

ABSTRACTS OF PRESENTATIONS

at the 18th Annual Conference of the Society of Ethnobiology
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How does our *Agave* grow? Karen R. ADAMS, Crow Canyon Archaeological Center; and Rex K. ADAMS, University of Arizona.

Agave murpheyi is considered a likely candidate for cultivation by ancient Salado and Hohokam groups in Arizona. The reasons for this will be reviewed. A slide presentation will illustrate the growth and development of 359 bulbils (miniature agaves) on the flowering stalk of a single mother plant from spring 1993 through late summer 1994.

Some successes and failures of indigenous management in a Maya town: E. N. ANDERSON, University of California, Riverside.

Chunhuhub, Quintana Roo, Mexico, is a Maya town that has grown up in the last fifty years from what was old-growth forest. In that time, it has lost the larger and rarer species of wildlife. Other species are no longer found in the central, inhabited area. Forests have been altered. On the other hand, the *ejido* [farming cooperative] is still primarily forest, rich in plant and animal species.

The edible corm plant *Dichelostemma capitatum*: A study of its vegetative reproduction response to different indigenous harvesting regimes: M. Kat ANDERSON, University of Kansas.

Blue dicks (*Dichelostemma capitatum*) was the most widely eaten underground swollen stem by California Indian tribes historically. It is still harvested today with a digging stick by a few native people of different cultural groups. Native Americans sometimes assert that the removal of underground plant parts can stimulate bulb and corm production, maintaining or increasing the population abundance and density and the size of the tract. This talk will focus on an experiment conducted at the University of California at Berkeley which attempted to mimic traditional indigenous harvesting regimes of blue dicks.

Ecology within the four Sacred Mountains: Traditional Dine perception of cosmology through intrinsic relationships and order: David BEGAY and Nancy MARYBOY, Navajo Community College.

This presentation will focus on traditional Dine (Navajo) epistemology and organization of knowledge, based on the natural order and cyclical systems of Mother Earth and Father Sky, as expressed through ceremonialism. The focus will be on the understanding of an ecological order based on the interrelationships manifested through the Four Sacred Mountains. Current Dine natural resource management will be discussed within a systemic framework of traditional harmonious relationships of positive and negative forces.

Beans as markers of cultural change in northern Sonora, Mexico: Stephen J. BOUSCAREN, San Diego City College.

The tepary (*Phaseolus acutifolius* A. Gray) is an arid-land adapted bean primarily grown and consumed in northwestern Mexico and southwestern United States. A study of the

tepary system (consumption, marketing, and production subsystems) was carried out in northern Sonora, Mexico, in an attempt to understand why the production and consumption of teparies was declining. Within the study area, rapid cultural and infrastructural changes have resulted in the decreased biological diversity of some types of beans such as the tepary and in the increased diversity of others such as the pinto or *garrapata*. These changes are reflected in the availability of bean germplasm for producers, types of beans found in the markets, changing food preferences among consumers, and in consumers' folk classification schemes of legumes.

Pollen and opal phytolith evidence of prehistoric agriculture in the lower Verde River Valley, Arizona: *Steven BOZARTH, University of Kansas.*

Pollen and phytoliths were isolated and comprehensively analyzed in 397 samples collected at 28 Preclassic and Classic sites in the lower Verde River Valley of central Arizona. Abundant pollen and phytolith evidence for maize was found in both cultural periods. Bean pollen and phytoliths were recovered from Classic and Preclassic sites. Squash pollen was classified at sites of both cultural periods. Cotton pollen was found in Preclassic sites, but no microfossil evidence of this cultigen was identified in the Classic Period. The utilization of agave during the Preclassic Period is evidenced by the presence of agave pollen in a pit house village. The identification of agave-type phytoliths at a Classic Period field house indicates that agave was cultivated in the adjacent rock pile field. Pollen data demonstrate that chenopods/amaranths were utilized, and probably cultivated, during both cultural periods.

Ethnohistory, archaeology, and economy at the Vigil-Torres site: *Jeff BOYER, Linda MICK-O'HARA, Janet SPIVEY, and Mollie S. TOLL, Museum of New Mexico, Office of Archaeological Studies.*

The Vigil-Torres site, LA 77861, was one of the many Hispanic farms and homesteads surrounding the community of Río Chiquito/Talpa, first settled in the early 1800's. Ethnohistoric information portrays the adobe house as large and relatively elegant, befitting a family with substantial land and livestock holdings and prominent in northern New Mexico politics. Ethnohistoric data also imply access to and use of a considerable diversity of plant and animal products. Excavated features include a *soterrano* or root cellar, and a midden, used in the 1890's and perhaps as late as 1910. Botanical and faunal remains, viewed in counterpoint to ethnohistoric data, produce a more complete and complex picture of this rural farming economy. Biological artifacts also reveal differences between the inferred diet and the recovered remains, pointing out both taphonomic and historiographic issues.

Insights into social and economic behavior in a Basketmaker III pitstructure from flotation data: A stroke of luck: *Carol B. BRANDT, University of New Mexico, Albuquerque.*

A hot fire that was quickly smothered by a collapsing roof provided extraordinary preservation of perishable materials in a Basketmaker III pitstructure in west-central New Mexico (tree-ring dates A.D. 644–696). Flotation data from the features and floor indicate a reliance upon agriculture and the collection of local plants. Measurements of weedy seeds indicate human selection of the sunflower. Botanical materials that imply social activity include tobacco, jimsonweed, and unique wooden artifacts.

Green corn ceremonialism and ethnonutrition: The biocultural evolution of maize use: *Barrett BRENTON, Grinnell College.*

Native American farmers have traditionally taken part in ceremonies focused on the harvest and consumption of green corn (unripened maize). Culinary traditions range from pit-baked sweet corn to roasted unripened "field" corn. This paper discusses the ongoing

ceremonial significance of its consumption. A further focus will be on the biocultural evolution of corn use in the prehistoric Americas related to different food-processing traditions and the greater nutrient availability of unripened corn compared to ripened corn. Finally, I will discuss additional cross-cultural observances of the use of green corn in an attempt to formulate a more global and ethnonutritional perspective on its use today.

From Biosphere to Noösphere: a case study in cultural values and biodiversity in the Biosphere 2 Terrestrial Wilderness Biomes: *Tony BURGESS and Linda LEIGH, Biosphere 2.*

Biosphere 2 offers several lessons about the effects of cultural values on biodiversity. Management changed during the first mission as problems of atmospheric composition, human food shortages, and weed outbreaks developed. Biodiversity changes revealed by plant censuses from before and after the first mission are briefly summarized, together with general patterns of change in insect diversity. Most changes can be directly linked to human values. After the end of the first mission the "wilderness" was converted into a more intensively managed landscape to produce more human food and harvestable biomass.

Eighteenth century ethnobotany in western Chihuahua, Mexico: *Robert BYE, Universidad Nacional Autónoma de México.*

Colonial Mexican government-mission *Relaciones Geográficas*, or *Relaciones Topográficas*, recorded data on local natural and human resources including wild and cultivated plants. In 1777 the Franciscan clergy had 15 missions in western Chihuahua. Ethnobotanical information shows the prominence of certain plants used by Tarahumara Indians and illustrates the interchange between Indians and missionaries. Two hundred fifteen wild plants from the mountains and canyons are mentioned along with 81 cultivated plants. Experimentation with different grains (wheat, oats, barley), phenological observations of peach trees as climatic indicators, domestication process of mustards, commercial dyewoods (*Haematoxylon brasiletto*), arrow-poison plants (*Sebastiania pavoniana*), contrayerbas for arrow and animal poisons and various medicinal plants are documented.

Intracultural variation and innovation in the management of *Sabal* palms among the Maya of Yucatán, México: *Javier CABALLERO, Universidad Nacional Autónoma de México.*

Sabal palms have been a multipurpose plant resource for the Yucatec Maya for well over 1000 years. The way in which they have been managed has changed as a result of a combination of factors. This includes the introduction of these palms into cultivation. The relation between folk-biological knowledge and cultural change was investigated by applying an ethnobiological test to a sample of 17 informants representing different degrees of cultural change. Dried specimens showing different palm parts as well as color photographs of *Sabal* individuals were used as stimuli for the ethnobiological test. The statistical analysis of the responses to the test indicates that variation in ethnobiological knowledge about *Sabal* is patterned. The milpa cultivators, who can be considered the people best maintaining their traditional culture, are the ones who know most about these palms. They are also the ones responsible for the introduction of *Sabal* into cultivation. The analysis of intracultural variation suggests that technological innovation is closely related to the persistence of the traditional Maya culture.

