distance from the Ramsey Canyon stream. The area is overlain by stream-carried boulders and alluvium. Nearby tall trees provide a dense shade canopy, restricting the amount of sunlight that filters down to the Sting plants.

## PHENOLOGY

This perennial needle grass is nat always obvious a the landscape. In May it becomes noticeable via active vegetative growth that lasts for two months. Plants seem to be in full flower for the period of July through September. By July the First grains are ripening, and this maturing process continues through November. The plants resume a five month period of dormancy in December.

## ETHNOGRAPHIC/ARCHAEOLDGICAL RECORDS

In the ethnographic literature examined, only the Owens Unlay Paiute of California considered a species af needle
grass an important faod item. They harvested $\mathrm{S}_{\mathrm{s}}$ specigsa in the late spring, favoring the grains for mush (Steward 1933:243]. The Ramah Navajo of New Mexica, on the other hand, considered sharp-painted Stigg fruits with long awns a real nuisance, and only gathered them for use as play arraws [Uestal 1952:17]. Various Plains graups of the Missouri River Regian used S. sparteg as a hairbrush; they wald bind the stiff awns into a bundle, then burn off the ends of the pointed grains and use the remainder on their hair [Gilmore 1977:14-15].

Stipg neqmexicana chaff, recovered in numerous strata From the archaic age [B.C. 1600 - A.D. 1] Fresnal Shelter in south-central new Mexica, suggested to Bohrer [1981:44] that the inhabitants considered the resource a cammon food item. The grass seems to have been brought frequently to the shelter and the heads processed. Archaealogists recavered evidence of Stipg in cordage use by the inhabitants of Danger Cave in the Great Basin Area of Utah [Jennings 1957:22日], as well as fram Cowboy Cave [Hewitt 1980a:6B]. SIGNIFICANCE FOR RUMANS

The grains of Stiga pringlei are mature for the five months of July through November at Ramsey Canyon, and presumably offer a food resouce that requires some sort of processing. The same parts could be gathered for play arrows and hairbrushes. It is not clear which part might be made into cordage, but if the stems/leaves are appropriate
they would be of some size from July through November. PREDICTIONS FOR THE ARCMAEDLQGICAL RECDRD

Needle grass parts exposed to fire, such as the grains parched for food or burned off in Eashioning a hairbrush, might be retained in the prehistoric record. Dry cave deposits might also preserve evidence of processing [chaff], or cordage.
 HABITAT

Ihalictrum fendleci does well in nearly full shade along the stream at Ramsey Canyon. The plants grow on a very steep slope underlain by granite bedrock, in an area subject to occasional stream scour.
phendolagy
This herbaceous perennial species of meadow-rue with unisexual flowers resumes active vegetative growth in March, followed by four months of stem elongation and leaf expansion. It flowers in August, and ripe achenes are available both in August and September. In October and November the plant remains vegetatively active, resuming dormancy for the months of December through February. ETHNOGRAFHIC/ARCHAEOLOGICAL RECDRUS

Maadow-rua plants, and occasionally the roots, have bean sought by a number of historic groups for medicinal tea and lotion preparations [Table 703. In addition, the fruits were gathered and stored with clothing for their pleasant

Table 70．Ethnographic references to the use of Thalictrum，especially I．Fendleri．
SPECIES PART AND USE

T．dasycarpum

```
plants, as lave
    charms
```

stems, hollow toy
Elutes

I．Fendleri

| PART AND USE | GRDUP［S］ | REFERENCE |
| :---: | :---: | :---: |
| Fruits［achenes］，kept Eor pleasant odor； stored with clothing | Teton Dakota， Missauri River Region | Gilmare 1977： CB |
| plants，as love charms | Ponca，Missouri River Region | Gilmore 1977： 28 |
| stems，hallow toy Elutes | Teton Dakata， Missouri River Region | Gilmore 1977：28 |
| plants，as a medicinal tea | Acoma and Laguna， New Mexica | Swank 1932：72 |
| plants，as a medicinal tea | Tarahumara，Chihuahua | ```Pennington 1963: 181``` |
| plants，as a medicinal tea or lotion | Tepehuan，Chihuahua | ```Pennington 1969: 179``` |
| plants，as a medicinal／ ceremonial tea or lotion | Navajo | Wyman and Harris 1941：5日，67； <br> Elmore 1944： |
| plants，as cigarettes and＂tabacco＂；smoke fram plant inhaled； leaves made inta pillows | ```Spanish Americans of Ria Grande River, New Mexico``` | Curtin 1965：177 |
| plants，as medicine and ashes used in black－ ening in ceremonies | Ramah Navajo， New Mexica | Uestal 1952：28 |


ador, children made toy flutes from the hollow stems, and people made both cigarettes and "tobacco" from the failage. No archaeological record located.

## SIGNIFICANCE FOR HUMANS

Peaple living at Ramsey Canyon had access to Ihalictinum Eendleri plants from March through November, to prepare medicinal teas and lotions, make cigarettes and toy flutes, and acquire leaves as "tabacca". Likewise, the roats would be availble during this same period as a tea ingredient. Ripe fruits [achenes] could only be gathered during August and September.

## PREDICTIONS FOR THE ARCHAEDLOGICAL RECORD

Since the part of meadow-rue most likely to preserve [achene] is in no way processed in a manner which might insure preservation, it is not expected that its use in prehistory would leave evidence in the archaealogical record.

Irgdescantig gingtorum Greane. RC-1 [KA \#210-83] UA254987


## HABITAT

At Ramsey Canyon Icodescantia pinetorum grows in the same dry site as Commelina dignthifolig. The alluvial soil is interspersed with large granite boulders, and the plants are exposed to the sun much of the time.

## PHENOLOGY

The phenology of spiderwart is quite similar to that of closely-related Commeling. Irgdesscontig actively grows during the months of July to September. Flowering is underway in August, and during September both flowers and immature fruit are present. Although leaves continue to expand, stem elongation slows toward the month of Dctober, when the plant goes dormant for another nine months. Mature fruit are most likely available early in October.

ETHNDGRAPHIC/ARCHAEDLOGICAL RECORDS
Parts of spiderwort cited in historic literature include the seeds, leaves, stems, tender shoots and roots. The Tepehuan of Chihuahua treated badly swollen eyelids with
the seeds [Pennington 1969:178]. Leaves, stems and tender shoats have apparently been eaten by the Acoma and Laguna [Swank 1932:73], Hapi [Whiting 1966:70; Hough 1898:143] and various groups in northern Arizona [Bartlett 1951:49-50]. Medicinally the Kayenta Navajo used a species of Irades= cantig as an aphrodisiac $[$ wyman and Harris 1951:16], as did the Ramah Navajo of New Mexica [Uestal 1952:20]. The Ramah Navaja alsa gave a decoction of the root to someane with internal injuries or when a person was suffering from a "deer infection". No archaeological record found.

## SIGNIFICANCE FOR HUMANS

As for Commeling, young plants of spiderwort could be harvested in July for greens. Medicinal needs for the entire plant would be satisfied during the three-month growing season of July through September. During this period above-ground parts would alsa signal root presence. Seeds sought for an eyewash might be available only after September.

## PREDICTIDNS FDR THE ARCHAEDLDGICAL RECDRD

The ancient record might retain only spiderwart seeds if they were accidentally charred in some way. Preparing them for an eyewash wald generally assure their disintegration. Dther, more perishable parts would not likely be retained.


Iunha latiEalia grows in the stream and along edges of ponded water at Canelo Hills. Plants receive from 100\% exposure to the sun's rays ta less than $50 \%$ in areas where streamside vegetation provides an overhead canopy.

PHENOLOGY
In January the young leaves of this species of cattail are present, just emerging from the surface of the water. For a total of five months this is all that is visible. By June the plants are rapidly elongating, preparatory to developing a flowering spike at the apex of the stalk [stem]. Flowering occurs in July, and mature female spikes release minute seeds in August and Septamber, although same of the ripe female spikes remain intact on the plants far an additional period of time. The mature seeds can be seen drifting fram the plants via short attached hairs that keep them bouyant on air currents.

It seems that every part of the cattail plant has had multiple uses the world over (Morton 1975). In the American Southwest, groups have sought the rhizomes, stalks, leaves, pollen, entire flowering spikes [mature and immature], and seeds to satisfy a whale range of neads [Table 71]. The Hopi were thought to have introduced cattail plants into a wash closer to one of their villages, so that the resource would be more conveniently located [Whiting 1965: 54]. Ceremonially they considered cattail important because of its association with water [Whiting 1966]. Articles of cattail that had worn out were never burned, but simply set aside by the Ramah Navajo of New Mexica, as they considered the entire plant to be a medicine [Uestal 1952:14-15].

Cattail rhizames have been dug up and eaten raw, dried, or roasted; occasionally they were even ground into meal. This part likely kept many peaple from starving to death through time. For example, Northern Paiute were known as "cattail eaters" because they had little else to eat at certain times of the year [Stewart 1941:428]. The Cocopa of the Colorada River delta in Sonora and Baja California, were often hungriest just before the wild grass لnigla ripened; during this period cattail rhizames could be the main source of food for families $[K e l l y$ 1977:26, 39].

The stalks [stems] and leaves were collected for a variety of household purposes. For basket-making the Pima

| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Typha domingensis* | leaves, waven inta mats and rooEs | Pima, Arizana | $\begin{aligned} & \text { Curtin 1984: E4- } \\ & \text { 65, } 117 \end{aligned}$ |
|  | pallem, eaten raw, as a Elavoring, a thin gruel, or baked; sometimes stored | Mahave, Yuma, Cocapa, Maricopa, Arizana | ```Castetter and Bell 1951 : 209-210``` |
|  | pollen, eaten and used as bady decoration | Pima, Arizona | Curtin 1984:64E55, 117; Russell 1975:161 |
|  | rhizome, eaten raw or dried for later | Mohave, Yuma, Cocopa, Maricopa, Arizona | ```Castetter and Bell 1951:209-210``` |
|  | spikes [immature], eaten raw and cooked | S. Paiute, Nevada | Bye 1972:91 |
|  | spike [mature female], as stuffing For pillows | Pima, Arizona | Curtin 1984:6465, 117 |
|  | spike [mature Female], chewed with tallow as gum | Hopi, Arizoma | Whiting 1966:64 |
|  | stalk, chewed for sweet taste by children | Hopi, Arizona | Whiting 1965:64 |
|  | stalk, split for basketry | Pima, Arizana | Curtin 1984:6465, 117; Russell 1975: 133 |


| SPECIES | PART AND USE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Iypha domingensis* | stalk, used in roof construction | Pima, Arizana | Russell 1975:154 |
| T. latifalia | leaves, unven inta baskets | Spanish-Americans, Rio Grande River, New Mexica | Curtin 1965:16 |
|  | leaves, made inta bed mats, baskets, water jugs | Ramah Navaja, <br> New Mexico | Vestal 1952:14-15 |
|  | leaves, used for ceremanial necklaces and wristbands | Navajo | Elmare 1944: 24 |
|  | leqves, used in house construction | Kawaiisu, California | Zigmund 1981:68 |
|  | plant, used in making emetics | Navajo | Wyman and Harris 1941:58 |
|  | plant, used in Lightningway Ceremony | Ramah Navaja, New Mexica | Vestal 1952:14-15 |
|  | plant, as thatching <br> for tepees, wick-i-ups | White Mt. Apache, Arizona | $\begin{aligned} & \text { Reagan 1929: } \\ & 151,161 \end{aligned}$ |
|  | pollen, used in ceremanial manner | Mescalera and Chiricahua Apache | ```Castetter and Dpler 1936:35, 47``` |

[^4]| SPECIES | PARI AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| T. latifalia | pollen, used extensively in ceremonies | Navajo | Elmore 1944:24 |
|  | pollen, used in Lightningway Ceremony | Ramah Navajo, <br> New Mexico | Uestal 1952:14-15 |
|  | pallen, gathered for ceremonial use | White Mt. Apache, Arizona | $\begin{aligned} & \text { Reagan 1929: } \\ & 151,161 \end{aligned}$ |
|  | pallen, made inta cakes and mush | Cahuilla, California | Bean and Saubel 1972: 142-143 |
|  | pollen, roasted in leaves for a food; alsa a face paint | N. Paiute | Loud 1929: 158-159 |
|  | pollen, eaten raw, as a flavaring, a thin gruel, or haked; sometimes stored | Mahave, Yuma, Cocopa, Maricopa, Arizona | ```Castetter and Bell 1951: 209-210``` |
|  | rhizome, eaten when Faod scarce | 9 of 13 N. Paiute bands | Stewart 1941:428 |
|  | rhizome, eaten when food scarce | Cocopa, Lower Colorado River | Kelly 1977: 26, 39 |
|  | rhizome, eaten raw | Kawniisu, California | 2igmund 1981:6日 |
|  | rhizame, eaten | Kaibab Paiute, Utah and Arizona | Kelly 1964:46 |


| SPECIES | PART AND USE | GRDUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| T. latifalia | rhizome, eaten | Mescalerg Apache, New Mexica | Castetter 1935:53 |
|  | rhizame, eaten | Acoma and Laguna, New Mexico | Swank 1932:73 |
|  | rhizame, eaten raw | Ramah Navajo, <br> New Mexica | Uestal 1952:14-15 |
|  | rhizome, dried and ground into meal | Cahuilla, Califormia | Bean and Saubel 1972: 142-143 |
|  | rhizame, eaten raw or dried for later | Mohave, Yuma, Cocopa, Maricopa, Arizona | $\begin{aligned} & \text { Castetter and Bell } \\ & 1951: 209-210 \end{aligned}$ |
|  | rhizome, eaten raw or cooked with meat | Mescalera and Chiricahua Apache | ```Castetter and Dpler 1936:36, 47``` |
|  | rhizome, as a medicine | Cahuilla, California | Bean and Saubel 1972: 142-143 |
|  | seeds, eaten when immature | Kawaiisu, California | 2igmund 1981:6日 |
|  | seeds, eaten when mature; alsa used for sandal padding | N. Paiute | Loud 1929: 158-159 |
|  | ```shoots [tender], eaten``` | Acoma and Laguna, New Mexico | Swank 1932:73 |

Table 71 [cont.] Ethnographic references to the use of Iugha.

| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| T. latifolia | shoots, ground and eaten in Eamine times | San Felipe, New Mexica | Castetter 1935:53 |
|  | spike [immature], enten in the spring raw or cooked | Paiute | Palmer 1978:604 |
|  | spike [mature male], pallen harvested for food and medicine | Cocopa, Lower Colorado River | Kelly 1977:26, 39 |
|  | ```spike [immature female], eaten raw``` | Kamaiisu, Califarnia | Zigmund 1981:6日 |
|  | spike [mature female], eaten | Kaibab Paiute, Utah and Arizona | Kelly 1964:46 |
|  | spike [mature female], as dressings far burns, filling for pillows, cradle boards and quilts | Plains groups | Gilmore $1977: 12-$ 13 |
|  | spike [mature female], stuffed into pillows | Spanish-Americans, Rio Grande River, New Mexica | Curtin 1965:16 |
|  | spike [mature female], shook in rain dance to simulate clouds | Acoma and Laguna, New Mexico | Swank 1932:73 |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| I. latifolia | ```spike [mature female], used ritually in a marner similar to prayer pallen or meal``` | Keresan pueblos, New Mexico | White 1945:560 |
|  | stalk, as mats, bedding and for ceremonial bundies | Cahuilla, California | Bean and Saubel 1972:142-143 |
|  | stalk, made into ceremonial objects | Plains graups | ```Gilmore 1977:12- 13``` |
|  | stalk, as raof thatching | Isleta, New Mexico | Jones 1931:44 |
| Typha spp. | pallen, as a prayer pollen, but formerly perhaps as a food; gathered in June | Apache, Arizona | ```Buskirk 1949: 347-34日``` |
|  | rhizome, roasted as Faod | Apache, Arizana | ```Buskirk 1949: 347-34日``` |
|  | seeds, eaten roasted | Gosiute, Nevada and Utah | Chamberlin 1911: 383 |

gathered grean staiks in July [Russell 1975:161] or August [Curtin 1984:64-65], and peeled, split them inta halves, and then laid them on the ground to dry and bleach in the sun. The stalks were also sought as raw material for mats, bedding, roaf thatching, and ceremonial bundles. The stems and leaves have served as flaating islands for people of Lake Titicaca in Peru, and the Aztecs of Mexico made islands of this material in the middle of swamps $[$ Morton 1975$]$. Southwestern groups ate the young stalks [as shoots] when they were tender in the spring, or children chewed on mature stalks for sweetness. Sometimes the stalks were even ground up for food. Leaves served many of the same material culture needs as stalks, having been gathered for mats, roof thatching, water jugs, and ceremonial jewelry.

People collected pollen as a food and a face and body paint. Apparently it was occasionally stored. The Apache gathered it in June [Buskirk 1949:347-34日]. Groups living along the Lower Colorado and Gila Rivers in Arizona would callect large numbers of unripe heads and carry them to a single location; as the heads ripened they were tapped for their pollen load [Castetter and Bell 1951:209-210]. As a Food, it could be eaten raw, roasted, or made into cakes or mush. For example, the Northern Paiute in Nevada inclosed pollen in the leaves of a rush plant and roasted it in ashes, causing it to become hard and sweet like candy [Loud 1929:158-1593.

People also collected pollen for use in ceremonies and prayers. It is likely that it was utilized heavily in the past, as the Navajo gathered it in abundance before substituting it with easily acquired Zeg [corn] pallen [Elmore 1944:243.

The immature and mature male and female flowering spikes served many purposes. Peaple sought immature spikes as a food, to be eaten raw or cooked. Mature male spikes with pollen were sometimes eaten or made into a medicinal preparation. Mature female spikes with the fluffy seeds were not only eaten and chewed as gum, they provided dressings for burns, stuffing for pillows, cradleboards, and quilts, and were shook in rain dances to simulate clauds.

Individual seeds have provided food when both immature and mature. In 1933 Harrington described a Paiute woman preparing the mature seeds of Iugha latiEqlig as a food. She essentially pulled a large mass of the dried heads apart onto a smooth, hard surface, and then set fire to the mass. As the flame instantly ran thraugh the pile it burned off the attached hairs and left the toasted seeds intact. The woman repeated this a number of times until the ground was covered with seeds. Then she swept up the pile and winnowed it to remove any dirt. According to the woman, this food source was once commonly eaten by her people. Loud [1929: 158-1593 describes essentially the same preparation
technique, and noted that at the end of a day's labor there could be a sufficient quantity of seed upon the ground to fill several sacks. The Gosiute in Nevada and Utah burned the ripe spikes, and the seeds became roasted and loosened from their seed hairs in the process; once freed, the seeds were processed and eaten [Chamberlin 1911:383]. Ripe seeds also provided padding for sandals.

The archasological record reveals collection of cattail leaves, pollen, seeds, and possibly other parts in prehistory $[$ Table 72]. Leaves have been fashioned into sandals, and along with stalks were perhaps made into mats, baskets, rope and other household items. Pollen has been eaten either as pure pollen or as male spikes. Pollen was baked or roasted prior to consumption, as Napton and Kelso [1969:21-23] noted some "charred" cattail pollen grains in an A.D. 740 coprolite from Lovelock Cave. Pollen associated with a burial suggests ceremanial use [Pippin 1979:249-250]. Pollen recovered from Pueblo Grande Ruin in Arizona [Gish 19793 may represent ancient gathering of plants with mature reproductive spikes for use in roof construction.

Whole Iyphe seeds, along with Scirgus seeds, comprised over $90 \%$ of the seeds recavered fram 50 coprolites at Lovelock Cave in Nevada, spanning the time period A.D. 750-1800. Evidence of roasting and carbonization suggested the seeds were parched prior to eating them [Cowan 1967:22-23]. In addition to praviding a food, the downy seed hairs appear to

| SPECIES | PART AND USE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| I. domingensis | pollen, from plants used in rafe construction; as part of mud used in plastering | Puebla Grande Ruin, Arizona | Gish 1979 |
| T. latifolia | parts [variaus], used in several ways | Dzark Bluff-Dueller Culture, Arkansas and Missauri | Gilmore 1931:93 |
|  | pollen, in coprolites, suggests consumption of pallen ar male spikes | Antelape Hause, Arizona | Williams-Dean and Bryant 1975:107 |
|  | pollen, from a burial context, suggests ceremonial use | Guadalupe Ruin, New Mexico | Pippin 1979: 249-250 |
|  | spikes [male and Female] and ather parts | Bat Cave, New Mexico | Smith 1950:166 |
| Typhn spp. | leaves, made into a sandal | Lavelock Cave, Nevada | Loud and Harrington 1929: 55-93 |
|  | leaves or stalks, as mats, twined baskets, rope, balls and irregular bundles | Lovelock Lave, Nevada | Loud and Harrington 1929:55-93 |
|  | pollen, in coprolites | Lake Cahuilla, Califarnia [A.D. 900-1500J | Wilke 1978:70-72 |


| SPECIES | PART AND USE | GROUP [S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| Typha spp. | pollen [charred], in copralites, suggests consumption of baked pallen or roasted male spikes | Lquelack Cave, Nevada [A.D. 740 and A.D. 1800J | Napton and Kelso 1969:21-23 |
|  | pallen, in copralites, suggests consumption of pallen or male spikes | Hay House, Calorada [Puebla III] | Scott 1979:271 |
|  | pollen | Chaco Canyon, New Mex. [A.D. 750-1100] | Cully 1977:50 |
|  | pollen, from a floar and metate | Grasshopper Pueblo, Arizona [A.D. 130014003 | ```Bohrer 1982:101- 102``` |
|  | seeds, in coprolites, as roasted or parched food | Lavelock Cave, Nevada [A.D. 750-1800] | $\begin{aligned} & \text { Cowan 1967: } \\ & \text { 22-23 } \end{aligned}$ |
|  | seeds, same parched | Lake, Cahuilla, Calif. [A.D. 900-1500] | Wilke 1978: 70-72 |
|  | seed hairs [down], possibly as a sandal lining | Lavelock Cave, Nevada | Loud and Harrington 1929:55-93 |

have been utilized as padding for a sandal. Elsawhere, coprolites from ancient Lake Cahuilla in California CA.D. 900-15003 had evidence of both cattail seed and anther use as food [Wilke 1978:70-72].

In two prehistoric locations researchers commented that ancient occupants of an area either traveled some distance to obtain cattail resources, or the plants grew closer to the locations than at present. At the time abundant Iyphg latifglig material was racovered from Bat Cave in New Mexico, the ciosest cattail stand was 12 miles distant [Smith 1950:166]. Presence of cattail pallen grains in a Chaco Canyon pueblo dating to A.D. 750-1100 in north-central New Maxico suggestad that the resaurce either grew nearby in prehistory or that the inhabitants traveled some distance to acquire it [Cully 1977:50], as no cattail could be found in the local area when the site was excavated.

SIGNIFICANCE FDR HLMANS
Iugha latifalia plants provide resources in all months except December, although observant individuals could still find the underground rhizomes at this time. For the five months of January through May a few emergent leaves signal the location of rhizomes that would presumably have a larger proportion of nutrients than later when the developing plant has depleted them. Young shoats [stalks] would provide a tender food during June. Toward the end of that month immature flowering spikes could be harvested and eaten.

Pollen or the entire mature male flowering spikes wauld generally be available in July; on the other hand the mature female flowering spikes and seeds often cling to the apex of the plant from August through November. If stalks are harvested for basketry material, they might be preferred in July and August, as the ethnographic record suggests. Oither household needs, such as bedding, mats, roof thatching, etc. might be satisfied with leaves picked at any time from July thraugh November. Larger leaves needed for household items and for use in ceremonies could alsa be collected July through November.

PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD
Rhizomes are not expected to preserve unless accidentally charred during roasting. Young shoots eaten fresh are too fleshy to survive, as are immature flowering spikes. Pollen could be recovered in human fecal material, or in high concentrations suggestive of prehistoric use. Chances of recovery of cattail seads are low, due in large part to their minute size [generally less than 0.5 mm . Stalks and leaves fasinioned inta various inuschold iteme would likely preserve only in well protected locations.

Yiguierg longifolig CRabbins \& Greenm.] Blake CH-7 [KA \#155-83] UA255000
 habitat

Uiguienc lonaifalia grows on the stream flanks in Canela Hills. The alluvial soil is dry and the plants are fully exposed to the sun's rays.

## PHENDLOGY

Yiguieca is an annual plant, flowering August through October. Ripe achenes are available in October and November. Uegetative growth spans most of the period the plant is active, except for November, when all growth has ceased and only mature fruit is present. The plant overwinters as dormant seed in the soil from December to July.

## ETHNDGRAPHIC/ARCHAEDLOGICAL RECDRDS

The only reference to historic use of Uiguiega longifolig concerns the Ramah Navajo of New Mexica, who considered it a life medicine [Uestal 1952:54]. It is not known what part of the plant they used.

Other Yiguiera species are cited in the ethnographic
literatura. The Ramah Navaja noted that $Y_{\text {, }}$ multiEloca was a sheep and dear food, and possibly a witcheraft plant as well [Uestal 1952:54]. The seeds [achenes] of $\underline{Y}_{2}$ multifloca have been "used" [eaten?] by people in Utah and Nevada [Yanovsky 1936:63]. The Tarahumara of Mexico crushed and applied the roots of $Y_{\perp}$ decurrens as a poultice for treating boils and infections. This same group ate the tender raw leaves of $\underline{U}_{1}$ helignthoides [Pennington 1963:110, 128, 191].

Some references to Yiguieca species suggest the plant is poisonous. Yiquieca quau poisons cattle with either cyanide or nitrata 〔Lewis and Lewis 1977:58]. The Tarahumara of Mexico used the roots of $U_{\text {_ }}$ decurrens as a fish poison; they harvested the plants from damp places along ravines, crushing and dumping the roots into water to stun fish. Apparently the roots could also be gathered and stored for future use [Pennington 1957].

SIGNIFICANCE FOR HUMANS
Ceremonial needs for Uiguiera could be met at any time the plant is available above ground, August through November. Achenes can be harvested for faod in both Dctaber and November. Actively growing leaves available far greans are found on the plants from August through Dctober. It is unknown if the generally small size of the roots of this annual plant might lessen the chances it would be chosen for a fish poison. Roots would reach maximum size in Dctober, and above ground parts wauld signal their lacatian in bath

Qctaber and November.

## PREDICTIONS FOR THE ARCHAEDLOGICAL RECDRD

Perhaps the part with the best chances of preservation in ancient sites would be the achenes, which would likely be prepared in much the same way as sunflower [Helianthus] achenes. This would include parching or raasting, techniques that might introduce the achenes into firepits and eventually into trasin deposits. The fact that it is very difficult to tell some spacies of Helignthus from Yiguieca achenes when they are charred makes it hard to know just which taxon is contained in a particular prehistoric context. It seems reasonable that both might be present. Ancient preparation of the leaves as greens, and use of the roots as a fish poison reduce chances these parts would preserve.

Yitis orizonica Engelm.
RC-7 [KA \#120-83] UA254615; UA255045


HABITAT
Yitis acizonicg thrives in wet soil within three feet of the stream at Ramsey Canyon. The location is composed of water-carried boulders and cobbles, with a small amount of alluvial sail. Very few direct sun's rays reach the grape plants, due to the dense shading provided by an overhead canopy of tall trees.

## PHENOLOGY

Leaves first emerge from this woody-stemmed climber in March, and by April flawer buds have formed. Flowering occurs in May, with the ripe fruit available from August through November. Uegetative growth slows considerably by September .

EIHNDGRAPHIC/ARCHAEOLOGICAL RECORDS
Numeraus histaric graups have eaten the fruit of wild grapes either fresh or dried, sometimes gathering it in quantities and often storing it for winter use [Table 73]. It seems that the entire fruit, including the hard seed, was

Table 73. Ethnographic references to the use of Uitis.

| SPECIES | PART AND USE | GROUP[5] | REFERENCE |
| :---: | :---: | :---: | :---: |
| U. arizonica | fruit, eaten fresh or dried and ground for winter use | Apache, Arizona | Buskirk 1949:340 |
|  | Fruit, eaten fresh, or dried in quantity for winter use | 5. Paiute, Nevada | Bye 1972:96 |
|  | Fruit, eaten Fresh or dried for winter use | Mescalero and Chiricahua Apache | ```Castetter and Opler 1936:44-45``` |
|  | Fruit, eaten in large quantities, ar dried For winter use; sometimes ground and cooked | Groups in California, Arizana and Utah s | $\begin{aligned} & \text { Palmer 1878:599- } \\ & \text { 600 } \end{aligned}$ |
|  | fruit, eaten | Navajo | Elmare 1944:62 |
|  | Fruit, eaten | Western Apache, Arizana | $\begin{gathered} \text { Gallagher } \\ \text { 1977:30 } \end{gathered}$ |
|  | fruit, eaten | Isleta, New Mexica | Jones 1931:44 |
|  | Eruit, eaten | Jemez, New Mexico | Cook 1930:2日 |
|  | fruit, eaten | Tepehuan, Chihuahua | Pennington 1969: 136, 183 |
|  | fruit, eaten | Tarahumara, Chihuahua | Pennington 1963: $117$ |


| SPECIES | PART AND USE | GROUP[S] | REFERENCE |
| :---: | :---: | :---: | :---: |
| U. arizonica | juice, used to paint bodies of dancers | Jemez, New Mexico | Coak 1930:28 |
|  | lenves, as a medicinal poultice | Tepehuan, Chihuahua | $\begin{aligned} & \text { Pennington 1969: } \\ & \text { 136, 183 } \end{aligned}$ |
|  | seeds, ground and eaten | 5. Paiute, Nevada | Bye 1972:96 |
|  | ```seeds, ground and eaten``` | Groups in California, Arizana and Utah | Palmer 187日:593- 600 |
|  | vine, made inta a cross as part of courtship offering | Navaja | Elmore 1944:62 |
| U. cinerea | Fruit, eaten Fresh ar dried for winter | Plains groups of Missouri River Region | Gilmore 1977:50 |
|  | ```Eruit, eaten Eresh or dried for winter; made into jam/jelly``` | Kiowa, Oklahoma | Vestal and Schultes 1939:42 |
|  | sap Fram vines; tapped in spring and drunk | Plains groups of Missouri River Region | Gilmare 1977:50 |
| Uitis spp. | Fruit, eaten Fresh or dried and stared; dried fruit made into cakes and baked | Comanche, Oklahoma | Carlson and Jomes 1940:527 |
|  | fruit, eaten Eresh | SE Yavapai, Arizana | Gifford 1932:212 |

consumed. At times the seeds alane have been ground and eaten. In other uses, the juice has provided a body paint, sap was tapped from the vines as a drink, and the flexible vine was formed into a cross and used as part of a courtship offering.

Havard [1835:104] suggested the Pueblo Indians of Arizona cultivated the canyon grape [Yitis grizonica], as someone observed the plants growing in rows near Fort Whipple. Palmer [1870:415] provides elaboration on this idea. He suggests the ancient Puebloans cultivated a wild grape [as Yitis califocnig<u_ gcizonensis], because of the peculiar distribution of the plants near ruined settlements. Near Fort Whipple in Arizona, they were arranged in raws and seemed to be very old. At Camp Lincoln on the Verde River close to a number of prehistoric ruins, a small stream called Clear Creek passed close by, on sech side of which was a narraw strip of rich land covered with brush and grape vines. These grape vines differed in many particulars from those native to the locality. The native kinds, found so universally in the nearby woods, were growing abundantly all around. The potentially "cultivated" vines next to the stream appeared quite old, having been repeatedly burnt off, according to evidence of the stumps. Dr. Engelmann, a taxonomist in St. Louis, grew the seeds from some of these unusual grapes and thought that perhaps five or six varieties were represented.

Uitis remains have been recovered from sites in Arizona, New Miexico, and elsewhere in the United States. A single canyon grape fruit was excavated from the Tonto Ruins in sauth-central Arizona dating to the A.D. 1300's [Bohrer 1962:100]. Canyon grapes were also among the remains listed by Judd (1954:61] as having been found in Pueblo Bonito household debris from the 13th century A.D. Abundant wild grape remains of species native to Arkansas and Missouri were recovered from Ozark Bluff-Dweller sites, suggesting their favor as a food [Gilmore 1931:93]. SIGNIFICANCE FOR HUMANS

Canyon grape fruit could be collacted in Ramsey Canyon for food or body paint from August through November. Sap from vines might flow more profusely in the spring for a few months [February-March] prior to resumption of growth. The vines could be gathered year-round, but are most flexible during the earlier part of the growing season. predictions for the archaedlogical record

Since wild grapes are often eaten fresh, or dried and graund far later use, it is unlikely much wauld remain in the ancient record to signal use. Finding whale seeds in human coprolites would be expected. Recovering the rather fragile vines would not.

Ethnobotanical considerations
Ethnobatanists examining material from ancient sites can benefit by organizing the preceding data in different ways. For example, all taxa can be examined by category of use, such as "Food" or "medicine", for an emerging view of which riparian plant resaurces are available for these uses at specific times of the year. Such an overview will permit one to evaluate productive and poor harvest seasons; information on season of actual use may not be the same as that of harvest, since most plant parts can be processed and stored for long periods. An ethnobotanist can also gain perspective on the variety of alternative plant resource choices in a specific season.

Another way to organize the data is according ta the uses to which different plant parts have been put by humans. This provides insight into the range of reasons people actually chose a particular part. For example, the ethnobotanist trying to interpret the meaning of an ancient burned piece of bark will benefit by reviewirl the many needs for which people have gathered bark in histaric times. There are different pathways that plant parts may enter the archaealogical record, and same may produce similarappearing ancient debris, making it difficult to clearly distinguish separate paths of entry. Therefare, along with a
careful scruting of the context of recavery, it is helpful if one can keep in mind the diversity of reasans far which a particular part might be acquired.

The ethnobatanist shauld keep in mind that paple might do mare with a native plant than simply harvest useful parts. For this reason, a section on native plants which might have received casual care in historic times has been included. Although such care may not lead to the kind of marphological changes useful in recognizing damestication, one may be mare careful about documenting basic morpholagical characteristics in certain archaealagical taxa if historic records suggest intensified human interest.

Insight into human choice of riparian plants is gained when additional data is examined. For example, by knowing the general representation of the different lifeforms on the landscape, $\square$ a tionately. In another view, when pollen wash samples from specific fruit and vegetative parts have been scrutinized for the presence of pollen, an understanding of mechanisms for pollen transport into ancient dwellings is provided.

## Food

Food being a preeminent human need, the camplete literature base was organized to view the range of plant Foods available in each month fram January to December [Tables 74-85]. Although Fruit, seeds, stems and leaves would be expected to serve as food, the tables also contain evidence of a wide variety of parts such as flawers, pollen, bark, galls, and underground vegetative structures that could be eaten.

When one looks at the number of plant species that offer food resources during each month, the data suggest periods of both potential abundance and scarcity. There is a range of as many as 49 edible species in September to as Few as 15 in December [Table BG]. Threa distinct periods of the year seem apparent: [1] the period of December through March, when the least number of edible species [ranging between 15 and 23] are available; [2] the period of April through June, when moderate numbers of species Cranging from 25-32] can be acquired; and [3] the highly productive period of July through November, when between 39-49 separate species offer parts to be gathered.

The view that December-March may be the most difficult time ta acquire Eood resources in riparian habitats is altered samewhat if one further considers that repraductive

Table 74. Foods available in the month of January. Lifeform categories are T[rees], S[hrubs], P[erennials], and A[nnuals].

## Iaxon

Abies concalor
Apodanthera undulata
Aralia racemosa
Arbutus arizonica
Berberis wilcoxii
Ceanothus fendleri
Equisetum spp.
Juniperus deppeana var. pachyphloea
Lactuca graminifalia
Oxalis spp.
Populus fremontii
Quercus spp.
Ranumeulus spp.
Rhus trilobata var. racemulasa
Ribes aureum
Rumex violascens
Salix spp.
Stachys coccinea
Typha latifolia

Part
Lifeform
inner bark T
fruit, seeds $P$
root
P
berries I
berries 5
inner bark 5
plant, root $P$
berries, inner bark $T$
leaves $P$
plant, leaves A/P
inner bark I
bark, gall T
plant, root P
bark, berries 5
leaves 5
leaves, root A
bark I
fruit $P$
rhizome $P$

Table 75. Foods available in the month of February. Lifeform categories are I[rees], S[hrubs], P[erennials], and A[nnuals].

Taxon
Abies concolor
Acer saccharum ssp. grandidentatum
Apodanthera undulata
Aralia racemosa
Arbutus arizonica
Arctostaphylos pungens
Berberis wilcoxii
Ceanothus fendleri
Equisetum spp.
Juniperus deppeana var. pachyphlaea
Lactuca graminifalia
Mimulus guttatus
Pinus discolor
Populus fremontii
Pseudatsuga menziesii var. glauca
Quercus spp.
Ranunculus spp.
Rhus trilobata var.
racemulosa
Ribes aureum
Rumex violascens
Salix spp.
Stachys caccinea
Typha latifolia

Part
Lifefarm
inner bark I
inner bark, sap I
Fruit, seads $P$
root $P$
berries I
Elowers 5
berries 5
inner bark S
plant, root $P$
berries, inner bark T
leaves $P$
leaves $P$
inner bark I
buds, inner bark T
inner bark I
bark, gall T
plant, root P
bark 5
leaves $S$
leaves, root A
bark, flowers I
fruit $P$
rhizome $P$

Table 76. Foods available in the month of March. Lifeform categaries are T[rees], S[hrubs], P[erennials], and A[nnuals].

Taxan
Aralia racemosa
Ceanothus fendleri
Equisetum spp.
Fraxinus pennsylvanica spp. velutin
Juniperus deppeana var.
pachyphloea
Lactuca graminifalia
Mimulus guttatus
Pinus discolor
Pinus engelmannii,
P. strobiformis

Plantago spp.
Populus fremontii
Pseudotsuga menziesii var. glauca
Quercus spp.
Ranunculus spp.
Rhus trilabata var.
racemulosa
Rumex violascens
Salix spp.
Scirpus spp.
Typha latifalia

Part Lifeform

| root | P |
| :---: | :---: |
| inner bark | 5 |
| plant, root | P |
| inner bark | I |
| berries, inner bark | T |
| leaves | P |
| leaves | P |
| inner bark | I |
| inner bark | I |
| leaves | A |
| buds, inner bark | T |
| inner bark | I |
| bark, gall | T |
| plant, root | P |
| bark | 5 |
| leaves, root | A |
| bark , Elowers, | I |
| root, stems, | P |
| Shoots rhizome | P |

Table 77. Foods available in the month of April. Lifeform categaries are T[rees], S[hrubs], P[erennials], and A[nnuals].

Taxan
Apocynum sibiricum
Aralia racemosa
Carex spp.
Ceanothus Fendleri
Chenopodium off. neomexicanum
Descurainia pinnata spp. ocroleuca
Equisetum spp.
Fraxinus pennsylvanica spp. velutin
Juniperus deppeana var. pachuphloea
Lactuca graminifalia
Lonicera albiflora var. dumasa
Mimulus guttatus
Pinus discalar
Pinus engelmannii, $P$. strabiformis
Plantago spp.
Papulus Eremontii
Quercus spp.
Ranunculus spp.
Rhus trilabata var. racemulosa
Rudbekia laciniata
Rumex violascens
Salix spp.
Scirpus spp.
Sporobalus airaides var. wrightii
Typha latifalia

Part
Lifeform

Table 78. Foods available in the month of May. Lifeform categaries are T[rees], SChrubs], P[erennials], and A[nnuals].

Taxon
Apocynum sibiricum
Aralia racemosa
Carex spp.
Ceanothus fendleri
Chenopadium aff. neomexicanum
Descurainia pinnata spp. ocroleuca
Equisetum spp.
Fraxinus pennsylvanica spp. velutin
Helianthus annuus
Ipomoea hederifolia
Juniperus deppeana var. pachyphloea
Lactuca graminifalia
Lanicera albiflora var. dumosa
Mimulus guttatus
Oxalis ssp.
Plantago spp.
Populus fremontii
Quercus spp.
Ranunculus spp.
Rhus trilabata var.
racemulosa
Robinia neomexicana
Rudbekia laciniata
Rumex violascens
Salix spp.
Scirpus spp.
Sporobolus airoides var. wrightii
Typha latifalia

Part
fibers P
root
P
stems $P$
inner bark $S$
leaves $A$
seeds A
plant, root P
leaves $T$
leaves A
leaves, root $A$
berries, imner bark $T$
leaves $P$
flowers S
leaves $P$
plant, leaves A/P
leaves, seeds $A$
inner bark I
bark, gall, leaves $T$
plant, root $P$
bark 5
flowers I
young shoots $P$
leaves, root A
bark, leaves $T$
pollen, root P
young shoots $P$
rhizame $P$

Table 79. Foods available in the month of June. Lifeform
 A[nnuals].

Taxon
Apocynum sibiricum
Aralia racemosa
Asclepias subverticillata
Asclepias tuberosa ssp. interior
Berula erecta
Carex spp.
Ceanthus fendleri
Chenopadium aff. neamexicanum
Descurainia pinnata ssp. ocroleuca
Desmodium spp.
Equisetum spp.
Helianthus annuus
Ipomoea hederifolia
Juniperus deppeana var. pachyphloea
Lactuca graminifolia
Lithospermum multiflorum
Lonicera albiflora var. dumosa
Latus oroboides var.
nummularis
Mentha arvensis var. villosa
Mimulus guttatus
Denothera rosea
Oxalis spp.
Plantago spp.
Poa fendleriana
Populus fremontii
Quercus spp.
Ranunculus spp.
Rhus trilobata var. racemulosa
Rumex violascens
Salix spp.
Scirpus spp.
Iypha latifalia

Part
Lifeform

| fibers | P |
| :---: | :---: |
| root | P |
| leaves | P |
| root, young shoots | P |
| leaves | P |
| achenes, stems | P |
| innerbark | 5 |
| leaves | A |
| seeds | A |
| leaves | A/P |
| plant, root | $P$ |
| leaves | A |
| leaves, root | A |
| inner bark | I |
| leaves | P |
| leaves | P |
| berries | P |
| plant | P |
| leaves, stems | P |
| leaves | P |
| flowers, leaves, plant | P |
| plant, leaves | A/P |
| leaves, seeds | A |
| caryapses | P |
| imner bark | I |
| bark, gail, leaves | I |
| achenes, plant, root | P |
| flowers, seads, pads | 5 |
| leaves, raot | A |
| bark, leaves | I |
| pollen, rat | P |
| flowers, young shoots | P |

Table 80. Foods available in the month of July. Lifeform categaries are I[rees], S[hrubs], P[arennials], and A[nnuals].

## Taxan

Apocynum sibiricum
Aralia racemosa
Asclepias subverticillata
Asclepias tuberosa ssp.
interior
Berberis wilcoxii
Berula erecta
Carex spp.
Ceanothus fendleri
Chenapodium aff. neomexicanum
Commelina dianthifolia
Cyperus spp.
Desmodium spp.
Equisetum spp.
Eragrostis intermedia
Helianthus annuus
Ipomoea hederifolia
Juncus spp.
Juniperus deppeana var. pachyphloea
Lactuca graminifalia
Lithospermum multiflorum
Lotus oroboides var.
nummularis
Mentha arvensis var. villasa
Mimulus guttatus
Monarda austromontana
Denothera rosea
Dxalis spp.
Pennellia langifalia
Plantago spp.
Populus fremontii
Portulaca umbraticola
Quercus spp.
Ranunculus spp.
Rhus trilobata var. racemulosa
Ribes aureum
Robinia neomexicana
Rumex violascens
Salix spp.
Scirpus spp.
Tradescantia pinetorum
Typha latifolia

Part
Lifeform
fibers $P$
young shoots $P$
leaves, young pods $P$
bud, flower, pod, P root
berries $S$
flowers, leaves $P$
achenes, stems $P$
inner bark 5
leaves $A$
plant $P$
root, tubers $P$
leaves $A / P$
plant, root $P$
caryopses $P$
leaves $A$
leaves, root A
seeds $P$
inner bark $T$
leaves $P$
leaves $P$
plant P
leaves, stems $P$
leaves, fruit $P$
plant, leaves A
flowers, leaves, plant $P$
bulb, leaves, plant $A / P$
plant $A$
seeds A
inner bark T
leaves, stems A
bark, gall, leaves I
achenes, plant, root $P$
bark 5
fruit 5
seeds, young pods T
leaves, root A
bark, leaves I
pollen, root $P$
plant $P$
pollen, stalk $P$

Table 日1. Foods available in the month of August. Lifeform categories are T[rees], S[hrubs], P[erennials], and A[nnuals].

Taxan
Allium cermuum var. neomexicana
Apocynum sibiricum
Arctostaphylos pungens
Asclepias subverticillata
Asclepias tuberosa ssp. interior
Berberis wilcaxii
Berula erecta
Bidens pilosa
Bramus carinatus
Carex spp.
Ceanothus fendleri
Chenapadium aff. neamexicanum
Cyperus spp.
Desmadium spp.
Elymus canadensis
Equisetum spp.
Eragrostis intermedia
Helianthus annuus
Ipomoea hederifalia
Juncus spp.
Juniperus deppeana var. pachyphloea
Lactuca graminifolia
Lithospermum multiflorum
Mentha arvensis var. villosa
Mimulus guttatus
Mirabilis coccinea
Monarda austromontana
Denothera rosea
Oxalis spp.
Panicum spp.
Pennellia langifalia
Pinus engelmannii,
P. strobiformis

Populus fremontii
Portulaca umbraticala
Prunus serotina ssp. virens
Quercus spp.
Ranunculus spp.
Rhus trilobata var. racemulosa

## Part

Lifeform
bulb, leaves $P$
fibers $P$
Fruit, seeds 5
leaves, young pods $P$
bud, flower, pod, $P$ root
berries $S$
flowers, leaves $P$
leaves, young shoots A
caryopses $P$
achenes, stems $P$
inner bark 5
flowers, leaves A
root, tubers $P$
leaves $A / P$
caryapses $P$
plant, rant P
caryopses $P$
leaves $A$
leaves, root $A$
seeds $P$
inner bark T
leaves $P$
leaves $P$
leaves, stems $P$
Eruit, leaves $P$
seeds $P$
plant, leaves $A$
flower, fruit, leaves $P$ plant, seeds
bulb, leaves, plant A/P
caryopses $P$
plant A
seeds I
inner bark I
leaves, stams A
fruit 5
bark, gall, fruit I
leaves
nchenes, plant, root $P$
bark 5

Table 81 [cont.] Foods available in the manth of August.

Taxon
Ribes aureum
Robinia neamexicana
Rumex violascens
Salix spp.
Scirpus spp.
Stachys caccinea
Typha latifalia
Uiguiera longifolia
Uitis arizonica

## Part

Lifeform
Eruit S
seeds
S
leaves, root, seeds $A$
bark, leaves I
achenes, pollen, root $P$
fruit
fruit, seeds, stalk $P$
leaves A
Fruit, seeds 5

Table B2. Foods available in the month of September. Lifeform categories are I[rees], S[hrubs], P[erennials], and $A[n m u a l s]$.

Taxan
Allium cernuum var. neamexicana
Anoda cristata
Apocynum sibiricum
Apodanthera undulata
Arctostaphylas pungens
Asclepias subverticillata
Asclepias tuberasa ssp.
interior
Berberis wilcoxii
Berula erecta
Bramus carinatus
Carex spp.
Ceanothus fendleri
Chenapodium aff. neomexicanum
Cucurbita faetidissima
Cyperus spp.
Desmodium spp.
Eleocharis rostellata
Elymus canadensis
Equisetum spp.
Eragrostis intermedia
Helianthus annuus
Ipomoea hederifolia
Juglans major
Juncus spp.
Juniperus deppeana var. pachyphloea
Lactuca graminifolia
Lithospermum multiflorum
Mentha arvensis var. villosa
Monarda austromontana
Oxalis spp.
Panicum spp.
Pinus engelmannii,
P. strobiformis

Populus fremontii
Portulaca umbraticala
Quercus spp.
Ranunculus spp.
Rhus trilobata var. racemulosa
Ribes aureum
Robinia neomexicana

Part
bulb, leaves
Lifeform
P
plant, leaves A
Eibers $P$
Fruit, seeds P
Fruit, seeds $S$
leaves, seeds $P$
root, young pods $P$
berries $S$
leaves $P$
caryopses $P$
achenes, stems $P$
inner bark $S$
leaves, seeds $A$
Fruit $P$
achenes, root, tubers $P$
fruit, leaves A/P
achenes $P$
caryopses $P$
plant, root P
caryopses $P$
leaves $A$
leaves, root A
fruit T
seeds $P$
berries, inner bark I
leaves $P$
leaves $P$
leaves, stems $P$
plant, leaves A
bulb, leaves, plant $A / P$
caryopses $P$
seeds I
inner bark T
leaves, seeds, stems $A$
bark, fruit, gall T
leaves
achenes, plant, root $P$
bark, berries $S$
fruit S
seeds I

Table B 2 [cont.] Foods available in the month of September.

Taxon
Rumex violascens
Salix spp.
Scirpus spp.
Setaria geniculata
Sporobolus airoides var. wrightii
Stachys coccinea
Stipa pringlei
Typha latifolia
Viguiera longifalia
Uitis arizonica

Part
Lifeform
root, seeds A
bark, leaves I
root
caryopses
caryopses
fruit
P
caryopses $P$
Fruit, seeds, stalk $P$
leaves $A$
fruit, seeds

Table 日3. Foods available in the month of October. Lifeform categories are I[rees], S[hrubs], P[erennials], and $A[m m u l s]$.

## Taxon

Abies concolor
Anoda cristata
Apocynum sibiricum
Apodanthera undulata
Arctostaphylos pungens
Asclepias tuberosa ssp. interior
Berberis wilcoxii
Bouteloua gracilis
Bromus carinatus
Ceanothus Fendieri
Chenopodium aff. neomexicanum
Cyperus spp.
Desmodium spp.
Elymus canadensis
Equisetum spp.
Eragrastis intermedia
Eriochloa lemmoni var.
gracilis
Helianthus annuus
Ipomoea hederifolia
Juglans major
Juncus spp.
Juniperus deppeana var. pachyphloea
Lactuca graminifalia
Leptochloa dubia
Mentha arvensis var. villosa
Monarda austromontana
Muhlenbergia spp.
Oxalis spp.
Panicum spp.
Pennellia langifalia
Phasealus acutifalius var.
acutifal
Physalis virginiana var.
sonarae
Pinus discolor
Pinus engelmannii,
P. strobifarmis

Populus fremontii
Portulaca umbraticola
Quercus spp.
Ranunculus spp.