Traditional management and morphological variation in *Leucaena esculenta* (Moç. et Sessé ex A. DC.) Benth. (Leguminosae: Mimosoideae): *Alejandro CASAS and Javier CABALLERO, Universidad Nacional Autónoma de México.*

Leucaena esculenta is an important food resource for the Mixtec of Guerrero, Mexico. Artificial selection in *L. esculenta* subsp. *esculenta* by the local people was studied. Morpho-

logical characters of seeds and pods of individual trees of this subspecies were measured in order to compare phenotypic variation in populations subject to different regimes of management. Samples of trees were analyzed from a) a wild population not affected by intentional disturbances, b) a wild population selectively managed, and c) cultivated individuals. Cluster analysis and ordination methods were used to examine differences between populations. A marked divergence between the three populations was found, especially between the managed and unmanaged wild populations. The frequency of the phenotypes preferred by people was found to be higher in the wild population consisting of tolerated individuals. Our study shows that through *in situ* forms of management, people are able to modify the phenotypic structure of plant populations. Possible routes of plant domestication are discussed.

Ritual reflected in the pollen record? Maize pollen recovered in Pueblo II/Pueblo III structures: *Linda Scott CUMMINGS, Paleo Research Labs.*

Highlights of a pollen record from pithouses, kivas, and their attendant features illustrate the diverse nature of the record for Anasazi occupations along the Puerco River in northeastern Arizona. Floors yielded information concerning patterns of activity within structures, including ritual. Extremely high frequencies of *Zea mays* (maize) pollen (25–90%) indicate ceremonial activity. Starch granules contributed to the interpretation of grinding activities and clarified use of maize pollen. *Nicotiana* seed fragments point to the potential for identification of diverse remains contained in pollen samples.

Prehistoric dietary diversity and coprolite phytolith content: *Dennis DANIELSON and Karl REINHARD, University of Nebraska-Lincoln.*

Coprolite analysts traditionally concentrate their efforts on macroscopic and pollen evidence. We have examined 80 coprolites from six prehistoric sites to evaluate phytolith content. Three Anasazi sites (Antelope House, AZ; Salmon Ruin, NM; and Bighorn Sheep Cave, UT) and three Archaic sites (Bighorn Cave, AZ; Hinds Cave, TX; and Dust Devil Cave, UT) were studied. The analysis shows that phytoliths are very common in coprolites and can make up to ten percent of the mass of coprolites. The phytolith data provide evidence of plant consumption that is not present in the macrofloral or pollen remains from coprolites. A surprising diversity of phytoliths is present in coprolites from vegetative tissue of many plant species. Since phytoliths are harder than tooth enamel and are most abundant in Archaic coprolites, it is probable that phytoliths caused dental disease in remote times and may have resulted in the use of analgesic plants by various cultures.

Semantic classification and biological nomenclature in Mixtec: *Alejandro DE AVILA, Sociedad para el Estudio de los Recursos Bióticos de Oaxaca (SERBO), A.C., & University of California at Berkeley.*

Mixtec constitutes a group of related languages spoken in an ecologically diverse region in southern Mexico. Noun classification is a salient feature of the Mixtec languages. Most plant and animal names are preceded by semantic classifiers. A preliminary survey of contemporary and 16th-Century dialects shows that the composition of the major categories marked by these classifiers is quite consistent across the Mixtec region. Edibility, usefulness, and other, mostly cultural, criteria underlie this system of nomenclature, in apparent contradiction to Berlin's (1992) general principles of ethnobiological classification. Mixtec plant and animal names provide valuable clues for the study of Mixtec cultural history. Their etymologies denote former uses or mythological significance of certain species. Cross-dialectal comparison of plant and animal terms appears to evidence a higher proportion of cognate terms for species characteristic of pine-oak forests, an indication perhaps that proto-

Mixtec developed in the highlands. Plant names, in particular, seem to bear traces of an older classification system in the guise of a fossilized word-initial clitic.

Contribution to the determination of the melliferous flora of the south region of the State of Coahuila, Mexico: Manuel DE LA ROSA-IBARRA and José GARZA, *Universidad Autónoma Agraria "Antonio Narro"*.

The objective of the present work was to investigate the plant species that contribute in greatest measure to the production of honey in the apple-cultivation zone in the south of the State of Coahuila. During a 12-month period, the plants of the zone were collected and identified taxonomically. A pollen collection was established for use as a reference in the identification of melliferous plants. Melisopalynological studies were used to determine the species used most by bees in the manufacture of honey. These results will permit collection of seeds of these plants and the dissemination of these seeds in the area in order to increase honey production.

A preliminary list of the medicinal plants of Nuevo León State, Mexico: Manuel DE LA ROSA-IBARRA, *Universidad Autónoma Agraria "Antonio Narro"*.

Medicinal plants have been employed by the inhabitants of this part of Mexico from very remote times to alleviate disease and pain. This is commonly accomplished with very good results and without the after-effects of most modern medicines. In this study, information was gathered directly from the inhabitants of 22 *ejidos* (farming cooperatives) in 5 *municipios* (counties) of Nuevo León State. This was in addition to information obtained in markets in metropolitan Monterrey. We found 87 species from 78 genera in 51 plant families with assorted uses from simple headaches to diabetes.

Kakau i ka Uhi: plants and tattooing in Hawai'i: Anna DIXON, *University of Hawai'i-Manoa*.

This paper investigates plant taxa used in pre-European Contact and early Post-Contact Hawai'i for the purpose of tattooing. The practice of tattooing was a widespread form of body ornamentation in Polynesia, particularly on the high islands and some atolls. Tattooing needles have been found in archaeological contexts throughout Polynesia. In the Hawaiian Islands, a variety of plant substances was employed to produce tattoo designs. Although most of these fall under the category of "dye plants," at least three indigenous taxa (*Pelea anisata*, *Plumbago zeylanica*, and *Sisyrinchium acre*) and one Polynesian introduction (*Aleurites moluccana*) apparently created designs through chemical action.

Ethnobotany of the Mayo near Alamos, southern Sonora, Mexico: Daniel A. DUNCAN, Thomas A. KLEESPIE, and Francis C. SHERLOCK, *University of Arizona*.

In a KUAT television segment of "The Desert Speaks," David A. Yetman and Thomas R. Van Devender interviewed Mayo Indians about traditional plant uses in tropical deciduous forest and thornscrub. Trees are cut for wood for furniture and living fences at specific times. Men typically bring plant products to the women. In Teachibe, women weave woolen blankets. Chiju (*Indigofera suffruticosa*) yields a blue dye. Most plants are for personal use; chiltepín (*Capsicum annuum*) and pitahaya (*Stenocereus thurberi*) are sold. Conversion to agricultural fields and buffelgrass (*Pennisetum ciliare*) pastures threaten Mayo plant resources.

Prehistoric plant-food diversity of the Verde River Valley, northern Arizona: Cherie A. EDWARDS, *University of Nebraska-Lincoln*.

The analysis of macrobotanical remains from prehistoric cave sites in the American Southwest has long been used to evaluate prehistoric diet. Presented here is such an analysis of dry cave plant materials from Sinagua sites in the Verde River Valley of Arizona. In-

cluded in the analysis are midden and coprolite samples from cave deposits which date from A.D. 1100–1300. The analysis of the deposits reveals a surprising diversity of wild and cultivated plants. Both the seeds and the vegetative parts of the plants were eaten, which testifies that these prehistoric horticulturalists subsisted on a diet that included a diversity of plant foods.

Preserving herbal traditions in southwestern New Mexico: *Tomas ENOS, The Herbal Medicine Project.*

The preservation of ethnobiological information in indigenous cultures is a critical component of scientific understanding of the natural world. As cultures undergo contact and change, new mechanisms must evolve that support the continued utilization of ancient knowledge. Educational programs which place the keepers of the knowledge in the role of primary investigator and professor are becoming essential to a complete system of investigation and preservation.

Indigenous patterns of conserving biodiversity: Pharmacologic implications: *Nina L. ETKIN, University of Hawaii-Manoa.*

While the preservation of species is being debated from a variety of Western postures, predominantly economics, the significance of those taxa has not been properly assessed in the cultural and microecological contexts of their use. Instead, species designated for conservation have been identified by outsiders who are culturally and politically detached from the threatened environments. Ethnopharmacologists—and primarily those representing the social sciences—have drawn on the cogency of indigenous knowledge of biotic diversity and its conservation. This paper reviews how local paradigms of plant use and conservation can be integrated into conservation efforts, and problematizes the issue specifically with reference to the use of plants by Hausa peoples in northern Nigeria.