Part
Lifeform
seeds T
pianc, ieaves A
Fibers $P$
Fruit, saeds P
fruit, seeds 5
root $P$
berries S
caryopses $P$
caryopses $P$
inner bark $S$
seeds A
achenes, root, tubers $P$
fruit, leaves A/P
caryapses $P$
plant, root P
caryopses $P$
caryopses A
achenes, leaves $A$
leaves, root $A$
fruit T
seeds $P$
berries, inner bark I
leaves $P$
caryopses $P$
leaves, stems $P$
plant, leaves A
caryopses $P$
plant, leqves A/P
caryopses $P$
seeds A
seeds A
Eruit P
seeds I
seeds I
inner bark I
leaves, seeds, stems A
bark, fruit, gall I
achenes, plant, root $P$

Table 83 [cont.] Foods available in the month of October.
Taxon
Part
Lifeform

Rhus trilobata var. racemulosa
bark, berries 5
Salix spp.
Scirpus spp.
Setaria geniculata
Stachys caccinea
Stipa pringlei
Typha latifalia
Uiguiera longifalia
Uitis arizanica
bark, leaves T
root $P$
caryopses $P$
fruit $P$
caryopses P
fruit, seeds, stalk P
achenes, leaves A
fruit, seads S

Table 84. Foods available in the month of November. Lifeform categories are I[rees], S[hrubs], P[erennials], and $A[n m u a l s]$.

Iaxan
Abies concolor
Anoda cristata
Apodanthera undulata
Aralia racemosa
Asclepias tuberosa ssp. interior
Berberis wilcaxii
Bouteloua gracilis
Bromus carinatus
Ceanothus Fendleri
Cyperus spp.
Desmodium spp.
Elymus canadensis
Equisetum spp.
Eragrostis intermedia
Helianthus annuus
Juglans major
Juniperus deppeana var. pachyphloea
Lactuca graminifolia
Monarda aust.romontana
Muhlenbergia spp.
Oxalis spp.
Panicum spp.
Pennellia langifolia
Phasealus acutifolius var. acutifal
Physalis virginiana var. sonorae
Pinus discolor
Pinus engelmannii,
P. strobiformis

Populus fremontii
Portulaca uimbraticala
Quercus spp.
Rhus trilobata var. racemulosa
Rumex violascens
Salix spp.
Scirpus spp.
Stachys coccinea
Stipa pringlei
Typha latifolia
Uiguiera longifalia
Uitis arizonica

Part
Lifeform
seeds I
plant, leaves A
fruit, seeds $P$
root P
root P
berries $S$
caryopses $P$
caryopses $P$
inner bark 5
root, tubers $P$
fruit, leaves $A / P$
caryopses $P$
plant, root P
caryopses $P$
achenes, leaves $A$
Fruit $T$
berries, inner bark I
leaves $P$
plant, leaves A
caryopses $P$
plant, leaves A/P
caryopses $P$
seeds A
seeds A
Eruit $P$
seeds I
seeds I
inner bark I
leaves, seeds, stems $A$
hark, fruit, gall T
bark, berries 5
leaves A
bark, leaves I
root $P$
fruit P
caryopses $P$
fruit, seeds, stalk $P$
achenes A
fruit, seeds 5

Table 85. Foads available in the month of December. Lifeform categories are T[rees], S[hrubs], P[erennials], and A[nnuals].

## Plant

Apodanthera undulata Aralia racemosa Berberis wilcoxii
Ceanothus fendleri
Equisetum spp.
Juniperus deppeana var.
pachyphloea
Lactuca graminifolia Oxalis spp.
Populus fremontii
Quercus spp.
Rhus trilobata var. racemulosa
Rumex violascens
Salix spp.
Scirpus spp.
Stachys coccinea

## Part

fruit, seeds $P$
root $P$
berries 5
inner bark 5
plant, root $P$
berries, inner bark I
leaves $P$
plant, leaves A/P
inner bark I
bark, fruit, gall T
bark, berries 5
leaves A
bark I
root P
fruit P

Table 86. Annual view of plant species with potentially gdible reproductiven and vegetativeø parts; bamed upon data in Tables 74-85. Fercentages may sum to more than $100 \%$ : as some species simultaneously offer more than one edible resource in any given month.

| Month | Spec reprod No | with ve parts $\%$ | Spec veget No. | $\begin{aligned} & \text { with } \\ & \text { ve parts } \\ & \% \end{aligned}$ | Total No. Species |
| :---: | :---: | :---: | :---: | :---: | :---: |
| January | 6 | さ2\% | 15 | 79\% | 19 |
| February | 7 | $30 \%$ | 18 | 78\% | 23 |
| March | 2 | $11 \%$ | 19 | $100 \%$ | 19 |
| April | 2 | $1 \%$ | 25 | 100\% | 25 |
| May | 6 | 22\% | 24 | 87\% | 27 |
| June | 10 | S $1 \%$ | 29 | 91\% | 32 |
| July | 14 | $35 \%$ | 35 | 88\% | 40 |
| August | 26 | $55 \%$ | 35 | $75 \%$ | 47 |
| September | 51 | $65 \%$ | 31 | $6 \mathrm{~B} \%$ | 49 |
| Qctober | 34 | 72\% | 23 | 49\% | 47 |
| November | 25 | 64\% | 20 | $51 \%$ | 39 |
| December | 6 | 40\% | 12 | 80\% | 15 |

[^5]parts [flowers, pollen, fruit, seeds, young pads, etc.] might generally provide a more valuable calaric and nutritianal contribution than non-reproductive parts. When the data is scrutinized with this in mind [Table 日G], a new view emerges. The manths of December through February actually offer a number of reproductive parts, mostly fruits that cling to plants or items that survive lang periods before decaying, plus a few early flowering resources that can be gathered.

What may actually be the time of greatest patential food stress, at least from the standpoint of reproductive part availability, are the manths of March and April. Then the only reproductive resources are juniper berries and a few flowers. By March the fruit that had been clinging through the winter to branches of other species has abscissed and can no longer be found. One can speculate that the low overall nutritional opportunities of this period, coupled with the fact that a series of consecutive months have just passed when a rather narraw range of reproductive parts could be gathered, would make these two spring months the most critical for humans saaking plant Foods. Dpportunities ta gather repraductive parts increase substantially in May, June, and July, as the year experiences a renewal in reproductive activity. As early as May the seeds of Descurginig and Elantggg can be gathered, as can the flowers and pollen of a number of plants.

The mast abundant period of reproductive part availability spans the months of August through November, when over $50 \%$ of the species offer harvestable reproductive items. While the number of vegetative resources drops samewhat after July, mature fruit and seeds of a wide variety of species could still be gathered and prepared for storage.

Although this study has laid out a range of possible plant foods that could be acquired monthly in southeastern Arizona riparian habitats, it is premature to speculate on actual choices that humans might make. For example, this study lacks nutritional data on wild plant parts, many of which have never been evaluated for possible contributions to a human diet. It also lacks basic information on potential productivity; year to year fluctuations in amount of harvestable resources could vary for each species, especially for reproductive parts. In addition, the amount of effort required of humans to gather and process each potential faod could vary considerably, and would be expected to influence any ultimate benefits. Finally, the potential contribution of faunal resources to human diet would be expected to affect chaices in plant foods. Unanswered questions on the total yield of the riparian habitat for humans and the maximum number of foragers that could be supparted in either location still remain.

Incidental faod
A rumber of plant taxa have been cited as providing resources that can be grouped under the categary of incidental foods. This would include items sought as chewing gum, flavoring or seasoning, beverages [including alcohalic], as a catalyst for fermented drinks, and as material used to line ovens to produce steam for baking other Foods.

Trees, shrubs, perennial herbs [including grasses] and annuals are all represented, as are a wide range of the parts sought. While some of these parts would be available over the entire year, most wald not. Except in the case of the beverages, the actual contribution of these items to diet would likely be minimal.

The possible ways to satisfy a single need seem diverse. For example, one can apparently gather chewing gum from the resin of dbies and Rinus, the sap of Asclepios, the flowers and stalk of Helignthus, the root of Lactuca, the buds of Ropulus, and the fruit of Ropulus and Iupha. Beverages could be made from branches/twigs, flowers, fruit, leaves, roots, sap, young shoots, and whole plants of at least sixteen different species studied.

One incidental food use is that of an agent added to a roasting pit to produce steam during baking. One would suspect that the archaedlogical record of deep firepits could well retain the burned residue of species sought for
this purpose. If certain burned remains show up only in roasting/ baking pits and trash deposits, and nat in suspected food preparation areas at an ancient site [hearths, milling areas], one might reserve judgement on whether the remains actually represent ancient food use [Bohrer 1987]. For example, if caryopses of the grasses Bouteigug curtipendulg and Muhledbergig show up in certain ancient charcoal deposits, the archaeabatanist should carefully consider a non-food use of these species.

Medicine
Plants useful as medicines would provide an impartant component of riparian habitat vegetation. At least one hundred and forty medicinal needs satisfied by 72 separate taxa were recorded from the ethnographic literature searched.

Parts sought for medicinal preparations offer diverse periods of quailability. For example, some could be gathered at any time during the year, such as bark, inner bark, branches/twigs, galls, needles, and resin. On the other hand, parts such as developing buds and undergraund bulbs would only be available for one or two manths. Likewise, medicinal preparations that used flowers, fruit, leaves, plants, stems, roots and root bark might require that a medicinal practicioner gather them during a rather restricted number of months, depending on the taxon sought.

Ceremonial needs
Plants in and adjacent to riparian habitats could satisfy a number af ceremanial needs. The specific uses are listed in the results section of this study. The total range af needs is braad, and includes teas, ritual smaking materials, prayersticks, ceremonial emetics, applications Far wounds, ashes for ceremonial painting, decarations for dances, and special caloring materials. Riparian plants were sametimes intentionally sought because of their association with water.

Nearly half of the twenty-eight species sought for ceremanial use could be acquired year round. In these cases the part required is a vegetative ane such as needles, branches/twigs, leaves, plant, stems, or wood. Many of the remaining items are reproductive parts such as Elowers, Eruit/seeds, pallen, and annual plants restricted in their availability.

Construction material

Plants in and araund riparian habitats offer potential construction material. Wood of at least eight tree species cauld be saught to provide major and minar construction beams Ear structures. Conifers contribute the bulk of this material along with Eggulus and Sglix. Branches of the shrub Amgrghg and leaves and stems of three grasses [日ndrogogon. Elymus and Setgrig] and two perennial herbs [Jyncus and

Iyphgl offered filling material.
Many of these resources could be gathered at any time during the year, since wood and branches are always available. Leaves and stalks, on the other hand, are restricted ta certain seasons and would have to be harvested and stored, if needed for future use.

One of the more intriguing construction uses offered by riparian trees includes carving rafts from roots. Bath Populys and Salix roots have been fashioned into rafts for short voyages on calm waters by various Lower Colorado river groups. Unless a tree has been uprooted by nature, much energy might be required to access roots large enough for this purpose.

## Dyes/paint/tanning agents

The potential for acquiring dyes and paint in riparian habitats during most months of the year seems high. Dyes, especially, are offered by a diversity of taxa and a variety of parts. All the lifeforms studied offered at least one reproductive [flowers, fruit] or vegetative part [bark, branches/twigs, galls, leaves, resin, root, rootbarkj as some type of dye. Paints could be gathered from a number of species. A single tanning agent [Rumea] could also be had.

Same of these resources are restricted in period of availability, especially if the plant is an annual plant, or the part sought is reproductive. Others that offer bark,
brancies/twigs, galls, raots and other vegetative parts could be gathered January through December.

Fuel
Trees, shrubs and two annual plants provide potential fuel, tinder and firesticks. The annual plants cHelignthus and Rymex] offer firestick material from stalks and tinder from roats. Wood, twigs, bark and branches of thirteen additional taxa could be gathered all months of the year. There seems to be no lock of fuel resources among the taxa of riparian habitats.

Househald neads
A whale range of household needs can be served by riparian plant resources. Material far basketry, matting, utensils, nets, rope, string, brooms, brushes, polishing, crafts, musical instruments, sealants and mending can all be found, along with bug repellants CCercocgrpus twigs, Pseudgtsugg resin and Sglvig leaves], and a means to forecast the weather [Bouteloug gracilis spikelets].

Trees, shrubs and perennial herbs are well represented to serve household needs. They offer raw materials that can be gathered year round as well as those restricted in availability. A number of grasses are included in this graup.

Few annual plants are on the list of species that might
be sought for household use. This includes the stalk of Helianthus anauus that could be fashioned inta a musical instrument, and the leaves of Salyia reflexa as a bug repellant. Annual plants are perhaps not as reliable ta be routinely saught far household requirements.

Hunting tools/Eish paisons
Seventeen separate taxa offer potential resources for the hunter. In general, raw materials for hunting toals could be sought year raund. Arrowshafts could be Eashianed fram the stems af various grasses, twigs made into arrow foreshafts, and wood carved into arrow tips, bows, and clubs. Branches might become throwing sticks, bous or arraw shafts.

Plants representing all lifeforms offer material for stunning Fish in an attempt at capture. Eyphorbig plants, the bark and leaves of Juglans major and Prunus sergting, and Sisyrinchium and Uiguiega roots cauld be collected at various times for this purpose.

## Personal requirements

Grooming. Grooming needs might be satisified by at least 17 separate taxa present in and adjacent ta riparian habitats. These taxa could provide hairbrushes, hair rinse, soap, and other tailetries. Some wauld be available throughout the year; athers could only be acquired during limited periods.

Clothing<gdornment, Leaves, stems, fibers, bark, inner bark and branches of five taxa [Adcopogan. ARocunum, Ropulus. Eseudgtsuga and Salix] provide potential raw material for Eashioning clothing, especially during the months of April through Dctober. Reproductive parts of Juglons. Juniperus and Populys could be strung as beads for persanal adornment. Smaking. Acquisition of "tobacco" \{not the cultivated tobacco Nicotigagu and smoking paraphernalia such as cigarette wrappers and pipestem material would be possible over a fairly broad range of months. Riparian habitats offer $\theta$ bies concoloc needles, Acctostaphulos pungens leaves, Mentha acyensis leaves/stems, Rhus trilgbata leaves, Salix leaves and Ibalictrum Eendleci plants as potential native smaking tobaccos. Abies cancalor twigs can be made into pipestems and Queccus leaves fashioned into cigarette wrappers.

Examining the diversity of uses to which different plant parts are put

## Repraductive parts-Elowers

The uses to which flowers can be put are varied. Dne of the most important reasans they wauld be sought is as a Food. The flowers of Acctostaphulqs. Asclepias, Berula Chengpodium, Lonicerg, Dengtherg_ Robinig. SciEpus, and Tupha might be gothered for meals. As incidental foods Elowers could be prepared as a beverage and employed as a seasaning. A number of medicinal and ceremonial needs could be met by pollen from flowers. Less common reasons flowers might be saught include preparation af paints and dyes, and use as a hairbrush [Stipa peinalei], tays [inflated calyx of Phusglis yirainiqna and florets of Stipa peinaleij, a soap [Ceanothus Eendlerit] and a means to forecast the weather [Bqutelouq geacilis].

Flowers are varied in period of availability. Some are available For gathering during a single month while athers can be harvested for up to four months. Same flowers are available far all manths except December and January.

Reproductive parts-fruits/seeds
A wide range of fruits $\{i n c l u d i n g$ achenes, berries, caryopses, and young pads] and seeds can be sought in riparian habitats for a variety of uses, mast commonly as food. Beverage and flavoring needs could also be satisfied.

Many reproductive disseminules can be harvested for use in medicinal preparatians and as ceremanial paraphernalia. Other reasons that fruit and seeds might be collected include their use as paint, dyes, soap, toys, utensils [Cuyynbita Egetigissimg], beads, a hair rinse, incense, mending material, a toiletry and as chewing gum 〔Ropulus Enemontil and Typhg lotifolig].

Uegetative parts-above graund
The range of above graund vegetative parts that can be gathered to satisfy same need includes bark, branches, fibers, inner bark, leaves, needles, plant, stalk, stems, twigs, wood, wood knots and young shoots. Likewise, the uses to which these parts can be put is extremely diverse and encompasses most of the use categories reported in this study. The year-round availability and accessibility of many of the parts increases their general value far humans.

Uegetative parts-below graund.
Underground vegetative parts such as bulbs, roots, root bark, rhizomes, stolons and tubers offer a number of potential resources for humans in riparian habitats. Some of these parts provide food, flavorings or various beverages. Many, it seems, affer material for medicinal preparations. More restricted uses include dyes, raw material for basketry and hair brushes, tanning agents, soaps, hair rinses, toys, Fuel, tinder, fish paisans, and construction material [large
roats of both Populus and Sglixl. The period of quailability of these parts varies considerably, fram yearround for the trees and shrubs to a restricted number of months for the perennial herbs [including grasses] and annual species. It is possible that astute observers will recall the locations of important herbaceous plants, so they can return to harvest undergraund resaurces even when little or no above-ground evidence signals their presence.

Miscellaneaus above graund parts
A series of miscellaneaus parts such as buds [Elouer and/ar vegetative], galls, latex, resin, and sap have been reparted in the ethnagraphic literature as providing patential resaurces far humans. A number of trees, as well as same shrubs and herbaceaus perennial species in the twa study areas patentially offer these items. The uses to which these parts are put are quite varied, and include fad [Acet sap, Asclepigs buds], medicine [Abies resin, Euphorbig latex, Quercus galls], gum [Pinus resin, Ropulus buds], dye [Duercus galis, Ropulus buds], sealants [Pinus and Rseudgtsuga resin] and bug repellants [Eseudotsuga resin], among others.

Wild plants of riparian habitats possibly receiving special care by humans

Same af the native taxa included in this study, ar their close relatives, have possibly received special care by humans. Such care might take the form of pramating the growth of a species near dwellings by use of simple horticultural techniques or by transplanting plants closer to a village. There is same ram for daubt, hawever, whether the species referred ta are actually native or have been conEused with non-native species introduced as cultivars.

Taxa receiving special care include a grass, two herbaceous taxa and three woody species. Palmer first suggested [1870] that native panic [Pgnicym] grass was planted by tribes alang the Calarado river delta as the river receded in the spring, Later in the year the planters returned and harvested the ripe heads. Dthers feel that Ronigum songrum was probably the species sown, harvested, and culturally selected in histaric times [Nabhan and Dewet 1984].

A native species of groundcherry [Physglis] is one nf two herbacequs plants referenced as receiving intensified care. Madern Zuni wamen were said to have cultivated Phusglis virginjang var. sonorge [as synanym Rhusalis longiEglig] in their gardens [Stevenson 1915], even thaugh associated plants grown in the same gardens included nonnative species of chili [Copsicum spp.] and coriander [Cofigndeym sativum]. All these plants, along with onions
[allium], provided the ingredients far "salsa", a Spanish relish dish. While it is still possible the Zuni encouraged a native Rhysalis instead of the typical Phusalis ixgearpg utilized in Mexico for "salsa", it would not be umreasanable to assume that Rhusalis ixacacag alsa grew in the same Zuni gardens observed by Stevenson. From this perspective, some doubt exists whether native Rhysglis virginigng was actually receiving special care.

It seems more likely that a native species of cattail (Iypha) actually received extra treatment. In Arizona the Hopi were thought to have carried Typha domingensis plants into a wash near one of the villages from a distant location, so that they would be conveniently located (Whiting 1965:64]. The Hapi had needs far cattail stalks and spikes. Once established, little effort would be needed to keep cattails growing in the wash, unless drought destroyed the population and plants had to be reintroduced.

There are three wandy riparian species that likely received special care from humans. Both cottonwood (Rapu= lus] and willow [Salixy] seedlings were transplanted closer to villages in historic times, again the effort provided by the Hopi of Arizona. As for cattail, these young trees were planted in washes near the Hopi villages, so the resources could be easily acquired to fulfill the many needs people had for them [Whiting 1965:72].

Uitis or wild grape is anather woody species that has possibly recaived special care by Native Americans. In 1870 Palmer suggested ancient Pueblaans in Arizone may have cultivated a wild grape because of the distribution of the plants near ruined settlements. However, the expectation that ancient cultivated grape plants wald be visible in rows in fields in historic times seems unwarranted. Although some of these "cultivated" patches were indeed near ancient settlements, Ethers were near the historic forts of Fort Whipple and Camp Lincoln. Even though descriptions suggest the "cultivated" plants seemed different fram the nearby wild grapevine populations, one cannot rule out that histaric settlers were responsible for the changes.

References to cases of special care of native plants, while nat always clear, suggest that people have a practical approach to plant acquisition. If a group is sedentary, and already raising damesticated craps, the knowledge and skills are present to successfully transplant and care for native species. Evidence of such care might be very difficult to come by in the archaealogical record, because the morphological changes that signal domestication could well be lacking in species receiving only minimal attention. Yet it would not be surprising that the hints to special care of native plants revealed by the ethnographic record reflect similar forms of intensified care of native plants in prehistory.

Lifeforms in relation to potential importance to humans versus their general representation in southwestern floras


#### Abstract

One can examine basic lifeform categories to see if certain ones disproportionately satisfy human needs. When the ethnographic records of the 18 trees, 15 shrubs, 73 perennial herbs [including grasses] and 21 annuals are tallied by lifeform, a pattern emerges [Table 87]. It appears that trees and shrubs may serve a slightly greater number of needs in relation to the number of species available, while herbaceous perennials and annuals offer fewer overall resources in relationship to the number of species they represent. This is not surprising, considering the broad range of months over which tree and shrub parts can be gathered for various needs, in comparisan to perennial herbs and annual species.

The importance of trees and shrubs is reinforced when one also considers the general distribution of appraximately 5458 species in the Southwestern flora, CMcLaughlin 1986: 54]. While only a fraction of the Southwestern regional flora [2\%] is represented by trees, the 109 separate tree species occur in more separate floras, on the average, than species representing any other lifeform [Table BB]. Herbaceous perennials, on the other hand, comprise 59\% of the Southwestern regional flora, but are the most restricted in geographic extent. From the viewpoint of humans being able to exploit a geographic area unfamiliar to them, they


Table 97. Lifeform distribution compared to the number of separate ethnographic citations for each lifeform category.

| Lifeform | \# species <br> studied | \# separate <br> ethnographic <br> records |
| :--- | :---: | :---: |
| Trees | $18[14 \%]$ | $150[26 \%]$ |
| Shrubs | $15[12 \%]$ | $97[17 \%]$ |
| Perennials* | $73[57 \%]$ | $246[43 \%]$ |
| Annuals | $21[17 \%]$ | $84[14 \%]$ |
| Totals | $127[100 \%]$ | $577[100 \%]$ |

*Herbaceaus taxa, including grasses.



#### Abstract

wald be more likely to encounter familiar species in the order [1] trees, [2] shrubs, [3] annuals, [4] cacti/ succulents, and [5] perennial herbs. This ranking of chaice is hinted at in Table 97, where the riparian trees and shrubs seem to have ethnographic records of use that are more numerous than their general representation on the landscape.


Results and discussion of pollen wash studies

Examination of fourteen pollen wash samples provides data to evaluate predictions on whether pollen will be retained on fruits or leaves. Two underlying assumptions are that [a] pollen types normally transparted by insects are nat expected to travel far from a parent plant without aid of insects or other animals [including humans] ard [b] pollen from wind-pallinated plants will be carried long distances and braadly dust regional vegetation.

The results of these experiments will not directly explain archaealogical sediment samples for twa reasans. First, ancient soil contains a variety of organic and inarganic particles in addition to pollen grains, diluting any original concentration of pollen that derived from food processing in a particular location. The perishable nature of pallen grains will also diminish the original concentration over time. Second, we are unable ta assume a constant rate of pollen input into archaealogical sediments. Archaealogical samples can represent unknown amaunts of time, from a single food processing event to repeated episodes of human activity in one location, while the data fram these experiments represent only single food gathering events.