Cosmology and conservation: The case of gender in Campeche-Maya plant taxonomy: *Betty FAUST, Centro de Investigaciones y Estudios Avanzados (Mexico).*

Analysis of plant descriptions used by a Campeche-Maya *h'wèen* (traditional ritual expert and healer) in the making of 350 collected medicinal species has revealed connections to a larger cognitive map, a cosmology with implications for conservation (following Goetz). The Campeche-Maya taxonomy of plants is keyed through concepts of gender to a more general cosmological framework in which the underlying creative forces of the universe are understood as dichotomous, interdependent sets, male and female, which cooperate in continuous cycles in the regeneration of life. Human sexual behavior and reproduction is a subset of this larger system and is often a symbolic device for representing its more complex processes. Gender in plant taxonomy cognitively connects plant identification with both human relationships and a system of understandings about the connections and interdependencies between humans and nature. These traditional connections provide a cognitive mechanism for maintaining awareness of the importance of conservation of rare species and their fragile habitats, which has also been observed in the behavior of the *h'wèen* when collecting plants.

Ethnobotany: A 100-year retrospective: *Richard FORD, University of Michigan.*

One hundred years ago, John Harshberger first used the term ethnobotany. The first practitioners were both anthropologists and botanists interested in the natural history of American Indians. The objectives of the field changed when anthropology became a social science and botany assumed an economic orientation. Anthropological emphasis moved toward folk systematics and ethnoscience. Convergence of these trends occurred when ecol-

ogy was favored as a way to understand human-plant relations and to study biodiversity again from an ethnobotanical perspective. Most recently, plants have become a surrogate for examining post-modern themes of gender, class, and ethnicity in anthropology but is expanding along more conventional approaches by botanists in the non-Western world.

Taxonomy and transformation in Nage conceptions of the animal world: *Gregory FORTH, University of Alberta.*

This paper explores the notions of transformation among the Nage people of central Flores in relation to issues of taxonomy. A local belief that certain animals can change permanently into zoologically quite different species (such as deer and dolphins) potentially challenges the view that natural kinds, in contrast to other entities included in standard folk classifications, are perceived as possessing invariable essences that form the basis of taxonomic hierarchies. Nage conceptually connect natural categories in a variety of ways, constituting several analytically distinct modes of classification.

Death Valley agriculture: *Catherine S. FOWLER, University of Nevada-Reno.*

In 1980 William Wallace examined the case for native agriculture among the Death Valley Shoshone, noting that the historical sources are far from clear as to its antiquity and to the crops involved. This paper reexamines the evidence, combining it with some new ethnographic and linguistic data to suggest that planting corn, beans, and squash probably is not much older than the 1830's in the area. A combination of sources is also suggested, with the Southern Paiute playing a substantial role. Ecological factors may also have played a role in limiting its occurrence.

Famine foods: Little-known plant-food resources: *Robert L. FREEDMAN, Orinda, California.*

The study of little-known plants used throughout the world for food during periods of famine and food scarcity is reviewed here. These plants, commonly referred to as "famine foods," have received scant attention from ethnographers and less from agriculturalists. In addition to pertinent historical background, current and recent research trends are examined, and the "New Crops" potential of particular famine foods is considered.

Ejido Joya de Salas: A case study at El Cielo Biosphere Reserve, northeastern Mexico: *Claudia GONZALES-ROMO, W. Hardy ESHBAUGH, and Adolph M. GREENBERG, Miami University.*

Joya de Salas is located 7 hours on horseback from the Jaumave Valley, Mexico, in the western range of the Sierra Madre Oriental at an elevation of ca. 1900 m. Joya's residents have long made a living from the land by cropping, cattle-raising, horticulture, plant-gathering, logging, etc. In 1987 logging activities ceased due to the establishment of El Cielo Biosphere Reserve, which resulted in the loss of a secure income for the 45 resident families. For the campesinos and their families, a lack of understanding regarding the nature of the biosphere reserve has resulted in an incomprehensible set of forest and wild animal resource-use limitations imposed by state and federal governments. This study explored and assessed past and contemporary knowledge, including expertise about the area's natural resources, and how this is relevant to present conservation effort at El Cielo Biosphere Reserve.

Strategies for the management of natural resources: *José GONZALEZ and Regina LEAL, Universidad Autónoma Metropolitana-Iztapalapa.*

In order to satisfy the need for production, peasants require the utilization of renewable natural resources such as water, soil, cultivated plants, and other vegetation (forest,

pasture, etc.). Nevertheless, these resources cannot be exploited without taking into account the legal, social, and economic context in which the indigenous peasant communities are located. In this paper, we review the socioeconomic strategies used by the community of Santa Catarina del Monte for the management of natural resources. We also show how this community integrates the different options offered by the natural milieu in order to satisfy its subsistence demands and the production of commercial benefits.

"A place that's good": Gitksan ethnoecology: *Leslie M. JOHNSON GOTTESFELD, University of Alberta.*

The Gitksan of northwestern British Columbia live in a mountainous, densely-forested environment. Gitksan landscape perception differs from that of Western ecology. In Western ecology, plant communities are based on the dominant species of geomorphic features (e.g. floodplain cottonwood forest, sphagnum bog, black-spruce swamp). Gitksan terms collected for ecological or habitat features include "swamp" *lalax'o*, "meadow" or ravine *lax'amit*, and a generalized bush/forest term *gilix* "woods" or *spagadegantx* "being out in the bush." Terms such as "aspen forest" do not seem to be present. Gitksan landscape perception is organized with reference to "mountains" and "rivers," to drainage basins and divides; this is quite natural when the nature of the landscape is taken into account. These orienting perceptions are intimately bound up with the territory system, where landscapes, including drainage basins and river fishing sites or mountains forming one side of major lakes or rivers, are delimited as owned properties of House groups. Vegetation is described by discussion of specific species and where they can be found, and the uses of the plant species. Generalized habitat indications such as "in the swamp" or "halfway up the mountain" suffice to indicate the ecological setting.

Out of California: Cultural geography of native North American tobacco: *Julia E. HAMMETT, Muwekma Tribe and Stanford University.*

The evidence for expansion of tobacco (*Nicotiana* spp.) points to two independent prehistoric invasions into the interior of North America, one from the south, another from the far west. The far-western part of the United States is the birthplace of several tobacco taxa; at least two of these are anthropogenic. California and Great Basin ethnographies are rich in examples of plant management strategies including prescribed burning, weeding, and planting seeds. Archaeological pipes, tubes and archaeobotanical residues attest to the longevity of tobacco use in California.

Ethnic homegardens of Santa Cruz County and San Jose, California: *Michael HATHAWAY and Maria AUFMUTH, University of California-Santa Cruz.*

This paper is a cross-cultural survey of home gardens in Santa Cruz County and San Jose, California. Gardeners from Portuguese, Mexican, Japanese, Sri Lankan, and Filipino backgrounds were interviewed, their gardens mapped to scale, and plant species designated. The following issues were examined: the transfer of intergenerational knowledge, aspects of cultural background which contribute to the maintenance of biodiversity, and the variety of ways by which home gardeners conceptualize their gardens.

Seal transport and consumption amongst historic Inuit: Implications for Inuit-European relations on southeast Baffin Island, Canada: *Anne HENSHAW, Harvard University.*

This study examines the transport and consumption of seal, the mainstay of historic Inuit diet, during a period of rapid social and economic change. I present zooarchaeological results from three historic Inuit habitation sites located on southeast Baffin Island to show that throughout the historic period (A.D. 1576–1930), seal carcasses were brought

back whole to individual Inuit households, where subsequent butchery and distribution took place. This conclusion is supported by ethnographic descriptions and taphonomic considerations; its significance is interpreted in light of the role Inuit family cohesion played in maintaining economic independence from European agents of change.

A rediscovered agave in central Arizona: *Wendy HODGSON, Desert Botanical Garden.*

A previously undescribed agave was rediscovered in 1988 in Tonto Basin, Gila County, by Rick DeLamater. First found by Susan D. McKelvey in 1929, further searching has resulted in the documentation of over 90 sites. Like the Hohokam agave (*Agave murhpeyi* Gibson), the Tonto Basin agave (to be named *A. delamateri* Hodgson & Slauson, ined.) is believed to have been grown extensively by a pre-Columbian culture, namely, the Salado. Its past and present distribution, characteristics, similarities and differences with other agaves will be discussed. In addition, factors which may have influenced how the plants were managed will be addressed and comparisons made with those of the Hohokam agave. Finally, a recent discovery of an unknown agave in the Grand Canyon will be discussed, providing further evidence that agaves were an important resource north of central Mexico, with distributions influenced by human intervention.