Predictions Far pollen entrapment [Table 日9] are based on a variety of morphological features [Bohrer 1991b]. Flowers with stamens attached above the ovary [epigynous],

Table 89. Pollen nash predictions.

| Species and Farts Hashed | Characteristics iaportant to pollen entrapaent | Fredictions on entrapaent | Location and Date Harvested |
| :---: | :---: | :---: | :---: |
| Arctostaghulos | superior ovary; fruit coat | pollen expected | Samsey Canyon |
| pungens fruit with stems | very slick; 5 sepals still attached; soae flowering | to be retained between sepals and | Sept. 3, 1983 |
| and sepals | while fruit are eaturing | fruit; saee pollen onto fruit during limited flowering |  |
| Berberis | superior ovary; 5moath fruit | pollen not expected | Raasey Canyon |
| nilcoris | coat; no shriveled flowers | due to slick fruit | Aug. 20, 1083 |
| fruit | present; pollination | coat and lack of |  |
|  | finished | flower 5 |  |
| Juniperus | No longer pollinating, tut | pollen not expected | Ramsey Canyon |
| degegana | male cones still on tree; | on glaucous berry; | Sept. 17, 1983 |
| berriss | 5aooth, glaucous berry coat; overlapping stales on twigs | only expected if <br> twigs or cones picked |  |
| Honar da | flowering concurrent with | pollen expected | Canelo Hills |
| 3ustro- | presence of young leaves; | due to concurrent | Sept. 3, 1983 |
| ngntana | leaves are hairy and have | flowering, hair on |  |
| leaves | punctate oil glands | leayes, and 0.1 glands |  |
| Qxalis | \$lowering concurrent with | pollen expected | Rassey Canyon |
| decanhylla | fruiting, and flowers close | on pordus leaves | Sept. 17, 1983 |
| leaves and stems | to foilage; leaves slightly porous |  |  |
| Panicue | not flowering: 5!ick glumes | no pollen expected | Rassey Canyon |
| bulgosym | palea and leana |  | Oct. 8, 1983 |
| spikelets |  |  |  |
| Panicur | flowering concurrent with | pollen expected | Canelo Hills |
| Qbtusut | ripening caryopses; shriveled | from shriveled | Sept. 3, 1987 |
| spikelets | stigmas still attached to | stigeas, and when |  |
|  | of gluese papery with | frow nearby |  |
|  | ridges | flowers |  |

Table 89 (cont). Pollen mash predictions.

| Speries | Characteristics iaportant to pollen entrapment | Predictions on entrapaent | Location and Date Harvested |
| :---: | :---: | :---: | :---: |
| Quercus <br> egeric <br> fruit with caps | fruit topped by a cap or cup of hairy scale5; hairy knob on basal end of fruit (style) present | pollen expected on hairy cap or style base | Rabsey Canyon Sept. 3, 1983 |
|  <br> californiz <br> fruit | superior ovary; fruit coat shiny \& slick; pollination past; no other parts retained in harvest | no pollen expected due to slick fruit coat and asychronous flowering and fruiting | Canelo Hills <br> Sept. 3, 1983 |
| Ehus <br> trilobata <br> fruit | not flowering; superior ovary; fruit coat has hairs and is sticky; no shriveled attached flowers | pollen expected to stick in hairy, sticky truit coat | Canelo Hills <br> Oct. 8, 1983 |
| Ribes aurgug <br> fruit and attached flowers | inferior ovary; fruit coat slick; pollination finished, but shriveled flowers still present | pollen expected to be retained in old flower heads | Canelo Hills <br> Aug. 20, 1983 |
| Rugex <br> viglagcens <br> papery <br> fruit | superior ovary; fruit coat irregular: some nearby Rumex plants are pollinating | pollen expected to cling to irregular fruit coat, perhaps sowe froe nearby flowers | Canelo Hills <br> Aug. 20, 1983 |
| Setaris geniculata florets | flowering past; no hairs; palea and leama slick; no stigwas still attached | no pollen expected | Canelo Hills <br> Oct. 8, 1983 |
| Vitis <br> ardzonica fruit, pedicels and aborted flomers | superior ovary; fruit coat fairly slick; pollination past; some aborted fruit still have shriveled flowers | pollen expected from pedicels and aborted flowers | Ramsey Canyon Sept. 3, 1983 |

or closely surraunding it \{perigynous〕, are assumed to have greater opportunity to shed pollen directly onto developing Eruit than are hypogynous plants. Smooth and shiny fruits would be less likely to trap pollen than fruits with hairs, pores or sticky residue. Fruits with tightly enclosing parts, such as the bracts [palea, lemma, and glumes] of taxa in the grass [Gramineae] family, cauld collect pollen that has drifted down from flowers higher on the stem. Shriveled flowers, hairy pedicels, and stems that do not absciss upon harvest of mature fruit could also harbor pollen. Fruit and leaves of plants that flawer over a relatively short period of time may receive less of a pollen dusting than those of plants which bloom over several weeks. An indeterminate inflorescence with flowers opening at the top can shed pollen onto maturing fruit and leaves below. Likewise, in a population where individuals are pollinating at different times, pollen from Elawering plants can be transferred to mature parts of adjacent individuals. Mairy or sticky vegetative parts would be expected to capture pollen from windborne species. Leaves with pores or convoluted surfaces could alsa act as potential pallen traps.

Predictions on pollen entrapment outlined in Table 89 can be compared to the experimental results highlighted in Table 90 [see Appendix 4 for full sample details]. All samples but two [Juniperys and Uitis] had sufficient amaunts of pollen to enable minimum counts of 200 grains per sample.

Table 90. Sumarized pollen grain data froa modern pollen mash samples. Full details on samples are in appendix 4.

| Taxon Examined | Pollen Sum | Lycopodium Tracers | Pol <br> of $t$ <br> $\pi$ | grains nashed $\%$ | Concentration ${ }^{\text {s }}$ | Dther Tax $\mathrm{a}^{2}$ <br> ก | Other Major Types | Foll <br> ก | \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Arctostaghylos Eungens | 384 | 201 | 33 | 9 | 1986 | 26 | Granineas <br> Guercus <br> Chenopodiineas <br> Aabrosia | $\begin{array}{r} 157 \\ 44 \\ \mathrm{e} 32 \\ 24 \end{array}$ | 41 11 8 6 |
| Erberis <br> nicoxid | 496 | 65 | 359 | 72 | 66,829 | 19 | Guercus Rune: | $\begin{aligned} & 62 \\ & 19 \end{aligned}$ | 13 |
| Suniperus degeegna | 28 | 78 | 5 | 18 | 775 | 4 | Granineas <br> Quercus <br> Tubuliflorae | 6 6 4 | 21 21 14 |
| Monarda gustrogontana | 354 | 12 | 12 | 3 | 12,100 | 14 | Aabrosia <br> Tubuliflorae <br> Graaineas <br> Chenopodiineas | $\begin{array}{r} 165 \\ 68 \\ 44 \\ 1823 \end{array}$ | 47 19 12 6 |
| Qualis decaghylla | 239 | 307 | 1 | . 5 | 39 | 23 | Pinus <br> Granineas <br> Aabrosia <br> Tubuliflorae | $\begin{aligned} & 65 \\ & 28 \\ & 23 \\ & 22 \end{aligned}$ | 27 12 10 9 |
| Fanitum bulbosug | 205 | 694 | $103^{3}$ | 50 | 1795 | 10 | Tubuliflorae | 54 | 26 |
| Panigug <br>  | 355 | 98 | 1593 | 43 | 14,361 | 6 | Tubuliflorae Aebrosia | $\begin{array}{r} 137 \\ 30 \end{array}$ | 38 8 |
| Quercus egoryi | 291 | 226 | 44 | 15 | 2355 | 19 | Gramineat Chenopodiineae | 128 20 | 42 7 |
|  Edifornica | 230 | 261 | 13 | 6 | 602 | 14 | Gramineaz <br> Aibrosia <br> Tubulifloras | 101 47 34 | 44 20 15 |

Table 90 (continued). Sumarized pollen grain data from aodern pollen wash samples.

| Taxon Exacined | Pollen Sus | Lycopodiua Tracers | Pollen grains of taxon mashed |  | Concentration ${ }^{2}$ | Other <br> Taxa ${ }^{2}$ | Other Major Pollen |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Types |  | n | $\%$ |
|  |  |  | $n$ | \% |  | n |  |  |  |
| Phus trilogata | 221 | 133 | 3 | 1 |  | 272 | 15 | Tubuliflorae | 69 | 31 |
|  |  |  |  |  |  |  | Gramineae | 49 | 22 |
| Ribgs | 352 | 10 | 279 | 79 | 337,590 | 14 | Quercus | 19 | 5 |
| dereve |  |  |  |  |  |  |  |  |  |
| Rugex | 481 | 10 | 464 | 96 | 561,440 | 7 |  |  |  |
| viglascens |  |  |  |  |  |  |  |  |  |
| Setaria geniculata | 30.3 | 296 | $55^{4}$ | 18 | 2248 | 20 | Tubulifloras | 111 | 37 |
|  |  |  |  |  |  |  | Aabrosia | 30 | 10 |
|  |  |  |  |  |  |  | Gramineas lother) | 26 | 9 |
| Vitis <br> arizonica | 111 | 31 | 8 | 7 | 3122 | 17 | Finus | 34 | 30 |
|  |  |  |  |  |  |  | Granineae | 17 | 15 |

${ }^{2}$ Concentration is estimated by comparing the nuaber of pollen grains representing the taxon washed to the Lycogodiun spores recovered; in all cases concentration reflects estiaated number of pollen grains per $1-2$ cups of fruit or leaves harvested.

2 Includes separate unknown grain types, but does not include deteriorated grains that could not be deseribed.
${ }^{3}$ Identified as "Granineae type".
4 Indentified as cf. Setaria.

Bath pollen percentages and concentrations were calculated. Addition of one Lycopodium tablet [12,100 spores] to ench sample freed the data from percentage constraints and permitted estimation of the pollen concentration per sample by solving far $[X]$ in the following equation:

$$
\begin{aligned}
& \text { \# Lycopodium spores recovered } \\
& 12,100 \text { spores added to sample }=\text { \#pllen grains regovered } \\
& \text { [X] Total pollen grains }
\end{aligned}
$$ Because variable amounts [1-2 cups] of material were washed, pollen concentration data is not totally comparable.

Acctastaphylas pungens. Pollen was predicted to be retained on manzanita fruits with their stems and sepals collected from Ramsey Canyon in September. Only a few manzanita flowers ware pallinating when the fruits were harvested. Nevertheless $9 \%$ of the pollen collected by this insect-pollinated shrub was identified as Acctastaphylos, having a concentration of 1986 grains per $1-2$ cups of fruit washed.

Pollen from 26 additional taxa contributed pollen grains to this sample, including $41 \%$ Gramineae pallen. Mast of these other pollen taxa represent wind-pollinated plants whose grains may have became trapped between the developing Arctostaphulas fruit and adhering sepals.

The recovery of $9 \%$ Acctastaphulas pollen suggests the fruit serves to transport the grains. Alsa, pollen from wind-pollinated taxa, particularly Gramineae and Quercus, could enter ancient dwellings via attachment to manzanita

Fruit gathered during September when local grasses like
 Ronicum and Stipa are flowering.

Pollen recovered in the wash also represents taxa [Sglix_ Juniperus. Ropulus, Rinus. Quercus] that were observed to pollinate some months earlier than the period of the September pallen wash. These aseasanal foreign grains are easy to account for. Manzanita fruits present in March slowly develop over a five-eight month period, presumably able to catch pollen of any area plants that flower during that long time span. Although the numbers of pollen grains for most of these taxa is low, the presence of $11 \%$ Querens pollen suggests an avenue for transport af ak pallen grains unrelated to aak harvest.

Becbencis wilcaxii. Barberry pollen was nat predicted to be retained on the smooth surfaces of fruit harvested from Ramsey Canyon in August. Yet 72\% of the pallen washed From the fruits was from Berberis, with a relative concentration of 66, 829 Becheris grains per $1-2$ cups of fruit. The high percentage and concentration suggests that shriveled flowers, concurrent flowering, and textured fruit coat are not necessary to entrap Becbecis grains.

Nineteen additional taxa, mostly wind-carried types including 13\% Quercus pollen, accompanied the Berberis pollen grains in the wash sample. Immature Berberis fruit are observed in April after March flowering; fruit ripens in

July, and can remain on branches for eight Eull months. Thus there is a long period of time in which airborne pollen can settle anto fruit caats.

Juniperus deppeqna. Although the pollen wash sample from Juniperus berries had little pollen, some information is available from the 28 grains counted from ripe berries collected in Ramsey Canyon in September. Juniperus pollen grains were not predicted to be entrapped by the glaucaus berry coat. Yet $18 \%$ juniper grains were counted, with a cancentration of 775 grains per the $1-2$ cups of mature berries washed.

Althalag conclusions based an $2 \theta$ pollen grains should be considered tentative, these results suggest that juniper berries retain wind-carried pollen. However, a low pollen concentration shows them to be only partially effective as a pollen trap. No predictions regarding Juniperus pollen in archaeological sites can be made based upan these limited data.

Pollen from four additional wind-pollinated taxa were also recovered in the juniper berry wash weter. Since juniper berries are available for many months, there is ample time for pollen Eram other species to became attached.

Monarda ${ }^{\text {Mustramontana. Pollen was expected to be }}$ recovered from bee-balm leaves washed in September, due to concurrent flowering, presence of hair on the leaves, and
the entrapping qualities of leaf ail glands. However, only 3\% Labiatae pollen [cf. Manarda] was recovered. The concentration has been calculated at 12,100 grains per 1-2 cups of bee-balm leaves. Fourteen additional wind-pollinated taxa were faund.

The prediction that pollen would be present on Mangrda leaves has been met. However, two other intriguing results have occurred. The first is the recovery of a variety of non-Monardg pollen types that have apparently become entrapped on the leaves. Second, there is a rather high concentration of Mongrdg grains in relation to their low pollen percent [3\%]. This suggests that although Monarda leaves trap high numbers of pollen grains, use of bee-balm leaves as greens may not be revealed by the percentage of Labiatae pollen grains in archaeological sites.

Qxalis decaphulla. Pollen was predicted to be retained on the somewhat porous leaves of Qxalis picked and washed in September from Ramsey Canyon, While this prediction turned out to be correct, only a single grain was identified as Qxalis. The concentration of Oxolis is also quite low, at 39 grains per the 1-2 cups of leaves washed.

Qxalis is a low-growing insect-pollinated plant, barely six inches high and faund in an open sunny location among dense vegetation. The likelihood that wind-carried pollen would settle onto Qxalis leaves is borne out by recovery of pollen from 23 additional taxa.

The fact that the leaves were washed in mid-September, nearly a manth after flowering had passed, may help explain the low recovery of $0 x a l i s$ pollen. What is not easily explained is the presence of other pollen types shed into
 observed in July. Far example, phenological records elsewhere in this report reveal that three local species of Pious have all flowered before July, yet $27 \%$ of the pollen in the Qxalis wash water was identified as Rinus. Other taxa contributing aseasonal pollen types in low amounts include Ebies, Juniperys, Populys, Quercus, and Pseydgtsygg. Perhaps pollen shed earlier has been put back into circulation by turbulence and redeposited on newly emerging Qxalis vegetative parts. The Rinus pollen may have been released after temporary entrapment in needles. Plants low to the ground are also more likely to intercept recycled saltatory pollen [口'Rourke 1986:136-137].

This examination reveals that acquistion of Qxalis leaves may not leave a pollen record. If humans utilize this resource, other types of evidence will have to be preserved. Potential confusion in interpreting the archaeobotanical record has been revealed by the unexpected recovery of $27 \%$ Pinus pallen grains, as well as pollen from at least five wind-pollinated taxa that are known to have flowered months before the emergence of Oyglis leaves.

Panicum bulbosum. Pollen was unexpectedly recavered Fram an Dctaber wash of Eanicum bulbosum spikelets harvestéd From Ramsey Canyon. At least half of the grains represented Gramineae, with a relative concentraiton of 1795 grains per 1-2 cups of spikelets. Flowering of $\mathrm{E}_{\mathrm{c}}$ bulbosum in Ramsey Canyon in August and September coincided with flowering of other local grasses such as Agropurgo, Bquteloug. Efagras tis. Leptochlog, Mubleqbergia and Stipa. Therefore, the Gramineae grains recovered could be from a combination of these fall-flowering grasses. Rgnicum bulbosum spikelets can obviously trap pollen, perhaps inside the florets during early development.

Some pollen grains recovered in the $\mathrm{R}_{\mathrm{c}}$ bulbosum wash represent taxa that pollinated months earlier [ywniperys. Juglans. Rinus, Quercus], but samehow became attached to spikelets that developed later in time. More than one mechanism might account far the presence of these aseasonal pollen grains. Redeposition of pollen by wind currents is one avenue. Low-growing plants in the zone of saltation are especially susceptible to exposure to pollen in turbulent air [0'Rourke 1986:136-137]. Also, even ofter the full flush of flowering of a taxon, small amounts of pollen might still be shed for some weeks following, providing a low, but steady, source of pollen grains.

Panicum obtusum. Unlike the prediction for Ponicum bulbosum, the expectation that Panicum obtusum spikelets
would retain pollen was supported. Spikelets harvested in Canela Hills in September still had shriveled stigmas attached to them. Alsa, many nearby $P_{\perp}$ gbtysum plants were pollinating at the time of harvest. Thus, it seemed likely that Gramineae pollen would be recovered.

Forty-three percent of the pollen grains represented Gramineae pallen. The concentration of 19,631 grains is considerably higher than that of Panjgum bulbosym [1795] spikelets harvested lang after Elowering had ceased.
 the hairy fruit cap and attached style base of mature nuer= 드표 Emoyy fruit From Ramsey Canyon washed in September. Fifteen percent of the grains recovered were oak. Presence of a single oak tetrad hints that immature aak pollen may become entrapped by developing fruit. The concentration of Quercus pollen is 2355 grains per 1-2 cups of acorns.

Presence in the wash water of low amounts of Ceanothus, Juniperys, Pinus and Sglix pollen from spring flowering taxa in Ramsey Canyon may be due to entrapment. Since acorns mature over a minimum four-month period in the region, there is ample time for pollen from many taxa, including up to $42 \%$ Gramineae pollen, to adhere to the developing fruit.

Rhgmnus califocnicg. No pollen was expected to be retained on the shiny, smooth surface of Rbamaus califocaica fruits harvested in Canelo Hills in September. Of the pollen
grains counted, 6\% were identified as Rhamnus, with a rather low concentration of 602 grains per 1-2 cups of fruit. Since the prediction that pollen would not be found in the wash water was not met, the assumption that a smooth fruit coot is a poor pollen trap is not valid.

In additian to buck-thorn pollen, Fourteen additianal taxa were identified in the sample, including a significant amaunt of Gramineas [44\%] and Campasitae [35\%] pollan. For those taxa for which phenological data is available, the timing of flowering coincides with the five month period during which buck-thorn fruit develops.

Bbus trilobata. Rhus trilobata fruit was washed in Canelo Hills in October. The hairy, sticky fruit coat was correctly predicted to retain pollen. Although a total of 16 taxa contributed grains, only $1 \%$ of the total was from Rbus, representing a rather low concentration of 272 grains per 12 cups of fruit.

Of the additional taxa recovered, many are flowering when squawbush fruit develops. However, other taxa which shed pollen much earlier [Juglans. Junipecus. Ropulus and Querctus also contributed pallen to squawbush fruit coats, reinforcing the idea of pollen recirculation.

While the prediction that the sticky, hairy fruit coats of squawbush fruit will trap pollen has been verified, actual use of the fruit might not be readily deduced from the low recovery of Rhus pollen in archaeological sites. The
arehaeobotaniet may have to rely on finding the durable fruit stones, rather than on the pollen record, to suggest harvest of squawbush fruit.

Ribes gureum. A wash of Ribes quceum fruit gathered in Canela Hills in August was predicted to carry pollen in the shriveled flowers attached to the harvested fruit. This prediction was easily borne out by the recovery of $79 \%$ Ribes pollen grains, having a notable concentration of 337,590 grains per 1-2 cups fruit. This high percentage and concentration of golden currant pollen, caupled with the presence of two pollen clumps and a possible tetrad, verify that flowers were attached to the fruit.

Of the fourteen additional pollen taxa recovered from the wash of golden currant fruit, most were present in low numbers. If it can be assumed that pollen recovered from Ribes fruit was transported inside shriveled flowers, perhaps pollen of other taxa [Cyperaceae and Salix] became entrapped inside Ribes flowers open in March.

Taxa which flower ofter March include various members of the Gramineae family, Juglons, Quergus and a late flowering gllium. Pollen from these taxa may have become attached to the developing golden currant fruit coat, or on the outside of the shriveled Rites flowers.

That Ribes flowers remain attached to the fruit seems helpful in providing evidence for fruit harvest. If high
percentages and/ar concentrations of Ribes pollan are found in archaeological sites Cespecially with recovery of Ribes tetrads or pollen clumps], it seems reasonable to deduce the fruit had been gathered by prehistoric people.

Bumex vigloscens. The mature papery winged fruit of Rumex harvested in Canelo Hills in August was predicted to carry pollen on its irregular fruit coats. This prediction was substantiated by recovery of $96 \%$ Rymex grains, with an extremely high concentration of 561,440 grains per 1-2 cups fruit. Much of the pollen may have been shed in June when the majority of the population flowered, but same pollen may have been cantributed by late-pallinating plants.

The high parcentage and cancentration of pollen, coupled with the presence of six Rumex clumps and a single tetrad, suggests the pollen did not travel far. Rumex has a calyxlike perianth with the three inner segments that became enlarged and modified in fruit, providing a mechanism for stamens to shed immature or clumped pollen on parts that will eventually develop into the fruit.

The recovery of Rumex pollen on Rumex fruits is useful to the archaeobatanist. Nat only is there some basis for interpreting Rumex pollen in ancient samples, but it also suggests that plants with perianth parts that enlarge and modify in development might be likely ta retain greater amounts of pollen, including immature and clumped grains, than plants with flowers that shrivel and dehisce.

Setgrig geniculata, No pollen was expected in the water of Setacia florets washed in Canelo Hills in Dctober, yet grains were identified. Of these, $18 \%$ compare favorably with Setarig pollen reference material. The cf. Setarig grain concentration is 224 B per 1-2 cups of florets washed.

In addition to of. Setarian pollen, grains from twenty predominately wind-pollinated taxa were recovered, including 9\% grains from other Gramineae taxa. Since Setgrig flowers in August, maturing florets could receive pollen from other concurrently flowering taxa such as Plantagg lancealata, Rymex and Chenopodium. Redeposition may explain recavery of those pollen types CEnaxinus. Juniperus. Einus. Ropulus and Queccus] observed to shed pollen earlier in the year.

As with Ranicum bulbosum, a prediction of no pollen recovery was not demonstrated. Setacig florets must be able to trap pollen from Setorig plants and other taxa that is [a] shed at the time of Setarig flowering or [b] brought back into circulation by wind-currents and deposited on the florets or on the outside of the maturing fruit.

Uitis qrizonicg. The expection that pollen would be recavered from Uitis fruit From Ramsey Canyon washed in September was borne out. However, only $7 \%$ of the identified grains were from Uitis. The concentration of grape pallen was calculated to be 3122 grains per 1-2 cups fruit.

Seventeen taxa other than Uitis coniributed pollen to
this sample. Other natable taxa represented in the wash water included Pinus [30\%] and Gramineae [15\%]. Since Uitis has at least a four-month period of fruit maturation, there is ample opportunity for pollen grains from other taxa to settle on the fruit and on the pedicels that remain attached to the fruit when it is picked. Pollen from taxa that pollinated prior to Uitis flowering in May [Juniperus. Eseudatsuga and Salix] have likely been redepasited. Although the fruit coat of grapes is rather slick, their tendency to lase moisture and develap Folds and wrinkles may lend to their general ability ta entrap pollen grains. Shriveled flowers that remain attached to aborted fruit do not seem to carry much Yitis pollen, as revealed by the rather low concentration recavered. Ancient collection of wild grapes may nat be easily ascertained by examination of pollen samples.

Significance of pollen wash results
Some general points can be made from this project to analyze pollen entrapped on plant parts, keeping in mind that the number of samples analyzed is small and each one represents a single harvest event. Alsa, because the amount of material washed varied between ane and twa cups per taxon, the estimated pollen concentration data may not offer the insight it could have if sample volume, weight or surface area had been more precisely monitored.

One general observation concerns the variety of taxa that are represented in individual pallen wash samples. Each sample retained an average of 16 taxa per wash. Thus, a variety of pollen types may be intraduced to an archaealogical depasit on harvested fruit and leaves. Another general observation is that analysis of archaealogical pollen may benefit by calculating both relative pollen percentages and pollen concentration. Both indicies can provide insight into ancient plant acquisition.

Presence of shriveled flowers or flower parts is a good predictar that pollen will travel on the fruits. For example, Ribes [flowers], Ranicum qbtusum [stigmas], and Quercus [style bases] fruit, and to a lesser extent Witis [aborted flowers, pedicels] and Acctastaphulog [sepals] fruit retained pallen. Plants with perianth parts that enlarge and modify with maturity [e.g. Rumex] alsa have excellent pollen retention capabilities.

Plants with parts that are hairy, or that have ail glands, can capture pollen, thaugh not always in quantity, and then not necessarily from the taxan itself. Manarda leaves and Querceus acorn caps serve as efficient pollen traps. Surprisingly, the hairy and sticky exterior of Rhus fruit did not insure pollen capture, nor did the porous nature of the leaf surface of Qxalis.

Smooth or glaucous reproductive disseminules occasionally collect small amounts of pollen [Rhamnus_ Juniperus].

The reason why smoath-coated Berberis fruit had both a high percentage and concentration of Berberis pollen is unclear. The harvest method employed, that of picking the ripe barberry fruit one-by-ane, was not expected to concentrate pollen as other methods might, such as using a beater and basket or shaking a plant to loosen fruit. On the other hand, smooth-coated Uitis and Gcctostaghylos fruit may have retained pollen in part because additional pollen-harbaring parts [pedicels, sepals] remain attached.

Plants whose parts are harvested while individuals in the same stand are pallinating do not necesarily have increased chances of entrapping pallen of that taxan. For the four species that were flowaring when their leaves or fruit were picked and washed [Mongrdg. Qxalis. Ranicum obtusum and Rumpy], other reasans [discussed above] may have more influence on pollen retention than concurrent flowering.

On the other hand, lack of simultaneaus pollination of a taxa harvested for mature fruit or edible leaves does not preclude pollen retention, at least for Berberis_ Ribes, and Ronicum bulbosum. With the exception of Berberis, whose mechanism for retaining pollen is not understood, presence of shriveled flower parts or other parts which enclose during development seem important in trapping pollen.

With few exceptions, the pollen types recovered in the wash samples were from taxa known to be available in the
area. The majority of pollen grains on the fruit and leaves represented local vegetation. This same conclusion was reached in a separate study to wash grass coryzodsis humengidess culms to evaluate routes of pollen transpart into packrat middens $[$ Davis and Anderson 1997:189].