Humans and wetlands: Lessons learned by Biosphere 2: *Todd HORNE, Biosphere 2.*

Biosphere 2 offers a means to study human impacts on ecological structures and functions. Unlike Earth, Biosphere 2 must have constant human intervention in order to maintain the structure and function of its ecosystems. Wetlands of Biosphere 2 can be used to learn how human intervention maintains a wetland in an unstable state. Biosphere 2 wetlands are altered by water pollution, confined spaces and inadequate knowledge for management. Solutions to such problems can be addressed by observations of the states and dynamics of Biosphere 2 wetlands. This case study can be applied to the problems of planetary wetlands.

Identifying prehistoric food-processing methods with Electron Spin Resonance (ESR) Spectroscopy: *Andrea A. HUNTER, Michael P. EASTMAN, Sheri A. MAKTIMA, and Bernadette C. SLATER, Northern Arizona University.*

Electron Spin Resonance (ESR) Spectroscopy is currently being used to explore thermal histories of archaeological seeds recovered from prehistoric human coprolites. This technique is being applied in a study of coprolite macroremains recovered from Southwest archaeological sites. ESR experiments conducted on modern seeds prepared by a variety of food-processing methods were compared with ESR signals from archaeological specimens. Distinct signals were obtained from modern specimens and matched with archaeological signals. Experiments indicate that ESR *g*-value, line width, spin intensity, and line shape are useful parameters that identify maximum temperature and duration of heating associated with differential food-processing methods.

Pollen analysis in prehispanic vessels from the ancient city of Teotihuacán, México: *Emilio IBARRA-MORALES, Universidad Nacional Autónoma de México; and Aurora MONTUFAR, Instituto Nacional de Antropología e Historia.*

An archaeopalynological investigation was carried out on prehispanic vessels found in a small, well-preserved cave near the "Pyramid of the Sun" in the ancient city of Teotihuacán in central Mexico. The evidence consists of palynomorphs in a very good state of preservation, in association with prehispanic burials. Pollen remains include those of several botanical families including Gramineae (Poaceae), Pinaceae, Chenopodiaceae, and Amaranthaceae. A more detailed analysis is underway that will provide new data about the use of plants in funeral rituals in ancient Mexico.

Prehistoric human impacts on riparian fauna and issues of biodiversity in southwestern North America: Steven R. JAMES, Arizona State University and Gila River Indian Community.

Archaeofaunal data from Hohokam and Anasazi sites (ca. A.D. 1000–1500) along the Salt, Gila, Little Colorado, and Río Grande Rivers are examined with respect to over-exploitation of game and fish resources in the Southwest. Hohokam agriculturalists in particular brought about the decline of riparian fauna and may have caused local extirpation of some taxa. These results raise the question of where baseline management programs should be established.

Hypocholesterolemic constituents in plant dietary additives of a traditional subsistence community, the Batemi of Ngorongoro District, Tanzania: Timothy JOHNS, L. CHAPMAN, T. TICKTIN, McGill University; R.L.A. MAHUNNAH, Institute of Traditional Medicine; and P. SANAYA, Mugholo, Tanzania.

Reports of plants added to milk and meat-based soups by the Maasai and Batemi in East Africa support a role for phenolic antioxidants and hypocholesterolemic agents in the diet in low incidence of cardiovascular disease of populations that traditionally consume high levels of dietary fat and cholesterol. Plant food additives of the Batemi of Ngorongoro District, Tanzania, were tabulated based on interviews with 22 informants, and 17 specimens were collected in the field and analyzed for saponin and phenolic content. Sixty-three percent of the Batemi additives and 75% of these known to be used by the Maasai also contain potentially hypocholesterolemic saponins and/or phenolics.

The palm has its time: Natural history, use, and management of *Sabal uresana* in Sonora, Mexico: Elaine JOYAL, Arizona State University.

The results presented here are the ethnographic portion of an ethnoecological study to assess quantitatively traditional resource management (TRM) for one group of wild-collected plant species, i.e., palms, in Sonora, Mexico. Participant observation and formal interviews were used to learn (1) what local people, both indigenous and mestizo, understood of palm natural history, and (2) how palms were used and managed. Harvest pressure was assessed through a combination of ethnographic and ecological techniques. Weavers were asked to sort *cojoyos* (unexpanded leaves) according to use so that variation in *cojoyo* quality and in weavers' knowledge of them could be understood. *Sabal uresana* is one of the most economically important wild-collected plant species in Sonora. Knowledge of its natural history, use, and management varied greatly among users. Many understood basic phenology and that the palm produces few leaves and lives for many years. Many also had a limited view of overall distribution but could describe general habitat and associated species. The most important use of *S. uresana* was weaving for which *cojoyos* were employed. Weavers sorted *cojoyos* into as many as six categories, based on texture, color, and size. TRM consisted of limiting access to populations, "sparing," controlling harvest times and levels, and choice of leaf age and palm size.

Maasai political ecology: Fire management for cultural and biological diversity: Mark KAIB, Laboratory of Tree-ring Research, University of Arizona.

Augmented for 3000 years by hunting and gathering and the use of fire to induce grassland renewal, the Maasai developed a pastoral production system of annual cyclic migrations to make use of seasonal resources. Short-sighted development schemes over the last century have encouraged sedentary high-input land-use patterns and resulted in cultural and environmental degradation and incessant land disputes. Historical pastoral land-use

patterns illustrate the extensive ecological awareness of the Maasai. The current patchy landscape pattern is maintained by distinct yet interdependent economic practices including resource conservation, traditional pastoralism, and agricultural use. Fire management is a prime field where both conservation and cultural objectives can be complementarily integrated for sustainable ethnobioconservation.

Historical ethnobotany: A case study of the 1933 Huron Smith Winnebago manuscript: Kelly KINDSCHER and Dana PRICE, *University of Kansas*.

Historical manuscripts can provide excellent sources of cultural and biodiversity data, but may also prove to have inherent problems. The only known ethno-botany of the Winnebago is a 1933 unpublished manuscript. It has been archived in the Milwaukee Public Museum along with plant voucher specimens and photographs collected by Huron Smith, a museum botanist. At his untimely death the manuscript was 90% complete. Problems associated with this and similar manuscripts are quality of original work, verification of plant species, changes in botanical nomenclature, linguistics, decisions concerning editing changes, gaps in the manuscript, ownership of the manuscript, intellectual property rights, and bureaucracy of the institutions involved.

Agave cultivation and site use in the Silver Creek and Chevelon Creek Drainages, Sitgreaves National Forest: Julie L. KUNEN, *University of Arizona*.

Agave is known to have been cultivated prehistorically in the highlands of Mesoamerica and among the Hohokam. Less well-known is the use of agave in the northern Mogollon area. Data suggest that agave was cultivated prehistorically above the Mogollon Rim by people who extended the natural range of the plants. Agave sites provide information regarding economic strategies and land use among early residents of this region.

The Native American pipe in a modern context: Soren LARSEN, *Illinois State University*.

The material culture of a people can often aid in determining the environmental relationships of that particular group. In attempting to preserve biological diversity in a modern context, it is helpful to analyze the material culture of groups that have maintained successful environmental relationships. Through a cross-cultural study, it will be shown that ethnographic data support that the ceremonial pipe's use, symbolism, and ceremony directly defined and cemented a positive environmental relationship which preserved biological diversity on a regional basis.

Stalking the immortal vicious yucca: Elizabeth J. LAWLOR, *University of California-Riverside*.

The use of yucca as food and fiber is well-known in the Great Basin, but little attention has been paid to its significance as a food of the Chemehuevis and other Southern Paiutes of the Mojave Desert. Detailed information about the native names and uses of the various species has been unavailable. Stalking this information involved linguistic analysis of native terms and botanical inference from fragmentary descriptions of the yuccas' ranges and characteristics from published and unpublished data collected by Carobeth Laird, John P. Harrington, and Isabel T. Kelly. In mythology, the Immortal Yucca Date was the first source of plant food and the only plant who was a Person, while the Yucca Date Worm Girls were frequently encountered, treacherous characters who stabbed people with their long, sharp knives. The three important yucca species in the region were *Y. baccata* (banana yucca, *kaayuvimp̄*); *Y. schidigera* (Mojave yucca, *'uuvimp̄*), and *Y. brevifolia* (the Joshua tree, *sovaramp̄*). All of these produce edible fruit (*tcimpi*) across the desert homeland, thanks to Cottontail Rabbit's ambush and scattering of the Immortal Yucca Date.

Mushroom gathering in San Pedro Ecatingo, Mexico: *Edelmira LINARES and Robert BYE, Universidad Nacional Autónoma de México.*

Mushroom collection plays an important economic role in the mountain communities of southeastern Mexico state. In San Pedro Ecatingo over 20 families supplement their income with mushroom gathering (carried out mostly by women and children) during the rainy season. Today there are more "hongueros" and they claim that they obtain fewer mushrooms than collectors before them. Over 22 edible species have been documented to date; the more important ones include *Amanita caesarea*, *Morchella elata*, and *Ramaria* sp. Mushrooms are considered a meat substitute and may be the basis for a banquet; many collectors prefer to sell them in the regional market in Ozumba for economic benefit rather than include them in the household meals.

The significance of Lacandon Maya animal and plant *onen* or spirit-beings and their potential importance for interpreting ancient Maya art and iconography: *William J. LITZINGER, Prescott College; and Robert D. BRUCE S., Museo Nacional de Antropología.*

Prior discussion of the concept of the *onen* among the Lacandon Maya has focused on animal spirit-beings associated with the Lacandon lineages. Herein is presented an explanation of the nature of the Lacandon animal *onen* in contrast to animal spirit-beings among other Mesoamerican cultures. Evidence is then presented to suggest that in the past plant *onen* also existed among the Lacandon Maya. The cultural role of Lacandon animal and plant *onen* is examined in relation to the interpretation of some plant and animal motifs in ancient Maya art and iconography.

Ge Oidag (Big Field): *Danny LOPEZ, Baboquivari School District.*

Traditional Tohono O'odham agriculture in the village of Big Field began to decline rapidly after the late 1940s. Danny Lopez draws upon his childhood memories to recreate a prior era when food crops were raised and families cooperated in farming tasks. Recruitment for labor in cotton fields elsewhere initiated a trend toward greater participation in the cash economy. Boarding schools and military service were among the factors that further accelerated a transition to extra-local employment rather than the cultivation of surrounding fields. This transition is recounted by a Big Field resident who has witnessed all of these changes.

Morphophysiological variation in Mexican species of *Amaranthus*: Evolutionary tendencies under domestication: *Cristina MAPES, Javier CABALLERO, Eduardo ESPITIA, and Robert BYE, Universidad Nacional Autónoma de México and INIFAP.*

Amaranth (*Amaranthus* spp.) is an important food resource for indigenous peoples of Mexico. Grain-producing species and land races are mostly cultivated plants, while the species used as vegetables are commonly promoted in maize plots. There exist noticeable biological differences between these two types of amaranths. This study analyzes the morphophysiological variation in the Mexican species of *Amaranthus* and its relation to use and management. A sample of individuals from 14 collections corresponding to seven species and land races was grown in experimental plots and 18 morphological and physiological characters were measured. A statistical multivariate analysis was performed on these data. The results show that the grain-producing plants tend to allocate a high proportion of energy in the production of inflorescences while in plants used as vegetables the higher biomass proportion is found in the foliage. This suggests that domestication of Mexican species of *Amaranthus* follows two different paths according to the form of use and management by humans.

Natural history of domesticates: Lessons for the future? *Bruno D.V. MARINO-DUCE, Biosphere 2.*

Ever since the Holocene, humans and other people have selected a surprisingly small number of plants from their surroundings for intensive production of foodstuffs and recreational chemicals, resulting in domesticates that feed, clothe, and inebriate the inhabitants of Gaia today. The natural history of the primary domesticates provides insights into the processes that may influence the utility of these plants in the future.

Study of plant and animal remains in urban archaeology: The case of Exconvento de Santa Isabel-Bellas Artes, Mexico: *Abel MARTINEZ, Luz LAZOS, Alvaro ANGOA, Universidad Nacional Autónoma de México; Adolfo DE PAZ and David ESCOBEDO, Instituto Nacional de Antropología e Historia.*

Today, research methods can be presented in attractive visual manner through the use of video recordings. The archaeological project "Exconvento de Santa Isabel-Bellas Artes" has been a great opportunity for the application of video. This 10-minute video shows the basic steps in paleoethnobotany. In particular, the methodology includes: 1) collection and flotation of samples, and 2) identification of macroremains. These data determine the distribution and abundance of plant remains which helps explain their presence in the study site. This video was designed for didactic purposes, and illustrates the relevance of paleoethnobotany as a complement of archaeological studies.

Identification of carbonized archaeological remains of *Amaranthus* spp.: *Emily McCLUNG DE TAPIA, Universidad Nacional Autónoma de México.*

Amaranth use in prehispanic Mesoamerica is widely documented in Sixteenth Century ethnohistorical and historical sources. However, it was used at least as early as 5000 B.C. and possibly earlier. Although carbonized seeds suggesting the plant's importance have been recovered from numerous archaeological sites in the Central Highlands of Mexico, the state of preservation is a limiting factor for the determination of species. Morphological studies based on seeds of modern species were undertaken in order to develop techniques for species differentiation among cultivated and non-cultivated archaeological specimens. Testa thickness is a diagnostic characteristic which allows differentiation between cultivated and non-cultivated specimens, while surface texture allows differentiation between two cultivated species: *A. hypochondriacus* and *A. cruentus*.

Maximizing dietary diversity in prehistoric Durango, Mexico: *Timothy MEADE and Karl REINHARD, University of Nebraska-Lincoln.*

Coprolites were excavated from a cave dating from A.D. 600 on the Río Sape in central Durango, Mexico, and are the basis for dietary reconstruction. Macro-floral, palynological, phytolith, and zoological analyses of 50 coprolites were undertaken. These analyses revealed that a surprising diversity of cultivated and noncultivated plant species was eaten at the site. These included typical Mesoamerican cultigens such as chile, maize, and legumes with indigenous, long-established wild staples such as agave, prickly-pear, and ground cherry. The maintenance of wild plants of Archaic heritage after horticulture was introduced served to maximize dietary diversity.

Why didn't Native Californians invent agriculture? Or did they? *Charles MIKSICEK, Bio-Systems Analysis, Inc.*

Archaeobotanical data collected from various California sites suggest that the plant food contribution to subsistence was far more diverse than the acorn-based diet predicted

from late 19th-Century ethnographies. A complex of grasses (little barley, maygrass, ryegrass), legumes (*Lotus*, clover, lupine), and small seeds (goosefoot, chia, tarweed) is present in sites throughout California. This "grass-legume-small seed complex" has strong parallels with archaeobotanical data from sites in eastern North American and Early Neolithic sites in the Near East. Several of these taxa demonstrate morphological changes that suggest some degree of selection or environmental management beyond the simple gathering of a wild plant. These data suggest that pre-contact California could prove to be an important testing ground for many models for the origins of agriculture.

Indigenous intellectual knowledge: Owning or sharing: *Verna MILLER, University of Victoria.*

Ethical debate has been held on the question of ownership of indigenous intellectual knowledge. Indigenous cultures have had their knowledge compromised for the sake of academic and consumer validation without understanding of the spirit in which this knowledge is passed on. Prior to contact with western European cultures, aboriginal knowledge, food, and clothing were shared among community members. Since the "discovery" of indigenous knowledge by non-aboriginal Academia, the spirit of sharing has been grossly compromised. Haida elder Lavina White/Tthow Legwelth puts the present attitudes very succinctly. "They take our knowledge, our information, our art forms, and our artifacts, but they leave us out. They want everything that is us, but they don't want us." This presentation will address this situation and suggest ways in which the two cultures can reach a better understanding and mutual respect.

Biodiversity and sustainable agriculture: *Tilak Ram MOHATO and Bruno D.V. MARINODUCE, Biosphere 2 Research Group.*

The Intensive Agriculture Biome (IAB) of Biosphere 2, covering 0.55 acres (0.22 hectares), provides a unique opportunity to study the effects of agricultural practices on yield and overall plant diversity in an atmosphere with elevated CO₂. Observations on the plants selected, the control of pests, and the application of nutrients (derived from waste water) are used to assess the potential of intensive sustainable agriculture under a variety of conditions relevant to a rapidly changing global agricultural landscape.

The coevolution of maize and human cultures: A research proposal: *Deborah A. MUENCHRATH, Iowa State University.*

Maize and maize-based cultures evolved together over millennia. Ancient as well as contemporary maize-human relationships hold lessons pertinent for germplasm and resource stewardship. Understanding the coevolution of maize and associated human cultures may provide critical insights for charting future agricultural and societal development. An interdisciplinary research program to examine maize and cultures, and their relationships through time and across geographic areas, will be described.