Redeposition of pollen shed in a prior season generally contributes small amounts of the pollen recovered from plant parts. The average number of pollen grains from taxa known to pollinate in a prior season was less than two, with four exceptions. Three wash samples contained between 15-20 Quercus grains, and a single sample had 65 Pinus grains $[27 \%]$, all from past pollination of major contributors of anemaphilous pallen.

One can compare the results from all fourteen pollen washes for insight into transpart of wind-pollinated taxa. For example, although Querccus pollen was recovered from acorn fruit and ceps, it was recovered in even higher concentrations on fruit of erctostopbylos, Berberis and Ribes [Table 91]. A single Quercus tetrad recovered from the acorn wash distinguishes actual harvest of acorns; unless oak pallen tetrads are rautinely preserved, there may be no way to recognize acorn harvest from other natural mades of oak pollen transport.

Graminaae pollen pravides similar interpretive difficulties [Table g2]. Althaugh Eanicum and Setarig spikelets and Flarets retained 27-50\% grass pallen, all with cancen-

Table 91. Comparison of percentages and concentrations of Quereus pollen from pollen wash samples.

| Taxa | Pollen \% | Estimated concentration |
| :--- | :---: | :---: |
| Anctostaphylos | $11 \%$ | 2648 |
| Berberis | $13 \%$ | 11,541 |
| Juniperus deppeana | $21 \%$ | 930 |
| Quercus | $15 \%$ | 2355 |
| Ribes | $5 \%$ | 22,990 |

Table 92. Comparison of percentages and concentrations of Gramineae pallen fram pollen wash samples.

| Taxa | Pollen \% | Estimated concentration |
| :---: | :---: | :---: |
| Acctostophylos pungens | 41\% | 9451 |
| Juniperus deppeana | 21\% | 930 |
| Monacda austromontana | 12\% | 12,100 |
| Qxalis decaphulla | 12\% | 1103 |
| Eanicum bulbosum | 50\% | 1795 |
| Eanicum gbtusum | 43\% | 19,361 |
| Duercus emocui | 42\% | 6853 |
| Shamaus caliEacnica | 44\% | 4682 |
| Rhus trillabata | 22\% | 4457 |
| Setacia geniculata cf. Setaria | 18\% | 2248 |
| Other Gramineae | 9\% | 1062 |
| Yitis grizonicg | 15\% | 6635 |

trations of over 1795 grains, fruit and leaves of non-grass taxa had percentages and/or concentrations of Gramineae pollen higher than those of the actual grasses.

The data on Quencus and grass species indicate there are no simple quidelines for knowing how much Quercus pallen indicates harvest of acorns, or what levels of Gramineae pollen reflect gathering of grass spikelets or florets. This study has revealed alternative modes of transport for these taxa.

Although there may be multiple avenues for oak and grass pollen to enter a dwelling, this study does provide some guidance for archaeabotanists studying other pollen types from ancient sites. However, as noted before, one cannot directly translate the values for pollen grain transport from these single event pollen washes into expected values for pollen from archaealogical sites. Although human activities undoubtedly concentrated pollen in prehistory, long-term effects of degradation and the general dilution of pollen in archaealogical sediments makes it unlikely that pollen will often be recovered in its original concentration. The guidelines provided by this study should be considered maximum values of the pollen percentages and concentrations that might be recovered from single harvest events, rather than thase routinely expected.

Length of time during which pollen was deposited in an ancient context further camplicates interpretations based
on this data. A particular pallen sample taken by an archaeologist may represent a day, a manth or an even longer periad of pallen accumulation at a particular spot. Such variable [and often unknown] rates of deposition make it difficult to relate the pollen concentration to specific activities that may have produced the pollen record.

With these reservations in mind, a cambination of careful comparison of the contexts of recovery, coupled with the data from these madern pollen wash samples, may be useful in archaeological interpretation. Far example, finding high percentages or cancentrations of Berberis, Ribes and Rumex pallen would suggest Fruit gathering of these taxa. Recovering tetrads or pollen clumps of Ribes or Rymex wauld provide further support for gathering these two resources. A less secure interpretation of collecting Acctostaphylos fruit is hinted at by recovering low concentrations or percentages of manzanita pollen. As for bee-balm, even a low percentage of Monardg pollen could indicate prehistoric use of the leaves, especially if the concentration of grains is relatively high. Prehistoric harvest of Qxalis leaves, sticky-coated Rhus fruit, and relatively smooth and slick Rbamnus, Uitis or Juniperus fruit or berries will not be easily ascertained from the pollen record alone.

Phenology
Phenology has been defined as the study of "bialogical periadicity in relation to the seasanal sequence of climatic factars" [Daubenmire 196日: 71]. Since climatic factors can have an important influence on the development of a species, graup phenalagy may pravide clues to the relative importance of, for example, maisture [in deserts] or temperature [in temperate regions] in different seasons. However, in riparian habitats where water may nat be a limiting factor, plants may exhibit some indifference to climate ©Daubenmire 197日: 27J, and non-climatic factors assuma more of a key rale in plant growth, reproduction and dormancy.

Io explore the possibility of group phenological responses in the two riparian habitats studied, the percentage of species growing vegetatively [stem elongation, leaf grawth] and active reproductively [flowering, fruiting] far each major lifeform [trees, shrubs, herbaceaus perennials including grasses, annuals] was plotted at Ramsey Canyon and Canela Hills throughout a 12-month periad. This analysis did not include Canela Hills trees [nme or shrubs [nme] or Ramsey Canyon annuals $[n=4 j$ due to small data bases.

The graup phenological trends were compared to the average maximum and mimimum daily temperatures and total inches of precipitation recorded during the 16 month period
covering the buik of the field wark CTable 93 and Figures 5-83. Ta view this climatic data in perspective, weather data representing between $48-70$ years of record-keeping is available from Canelo Hills Ranger Station and Fort Huachuca near Sierra Uista [Table 94]. In general, in 1983 the state of Arizona came very clase to tying both the hottest and the wettest of 89 years of record keeping $[$ Sellers 1985:80]. Canelo Hills was indeed hotter and wetter [with twice the number of inches of precipitation than the averages at Canelo Hills Ranger Station. Ramsey Canyon hau more than twice the average inches of precipitation, but generaily cooler temperatures than the Fort Huachuca location. Since Fart Huachuca is located on gentle flanks that slope away from the Huachuca mountains, as opposed to the in-mountain narrow canyon setting of Ramsey Canyon, a comparisan of temperature records between the two areas is expected to deviate, with Ramsey Canyon likely to consistently experience lower average temperatures. The purpose of comparing group phenological activity with temperature and precipitation trends is to observe any direct carrelation between lifecycle events and these two environmental variables. Obviously other influences such as changing photoperiod, presence of pollinators, competition, residual soil moisture, and soil temperature could well play key roles in the timing of phenological events, sa this analysis cannot be considered inclusive.

Table 93. Summaries of maximum and minimum daily temperatures and total monthly precipitation.

| $\times$ Mas. | \% Mim. | Total |
| :---: | :---: | :---: |
| Temp | Temp | inches |
| (OF) | ( $\Phi$ F) | precip. |


198.3

| MAY | 75.74 | 45.35 | 0.04 | ---- | ---- | ---- |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| JNE | 81.70 | 51.56 | 0.11 | 86. 13 | 53.06 | 0.38 |
| JLY | 83. 3 | 56.90 | 5.42 | 88.29 | 63.09 | 4.20 |
| AUG | 79.22 | 55.29 | 8.75 | 86. 32 | 61.35 | 3.57 |
| SEF | 77.33 | 54. 43 | 9.11 | 86.46 | 60.65 | 8.00 |
| QCT | 65.80 | 44.19 | 4.48 | 74.93 | 48.8.3 | 1.91 |
| NOV | 55.56 | 3.3.46 | 3. 3.9 | 67.60 | 36.56 | 1.92 |
| DEC | 51.85 | 3.3 .83 | 1.92 | 62.25 | 34.70 | 6.90 |
| 1984 |  |  |  |  |  |  |
| JAN | 48.16 | 28.00 | 3.59 | 59.64 | 29.29 | 1.74 |
| FEE | 55.72 | 28.86 | 0.00 | 67.13 | 26.75 | 0.00 |
| MAR | 65.16 | 34.48 | 0.00 | 72.70 | 33.77 | 0.00 |
| AFR | 65.35 | 38.53 | 1.78 | 71.26 | 40.23 | 0.84 |
| MAY | 79.90 | 52.19 | 0.32 | 86.80 | 52.25 | 0.26 |
| JNE | 78.03 | 53.73 | 2.70 | 86.83 | 59.30 | 0.92 |
| JLY | 78. 74 | 55.41 | 5.02 | 84.70 | 63.54 | 6.93 |
| AUG | 75.64 | 54.51 | 7.99 | 8.3. 74 | 62.83 | 7.90 |



Figure 5. Maximum [upper graph] and minimum [laugr graph] avarage daily


 August 19日4. The faur manth pariad of flay thraugh August is based an


Figura 7 Maximum [upper graph] and minimum [10war graph] avaraga daily
 manth
$\square$


Figure 日. Manthly pracipitatian racardad at Canela Hills Cignega, Jung an data averaged far both yenrs.

Table 94. Average daily temperature and annual precipitation for Canelo Hills Cienega. Ramsey Canyon: and two nearby weather stations.

| Location and | Avg. Daily | Avg. Daily Avg. Annual |  |
| :---: | :---: | :---: | :---: |
| Feriod covered | Max. Temp. | Min. Temp. Frecipitation |  |
|  | $(\circ F)$ | $(\circ F)$ | (inches) |


| Canelo Hills <br> $(15$ months) | 77.6 | 48.4 |
| :---: | :---: | :---: |


| Canelo Hills <br> Ranger Sta. ${ }^{2}$ <br> (60 years) <br> (70 years) | 74 | 40 | 17.8 |
| :---: | :---: | :---: | :---: |
| Ramsey Canyon (16 months) | 69.8 | 45 | 40.9 |
| $\begin{aligned} & \text { Fort Huachuca }{ }^{2} \\ & \text { (46 years) } \\ & (47 \text { years) } \end{aligned}$ | 74.8 | 48.9 | 15.4 |

${ }^{1}$ Data from Sellers 1985.

Active stem and leaf growth for sixteen tree species at Ramsey Canyon begins in March and is concentrated in AprilAugust, rapidly tapering off in September [Figure 9]. This period of vegetative activity does not correlate with local precipitation [Figure 6], which remains low until the month of July, near the end of the active vegetative period. Maximum daily temperatures [Figure 5], on the other hand, are rising when tree vegetative growth resumes in March, and remain high during the peak period of stem and leaf elongation May-August. Temperatures begin a rapid decline after September, the last month of vegetative growth noted for the sixteen tree species. At least far trees, vagetative growth may be responding directly only to temperatures.

Reproductive events displayed by Ramsey Canyon trees include full flowering observed from February through June, and presence of mature fruit in each of the 12 months. Full flowering is rather equally spread over the spring months, when temperatures are rising sharply fram month to manth and precipitation remcins low. Possibly some temperature thresholds are crossed in succession, beginning in February, that initiates Elowering in tree species. Since the months of February through June display the lowest amounts of precipitation of all 12 months, there appears to be no immediate tie between rainfall and flowering. Although ripe fruit can be found on some trees for every month of the


Figure 9. Group phenalogical activity of treas [n-16] ot Ramsey Canyon. Bors with thre日 vartical black lines signify octive tulig/stem growth; blank bars depict grawing leaves; diagonal inness sionting lower left document mature fruit.
year, availability reaches a peak during the months of September thraugh November. As temperatures are dropping rapidly and rainfall is variable at this time, there seems to be no clear-cut correlation between maturing fruit and prevailing temperature and precipitation conditions.

Shrubs
Active vegetative growth of 11 Ramsey Canyon shrubs parallels the trends just outlined for the trees. Stem and leaf growth build rapidly in March, are high for the months of April-August, and taper off in September [Figure 10]. Therefore, the same arguments above that suggest rising temperature may play a rale in vegetative growth of trees apply here. Likewise, there may be little direct influence of local precipitation.

Shrub flowering spans the months of February through August, revealing no period of intensity. This is also the periad of rising and maximum average daily temperatures [Figure 5], so temperature thresholds may be a factor in anthesis. As with trees, the low amounts of precipitation which fall during this period [Figure E] suggest that local rainfall is nat a flawering trigger. While it has already been noted that presence of mature fruit on trees seems not directly affected by temperature and moisture conditions in the months of maximum fruiting, it may be different for production of mature fruit on shrubs. Ripe fruit is avail-


Figure 10 Group phenglogical activity of shrubs [n-11] at Ramsay Conyan. Bars with three vertical ines signif goctive tuig/stem growthi bink bars depict growing leaves; diaponal finesslanting to the lawer right reveal rull Flowering; lines that'slont to the lawer left dacument maturafruit.
able for a seven-month period beginning in Juna and reaching a peak in September when over $70 \%$ of the shrubs display ripe fruit. This period coincides with rapidly increasing amounts of precipitation, which also reach a peak in September and then deeline until a sacond peak in December. Ihe relatively high daily temperatures of May-September may stimulate the subsequent June-December ripening of fruit.

## Perennials

A large number of herbaceous perennials at Ramsey Canyon [ $n=34]$ and Canelo Hills $\{n=46]$ permit comparison of the potential roles of local environmental factors between the two locations. At Ramsey Canyon, stem and leaf growth begins in March, rises gradually until over $80 \%$ of all perennial herbs are vegetatively active in July and August, and then tapers off by December [Figure 11]. There is a striking parallel between this pattern and the ones for average daily maximum and minimum temperatures $\{$ Figure 5], which rise gradually from January until July, then taper off by December. On the other hand, the precipitation that increases sharply from July until September, then drops off [Figure 6], does not correlate as well with Ramsey Canyon herbaceaus parennial vegetative activity.

Uegetative growth Eor perennial herbs at Canelo Hills [Figure 12$]$ is not as closaly linked to the avarage temparature curves as at Ramsey Canyon. At Canelo Hills, stem and


Figure 11 Group phenological octivity of parannigls [n-34] at Ramsey Canyan. Bars with threg varticnl black lines signify activa twig/stem grawthi blank bars depict grawing laques; diaganal lings slanting ta the lamer right ravanl


Figura 12 . Graup phenalogical activity of parannighs [n-46] at Canala Hills.


leaf growth resume early, then increase rapidly until June, when the maximum number of species [over $75 \%$ ] are vegetatively active. After Juna, the propartion of species that display stem and leaf elongation drops steadily for the remainder of the year. Temperatures, on the other hand [Figure 7], rise gradually until May, and then remain nearly steady far faur months. As at Ramsey Canyon there seems to be little direct influence of precipitation, as the peak of perennial herb leaf and stem growth is reached one month before the number of inches of rainfall per month [Figure 8$]$ rises dramatically.

The general trend in flowering of herbaceous perennials in the two locations is quite similar. At Ramsey Canyon flowering slowly increases from March and reaches a maximum in August when aver $80 \%$ of all perennial herbs are in flower. The percentage of species in flower then rapidly declines, and flowering ceases altogether by December. At Canelo Hills, the same pattern prevails. There, the first perennial herbs alsa flower in March, and gradually the percentage of taxa in flawer increases until a maximum of $54 \%$ is reached in August. Perennial herb group flowering then rapidly tapers off, until no species undergaes anthesis during the periad December to February. In both locations, rising and peak temperature periods coincide with the bulk of flowering. As temperatures decline, so does anthesis. Months of peak flowering and precipitation also coincide.

Fruiting of perennial herbs is also similar in the two study sites. Although a small percentage of species are in fruit at Ramsey Canyon nearly the entire year, the height of fruiting activity spans the periad from June through Navember, being centered on September and October. The precipitation graph parallels this fruiting trend, while the graphs depicting average daily maximum and minimum temperatures do not. At Canelo Hills a similar fruiting regime can be plotted for the herbaceaus perennial species. There fruiting flourishes from June through November, being centered on August thraugh October. At Canelo, the trend in monthly precipitation also parallels the curve of species in fruit, while maximum daily temperatures do not.

## Annuals

Annual taxa at Canela Hills display a biseasonal phenalogy [Figure 13]. Stem and leaf growth peak first in April for $25 \%$ of all annuals, and then in August for $60 \%$ of the group. A small peak in flowering also occurs in April, followed by a reduction in the number of flowering annuals until a dramatic increase in August-November. Fruiting peaks follow those of flowering, the first small one coming in June, and the second major one in October.

Rising daily average temperatures from January through May [Figure 7] could be tied to germination and seedling establishment. Law precipitation during this period [Figure 8] is not a deterrent to same annual plant activity.





Apparently residual sail moisture, soil temperature, and available heat in the enviranment are adequate to permit the first small peak of flowering. Temperatures have reached nearly maximum when fruiting follows in June, but rainfall is still very low. A periad of high temperatures and a dramatic increase in precipitation from July-September caincides with the second, majar, peak of annual taxa flowering and just slightly precedes the period of maximum annual plant fruiting. Drapping average daily temperatures beginning in September may induce a moderate reduction in the percentage of annuals in flower; those in fruit seem unaffected by this decrease.

Discussion of group phenology
The foregoing information on group phenology has been summarized in Table 95 . It becomes apparent that periods of rising and maximum temperatures frequently coincide with group phenological activity of riparian and adjacent habitat lifeforms, suggesting that in fact these taxa do not exhibit "considerable indifference to climate" [Daubenmire 1978:27]. Less often, periods of increased precipitation correlate with maximum flowering and fruiting, especially for perennials and annuals. This is understandable when one realizes that a number of these taxa actually grow along the drier Elanks adjacent to the riparian zone where water might, in fact, be a limiting factar.

Table 95. Passible diract influences of querage daily maximum and minimum temperatures and total manthly precipitation for lifecycle events of trees, shrubs, herbaceous perennials and anmuals. $R C=$ Ramsey Canyan; $\mathrm{CH}=$ Canela Hills; $T$ rising or maximum temperatures correlate with group activity; $P=$ monthly precipitation amaunts correlate with graup activity, blank spaces reveal no data available.

*Herbaceaus perennials, including grasses.

In an attempt to further evaluate the potential effect of temperature on phenological events, data was accumulated on overwintering bud formation for trees and shrubs in both study sites. The presence of buds in the axils of leaves was monitared September 1984 and June and July of 1985 [Table 36]. Only threa species formed overwintering buds as early as June, but fifteen more had them by July. Iw additional species had them by September and the remaining seven presumably formed them thereafter.

When one compares overwintering bud formation to both initiation and cessation of vegetative growth for each species, alsa summarized in Table 9G, there seems to be no clear pattern in the timing of these three events that could be used in a predictive way. The number of months that can pass between resumption of stem and leaf growth and formation of overwintering buds ranges from 1-6, while the amount of time until dormancy also varies. However, when one refers to the weather records for Ramsey Canyon and Canelo Hills [Table 93], it is clear that in both 1983 and 1984 the highest maximum and minimum temperatures centered on July. By August average daily temperatures had begun a steady decline. If the potential for heat accumulation has reached a peak by July, it may possibly be the trigger that initiates development of overwintering buds for a majority of tree and shrub species. Thus, temperature cues are again seen as correlated with a major phenological event.

Table 96. Tiaing of vegetative events for T(rees) and S(hrubs) at Rassey Canyon (RC) and Canelo Hills (CH), OB = overwintering buds present, $\mathrm{NB}=$ no overuintering buds seen, : = leaf/sten activity resumes, d= leaf/sten activity ceases.


Comparative phenological data on the species studied is scarce. A few pertinent observations were published in a journal written about Canelo Hills [Levine 1974]. Although the authar used common names for the plants he referred to, it is likely that they can be matched fairly accurately to species in this study. Levine's observations are generally, but not totally, in agreament with those of this dissertation. For example, by February 17, he noted the "willow near budding" and "the cattonwood's yellow catkins dangling like miniature beehives, humming with yellaw bees arriving everywhere at once" [Levine 1974:168]. His observations agree with those of the present study, which noted Sglix losiolepis to be in full bloom in February, and Popylus Eremontij to have also developed catkins by then. Levine's observation of "blue-eyed grass . . .flowing like a robe along either side of the cienega" on May 5th [1974:207] coincides with the present observation that Sisurinchium demissum begins full flowering in April and continues to bloom and develop mature fruit through August. Likewise, his notation that by fugust 17 the "walnuts begin their descent from a hundred trees beside the stream" [Levine 1974:70] complements the data of this study which noted the first mature Juglans majoc nuts to fall aff in September. In sharp contrast, Levine noted the presence of "maturing cattails" in the stream by April 13 [1974:190], whereas
developing female spikes of Iupha lotifolig weren't first noted by this authar until August of 1983 and July of 1985, respectively. Although it is likely that some differences in the timing of phenological events may be expected from one year to the next, it is unknown if a difference of three to four months is reasonable.

In another Southwestern location, phenological trends of initial growth and anthesis for a number of plants are available fram Fish Springs, a spring fed salt marsh lying in a harsh, arid basin setting in western Utah [Balen 1964]. The setting experiences mean annual precipitation of 7.13 inches with the bulk of that falling in the winter; annual temperature averages 51.30 F. This setting contrasts noticeably with Canela Hills Cienega, which averaged 36.4 inches of annual precipitation from June 1983-August 1984, and experienced an average temperature of 62aF.

Six of the species monitored at Fish Springs were identical or nearly so to six observed in Canelo Hills Cienega. When one compares the phenological records between the two locations [Table 973 same interesting paints emerge. In eight of the twelve comparisons, two weeks or less separated initial growth or anthesis. This similarity of response in species in diverse latitudinal settings and exposed to different environmental regimes suggests strong underlying genetic mechanisms may be operating in phenologi-

| Species | Initial Growth |  | Anthesis |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Fish Spgs. | Canela | Fish Spges. | Canelo |
| Eleacharis Egstellata | Apr 29 | Apr 29 | May 11 | Apr 29 |
| Juncus balticusa | Apr 14 | Mar 30 | May 5 | May 20 |
| Sciepus acutusb | Apr 12 | Mar 30 | May 9 | May 20 |
| Scinpus <br>  | Apr 14 | May 20 | May 4 | Jne 26 |
| Spocqualus ai든ㄹdesc | May 16 | Apr 29 | Jne 10 | Aug 7 |
| IUpha quaustiEaligd | Apr 17 | Jan 9 | Jly | Jly 20 |

a Data on this intraduced species is in Appendix 3.
b S. geytus is a synanym far S. validus in this study.
c S. girgides var. wrightij was manitored ot Canelo Hills.
d I. latifolig was manitored at Canelo Hills.
cal timing of these species. Such mechanisms might be what Daubenmire [1978: 27$]$ had in mind when he indicated factars other than climate may play important roles in initiating growth, reproduction or dormancy of riparian taxa.

In the remaining four comparisons, there is considerably more variation in phenological events. The eight week difference in the anthesis of Spargbolus girgides could be explained by the fact that at Canela Hills the robust var. wcightij might take longer to become reproductive. While Iupho latifolig was first seen emerging as young leaves in January at Canelo Hills, winter conditions seem not to faster emergence of Iupho in Utah until much later. Lack af synchraneity in phenalagical events Ear Scirpus qmericanus between the two locations may reveal a species more subject to local influences than the others.

Soil water level changes at Canelo Hills Cienega
Informal observations were made regarding the general soil moisture level at Canelo Hills. The lowest level was noted in June of 1983, when certain areas under the canopy af trees became dry on the surface. In contrast, the water level of cienega and stream reached a peak by January of 1984, when normally dry areas became soggy, the main channel of the stream appeared deeper and the stream level higher, and numeraus small streamlets appeared acrass the drier east flanks of the stream where no water had been earlier. By

February of 1984 it was suspected that the vegetation was taking up water in preparation for renewed growth, evidenced by a rapidly lawering soil water level.

These water level fluctuations generally agree with those at Fish Springs salt marsh in western Utah CBolen 1964:154-156] where fluctuations of more than four inches were observed [Bolen 1964:154-156]. Bolen felt these water level changes were due largely to the presence and activities of the vegetation. At first renewed growth in the spring hampered water movement in the soil, possibly by actual physical blockage of resumed rootlet growth. Later the marsh began to steadily lose water to the heavy evaparation and transpiration requirements brought on by summer heat. Dne of the effects of this fluctuating water table was to provide a zone of transitory habitats at the edge of the marsh for such annuals as Atciplex patula, Sugedg occidentalis and Chenopodium hubridum. It is reasonable ta suppose that fluctuating sail maisture levels along the flanks of the Canelo Hills stream and cienega may also provide transitory habitats for annuals.

SUMMARY

The natural history of wetlands in the American Southwest is poorly known. This is unfortunate when one considers that perhaps anly a small percentage of native Southwestern riparian vegetative types remain today, and that the areal extent of this habitat type continues to decrease. Althaugh a number af gaod general surveys of the plants and animals of various wetlands have been published, beginning with some excellent reports in the 1940 's, the literature reveals few autecalogical studies. Virtually nothing has been published on the phenology or timing of life cycle events of plants in and adjacent to any Southwestern wetlands.