Features of indigenous sustainable maize production in the arid southwestern U.S.: *Deborah A. MUENCHRATH and Ricardo J. SALVADOR, Iowa State University.*

Our research examines responses of a traditional cultivar, native to the Sonoran Desert, and a dent hybrid, adapted to the U.S. Corn Belt, to a range of irrigation regimes. Morphological and physiological responses are evaluated in the contexts of traditional indigenous and modern commercial planting arrangements. Objectives of the study are to: 1) identify biological attributes contributing to the reputed drought-tolerance of the native maize, and 2) determine the effect of production practices on the productivity of maize under arid conditions in New Mexico.

The landscape perceived: Fragmented ethnoecologies: *Virginia NAZAREA-SANDOVAL, University of Georgia.*

This paper analyzes the patterns of perception of the landscape by informants belonging to different ethnic, age, and gender groups. Thematic Apperception Tests (TAT's) consisting of photographs depicting various parts of the landscape around the Manupali Watershed in Bukidnon, Philippines, were designed to elicit different points of view on resource management as well as community relations. Human-plant interactions in different production regimes were central considerations in the responses of different categories of informants. A patterning of the relative salience of landscape features is demonstrated.

Plants and animals used in musical drums of Kerala, India: *T. S. NAYAR and P. PUSH-PANGADAN, Tropical Botanic Garden and Research Institute.*

Kerala, the southernmost state of India, has, over the centuries, evolved a musical culture having a conscious theoretical basis which involves usage of a remarkable variety of musical instruments peculiar to the region. Drums are used either for pure rhythmic intricacy or as accompanying instruments. They are made of wood and animal skin with high specifications. Plants and animals used for six art drums are detailed and locally evolved processing technology applied are discussed in the light of an age-old musical culture of Kerala.

Historic preservation and the cultural use of plants at Kalaupapa National Historical Park, Hawaii: *Earl NELLER, Kalaupapa National Historical Park.*

Polynesians brought approximately 30 cultivated plants to Hawaii, including taro, which became a major staple in the Hawaiian diet. Some of these plants are seldom seen today, such as *uhi*, the Hawaiian edible yam. Propagation of these plants in the gardens of Kalaupapa residents gives the public first-hand experience with plants important in ancient Hawaiian culture, an aspect of culture barely visible in the existing archaeological landscape. Remnant patches of Hawaiian plants in the park's wildlands are threatened by competition with noxious weed species, and their chances for survival are improved by continued cultivation in Kalaupapa's residential gardens.

Putting down roots: Edible roots, black holes, and Plateau prehistory: *Sandra PEACOCK and Nancy J. TURNER, University of Victoria.*

This paper examines the ethnobotanical and archaeological evidence for traditional root-vegetable use by the Plateau peoples of the southern interior of British Columbia. Contemporary interior Salish peoples identify at least twenty culturally significant root species. Several of these (e.g. *Allium* spp., *Balsamorhiza sagittata*, and *Erythronium grandiflorum*) were harvested intensively, in quantities of up to 50 kg or more per family per year, and pit-cooked in large earth ovens. Archaeological evidence indicates these practices are at least 2500 years old, suggesting the biological diversity observed today in former aboriginal root-gathering grounds is the result of indigenous peoples' on-going management of these critical resources.

Reconstructing subsistence in the lowland tropics: A case study from the Jama River Valley, Manabi, Ecuador: *Deborah M. PEARSALL, University of Missouri.*

This paper demonstrates how paeloethnobotanical data, specifically, charred macroremains and phytoliths, are used to reconstruct subsistence in the lowland tropical forest. The issue of when maize (*Zea mays* L.) became important in western Ecuador is central to the study. Analysis of macroremains indicates that a change occurs around A.D. 500 in the apparent importance of maize, in the context of expanding settlement. Phytolith data from a river profile

document progressive expansion and volcanic ashfall. Phytolith data from cultural contexts reflect the background vegetation, and also document the broad-based subsistence system that remains a feature of human-plant interrelationships in the valley throughout prehistory.

Capacidad de carga humana y biodiversidad en ecosistemas áridos del norte de México [Human carrying capacity and biodiversity in arid ecosystems of northern Mexico]: L. PEREZ R., H.J. LOPEZ G., R. NAVA C., and J. GUTIERREZ C., *Universidad Autónoma Agraria "Antonia Narro"*.

[Renewable natural resources have been subjected to intensive use. As a result, the arid environment has experienced change in diversity due to changes in the use of the soil, declining ground cover and species density, acceleration of soil erosion, migration of songbirds, devastation of harvestable resources, etc. This scene has produced human pressure with the sole end of sustaining the human population which uses it. The use of natural resources must be exploited in a manner subject to the carrying capacity of the ecosystem. This permits us to place the matter of potential productivity of arid ecosystems against the matter of biodiversity, as a strategy for conservation of natural resources under the present-day concepts of the sustainability of the ecosystem.]

Starvation and the Hualapai Indians at Hackberry, Arizona: Ethnobotanical remains and ethnocentric perceptions, 1875–1920: David E. PURCELL, *SWCA Environmental Consultants*; and Eric. C. HANSEN, *Zoobot Archaeological Consultants*.

Ethnobotanical specimens were recovered and analyzed from four features and six sub-features of Site AZ G:10:8(ASM), Hackberry Townsite, in Mohave County, Arizona. The features are affiliated with the circa 1875–1920 Hualapai Indian barrio or camp at Hackberry. Analysis of microremains yielded 26 taxa and pollen grains yielded 27. Archival primary sources describe mass starvation among the Hualapai which initiated contemporary distributions of food and cooking implements from 1879–1900. Only one domesticate was identified; however, the remainder are native species traditionally exploited by the Hualapai, or non-food resources. Faunal specimens were analyzed and likewise represent traditional preferences. The incidence of starvation appears to be an ethnocentric reaction to native subsistence practices, not chronic physiological deprivation.

A peek in the Anasazi pantry: Macrofloral evidence of possible food resources in Pueblo II/Pueblo III times: Kathryn S. PUSEMAN, *Paleo Research Labs*.

Macrofloral samples were examined from floor matrix and floor fill in pithouses, kivas, and surface rooms representing Anasazi occupations along the Puerco River in northeastern Arizona. Patterns of recovery indicate economic activity within the structures and may be used to address expectations for charred seed recovery. Floor-fill samples contained greater varieties and quantities of charred remains than did floor matrix samples. Samples contained evidence of all three expected cultigens (maize, beans, squash), as well as a variety of native plants.

Do edible insects play a financial role among different ethnic groups in Mexico? Julieta RAMOS-ELORDUY, *Universidad Nacional Autónoma de México*.

In Mexico many ethnic groups that consume edible insects also sell or exchange them for profit. This permits them to buy other necessary goods. We analyze the cost-benefit ratio for four edible insect species. The balance shows a profit. These are grasshoppers of the genus *Sphenarium*, ants called "chicatanas" (*Atta* spp.), "escamole" ants (*Liometopum apiculatum*) and the white agave-worm (*Aegiale* [*Acentrocneme*] *hesperiaris*). We shall here discuss their economic, ecological, and social effects in Mexico City and in rural areas.

First Mexican Congress of Ethnobiology (August 1994): Julieta RAMOS-ELORDUY, José M. PINO M., and Juan Manuel RODRIGUEZ, *Universidad Nacional Autónoma de México.*

In Mexico, the "Asociación Mexicana de Ethnobiología" was created on 30 March 1993 with 114 members. In August 1994, the First Mexican Congress of Ethnobiology was held in Toluca City. The response to this First Congress was amazing. There was a total of 186 papers presented by 370 Mexican and international authors, supplemented with videos and 14 magistral conferences. Governmental and private institutions as well as independent civil associations participated. The central topic was "Ethnobiology in the Knowledge and Conservation of Natural and Cultural Resources." This was divided into 8 subjects and complemented with a workshop on "Methodology in Ethnobiology." There was also a tasting of non-conventional resources and an exhibition and sale of Mexican crafts.

"If the threshing floor could talk . . .": Ethnographic studies of traditional crop processing in India: Seetha N. REDDY, *ASM Affiliates.*

This paper presents the results of ethnographic studies of traditional millet crop processing in India; the summer monsoonal cultivation of *Sorghum bicolor* and *Pennisetum typhoides*, and the opportunistic cultivation of *Panicum miliare*. The discussion will examine the definitive identification of their cultivation in South Asian archaeological contexts. Despite previous research, cultivation of millet crops as a distinct activity had not been clearly demonstrated at any site in India. The simple recovery and retrieval of archaeological botanical millet seeds from the sites is inadequate to argue for cultivation. The identification of actual cultivation is important in order to exclude the possibility that millet crop grains were being obtained through trade and exchange. To address this issue, an ethnographic study of millet crop processing particularly tailored for archaeological interpretations was conducted.