Historic and prehistoric literature reveals that groups in arid America have chasen to live in or next to riparian habitats. For example, in historic times the choice of campsite lacation by the Kaibab Paiute was governed strictly by the availability of water. Half of the 57 principal places recognized by the Kiliwa of southern California were springs or arroyos. A prehistoric record in Colorado reveals that thraugh time peaple lacated their habitations near riparian ecosystems. In the Great Basin of Utah, perhaps up to 10,000 years of cultural stability is represented in the organic remains of wetland locations; the records there suggest a variety in diet not matched in
historic subsistence records.
The San Pedra river valley in southeastern Arizona has hosted humans far millennia, many of them living in or near wetlands. The earliest Big Game Hunters 11,500 years ago ambushed large mammals, especially mammoth, at the sites of Lehner, Naco and Murray Springs. These hunters were Followed by a series of foraging traditions, leading eventually to settled groups that practiced simple ditch irrigation and floodplain agriculture. When some of the Spanish traveled thraugh the San Pedro valley in 1697, one observer estimated that aver 2000 native peaple lived in a series of 14 riparian villages, all along the river. The valley then witnessed a series of historic attempts to raise livestock and mine silver.

In light of the fairly continuous human occupation of the San Pedra river valley, it is not surprising that a number of major changes have been documented. Although the impact of such ancient activities as intentionally set Fires, land disturbance through agriculture, and local wood depletion cannat be ignored, perhaps the mast extensive changes are the result of historic forces. Chief among these were the grazing of thousands of domestic animals in the valley in the 17 th and 18 th centuries, and extensive wood cutting to Fuel silver smelting Eurnaces. Vegetation changes included the decimation of woodlands, changes in diversity of composition of the grass and shrub communities,
invasion of weedy species, and compaction of sails. Perhaps the most dramatic historic event was the late 1800's entrenchment of the valley and its tributaries, which continues today.

Even with a history of long-term human occupation and dramatic historic vegetation changes, the San Pedra valley still retains some well-preserved riparian habitats. For this reason, a series of wetlands in this valley were evaluated to locate two healthy habitats where native species were replacing themselves and where current impact from humans appeared minimal.

Ramsey Canyon and Canelo Hills Cienega, both under the care of the Arizona Chapter of the Nature Conservancy, met these requirements. Ramsey Canyon in the Huachuca Mauntains of Cochise County is drained by a freshwater semi-permanent stream that disappears before it reaches the San Pedra. Canela Hills Cienega in Santa Cruz County is a permanent wetland that is fed by two permanent underground springs discharging into $D^{\prime}$ Donnell Creek.

A suite of 127 native plant species were observed over a 16-month periad and phenological changes nated, especially stem elangation, leaf expansion, flowering and fruiting. Herbarium specimens that support plant identifications at permanent collecting stations have been deposited in the University of Arizana Herbarium, Tucson.

It would be reasonable to assume that phenological events wauld vary in timing from year to year; the magnitude of variation remains to be determined. Informal observations made during this study suggest that a two week shift in the timing of flowering or fruiting might be common. The data was gathered primarily to perceive the potential value of riparian plants for humans during the year. Hawever, plant ecologists can use phenological profiles to view strategies of competitive plant taxa to maximize photosynthate praduction under favorable enviranmental regimes, and to evaluate the importance of life-cycle event timing for ruderal and stress-tolerant species. Wildiife biologists can use it to understand animal use of wetlands.

The first major goal of this study, to provide a braad and full view of the availability of riparian plants to humans in the American Southwest, has been satisfied by merging these newly developed phenalogical prafiles with a broad review of both historic and prehistoric records on actual and inferred plant use by humans. It seems that these riparian habitats offer humans a wide range of plant taxa and parts throughout the year that could satisfy a diversity of human requirements. All major lifeforms contribute to this potential resaurce base for foragers.

The primary reason plants would be gathered would be for food. Periods of scarcity and abundance could be expected. The period of greatest potential food stress,
when the smallest number of nutritionally valuable reproductive parts are available, is during March and April. In strong contrast the manths of August through Navember appear to offer maximum harvesting opportunities. Actual selection would be based not only on the presence of a particular resource at a given time, but on other factors such as: [1] alternative choices, including faunal resources, [2] effort required to acquire and process each separate faod, and [3] productivity. The actual nutritional benefits accrued might indirectly influence selection.

Non-reproductive parts available for food include bark, buds, bulbs, fibers, galls, inner bark, leaves, plants, rhizomes and roots, sap, shoots, stems, and stalks. Some of these parts could be gathered year round, if necessary. For that reasan many might be considered famine foods.
fit addition to food, riparian plants could be saught for a series of other uses. These include incidental foods, medicines, ceremonial needs, construction material, dyes/ paint/ tanning agents, fuel, household needs, hunting tools/ fish poisons, and as clothing/adornment, grooming and smaking materials. Plants satisfying this series of needs vary widely in period and length of availability.

An examination of the different uses to which a particular category of parts can be put also reveals variety. As an example, flowers could be eaten, employed as a seasoning
and beverage, made inta a medicinal preparation or sap, sought as ceremonial paraphernalia, prepared as a dye, Fashioned into a toy, used as a hairbrush, and observed to forecast winter weather. Other reprociuctive parts, as well as vegetative above and below ground parts reveal the same diversity of uses to which flowers are put.

Possibly same native plants that commonly occur in mesic settings have received special care by humans, at least in historic times. Whether this care reflects longterm traditions stretching back to prehistoric times is unknown. This is because the care given may have been quite casual, resulting in none of the observable marphological changes in reproductive parts that are commonly used to suggest prehistaric domestication or intensified horticultural efforts.

The six plant taxa possibly receiving special care have been divided into two groups. These include: [1] plants that are quite likely native, including species of Eanicum. Populus. Splix and Iypha, and [2] plants that are possibly introduced cultivated varieties such as Ehysalis and Yitis. Although Physalis and Uitis might actually represent native southwestern species, the evidence is equivocal. In any event, it seems likely that peaple having need for particular riparian species were not averse to activities that would make acquisition easier.

Trees and shrubs serve human needs mare of ten than
other lifeforms. Of the Southwestern Elora composed of over 5400 species, only $2 \%$ [ $n=109]$ are tree species. Yet trees are widespread, so one is more likely to encounter a familiar tree in a new area than a familiar shrub, herbaceous perennial or annual. Since the total number of tree species is small to begin with, the uses and needs to which trees are put by humans could be learned more quickly and shared mare readily among groups. Shrubs follow trees in the frequency with which one might encounter them, and for the same reasoning might be selected by humans in greater proportions than actually represented on the landscape.

In addition to an ethnobotanical overview, lifecycle data has also provided some ecological insights. Far example, when the yearly phenological profiles are grouped by lifeform, they can be used to assess graup patterns of stem elongation, leaf growth, full flowering or mature fruit presence. These patterns correlate with local weather data in a year that experienced close to the highest average temperatures and maximum precipitation in over 80 years of recarded data. Rising and maximum temperatures caincided with many phenological events, including the formation of averwintering buds. This implies that plants in riparian lacations are not indifferent to climate. Less often, periods of increased precipitation fell within times of
maximum flowering and fruiting of herbaceaus perennials [including grasses] and annuals. For certain species adjacent ta a riparian habitat, precipitation may critically influence phenology.

Phenological data From other saurces includes comments by an earlier abserver on flowering events of species at Canela Hills. These observations were in agreament far four taxa, differing only in the record of Iyphg. In a study of wetlands plants in a salt marsh in Utah, general agreement existed in the initial growth and anthesis of six similar or identical species. Such similarity of responses from some of the species in diverse geographicsl settings with different environmental regimes suggests a simple genetic mechanism underlying phenology.

Soil moisture levels, informally monitared at Canelo Hills, seemed to follow a yearly regime similar to that observed elsewhere. Cienega and stream levels were at a low in the month of June, and highest in January. Noticeable water table drop in February can be related to increased uptake by the local vegetation in anticipation of the upcoming growing seasan. These water level differences agree generally with those observed ai a sait water marsh in western Utah, where it was suspected that vegetation also played a key role in changing levels. Fluctuating water levels around the flanks of a riparian habitat in a desert region could be expected to provide a transitory habitat for
plants that could either: [1] adapt to such changes or [2] mature reproductively within the relatively short periad af time during which water was present in the sail.

To understand the archaealogical record of ripariari plant remains, $I$ predicted what plant parts might survive in the archaealogical record, based on the inherent qualities of plant parts and on ethnobotanical records of preparation and luse that wiullu promote or inhibit preservation. It seems reasonable to assume that any part rautinely exposed to fire has an increased chance of preserving via charring. Taugh parts such as nutshells or small round seeds, and parts with certain chemicals such as lignin in wood, are thought to have increased chances of preservation. Fragile flowers and leaves, or resources prepared in ways which might obliterate anatomical characteristics cbailing, mashing3, would have lowered chances of survival.

With this perspective comes the revelation that many plant parts sought by humans, at least in historic times, appear to have poor chances of surviving in an archaeological setting. One can appreciate the skewed nature of an ancient record that preserves only charred seeds, fragments of fuel wood, and perhaps large woody roof beams. The bulk of the record may be missing, including buds, bulbs, fibers, flowers, galls, inner bark, latex, leaves, needles, plants, resin, rhizomes, roots, root bark, sap, stalks, tubers,
twigs, young pods, and young shoots. These parts are rare in Squthwestern sites, except in dry caves. At covered, dry sites the abundance of fragile material can be averwhelming. Another perspective lost from the ancient record is the diversity of uses to which certain plant parts can be put. Far example, medicinal preparations, paints, dyes, sap, toys, utensils, beads, incense, hair rinses, mending materials, tailetries, and chewing gum are just a few of the nan-Eodd needs to which seeds and Eruit have been put in historic times. Incidental gathering of maist herbage and grass stems to provide steam in a roasting pit would not easily be recognized from plant remains charred during faod preparation, except via careful comparison of all site contexts.

To provide insight helpful to an archaeobotanist interpreting pollen from an ancient site, I conducted a pollen wash study of selected reproductive and vegetative parts. Far fourteen separate samples, pollen fram an average of 16 additional taxa were recovered on a specific part. Concurrent flowering of a taxon harvested is not necessary for pollen entrapment, nor is lack of flowering detrimental. With few exceptions the pollen types recovered were fram taxa known to be available in the area. Alsa, redeposition of pallen shed in a prior seasan contributes only moderate amounts of pollen to parts harvested. Data Eram this study is alsa helpful in understanding
mechanisms and likelihood of pollen entrapment. For example attached flowers or flower parts CRibea, Ranicum qbtusum Uitis, Arctostaphylos and Queccus] will likely retain pollen. Alsa, plants with perianth parts that enlarge and madify in development [Rumex] will entrap abundant pollen, as will parts with hairs [generally] ar ail glands [Manarda. Quercuss. Insect-carried pollen grains are nat necessarily apt to fall from a flower to lower leaves below [Qxalis], although if they do the event may be revealed orily by examining pollen concentration rather than by the relative pollen percentage [Mongrdg]. Smooth or glaucaus fruit coats occosionally carry small amounts of pollen $\{$ Rhamnus. Juniperyss, sometimes entrapped by pollen-harboring parts such as pedicels and sepals [Uitis. Arctostaphylos]. Dccasionally a smooth-coated fruit [Berberis] retains quantities of pollen for reasons not understood.

Other insight into pollen transport of the fourteen species is revealed by this study. Percentages or concentrations of Quercus and Gramineare pollen caught by foreign taxa easily mimic thase obtained when acarns or grass parts are actually collected. Thus, actual harvest of acorns or grass spikelets or florets as resources may not be ascertainable thraugh analysis of the pallen recard. Guidelines for interpreting pollen representing the remaining taxa have alsa been developed.

There are two major reasons why data presented here would be useful to colleagues elsewhere in southeastern Arizona. Riparian species often have expanded elevational distribution and geographic spread, in relation to dry site upland species. Of the 127 species included in this study, 16 appeared in a list of plants broadly distributed among 50 southwestern floras. Sa data from Ramsey Canyon and Canela Hills on these taxa may be of use to those studying other regional wetlands. Also, the worldwide record of plant domestication suggests that humans in different locations tend to be attracted to similar taxa. The extensive ethnographic citations to many of the species in this study reveals that the same native plants have been repeatealy sought by groups spread over wide areas. It therefore seems likely that the perspective on riparian plant use provided here may alsa have applicability for other specialists working with the sautheastern Arizona ancient plant record.

Appendix 1. Basic observations on 10 riparian habitats in southeastern Arizona visited in 1983. Roman numerals represent the authar's subjective evaluatian of the native plant diversity and protected [from present impact] nature of the locations, relative to each other. A rating of 1 signifies best preserved and IU represents the worst. Note that same areas received the same relative ratings. Map references are to United States Gealogical Survey Quadrangle maps of Arizona.

## Ciensaga

I. Canelo Hills Cienega

Santa Cruz County, AZ; D'Donnell Canyon 7.5' Quadrangle; T21S, R1日E, Section 33; 4950' elevation. Uisited 1/29/83.

A very diverse native vegetation in a small area, due to the presence of a cienega fed by two springs, a freshwater stream, and the drier upland flanks. No evidence of current domestic animal grazing. A number of plant species in the area are domestic, such as pecan [Earyal, mulberry [Marys], pear [Pytys], and apple [Malus]. A small amaunt af introduced tumbleweed Solsolg was observed along the border of the cienega. The dominant Juncus in the cienega also appears to be an intraduced species, $J_{1}$ balticus.

## II. Empire Cienega

Pima County, AZ; Empire Ranch 7.5' Quadrangle; I195, R17E, Sections 17-18; 4600' elevation, Uisited 1/28/93. An area of moderate diversity of native plants. Grass species are dominated by the introduced bermuda grass Cyna= don, though at least six native grasses are also present. Dominant trees are Rquilus and Salix, plus Rraspois.

Appendix 1 [continued]. Basic abservations on 10 riparian habitats in southeastern Arizona visited in 1983.

Evidence of damestic animal grazing present in the form af abundant feces as well as obviously low-cropped vegetation. III. Pasteur Cienega/St. David Spring

Cochise County, AZ; St. David 15' Quadrangle; T18S, R21E, Section 29; 3720-3750' elevation. Uisited 2/13/83.

An area lacking in diversity of native plants. Intrauced Iamarix abundant araund man-made impoundment. Native Ropulus. Salix and Rrospois present. Evidence plentiful for domestic animal grazing, including many rales sunken into cienega that appear as hoof prints, and grass clasely cropped to the ground. Historic disturbance includes massive earth moving to make an impoundment to store water.
III. Babocomari Cienega

Santa Cruz County, AZ; Fart Huachuca 15' Quadrangle; Te1S, R19E, San Ignacio Land Grant. Uisited 1/29/83.

The area visited here may not have actually been the true cienega, for conflicting information from ather researchers disagrees with the pessimistic view presented here of the current vegetation status. The area visited for this study was strikingly lacking in diversity of native plants, and displayed evidence of continued and heavy domestic grazing. Intraduced bermuda grass Cynadan comprised the bulk of the grass present. Cattle were observed in the area; most vegetation had extensive evidence

Appendix 1 ［continued］．Basic observations on 10 riparian habitats in southeastern Arizona visited in 1983.
of cropping．A forest of deciduous trees at the edge of the cienega seemed more varied，with Ropulus．Juglans and Sambucus．

## Ecashuater Stceams

I．Ramsey Conyon
Cochise County，AZ；Miller Peak 7．5＇Quadrangle；I23S， R2OE，Sections 9－10；5700－6000＇elevation．Uisited 2／13／83．

A diverse，stratified vegetation，dominated by deci－ duous trees．Admixture of desert species［Ggave，Yuscg］and mantane elements［日bies．Pseygotsuga．Pinus］is striking．A variety of age－classes present for dominant species，im－ plying a healthy vegetation replacing itself．No indica－ tions of current damestic animal grazing．Extensive Yinge nojor covers stream banks 6－12 meters wide on either side in the lower portion of the canyon；in upper segment this introduced species is replaced by native Egyisetym．

II．Somoita Creek
Santa Cruz County，AZ；Mt．Wrightson 15＇Quadrangle； I22S，R15E，at the edge of present town of Patagonia；4000＇ elevation．Uisited 1／2日／日3．

A stratified somewhat diverse vegetation，dominated by deciduaus trees．Understory of tall grasses and shrubs． Some non－native species include Cunodon，Ailgnthus and Nicg＝ tigng［tree－tobacco］．No current evidence of domestic

Appendix 1 ［continued］．Basic observations on 10 riparian habitats in southeastern Arizona visited in 1983.
grazing animals；knee to waist－high perennial grasses suggests grazing pressure is low．Current human impact is implied by recently deposited garbage in the stream，and the proximity of a railroad track and small town．

III．D＇Donnnell Creek
Santa Cruz County，AZ；D＇Donnell Conyon 7．5＇ Quadrangle；T21S，R1日E，Sections 27－28．Uisited 1／29／日3．

Considered to be less diverse than other freshwater streams evaluated，with both streamside and slightly elevated adjoining aliuvial terraces rather manotonous in terms of numbers of species．Edges of stream are heavily covered with Bacchacis alutingsa．Lack of direct evidence of domestic animal grazing is reinforced by the waist to head－ high stands of Sㅁgㅁㅇㅁ이노 spp．that are in evidence．

III．Bass Creek
Cochise County，$A Z ;$ Winchester Mountain 15＇
Quadrangle；T12S，R21E，Sections 29，31，32；elevation 4027＇．Visited 4／9／日3．

Nice upper canopu of diverse trees，but lower vegetation is depauperate and sparse．Not nearly as varied as the other locations visited．Human impact is obvious in terms of current domestic animal grazing．

IU．Lower Sabino Canyon
Pima County，AZ；Sabina Canyon 7．5• Quadrangle；T12－

Appendix 1 [cantinued]. Basic abservations a 10 Eiparian habitats in sautheastern Arizana visited in 1983. 135, R15E, Sections 9-10 and partions of unsectioned National Farest Land; elevation 2BOO-3334'. Uisited 2/20/B3.

Streamside native vegetation less diverse than other fresh-water streams evaluated. No evidence of current domestic grazing, but the area is heavily impacted by humans. Hundreds of people hike, bike and take daily shuttle buses in the area.

## Sunam

I. Bingham Swamp

Fima County, $A 2 ;$ Redington 15' Quadrangle; T11S, R1BE, Sautions $22,23,26,27$; elevation 2680'. Uisited 4/15/83.

There appears to be a fair amount of native plant diversity in bath upper and lower canopies. The wetland is extensive, and of stagnant water. Domestic grazing animal presence is noted by law-cropped grass, warn paths, Eresh arganic deposits, and gentle mooing in my aar.

Appendix 2. Pracedure utilized to acetolyze madern pollen wash samples.

Acetolysis pracess applied to 14 pollen wash samples, based on procedures in Faegri and Iversen [1975:107] and under the guidance of Ms. Patricia Fall, Pallen Lab, Geasciences Dept., University of Arizona, Tucson. Driginal wash samples consisied of Fram .5-. 75 liter of distilled wash water, with a pH of $2-3$ due to addition $[a t$ the time of the wash] of 10\% HCl. Sieving of samples for large particles was not deemed necessary, but could accur at this point in the process.

1. A single Lucapadium pill [Batch No. 414931] was added to each wash sample. hucgpodium can serve as a tracer spare ta ascertain that sample processing was appropriately done. It can also serve as a method whereby ane can calculate approx-imate concentrations of pollen types present, based on the number of hycopodium spores encountered relative to a given number of pollen grains. This is possible because the number of mycogodium spores per original pill for this batch has been estimated at 12,100.
2. To concentrate the pallen and decant the weak HCl solution, small amaunts of the wash salutian were spun for 4 minutes at 2000 rpm until all had been centrifuged. Before each spin a good squirt of $100 \%$ ETOH was added to help the pallen settle to the bottom of the tube. A distilled water wash at the end of the process helped eliminate HCl.

Appendix 2 [coni]. Procedure utilized to acetalyze modern pollen wash samples.
3. After distilled water decanted off, test tubes were Filled $1 / 3$ to $1 / 2$ with glacial acetic acid to dehydrate the sample. Again some 100\% ETOH was added to help the pollen settle to the bottam. Five minutes of centrifuging were Followed by decanting the glacial acetic acid inta a separate beaker which would eventually be used to neutralize the acetolysis mixture.
4. Acetalysis $[$ ar degradation of arganic material, including the inside contents of the pollen grainsl Eollowed. While wearing a face mask and rubber gloves for protection:
a. 5 ml of acetic anhydride was added to each sample
b. exactly .5 ml of sulphuric acid was pipetted into sample
c. samples were stirred and placed into a bailing water bath for exactly 2 minutes
d. samples were centrifuged 4 minutes and decanted into the neutralizing mixture referred to above
5. Glacial acetic acid was added immediately after decanting, to neutralize or stop the acetoylsis process. Again the samples were centrifuged 4 minutes and the glacial acetic decanted. A distilled water wash Fallawed, with 4 additional minutes of spinning and decantation.
6. Two samples were examined under the micrascape at this time, and it was determined that same organic material still remained, including a number of possible Fungal

Appendix 2 [cont]. Procedure utilized to acetalyze madern pallen wash samples.
spores. It was decided that further processing was necessary to try and remove same of this material. If abundant silicates inad been observed, an $H F$ wash would have been needed, but this was not the case.
7. A $5 \% \mathrm{KOH}$ solution put into the test tubes was then heated for 2 minutes in a boiling water bath. Centrifuging for 4 minutes was fallowed by decanting. A minimum of two, and up to 5 [hot] distilled water washes Eallawed, depending on when the supernatent cleared up. After each wash, 4 minutes of centrifuging and decantation occurred.
8. Staining was accomplished by adding 1-2 drops of safranin red and a few $m l$ of distilled water. Again the samples were centrifuged and decanted.
9. Final preparation included adding a small amount [2-3 ml] of $I B A$, centrifuging, and decanting, and using TBA to help wash the pollen mixture into already labeled small glass vials. The small glass vials were centrifuged for 6 minutes, the TBA decanted off, and a volume of silicon oil equal to that of the mixture remaining in each glass vial added. Glass vials were placed into the dessicator with their lids off for avernight drying; they were removed the next day and tightly capped.

Appendix 3. Phenological data (sone incomplete) on non-native taxa. $=$ leaf/sten activity resumes, fb $=$ flomer buds, $f\}=$ full flowering, $f w=f l o w e r s$ withered, $F=$ nature fruit, $d=$ dormant.

| taxon | location | ARII No. JAN | FEE | MAR | APR | MAY | JNE | JLY | Allb | SEP | OCT | NDV | DEC |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Agropryon repens (L.) Beaur | CH-3 ( ${ }_{\text {(159-83 }}$ ) | UA255077 |  |  |  | $t$ | ff | $f *$ | F | F | $F$ | $d$ |  |
| Agrostis stolonifera L. | CH-2 (158-83) | UA255223 |  |  |  |  | * | ff | $f f, F$ | $f f, F$ | $d$ |  |  |
| Broaus anoalus Rupr. ex. Fourn. | RC-4 ( $1175-83$ ) | UA255024 |  |  |  |  |  | * | ff | $f f$ | $\mathrm{ff}_{9} \mathrm{~F}$ | F | d |
| Cardaria draba (L.) Desv. | [H-3 ( $3310-83$ ) | UA255493 |  | \$ | fb | ff, F | ff, $F$ | $d$ |  |  |  |  |  |
| Dactylis gloserata L. | RC-3 ( $073-83$ ) | UA255077 |  |  |  | \&f | $\ddagger f$ | $f(\underline{F}$ |  |  |  |  |  |
| Festuca pratensis Huds. | CH-1 ( ${ }^{\text {c }}$ 094-83) | UA255215 |  |  |  | ff | $f f, f$ | ff, F | F | $d$ |  |  |  |
| Juncus balticus Hilld. var. sontanus Engela. | CH 1 ( $124-83$ ) | UA254619 |  | 1 |  | ff | $f f$ | ff | $f_{n, F}$ | F |  |  |  |
| Morus aff. alba L. |  | UA255930 |  |  |  | ff, |  | $f$ |  |  |  | $d$ |  |
| Masturtiu officinale R. Br. | CH-8 ( $1148-83$ ) | UA255011 |  |  |  |  |  | ff, F | $f f, F$ |  |  | \% |  |
| Paspalun dilatatun Poir. | CH-2 (\$178-83) | UA255204 |  |  |  |  |  |  | $\ddagger$ | ff,F | ff,r | F | d |
| Plantago lanceolata L. | CH 2 (\$128-83) | UA254659 |  |  | 1 | ff | ff | ff | $\mathrm{ff}_{6} \mathrm{~F}$ | ff,F | ff, F | ff.F | d |
| Poa pratensis L. | RC $2 / 3$, $\mathrm{CH} 1 / 2$ | UA255490 |  |  | * | $f f$ | ff | $f n, F$ | d |  |  |  |  |
| Polypagon aonspeliensis (L.) Dẹsf. | CH-4 ( $133-83$ ) | UA255202 |  |  |  |  | ff | $f f$ | ff,F |  |  |  |  |
| Runix congloneratus Murr. | CH-3 (130-83) | UA254639 |  |  |  | * | ff | $f w$ | F | F | F |  |  |
| Ruaex obtusifolius L . | RC-6 (\$112-83) | UA254638 | t |  |  |  | ff | $\ddagger$ | fr, F | F | F |  |  |
| Sonchus asper (L.) Hill. | CH-1 ( $1155-83$ ) | UA255008 d |  |  |  |  | * | ff,F | $f f, F$ | $f f, F$ | ff, F | ff, F | ff, F |
| Spirea 5 p. | RC-1 ( $0666-83$ ) | UA255928 |  |  |  |  | fn |  |  | F |  |  |  |
| Trifolium repens L. | CH-4 (\$135-83) | UA254887 |  |  |  |  | ff |  |  |  |  |  |  |

Appendiy 4. Follen types recovered in distilled water washed over modern plant parts cidentified by first two letters of genus and speciesh, Tana with an 1 were not reported by Yatskievych (1980) or Toolin (1980) or directly observed in the region by the author.