Potential new crops in Sonora, Mexico: Medicinal plants of the Pima Bajo near Yécora: Ana Lilia REINA GUERRERO, *Universidad de Sonora.*

The Pima Bajo Indians in the Sierra Madre Occidental near Yécora (28–31°N, 108–110°W) commonly use 145 species of plants for medicine. Of these, 78% are wild and 62% are summer herbs. The related illnesses, uses, and techniques of preparation and consumption were recorded. The entire branch was most commonly used, followed by leaves, roots and bark. Medicines were most commonly administered as tea, followed by poultices and baths. Traditional plant medicines continue to be used due to the lack of medical services and the prohibitive cost of prescription medicines. A number of medicinal plants could be cultivated to relieve pressure on wild populations.

An evaluation of Anasazi diversity of wild plant use: Karl REINHARD, *University of Nebraska-Lincoln.*

The comparative analysis of coprolites from three Archaic caves and three Anasazi sites showed that the diversity of wild plants in the Anasazi diet was greater than that of hunter-gatherer diets. This discovery seemed counterintuitive, considering that wild plants were the staples of Archaic subsistence. Five hypotheses were presented to explain this which were related to aspects of preservation, development of species, increased wild plant diversity due to agriculture, need to increase micronutrient intake, and diversification of diet to support overly-large village populations. Recently these hypotheses were evaluated by the examination of a large series of coprolites from Antelope House in Canyon de Chelly.

A laboratory guide to plant remains in eastern North America: K. ROBERTS, G. POWELL, K. KELLER, K. BOROJEVIC, M. BROWN, M. WILLIAMS, K. ELLISON, and G. FRITZ.

Paleoethnobotany, the study of archaeological plant remains, has undergone a theoretical and technological revolution in the last two decades. Recently discovered cultigens in regional assemblages have reconfigured our understanding of prehistoric agriculture in eastern North America. Proof of these cultigens, as such, hinges on their distinctive morphology. "A laboratory guide to plant remains in eastern North America" provides images (photographs, micrographs, line drawings) of plant materials consistently encountered in archaeological assemblages and their modern counterparts. Salient morphological characteristics of seeds and other matter (i.e. nutshell and fruit rind) are described qualitatively and quantitatively within the context of their archaeological distribution. Domesticatory status, taxonomic issues, and use are discussed.

Quantitative ethnobotany in the Atlantic Forest (SE Brazil): *Silvia C. ROSSATO, Universidade de Sao Paulo; and Alpina BEGOSSI, Universidade Estadual de Campinas.*

The native vegetation of the southern coastal parts of Brazil is represented by remnants of tropical rainforests, with a high diversity of species, known as the Atlantic Forest. This region is partially inhabited by native populations, the caícaras, which have a subsistence economy based on fishing and small-scale agriculture (especially manioc cultivation). This study includes the ethnobotany of the communities of Casa de Farinha, Picinguaba, Puruba, and Vitória Island, Ubatuba District. We conducted interviews based on open-ended questionnaires and calculated diversity indices (Simpson, Shannon-Wiener, and rarefaction) related to plant uses. Comparisons among different categories (per sex and per age) show significant differences in the use of plants for construction and medicine. Comparisons among these and other Atlantic Forest communities show that differences in the use of plants are consistent with the classical theory of island biogeography.

Rarámuri necklaces: A rapidly changing folk-art form in the Sierra Madre of northern Mexico: *Enrique SALMON, Baca Institute of Ethnobotany; and Karen R. ADAMS, Crow Canyon Archaeological Center.*

Colorful seed bead necklaces are made and sold by Rarámuri (Tarahumara) women and children in the Sierra Madre uplands along the famous Copper Canyon railway. A collection of 30 necklaces made in 1994 reveals the necklace materials are quite varied. They include seeds, various fruit types, stems, wood and bark of at least 19 different taxa in at least 10 plant families, strung on a minimum of six modern materials. The materials used in construction include fruit or seeds of three domesticates, parts of three plants naturalized from the Old World, and parts of taxa that grow only in the lowlands or deep canyon bottoms. Alterations to raw materials include carving, cutting, filing, and dyeing, as well as soaking prior to piercing. Although the Rarámuri say their necklaces are traditional, neither the archaeological nor ethnographic record supports a history of necklace-making as seen today.

Traditional uses of lichens: *Sylvia Duran SHARNOFF, Missouri Botanical Garden.*

Reports of lichen use in traditional cultures are being gathered for inclusion in the first color identification manual of North American lichens. Lichens were used as food, both in times of famine and as a delicacy, and gathered as animal fodder. Lichens were widely used in medicine; complex biochemical compounds produced by many lichens have antibiotic properties. There are scattered reports of hallucinogenic lichens and lichens used as poison. Lichens yield excellent dyes; examples may be seen in Chilkat dancing robes, Navajo rugs, and Harris tweeds. Branching arboreal lichens were used as fiber for bedding, diapers, bandages, and even clothing.

The domestication of *Cucurbita pepo*: Reassessing the evidence from Tamaulipas: Bruce D. SMITH, *Smithsonian Institution*.

With the exception of *Cucurbita pepo* materials recovered from Guila Naquitz Cave, Oaxaca, which were assigned an age of 9800 B.P., two caves in Tamaulipas have yielded the earliest evidence of domesticated squash in the Americas. Excavated in 1954 by Richard S. MacNeish and David Kelley, Romero's Cave and Valenzuela's Cave in the Ocampo region of Tamaulipas, Mexico, yielded abundant plant remains, including squash seeds, rind and peduncle fragments. These specimens of *Cucurbita pepo*, recovered from Infernillo Phase (9000–7500 B.P.) and Ocampo Phase (6000–4300 B.P.) occupation layers within the Ocampo caves, have long been recognized as providing some of the earliest evidence for the domestication of this major crop plant. This paper reconsiders these Ocampo cave assemblages and their cultural and temporal context.

Seri ethnozoology: Awls, mule deer and tradition: Heriberto SOTO-TORAL, and O. J. POLACO, *Instituto Nacional de Antropología e Historia*.

In ancient times many people used animal products to manufacture tools. The Seri or Comcaac, Sonora, retain traditional knowledge of how to use mule deer (*Odocoileus hemionus*) metapodials to make awls. These are named *zix icoop* and at present are used to weave their baskets or "coritas." They are made by first waisting the proximal end to form a point, then retaining the distal end as a handle. A piece of coral (*zix cohq iquipemth*) is then used for sharpening the proximal end to complete the awl. During 1993 and 1994, we registered a total of 132 awls in use, 60 of the metacarpus and metatarsus. These belonged to 60 of 115 artisans. The mule deer is hunted in Seri lands and the coral is obtained from Isla Patos. The conservation of this knowledge and tradition is threatened because of recent statements that declare the mule deer a species in danger of extinction (and therefore protected) and the Isla Tiburón as a biosphere reserve.

Brainerd Ware pottery function explored through opal phytolith analysis of food residues: Robert G. THOMPSON, *Woodward-Clyde Consultants*; Rose KLUTH and David KLUTH, *Leech Lake Reservation Heritage Sites*.

Brainerd Ware pottery was thought to be a Middle Woodland form, found underlying Late Woodland ceramics. Recent AMS dates on food residues from Brainerd Ware vessels date to ca. 3000 B.P. The Brainerd Ware pottery tradition lasts until ca. 1500 B.P., over 1000 years. During this time the role of Brainerd Ware vessels changed. Early vessels contained little evidence of the use of grass seeds, but possible evidence for a focus on starchy seeds. The primary staple food of the Late Prehistoric in northern Minnesota and Wisconsin was wild-rice (*Zizania aquatica*). Wild-rice has been thought to be a late addition to the diet of this area. Analysis of opal phytoliths from food residues in Brainerd Ware pottery from north-central Minnesota show that this food was introduced much earlier.

The hands of a lizard: Chumash ethnoherpetology: Jan TIMBROOK, *Santa Barbara Museum of Natural History*.

During the 10,000 years that the Chumash and their ancestors have inhabited the Santa Barbara Channel region, they developed a distinctive relationship with the land and its flora and fauna, including reptiles and amphibians. In addition to being used for food and material items, these creatures also worked their way into Chumash mythology, cosmology, and art. This presentation, the title of which is derived from a Chumash legend, introduces the ways in which these indigenous people have interacted with the snakes, lizards, turtles, and frogs of south-central California.

Cultural dimensions of agrobiodiversity: The case of cowpea varieties in the US South: Eleanor TISON, *University of Georgia*.