Arpu Bewi Jude Moau Oxde Fabu Fach Euea khea Fhtr kiau Ruvi Sege Viar
Follen tyges identifiod Abies
Acacia polyad
Ambrosia
Amaranthareas
6f. Arctostaphyles

| Artemisia | 7 |
| :--- | ---: |

Berberis
cf. Canpanulaceaz
Ceanothus
Celtis
Cercocarpus
Chenopodiinea
Compositae (Liguliflorae)
5

Compositae (Tubuliflorae)
Cyperaceae
Beteriorated:

## Eroken

Concealed
Corroded
Cruapled
Degraded
cf. Deiphinium
Dodonaea\%
Ericaceae tetrad
Eriogonum
Euphortia
Fraxinus 1
Galium
Gramineae
Juglans
Juniperus
Labiatae
Leguainosae (Fapalion.)

| 157 | 6 | 6 | 44 | 2 |
| :--- | :--- | :--- | :--- | :--- |
|  | 1 |  |  |  |

Liliacaae
cf. Monarda austroamntana
Ustrya
12

Doxalis
1
Ficeat
1

Appendix 4 (continued). Pollen types recovered in distilled uater washed over plant parts.
Arpu Beni Jude Moau Dxde Pabu Paob Guea Rhca Rhtr Riau Ruvi Sege Viar
Fclien tyges itentified


## Rhamnus

13
$\begin{array}{ll}\text { Khus trilobata } \\ \text { Ribes aureum } & 376\end{array}$
Ribes aureur clump 2
Ribes aureum tetrad (?) 1

| Fosaceae |  | 1 |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Rume: |  | 19 | 2 | 2 |  |  | 2 |  |  |  | 1 |
| Rume: cluap ${ }^{2}$ |  |  |  |  |  |  |  |  |  |  |  |
| Fume: tetrad |  |  |  |  |  |  |  |  |  |  |  |
| Salix | 4 | 5 |  |  |  |  | 2 |  |  | 7 | 1 |
| Salsola | 4 | 1 | 4 | 1 | 2 | 2 |  | 1 | 2 |  |  |
| cf. Setaria ${ }^{\text {3 }}$ |  |  |  |  |  |  |  |  |  |  |  |
| Sphaeralcea |  |  |  |  |  |  |  |  |  |  |  |
| Thalictrus |  |  |  | 1 |  |  |  |  |  |  |  |
| Uubelliferae |  |  |  | 2 |  |  |  |  |  |  |  |
| Unknown | 5 | 1 | 1 | 1 |  |  | 5 | 4 | 1 | 4 | 3 |
| Vitis |  |  |  |  |  |  |  |  |  |  | 8 |

${ }^{1}$ Deteriorated dollen grains kere recognized accoraing te a scheme outlined by Cushing (i967). Eroken grains have suffered rupturing of the exine: concealed cannet be examinet fully due to attached debris: corroded grains have exines affected by etching or pitting: degraded grains have undergone a structura! rearrangement to the exine; crumpled grains are badly foided, wriniled or collapsed, Because of their deteriorated sondition, these grains were not identifiatle.
${ }^{2}$ lo-30 poilen grains per ciump.
s Reference slides of Setaria geniculata have pollen grains approximately $40-45$ microns in diameter, with relatively thick annuli.

## REFERENCES

Adams, Karen $R$.
1980a Relative numbers of native microfossils in strata of poor preservation with emphasis on flotation. IN: Investigations at the Salman Site: the structure of Chacoan saciety in the northern Southwest III. C. Irwin-williams and P.K. Shelley, editors. Final report to Funding agencies; on file Eastern New Mexico University, Partales. pp. 251-297.

1980b Pines and other conifers. IN: Investigations at the Salmon Site: the structure of Chacoan society in the northern Southwest III. C. IrwinWilliams and P.H. Shelley, editors. Final report to funding agencies; on file Eastern New Mexica University, Portales. pp. 353-535.

Altschul, Siri van Reis
1973 Drugs and Foods from Little-Known Plants. Notes in Harvard University Herbaria. Harvard University Press.

Ambra, Richard $\square$.
1967 Dietary-Technological-Ecological aspects of Lavelock Cave Coprolites. IN: Reparts of the University of California Archaealagical Survey 70: 37-4日.

Antevs, Ernst
1983 Gealogical dating. IN: The Cochise cultural sequence in southeastern Arizona. Anthrapological papers of the University of Arizona 42 , Tucson.

Bahre, Conrad J.
1977 Land-use history of the Research Ranch, Elgin, Arizona. Jaurnal of the Arizona Academy of Science 12 [Supplement 2]:1-32.

Bailey, Flora L.
1940 Navaho Foods and Cooking Methods. American Anthropologist 42 [n.s.]:270-290.

Barnett, Peggy R. and Nancy J. Coulam
1980 Plant Macrofossil Analysis. IN: Cowboy Cave, by Jesse D. Jennings. University of Utah Anthropological Papers 104, pp. 127-133.

Barrows, David Prescott
1900 The Ethno-botany of the Coahuilia Indians of Southern California. University of Chicaga Press.

Barstad, Janet Fisher
1981 Factors controlling plant distribution in a riparian deciduous forest in southeastern Arizona. MA thesis, Arizona State University.

Bartlett, J. R.
1854 Personal narrative of explorations and incidents in Texas, New Mexica, California, Sonora and Chihuahua connected with the United States and Mexican Boundary Commission, During the years 1850, '51, '52 and '53. D. Appleton and Eo., New York.

Bartlett, Katharine
1951 Edible wild plants of Narthern Arizana. IN: Plants of Northern Arizona, Museum of Northern Arizuna Reprint Series No. 1. Northern Arizana Society of Science and Art.

Bean, Lowell Jahn and Katherine Siva Saubel
1972 Temalpakh. Cahuilla Indian knowledge and usage of plants. Malki Museum Press, Morongo Indian Reservation.

Bemis, W.P., J.W. Berry, C.W. Weber and I.W. Whitaker 1978 The Buffalo Gourd: A New Potential Horticultural Crop. HortScience 13[3]:235-240].

Benz, Bruce F.
1984 Appendix B. Biotic Remains. IN: Dolores Archaeological Program: Synthetic Report 1978-1981, David A. Breternitz, principal investigator. U.S. Dept. of Interior, Bureau of Reclamation Report, Denver, Colorado.

Bluhm, Elaine and Rager Grange, Jr.
1952 Cordage, Knots, and Cordage Artifacts. IN: Magollan Cultural Continuity and Change, the stratigraphic analysis of Tularosa and Cordova Caves. By Paul S. Martin, John B. Rinalda, Elaine Bluhm, Hugh C. Cutler and Roger Grange, Jr., Fieldiana: Anthrapology 40:pp. 205-230.

Bock, Jane H. and Carl E. Back
1985 Patterns of repraduction in Wright's Sycamore. IN: Riparian Ecosystems and their Management:

Reconciling ConElicting Uses. First North American Riparian Conference. USDA Forest Service General Technical Report RM-120.

Bohrer, Vorsila 1.
1962 Nature and Interpretation of Ethnobotanical Materials from Tonto National Monument. IN: Archaealogical Studies at Ionto National Monument, Arizona, by Charlie R. Steen, Llayd M. Pierson, Vorsila L. Bohrer and Kate Peck Kent. Southwestern Monuments Pssociation Technical Series 2.

1966 Pollen Analysis of the Hay Hollow Site east of Snowflake, Arizona. Gaochronalogy Laboratories Interim Research Report 12, Univ. of Arizona.

1970 Ethnobotanical Aspects of Snaketown, a Hohokam Uillage in Southern Arizona. American Antiquity 35[4]:413-430.

1972 Paleoecology of the Hay Hollow Site, Arizona. Fieldiana Anthrapalogy 63[1]:1-30.

1973 Ethnobotany of Paint of Pines Ruin Arizana $W: 10: 50$. Economic Batany 27[4]:423-437.

1980 Relative numbers of five macrafossils in strata of maderate preservation. IN: Investigations at the Salmon Site: the structure of Chacoan Society in the northern Southwest III. C. IriuinWilliams and P.H. Shelley, editors. Final report to funding agencies; on file Eastern New Mexico University, Portales. pp. 242-249.

1981a Farmer Dietary Patterns of Peaple as Determined from Archaic-Age Plant Remains fram Fresnal Shelter, South-Central New Mexico. The Artifact, Ual. 19[3-4]:41-50.

1981b Methods of recognizing cultural activity fram pollen in archaealogical sites. The Kiva 46[3]: 135-142.

1982 Plant Remains from Rooms at Grasshopper Pueblo. Anthrapological Papers of the University of Arizona 40, Universtiy of Arizona Press, pages 97-105.

1983 New Life from Ashes: the Tale of the Burnt Bush [Rhus trilobatg]. Desert Plants 5[3]:122-124.

1984 Grasses Fram La Ciudad, Part I. Ethnobotanical Report for Dctober. Unpublished manuscript.

1997 Ethnobotanical investigations at the Duncan Site Oklahoma [34WA-2]. Report No. 4. Manuscript on File with Oklahama Archaealogical Survey, Norman, Dklahoma.

Bohrer, Vorsila L., Hugh C. Cutler and Jonathan D. Sauer
1969 Carbonized Plant Remains from twa Hohokam Sites, Arizona BB:13:41 and Arizona BB:13:50. The Kiva 35[1]:1-10.

Bolen, Eric G.
1964 Plant ecology of spring fed salt marshes in western Utah. Ecological Monographs 34:143-166.

Bolton, Herbert Eugene
1919 Kina's Historical Memoir of Pimeria Alta Val. I. The Arthur H. Clark Co., Cleveland.

Bolyard, Judith L.
1981 Medicinal plants and home remedies of Appalachia. Charles C. Thomas Publisher, Springfield, Ill.

Breternitz, David A.
1957 Heltagito Rockshelter [NA 6380]. Plateau 30[1]:1-8.

1960 Orme Ranch Cave, NA 6656. Plateau 33[2]:25-39.
Broaks, Richard H., Lawrence Kaplan, Hugh C. Cutler and Thamas W. Whitaker
1962 Plant materials from a cave on the Rio Zape, Durango, Mexica. American Antiquity 27[3]: 356-369.

Brown, D.E.
1982 Biotic Communities of the American Southwest-United States and Mexica. Desert Plants 4 [1-4] Special Issue, 342 pp.

Brown, David E. and C. H. Lowe
1974 A digitized computer-compatible classification for natural and potential vegetation in the Southwest with particular reference to Arizona. Journal Arizana Academy of Science 9 [Supplement 2].


Mexican Collection. Economic Botany 33[2]: 135-162.

Callen, Eric 0.
1967 Analysis of the Tehuacan Coprolites. IN: The prehistary of the Tehuacan Valley, Vol. I. Environment and Subsistence, edited by Douglas 5. Buers. University of Texas Press, Rustin, pp. 251-른ํㅗ.

Camazine, Scott and Robert A. Bye
1980 A study of the medical ethnobotany of the Zuni Indians of New Mexica. Journal of Ethmapharmacology 2:365-38日.

Campbell, C.J. and Win Green
1958 Perpetual succession of stream channel vegetation in a semiarid region. Journal Arizona Academy Sciences 5[2]: S5-98.

Carlsan, Gustav G. and Volney H. Jones
1940 Some notes on uses of plants by the Comanche Indians. Papers of the Michigan Academy of Science, Arts and Letters, Val. 25;517-542.

Carter, Gearge F.
1964 Stone Circles in the Deserts. Anthropological Journal of Canada 2[3]:2-6.

Castetter, Edward F.
1935 Ethnobiolorical Studies in the American Southwest I. Uncultivated Native Plants Used as Sources of Food. The University of New Mexica Bulletin, Whale Number 265, Bialogical Series, $4[1]$.

Castetter, Edward F. and Willis H. Bell
$195 \lambda$ Yuman Indian Agriculture. Primitive subsistence on the Lower Colorado and Gila Rivers. University of New Mexico Press, Albuquerque.

Castetter, Edward F. and M. E. Opler
1936 Ethnobiological studies in the American Southwest III. The Ethnobiology of the Chiricahua and Mescalera Apache. A. The Use of plants for food, beverages and narcotics. The University of New Mexica Bulletin, Whale Number 297, Bialagical Series Ual. 4 [5], Univ. af New Mexico Press.

Castetter, Edward F. and Ruti M. Underhill
1935 Ethnobialogical Studies in the American Southwest II. The Ethnobiology of the Papago Indians. The University of New Mexico Bulletin Whole Number 275, Biological Series Vol. 4, No. 3, University of New Mexico Press.

Chamberlin, Ralph U.
1911 The Ethno-Botany of the Gosiute Indians of Utah. Memairs of the American Anthropological Association 2[Part 5]: 329-405.

Coffin, Edwin F.
1932 Archamalogical explaration of a rock shelter in Brewster Caunty, Iexas. Indian Nates and Monographs 48, Museum of the American Indian, Heye Foundation, New York.

Cook, Sarah Louise
1930 The Ethmobatany of Jemez Indians. Unpublished MA Thesis, Biology Dept., University of New Mexica.

Coake, Philin St. Gearge
1848 Repart of iieutenant Calonel P. St. Gearge Cooke of his march fram Santa Fe, New Mexica to San Diego, upper California. 30th Congress, 1st session, House Executive Document 41 , Washington, pp. 549-562.

Coake, Ranald $U$. and Richard $W$. Reeves
1976 Arroyos and Environmental Change in the American South-West. Clarendon Press, Oxford.

Core, Earl L.
1967 Ethnobatany of the Sauthern Appalachian Aborigines. Economic Botany 21[3]:198-214.

Cosgrove, C.B.
1947 Caves of the Upper Gila and Hueco Areas in New Mexica and Texas. Papers of the Peabody Museum of American Archaeology and Ethnology, Ual. 24[2], Harvard University.

Cowan, Richard A.
1967 Lake-margin ecologic exploitation in the Great Basin as demonstrated by an analysis of copralites Erom Lavelock Cave, Nevada. IN: Reparts of the University of California Archaeological Survey 70:21-36.

Crane, Cathy Janet
1977 A comparisan of archaealogical sites on the Uncampahgre Plateau and adjacent areas. Unpublished MA thesis, Eastern New Mexica University, Department of Anthropology.

Cully, Anne C.
1977 Relation of Pollen Analysis to Archaealogical Excavations, Chaca Canyon. Unpublished MS thesis, Department of Biology, University of New Mexica, Albuquerque.

Curtin, L. S. M.
1965 Healing Herbs of the Upper Rio Grande. Southwest Museum, Los Angeles.

1984 By the Prophet of the Earth. Ethnobotany of the Pima. Reprinted from a 1949 edition. The University of Arizona Press, Tucson.

Cushing, Edward J.
1967 Evidence for differential pallen preservation in late Quaternary sediments in Minnesota. Review of Paleobotany and Palynalogy 4:87-101.

Cushing, Frank Hamilton
1974 Zuni Breadstuff. Museum of the American Indian Heye Foundation. Reprinted from a 1920 edition of Indian Notes and Monographs, Vol. UIII.

Cutler, Hugh C.
1952 A Preliminary Survey of Plant Remains of Tularosa Cave. IN: Magollon Cultural Continuity and Change, the stratigraphic analysis of Tularasa and Cordova Caves. By Paul S. Martin, John B. Rinalda, Elaine Bluhm, Hugh C. Cutler and Roger Grange, Jr. Fieldiana: Anthropology 40, pp. 461-479.

1956a Vegetal Material from the Site of San Cayetana. IN: The Upper Pima of San Cayetano del Tumacacori; by Charles C. Dipeso. Amerind Foundation No. 7, Dragoon, Arizona.

1956b UI. The Plant Remains. IN: Higgins Flat Pueblo, Western Naw Mzxico, by Paul S. Martin, John B. Rinalda, Elaine A. Bluhm and Hugh C. Cutler. Fieldiana Anthropology 45:174-183.

1963 Appendix B. Plant Remains from a Grand Canyon Rock Shelter Granary, IN: An archaeological survey of Nankoweap Canyon, Grand Canyon National Park, by Douglas W. Schwartz. American Antiquity 28[3]:289-302.

1964 Appendix A. Plant Remains from the Carter Ranch Site. IN: Chapters in the Prehistory of Eastern Arizona II, by Paul S. Martin, J. B. Rinalda, et al. Fieldiana Anthropology 55:227-234.

Cutler, Hugh C. and Lawrence Kaplan
1956 Some plant remains from Montezuma Castle and nearby Caves [Na 4007 B and C on Dry Beaver Creek]. Plateau 2日[4]:98-100.

Cutler, Hugh $C$. and Thomas W. Whitaker
1961 History and distribution of the cultivated cucurbits in the Americas. American Antiquity 26[4]:469-485.

Datta, S.C. and A. K. Banerjee
1979 Useful weeds of West Bengal rice fields. Economic Botany 32:297-310.

Daubenmire, Rexford
1968 Plant Cammunities, a Textboak in Plant Synecology. Harper and Row, New York.

1978 Plant Geography, with special attention to North America. Academic Press, New York.

Davis, Gooda Paschall, Jr.
1973 Man and wildife in Arizona: the pre-settlement era, 1823-1864. Unpublished Masters Thesis, University of Arizona Department of Biology, Tucsan.

Davis, Dwen K. and R. Scott Andersan
1987 Pollen in packrat [Negtomg] middens: pollen transport and the relationship of pollen to vegetation. Palynology 11:185-198.

Dick-Peddie, William A. and Jahn P. Hubbard
1977 Classification of Riparian Vegetation. IN: Importance, Preservation and Management of Riparian Habitat: A Symposium, edited by R.R. Johnson and D.A. Jones. U.S.D.A. General Technical Repart RM-43.

DiPesa, Charles C.
1948-49 Preliminary report of a Babocomari Indian Uillage. The Kiva 14[1-4]:10-14.

1951 The Babocomari Uillage Site in the Babocomari River, Southeastern Arizona. Amerind Foundation Papers No. 5, Dragoon, Arizona.

Dobyns, Menry F.
1981 From fire to flood: historic human destruction of Sonoran Desert Riverine Dases. Ballena Press Anthropological Papers 20.
Doebley, John F.
1976 A preliminary study of wild plant remains recovered by flotation at Salmon Ruin, New Mexica. Unpublished MA thesis, Eastern New Mexico University, Dept. of Anthropology.

1984 "Seeds" of wild grasses: a major food of Southwestern Indians. Economic Botany 3日[1]:52-64.

Eddy, Frank W., Maurice E. Cooley and Paul S. Martin, Bruce B. Huckell
1983 Cultural and Environmental History of Cienega Valley Sautheastern Arizona. Anthropological Papers of the University of Arizona 43.

Elmore, Francis $H$.
1944 Ethnobotany of the Navajo. Monographs of the School of American Research B, Santa Fe, New Mexica.

Emory, William H.
1857 Report on the U.S. and Mexican Boundary Survey, made under the direction of the Secretary of the Interior, Vol. 1, 34 th Congress, 1st Session, Executive Document No. 135, washington.

Engstrom, Albert
194 Growing cottonwod from seed. Journal of Forestry 46[1]:130-132.

Faegri, Knut and Johs. Iversen
1975 Textbook of pallen analysis, 3rd edition. Hafner Press, New York.

Felger, Richard S. and Mary Beck Moser
1974 Seri Indian Pharmacapoeia. Economic Botany 28[4]:414-436.

1976 Seri Indian Food Plants: Desert Subsistence Without Agriculture. Ecology of Food and Nutrition 5:13-27.

Ford, Richard I.
1968 Floral Remains. IN: The Cochiti Dam Archaealogical Salvage Project, Part I. Repart of the 1963 season. Assembled by Charles H. Lange. Museum of New Mexico Research Records 6. Museum of New Mexico Press, pp. 236-261.

Fradkin, P. L.
1981 A River No More. Alfred A. Knoph, New York.
Fransiscan Fathers
1910 An Ethnologic Dictionary of the Navaho Language. Saint Michaels, Arizana.

French, David H.
1965 Ethnobotany of the Pacific Northwest Indians. Economic Botany 19[4]:378-382.

Fry, Gary F.
1976 Analysis of prehistoric coprolites from Utah. University of Utah Anthropological Papers 97.

Fry, Gary and H. J. Hall
1975 Human Coprolites from Antelope House: Preliminary Analysis. The Kiva 41[1]:87-96.

Gaertner, Erika A.
1970 Breadstuff from Fir [Abies balsnega]. Economic Botany 24[1]:69-72.

Gallagher, Marsha U.
1977 Contemporary ethnobotany among the Apache of the Clarkdale, Arizona, area Coconino and Prescott National Forests. USDA Forest Service Southwestern Region Archaeological Report 14, Albuquerque, New Mexico.

Gasser, Robert E.
1977 Appendix B. The relationship of plant ecalogy and plant remains to prehistoric subsistence in Copper Basin. IN: Archaealogy in Copper Basin, Yavapai County, Arizana: model building for the prehistory of the Prescott region, by Marvin $D$. Jeter. Arizona State University Anthropological Research Paper 11.
1981 Appendix IU. Hohokam plant use at La Ciudad and other riverine sites: the flotation evidence. IN: Archaeological Investigations Arizona Department of Transportation, Phoenix Testing at La Ciudad [Group III], West Papago-Inner Loop [I-10]. Maricopa County, Arizona. Ms. on file, Museum of Northern Arizana, Flagstaff.
1982 Anasazi Diet. IN: The Coronado Project Archaeological Investigations. The Specialist's Volume: Biocultural Analyses. Compiled by Robert E. Gasser. Museum or Northern Arizona Coronado Series 4, MNA Research Paper 23.
Gentry, Howard Scott
1942 Rio Mayo Plants. A study of the flora and vegetation of the valley of the Rio Mayo, Sonora. Carnegie Institution of Woshington Publication 527, Washington, D.C.
Gifford, E. W.
1932 The Southeastern Yavapai. University of California Publications in American Archaeology and Ethnology 29[3]:177-252.
1933 The Cocopa. University of California Publications in American Archaeology and Ethnology 31[5]:257-334.
1936 Northeastern and Western Yavapai. University of Califarnia Publications in American Archaeology and Ethnology 34(4):247-354.
1967 The use of acorns in California. IN: The North American Indians, A Sourcebook, edited by Roger C. Dwer:, James J.F. Deetz and Anthony D. Fisher. The MacMillan Company, New York.
Gilmore, Melvin R.
1931 Vegetal remains of the Ozark Bluff-Dueller Culture. Papers of the Michigan Academy of Science, Arts and Letters, Vol. 14:83-104.
1977 Uses of Plants by the Indians of the Missouri River Region. University of Nebraska Press [reprinted from the 33rd Annual Report of the Bureau of American Ethnology, 1919].
Gish, Jannifer Wyatt
1979 Palynalagical research at Pueblo Grande Ruin. The Kiva 44(2-3]:159-172.

```

Glendening, G.E. and H.A. Paulsen, Jr.
1955 Reproduction and establishment of velvet mesquite as related to invasion of semi-desert grasslands. U.S.D.A. Forest Service Technical Bulletin 1127:1-50.

Gould, Frank w.
1951 Grasses of the Southwestern United States. University of Arizona Press, Tucson.

Grange, Roger, Jr.
1952 Woaden Artifacts. IN: Mogallon Cultural Continuity and Change, the stratigraphic analysis of Tularosa and Cordova Caves. By Paul S. Martin, John B. Rinalda, Elaine Bluhm, Hugh C. Cutler and Roger Grange, Jr. Fieldiana: Anthropology 40, pp 331-451.

Erime, J. P.
1979 Plant Strategies and Vegetation Processes. John Wiley and Sons, New York.

Gunda, Bela
1977 Gathering of wild plants among the Hungarian People. Acta Ethnographica Academiae Scientiarum Hungaricae, Iomus 26[1-2]:1-24.

Hammerson, Martha
1972 Histarical Resume of San Pedra Valley [Fort Hsachuca Area]. The Artifact 10[3]:21-23.

Harlan, Jack R.
1971 On the origin of barley: a second look. IN: Barley Genetics II, edited by Robert A. Nilan. Washingtan State University Press.

1975 Crops and Man. American Society of Agronomy, Crop Science Society of America. Madison, WI.

Harrington, M. R.
1930 Paiute Cave. Southwest Museum Leaflets 4:106-126.
1933 A cat-tail eater. The Masterkey 7[5]:147-149.
Hasse, Edward P.
1972 Survey of floodplain vegetation along the lower Gila River in southwestern Arizana. Journal Arizona Academy of Science 7:75-81.

> Hastings, James Rodney and Raymond M. Turner 1965 The Changing Mile. An ecological study of vegetation change with time in the lower mile of an arid and semiarid region. University of Arizona Press, Tucson.

Haury, Emil W.
1934 The Canyon Creek Ruin and The Cliff Dwellings of the Sierra fincina. Lancaster Press, PA.

1945 Painted Cave Northeastern Arizona. The Amerind Foundation, No. 3. Dragoan, Arizona.

1950 The Stratigraphy and Archaealogy of Ventana Cave Arizona. The University of New Mexica Press, Albuquerque,

1953 Artifacts with mammath remains, Naco, Arizona. American Antiquity 19[1]:1-14.

Haury, Emil W., E.B. Sayles and William W. Wasley 1959 The Lehner Mammoth Site, Southeastern Arizona. American Antiquity 25[1]:2-30.

Havard, U.
1895 Food Plants of the North American Indians. Bulletin of the Torrey Batanical Club 22:98-123.

1896 Drink Plants of the North American Indians. Bulletin of the Torrey Botanical Club 23:33-46.

Haynes, C. Vance
1981 Geochronology and Paleoenvironments of the Murray Springs Clovis Site, Arizona. National Geographic Society Research Reports 13:243-251.

1982 Archealogical Investigations at the Lehner Site, Arizona, 1974-1975. National Geographic Society Research Reports 14:325-334.

Heer, Oswald
1878 Abstract of the Treatise of the 'Plants of the Lake Dwelllings', IN: The Lake Dwellings of Switzerland and ather parts of Europe, by Ferdinand Keller, End edition. Translated and arranged by John Edward Lee. Longmans, Green and Co., Londan.

Heiser, Charles B., Jr.
1979 The totora [Scirpus californicus] in Ecuador and Peru. Economic Botany 32[3]:222-236.

Heizer, Rabert F. and L.K. Napton
1969 Biological and cultural evidence from prehistoric human coprolites. Science 165[3893]: 563-56日.

Hendricksan, Dean A. and W. L. Minckley
1984 Cienegas-Uanishing Climax Communities of the American Southwest. Desert Plants 6[3]:131-175.

Hevly, Richard H., Mary Lou Heuett and Stanley J. Olsen
1978 Paleaecological recanstruction from an upland Patayan rock shelter, Arizana. Journal of the Arizona-Nevada Academy of Science 13:67-78.

Hewitt, Namcy J.
1980a Fiber Artifacts. IN: Cowboy Cave, by Jesse D. Jennings. University of Utah Anthropalogical Papers 104, pp. 49-74.

1980b The Occurrence of Pinyon Pine at Cowboy Cave. IN: Cawboy Cave, by Jesse D. Jennings. University of Utah Anthropalogical Papers 104, p. 135.

Heyerdahl, Thor
1971 The voyage of Ra II. National Geographic 139[1]:44-70.

Hinton, Richard J.
1878 The Handbook to Arizona Payout. Chapter IX. Upham and Co.

Hocking, George M.
1956 Some Plant Materials Used Medicinally and Otherwise by the Navajo Indians in the Chaco Canyon, New Mexica. El Palacio 63[5-6]: 146-165.

Hagan, Patrick F.
1980 Appendix IX. The Analysis of Human Copralites from Cowboy Cave. IN: Cowboy Cave, by Jesse D. Jennings. University of Utah Anthrapological Papers 104, pp. 201-211.

Holden, w.C.
1937 Excavation of Murrah Cave. Bulletin of the Texas Archaeological and Paleontclogical Society 9:48-73.

Horton, J.S., F.C. Maunts and J.M. Kraft
1960 Seed germination and seedling establishment of
\begin{tabular}{|c|c|}
\hline & phreatophyte species. Rocky Mountain Forest and Range Experiment Station Paper 48. \\
\hline \multicolumn{2}{|l|}{Hough, Walter} \\
\hline 1898 & Environmental interrelations in Arizon \\
\hline & American Anthrapologist ald Series 11[5]: \\
\hline & 133-155. \\
\hline \multicolumn{2}{|l|}{Howell, John Thomas and Elizabeth McClintock} \\
\hline 1960 & Supplement [1960]. IN: Arizona Flora, \\
\hline & second edition, Thomas H. Kearney and Robert H. \\
\hline & Peebles. University of Califarnia Press, \\
\hline & Berkeley. \\
\hline \multicolumn{2}{|l|}{Hull, Frank W.} \\
\hline & Animal Skin Bags. IN: Cowbay Cave, by Jesse D. \\
\hline & Jennings. University of Utah Anthropological \\
\hline & Papers 104, pp. 137-144. \\
\hline \multicolumn{2}{|l|}{Humphrey, Robert R.} \\
\hline & Phenology of selected Sonoran Desert plants at \\
\hline & Punta Cirio, Sonora, Mexica. Journal Arizona \\
\hline & Academy of Science 10:50-67. \\
\hline \multirow[t]{4}{*}{Janetski 1980} & , Joel C. \\
\hline & Wood and Reed Artifacts. IN: Cowboy Cave, by \\
\hline & Jesse D. Jennings. University of Utah \\
\hline & Anthropological Papers 104, pp. 75-95. \\
\hline \multicolumn{2}{|l|}{Jennings, Jesse \(\square\).} \\
\hline \multirow[t]{2}{*}{1957} & Danger Cave. Memoirs of the Society for \\
\hline & American Archaealogy Na. 14 [American Antiquity \(23[2\), part 2\(]]\). \\
\hline \multicolumn{2}{|l|}{Johnson, R. Roy and Steven W. Carothers} \\
\hline \multirow[t]{4}{*}{1982} & Riparian habitats and recreation: inter- \\
\hline & relatianships and impacts in the Southwest and \\
\hline & Rocky Mt. Region. Eisenhower Consortium \\
\hline & Bulletin 12. \\
\hline \multicolumn{2}{|l|}{\multirow[t]{2}{*}{Johnson, R.R. and D.A. Jones [Tech. Coord.]}} \\
\hline & \\
\hline \multirow{4}{*}{1977} & riparian habitat: a symposium. USDA Forest \\
\hline & Service Technical Report RM-43, 217 pp . Rocky \\
\hline & Mt. Forest and Range Experiment Station, Fort \\
\hline & Collins, Colorado. \\
\hline \multicolumn{2}{|l|}{Johnsan, R.R. and J.F. McCormick [Tech. Coord.]} \\
\hline \multirow[t]{3}{*}{1978} & \\
\hline & floodplain wetlands and other riparian \\
\hline & ecosystems. USDA Forest Service General \\
\hline
\end{tabular}

Technical Report \(\omega \mathrm{W}-12,410 \mathrm{pp} . \quad\) USDA Forest Service, Washington, D.C.

Johnson, R.R., C.D. Ziebell, D.R. Patton, P.F. Ffolliott, R.H. Hamre [Tech. Coord.]

1985 Riparian ecosystems and their management: reconciling conflicting uses. First North American Riparian Conferance. USDA Forest Service General Technical Report RM-120.

Johnston, Alex
1970 Blackfoot Indian Utilization of the Flora of the Northwest Great Plains. Economic Botany 24[3]:301-324.

Jones, Volney \(H\).
1931 The Ethnobotany of the Isleta Indians. Unpublished M.A. Thesis, University of New Mexico.

1945 Appendix II. Plant Materials. IN: Archaealogical Studies in Northeastern Arizona, by R.I. Beals, et al., University of California Publications in American Archaeology and Ethnalagy Val. 44.

1946 Plant materials from Alkali Ridge sites. IN: Archaeology of Alkali Ridge, Southeast Utah, by J. D. Brew. Papers of the Peabody Museum of American Archaealogy and Ethnology 21.

1951 Chapter IU. Plant Materials from the Babocomari Uillage Site. IN: The Babocomari Uillage Site on the Babocamari River, Southeastern Arizona, by Charles C. DiPeso. Amerind Foundation Publication 5, Dragoon, Arizona.

1955 Appendix U. Plant materials fram a cave in Zion National Park [2NP-21]. IN: Archeolagy of Zion Park, by Albert H. Sciroeder. University of Utah Anthropolagical F'ipers 22.

Jones, Volney H. and Robert L. Fonner
1954 Appendix C. Plant Remains from sites in the Durango and La Plata Areas, Colorado. IN: BasketMaker II sites near Durango, Colorada, by Earl H. Marris and Robert F. Burgh. Carnegie Institution of Washingtan, Publication 604, pp. 93-115.

Joyce, John F.
1975 Vegetation Analysis of Walnut Canyon, Arizona.

Journal of Arizona Academy of Science 11[3]: 127-133.

Jucd, Neil M.
1954 The material culture of Pueblo Bonito. Smithsonian Miscellaneaus Collections Val. 124.

Kaemlein, Wilma
1963 A Prehistoric Twined-woven bag from the Trigo Mountains, Arizona. The Kiva 28[3]:1-13.

Kane, Allen E.
1984 Chapter 3. The prehistory of the Dolores Project Area. IN: Dalores Archaealogical Program: Synthetic Report 1978-1981, David A. Breternitz, Principal Investigator. U.S. Dept. of Interior, Bureau of Reclamation report, pp. 23-51.

Kaplan, Lawrence
1963 Archaeoethnobotany of Cordova Cave, New Mexica. Economic Botany 17[4]:350-359.

Kearney, Thomas H. and Robert H. Peebles
1960 Arizona Flora. With supplement. University of California Press, Berkeley.

Kelly, William H.
1977 Cocopa Ethnography. Anthropological Papers of the University of Arizonc 29.

Kelly, Isabel T.
1939 Southern Paiute Shamanism. Anthropological Recards 2[4], University of California Press, Berkeley.

1964 Southern Paiute Ethnography. University of Utah Anthropological Papers 69 CGlen Canyon Series No. 21].

Kendeigh, S.C.
1961 Animal Ecology. Prentice-Hail, Engelwaod Cliffs, New Jersey.

Kidder, Alfred Uincent and Samuel J. Guernsey
1919 Archeological explorations in northeustern Arizana. Bureau of American Ethnology Bulletin 65.

Kirkpotrick, David I. and Richard I. Ford
1977 Basketmaker food plants from the Cimarron
district, nartheastern New Mexica. The Kiva 42[3-4]:257-269.

Kokwara, J.O.
1976 Medicinal plants of East Africa. East African Literature Bureau, Nairabi.

Krenetsky, John C.
1964 Phytosacialogical Study of the Picuris Grant and Ethnobotanical Study of the Picuris Indians. Unpublished M.S. Thesis, Biology, The University of New Mexico.

Kroeber, A.L.
1908 Ethnography of the Cahuilla Indians. University of Califarnia Publications in American Archaealogy and Ethnology \(8[2]: 29-6 B\).

Lacy, John R., Phil R. Ogden and Kennith E. Foster 1975 Sauthern Arizona Riparian Habitat: Spatial Distribution and Analysis. School of Renewable Natural Resources and Office of Arid Lands Studies, Univarsity of Arizona, Tucson.

Lange, Charles H.
1968 Cochiti, a New Mexica Pueblo, Past and Present. Southern Illinois University Press, Carbondale.

Lehr, J. Harry
1978 A Catalogue of the Flora of Arizona. Desert Botanical Garden, Phoenix, Arizona.

Lehr, J. Harry and Donald J. Pinkava
1980 A Catalogue of the Flora of Arizona, Supplement I. Journal of the Arizona-Nevada Academy of Science 15[1]:17-32.

1982 A Catalogue of the Flora of Arizona, Supplament II. Journal of the Arizona-Nevada Academy of Science 17[1]:19-26.

Lentz, David L.
1984 Utah juniper [Juniperus osteaspermal canes and seeds from Salmon Ruin, New Mexico. Journal of Ethnobiology 4[2]:191-200.

Levine, Stephen
1974 Planet Steward. Journal of a Wildlife Sanctuary. Unity Press, Santa Cruz.

Lewis, Walter H. and Memory P.F. Elvin-Lewis 1977 Medical Batany, plants affecting man's health. John Wiley and Sons, New York.

Loud, Llewellyn L.
1929 Appendix 2. Notes on the Northern Paiute. IN: Lavelock-Cave, by Llewellyn L. Laud and M.R. Harrington, University of California Publications in American Archaeology and Ethnology 25[1]:152-164.

Loud, Llewellyn L. and M. R. Marrington 1929 Lovelock Cave. University of California Publications in American Archaealogy and Ethnology 25[1].

Lowe, C. H .
1964 Arizona's Natural Environment. Landscapes and Habitats. University of Arizona Press, Tucsan.

MacNeish, Richard S.
1967 A summary of the subsistence. IN: The prehistory of the Tehuacan Valley, Vol. I. Environment and Subsistence, edited by Douglas S. Byers. University of Texas Press, Austin.

McGinnies, \(w\).
1986 Flowering Periods for Common Desert Plants, Sauthwestern Arizona. Office of Arid Lands Studies, University of Arizona, Tucson.

McGregor, John C.
1941 Winona and Ridge Ruin, Part I. Architecture and Material Culture. Plant materials by Valney H. Jones. Skeletal Material by Katharine Bartlett. Museum of Northern Arizona Bulletin 18, Flagstaff.

McLaughlin, Steven P.
1986 A Floristic Analysis of the Southwestern United States. The Great Basin Naturalist 46[1]:46-65.

Marden, Lewis
1971 Titicaca, Abode of the Sun. National Geagraphic 139[2]:273-294.

Martin, Faul S.
1952 Miscellaneous Specimens. IN: Mogollon Cultural Continuity and Change, the stratigraphic analysis of Tularosa and Cardova Caves. By Paul S. Martin, John B. Rinalda, Elaine Bluhm,

Hugh C. Cutler and Rager Grange, Jr. Fieldiana: Anthropology 40, pp 452-457.
Martin, Paul S. [not as above]
1979 A survey of potential Natural Landmarks, Biotic
Themes of the Mojave-Sonoran Desert Region.
Biotic Themes. Prepared Eor the Heritage
Conservation and Recreation Service, U.S.
Department of, Interiar.


1878 Plants used by the Indians of the United States. American Naturalist 12:593-606; 646-655.

Pearce, J.E. and A.T. Jackson
1933 A prehistoric rock shelter in Val Verde County, Texas. The University of Texas Bulletin 3327.

Pennington, Campbell w.
1957 Tarahumar fish stupefaction plants. Economic Batany 12[1]:95-102.

1963 The Tarahumar of Mexica. Their environment and material culture. University of Utah Press.

1969 The Tepehuan of Chihuahua. Their material culture. University of Utah Press.

Peri, David W. and Scott M. Patterson
1976 'The Basket is in the roots, that's where it begins'. The Journal of Califarnia Anthropology 3[2]:15-32.

Phelps, Alan L.
1968 A recovery of purslane seeds in an archaeological context. The Artifact 6[4]:1-9.

Pippin, Lonnie Corlett
1979 The prehistory and paleaecology of Guadalupe Ruin, Sandoval County, New Mexico. Unpublished PhD dissertation, Washington State University, Dept. of Anthropology.

Reagan, Albert \(B\).
1929 Plants used by the White Mountain Apache Indians of Arizona. Wisconsin Archaeologist 8[4]:143161.

Robbins, Wilfred W., John P. Harrington and Barbara Freire-Marreco
1916 Ethnobotany of the Tewa Indians. Bureau of American Ethnology Bulletin No. 55, Smithsonian Institution, Washington.

Rabinsan, T.w.
1958 Phreatophytes. U.S. Geological Survey Water Supply Paper 1423.

1965 Introduction, spread and aereal extent of saltcedar [Iamarix] in the western states. U.S. Gealogical Survey Professional Paper 491-A:1-12.

Rose, J. N.
1899 Notes of useful plants of Mexico. Contributions from the U.S. National Herbarium 5[4]:209-259.

Roust, Norman 1.
1967 Preliminary examination of prehistoric human coprolites from faur western Nevada Caves. IN: Reports of the University of California Archaedlogical Survey 70:49-8B.

Russell, Frank
1975 The Pima Indians. Originally published as part of the 26th Annual Report of the Bureau of American Ethnology, 1904-1905; re-edition by the University of Arizona Press.

Sayles, E.B.
1983a Archaeological Analysis. IN: The Cochise Cultural Sequence in Southeastern Arizona. Anthropological Papers of the University of Arizona 42:58-81.

1983b Sulphur Spring Stage. IN: The Cochise Cultural Sequence in Southeastern Arizona. Anthropological Papers of the University of Arizona 42: 日2-89.

1983c Cazador Stage. IN: The Cochise Cultural Sequence in Southeastern Arizona. Anthropological Papers of the University of Arizona 42:90-113.

1983a Chiricahua Stage. IN: The Cochise Cultural Sequence in Southeastern Arizona. Anthropological Papers of the University of Arizona 42:114-124.

19e3s San Pedra Stage. IN: The Cochise Cultural Sequence in Southeastern Arizona. Anthropolagical Papers of the University of Arizona 42:125-131.

Schmutz, Ervin M.
197日 Classified Bibliography on Native Piants of Arizona. University of Arizona Press, Tucson.

Scott, Linda J.
1979 Dietary inferences from Hay House Coprolites: a palynalogical interpretation. The Kiva \(44[2-3]\) : 257-281.

Sellers, William D., Richard H. Hill and Margaret Sanderson-Rae, editors
1985 Arizona climate: the first hundred years. University of Arizona.

Smiley, Terah L.
1983 Paleo-ecological evidence. IN:The Cochise Cultural Sequence in Southeastern Arizona. Anthropological Papers of the University of Arizona 42:20-25.
cinith, C. E., Jr.
1950 Prehistoric plant remains from Bat Cave. Botanical Museum Leaflets, Harvard University 14[7]:157-180.

Smith, E. Linwood [principal author]
1974 Established Natural Areas in Arizona. A guidebook for Scientists and Educators. Planning Division, Office of Econamic Planning and Development, State of Arizona.

Smith, Janet Hugie
1972 Native pharmocapoein of the eastern Great Basin: a report on work in progress. IN: Great Basin Cultural Ecology, A Symposium, edited by Don D. Fowler, Desert Research Institute Publications in the Social Sciences \(\mathrm{B}, \mathrm{Reno}\), Nevada.

Sparkman, Philip Stedman
1908 The culture of the Luiseno Indians. University of Californic Publications in American Archaealogy and Ethnology \(\mathrm{\theta}[4]: 187-234\).

Spier, Leslie
1328 Havasupai Ethnography. Anthropolagical Papers of the American Museum of Natural Histary 29[Part III]:日3-392.

Standley, Paul C.
1912 Some Useful Native Plants of New Mexica. Smithsonian Institution Annual Report for 1911:447-462.

Stevensan, Matilda Coxe
1915 Ethnobatany of the Zuni Indians. Bureau of American Ethnology Annual Report [1908-1909] 30:35-102.

Medicinal plants of the Zuni. Revised and updated by Rabert E. Pearce and Orin W. Hatch. Llano Estacado:22-32, April.

Steward, Julian H.
1933 Ethnography of the Dwens Valley Paiute. University of California Publications in American Archaeology and Ethnology 33[3]: 233-350.

Stewart, Omer C.
1941 Culture Element Distributions:XIU. Northern Paiute. Anthropological Records \(4[3]: 361-446\).

Struever, Mary B.
1977 Relation of pollen and Flatation analyses to archealogical excavations, Chaca Canyon, N.M. [Flatation Component]. Unpublished manuscript, Deportment of Biology, Liniversity of New Mexico, Albuquerque.

Swank, Gearge R.
1932 The Ethnobotany of the Acoma and Laguna Indians. Unpublished MA thesis, Department of Biology, University of Naw Mexica, Albuquerque.

Swetnam, Thomas \(W\).
1984 Peeled ponderasa pine trees: a record of inner bark utilization by Native Americans. Journal of Ethnobialagy \(4[2]: 177-190\).

Thomas, Jack Ward, Chris Maser and Jon E. Rodiek
1979 Wildife habitats in managed rangelands--the Great Basin of southeastern Oregon. Riparian Zones. Pacific Northwest Forest and Range Experiment Staition, General Technical Report PNU-80.

Timbrook, Jan
19E2 Lise of wild cherry pits as food by the California Indians. Journal of Ethnobiology 2[2]:162-176.

1984 Chumash ethnobotany: a preliminary report. Journal of Ethnobialogy 4[2]:141-169.

Toalin, L. J.
1980 Final Report on the Flora of Ramsey Canyon. Manuscript on file with the Arizona Nature Conservancy, Tucsan.

Toolin, L., T. VanDevender and J. Kaiser
1979 The flora of Sycamore Canyon, Pajarita Mts., Santa Cruz Ca., Arizona. Journal Arizona-Nevada Academy of Science 14:66-74.

Turner, Christy G. II
1967 Bite-marks in Tule quids of prenistoric Nevada Indians. IN: Reports of the University of California Archaeological Survey 70:117-122.

Turner, Raymond M.
1974 Quantitative and historical evidence of vegetation changes along the Upper Gila River, Arizana. Gila River Phreatophyte Project. Gealogical Survey Professional Paper 655-H.

Turner, Raymond H. and Martin M. Karpiscak
1980 Recent vegetation changes along the Colorado River between Glen Canyon Dam and Lake Mead, Arizona. Gealogical Survey Prof. Paper 1132.

Tuthill, Carr
1347 The Tres Alamos Site on the San Pedro River, southeastern Arizona. The Amerind Foundation No. 4, Dragoon, Arizona.

Vestal, Paul A.
1952 Etinobotany of the Ramah Navaja. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University \(40[4]\).

Vestal, Paul A. and Richard Evans Schultes
1939 The Economic Botany of the Kiowa Indians, as it relates to the history of the tribe. Botanical Museum, Cambridge, Mass.

Warner, R. E. and K. M. Hendrix [editors]
1984 California riparian systems: ecology, conservation, and productive management. University of California Press, Berkeley.

Warren, Dauglas K. and Raymond M. Turner
1975 Saltcedar [Iqmarisk chinensis] seed production, seedling establishment, and response to inundation. Arizona Academy of Science 10[3]:135-144.

Wasley, William W.
1983 Environmental Setting. IN: The Cochise Cultural Sequence in Sautheastern Arizona. Anthropological Papers of the University of Aгizona 42:6-19.
```

Waters, Michael
1986 The Geoarchaeology of Whitewater Draw, Arizona.
Anthropological papers of the University of
Arizona 45, Tucson.
Watson, Patty Ja. and Richard A. Yarnell
1966 Archaeologicai and Paleoethnobotanical
Investigations in Salts Cave, Mammoth Cave
National Park, Kentucky. American Antiquity
31[6]:842-849.
Wetterstrom, Wilma Elaine
1976 The effects of nutrition on population size at
Pueblo Arroyo Hondo, New Nexico. Unpublished
PhD dissertation, University of Michigan, Dept.
of Anthropology.
Whitaker, Thomas W. and Hugh C. Cutler
1966 Food plants in a Mexico market. Economic Botany
20[1]:6-16].
Whitaker, Thomas W., Hugh C. Cutler and Richard S. MacNeish
1957 Cucurbit materials from three caves near Ocampo,
Tamaulipas. American Antiquity 22[4, part 1]:
352-358.
White, Leslie A.
1945 Notes on the ethnobotany of the Keres. Michigan
Academy of Science, Arts and Letters, Papers
30:557-568.
1962 The Pueblo of Sia, New Mexico. Bureau of
American Ethnology Bulletin 184.
Whiting, Alfred F.
1966 Ethnobotany of the Hopi. Narthland Press,
Flagstaff. Originaliy issued in 1939 as
Bulletin 15, Museum of Northern Arizona.
Wilke, Philip J.
1978 Late prehistoric human ecology at Lake Cahuilla,
Caachella Valley, Califarnia. Contributions of
the University of Califarnia Archaeological
Research Facility 38.
Williams-Dean, Glenna and Uaughn M. Bryant, Jr.
1975 Pollen Analysis of Human Coprolites from
Antelope House. The Kiva 41[1]:97-111.

```

Wilson, Hugh 0.
1981 Domesticated Chenopodium of the Ozark Bluff Dwellers. Econamic Botany 35[2]:233-233.

Wyman, Leland C. and Stuart K. Harris 1941 Navaja Indian Medical Ethnobotany. The University of New Mexico Bulletin, Whale Number 366, Anthropological Series 3[5].

1951 The Ethnobotany of the Kayenta Navaho. An analysis of the John and Louisa Wetherill ethnobotanical collection. University of New Mexica Publications in Biology 5.

Yanovsky, Elias
1936 Food Plants of the North American Indians. U.S.D.A. Misc. Publication No. 237, Washington.

Yatskievych, George
1980 Plant List. Nature Conservancy Q'Donnell Canyon Property, Canela Hills, Santa Cruz County, Arizona. Manuscript on file with the Arizona Nature Conservancy, Tucson.

Yatskievych, Gearge and C. E. Jenkins
1981 Fall Vegetation and Zanation of Hoaker Cienega. Journal Arizona-Neyada Academy of Science 16[1]:7-10.

York, J., J. Narris, G. Staten, C. Watsan, W. Dick-Peddie and E. Staffeldt
1961 Other Plant Remains. IN: A survey and excavation of caves in Hidalgo County, New Mexica, by Marjorie F. Lambert and J. Richard Ambler. School of American Research Monograph 25, pp. 94-97.

Young, Jon Nathan
1972 The Garden Canyon Site. The Artifact 10[3]:3-19.
Zigmund, Maurice L.
197日 Kawaisu Basketry. Journal of California Anthrapology 5[2]:199-215.

1981 Kawaiisu Ethnobotany. University of Utah Press, Salt Lake City.

Zimmerman, Robert C.
1969 Plant Ecology of an Arid Basin Tres AlamosRedington Area Southeastern Arizona. Geological Survey Prafessional Paper 485-D.```


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[^1]:    *Species listed as a symanym.

[^2]:    *Listed under a synanym Sgphig ginnatg.

[^3]:    ＊species listed as a symanym．

[^4]:    *lister as synomym Iypha ququstiEqliq.

[^5]:    - Feproductive parts include: achenes; berries: caryopses; flowers, fruit, pollen, seeds, young pods
    - Non-reproductive parts include: barks buds, bulb, fibers. gall, inner barks leaves, plant, rhizome, roots, stalk, stems, tubers, young shoots