In the southern United States, the cowpea (*Vigna unguiculata* subsp. *unguiculata*) is a culturally-relevant legume crop. Southern farmers and gardeners have developed, cultivated, and named localized cowpea varieties since the crop's introduction to the region in the early eighteenth century. Today, some of this agrobiodiversity is maintained by elderly home gardening seed savers. Using an ethnographic approach, case studies of this type of seed saver are investigated in order to examine the cultural factors that contribute to the *in situ* conservation of heirloom and folk varieties of a traditional crop.

"To preserve and maintain for the generations to come": Strategies for sustainable resource use among aboriginal peoples of British Columbia: Nancy J. TURNER, *University of Victoria*; Marianne BOELSCHER IGNACE and Ron IGNACE, *Simon Fraser University*.

This paper discusses the characteristics and application of Traditional Ecological Knowledge (TEK) of aboriginal peoples in British Columbia. Examples are provided from various groups of a range of features comprising TEK: respectful and interactive attitudes and philosophies; appropriate social institutions; strategies for monitoring, enhancing, and sustainably harvesting resources; knowledge of ecological principles; adaptive strategies; effective systems of knowledge transfer; close identification with ancestral lands; and belief in the power and spirituality of nature. These characteristics combine within a holistic perspective, enabling First Nations societies to live sustainably for many thousands of years.

Floristic variation in Nahua home gardens of Guerrero, Mexico: Alberto VILLA, *Escuela Nacional de Antropología e Historia*; and Javier CABALLERO, *Universidad Nacional Autónoma de México*.

Home gardens are an important agrosilvicultural system among indigenous peoples of Mexico. The structure and composition of home gardens may vary between different ecological and cultural zones. This study describes the Nahua home gardens of the tropical dry forest region of the State of Guerrero, a kind of home garden still poorly studied. A total of 40 home gardens from two villages with contrasting ecological and sociocultural conditions was sampled. Only one of the villages has tap water or any other means of irrigation. The statistical analysis of the data on floristic composition reveals significant differences between the home gardens of the two villages. Home gardens without irrigation are less diverse and have a higher proportion of native plants, mainly wild trees. In contrast, home gardens with irrigation are more diverse and tend to have a higher proportion of non-native plants. These differences also seem to be a reflection of modernization and sociocultural change. These differences may have important implications for conservation of the local flora.

***Euphorbia pulcherrima* Willd.: Cuetlaxochitl, símbolo y recurso de México [. . . symbol and resource of México]:** Marina VILLEGAS Y DE G., Ma. Eugenia ORDORICA V., Delfina RAMOS Z., and Ma. del Carmen FONSECA N., *Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional*.

[*Euphorbia pulcherrima* Willd. (Euphorbiaceae) is a beautiful plant native to the Republic of Mexico, where it is found wild and under cultivation in various regions. Its morphological variation is manifested in its size, branching, foliage, bracts, etc. There are individuals which do not produce flowers or fruits. The relation between this species and humans has been important from the time of the ancient Mesoamerican cultures to the present, both as a symbol and as a resource with various uses. At present, it is known, respected, and ap-

preciated by the Mexican people primarily under the name "nochebuena" among mixed-ancestry Mexicans; among indigenous groups there exist various names in the native languages. The principal uses are ceremonial, ornamental, and medicinal.]

Ethnobotany in the classroom: *Gail E. WAGNER, University of South Carolina.*

This presentation offers a three-year perspective on teaching ethnobotany via the four-field approach in anthropology: cultural, biological, linguistic, and archaeological. Mundane issues such as scheduling, textbooks and presentation are discussed. However, the focus is on course goals and relevance: what should one teach about ethnobotany?

Diversity in Chatino traditional medicine: *Janna WEISS, University of Texas-Austin.*

The ethnic group is the most common designation used for delineating ethnobotanical and ethnomedical studies. Fieldwork with the Chatino of Oaxaca, Mexico (1993–1994) suggests that considerable variation exists in traditional medical practices among the Chatino according to geographic location, linguistic subgroups, and diverse habitats. A transition zone exists between two neighboring Chatino municipalities where distinct material cultures and traditional medical concepts overlap. Aspects of diversity within Chatino traditional medicine will be presented.

Ethnobotany in Colonia la Esperanza de Tijuana, México: *Nancy WILLIAMS, San Diego, California.*

This paper describes an attempt to increase the awareness and understanding of plant uses for medicinal and practical purposes in a border town where most of the inhabitants were raised in different regions and cultures. I compare and contrast the plant uses as told to me by the men and women of the Colonia la Esperanza. Most of the residents migrated from other parts of Mexico and Central America. Some have lived in Tijuana for six months and some for over twenty years. Many bring knowledge from their birthplace, handed down to them by their parents, grandparents, or other elders. Many feel that there is no use in passing the knowledge on, either because the plants do not exist or because their children are disinterested. Several of the people grow their own familiar herbs, and are known throughout the community for their skills in healing with herbs.

The Huichol research and assistance project: A proposed program of cultural reciprocity: *Joseph D. WINTER, University of New Mexico.*

The University of New Mexico has been asked to develop a long-term program of research and assistance with the Huichol Indians of west-central Mexico. In return for technical, medical, and educational assistance, UNM faculty and students will be allowed to carry out controlled, non-invasive research. One element of the proposed program is the creation of a family-oriented agricultural organization that specializes in the collection, preservation, and growth of rare, endangered, and heirloom Native American crops such as traditional tobacco. This paper explains how the organization will operate.

Monte Mojino: Trees and Mayos in southern Sonora: *David A. YETMAN, University of Arizona; Thomas R. VAN DEVENDER, Arizona-Sonora Desert Museum; Rigoberto LOPEZ-E. and Ana Lilia REINA-GUERRERO, Universidad de Sonora.*

Mayo Indian consultants in four villages provided information on traditional uses of 91 species of trees in tropical deciduous forest and thornscrub. Uses of trees were categorized as follows: (1) inherent or esthetic, (2) livestock forage, (3) livestock management, (4) construction, (5) industrial, (6) artifacts, (7) medicines, (8) foods, or (9) cultural. Some eth-

nobotanical knowledge is rapidly disappearing. More pragmatic uses, especially construction, will pass to the Mexican mestizo intact, often with Mayo names. Conversion of forests to buffelgrass (*Pennisetum ciliare*) pastures threatens Mayo tree resources.

Desert and the sown: Pastoral/urban interaction in the Early Bronze Age southern Levant: *Melinda A. ZEDER, Smithsonian Institution.*

The development of a highly specialized economy, which is the hallmark of urban society in the Near East, made increasing specialization in pastoral production both a viable and economically rewarding option, for pastoralist and urban dweller alike. Yet at the same time the distance mobile pastoralists can maintain from centers of urban power also afforded them a great deal of autonomy from urban control, making them a frequently disruptive force for the political stability of urban society. Pastoralists have long been thought to have played a significant role in the rise and fall of urban societies in the southern Levant during the Early Bronze Age (3200–1800 B.C.). This paper examines the faunal evidence from a site on the edge of the Negev Desert spanning the first phases of the Early Bronze Age through the period of urban florescence and decay with an eye to exploring the role of pastoral specialists in the urban economy of the region.

Phytolith analysis and environmental conditions in San Lorenzo, Tenochtitlan Region, Veracruz, Mexico: *Judith ZURITA-NOGUERA, Universidad Nacional Autónoma de México.*

Results of the analysis of plant opal phytoliths recovered from excavations at the Olmec site of San Lorenzo, southern Veracruz, Mexico, contribute to the reconstruction of environmental conditions in the area, as well as to knowledge concerning plant use. Samples were recovered from different archaeological contexts through an intensive sampling strategy from floors, profiles, features, etc. The phytolith analysis shows characteristic species from tropical forest and gives information about Olmec subsistence and construction technique.

**SPECIAL SYMPOSIUM:
The Legacy of Sonoran Desert Ethnobiology**

*Organized by Gary P. NABHAN
Sponsored by the Arizona-Sonora Desert Museum,
Arizona State Museum, & Native Seeds/SEARCH*

The image of ethnobotany in the popular media suggests that all innovative fieldwork on the medicinal value of and all theoretical advances in our understanding of hunting societies derive from research in the rainforest. Ironically, one of the oldest traditions of ethnobiological study is rooted in the North American deserts. It is one which has already spawned commercial products from jojoba, guayule, creosotebush, and mesquite; it has also engendered a revival in the uses of mesquite, prickly-pear, and tepary beans among indigenous communities. Sonoran Desert-based researchers have been key to the history of dendrochronology and the effects of climate change on prehistoric peoples; to the debate regarding the human role in the extinction of Pleistocene megafauna; and to the revival of desert-adapted native crop diversity in water-limited regions. Ethnobiologists interested in folk classification also recognize the uniqueness of Seri Indian over-classification of certain wild plants and animals, for few studies of hunter-gatherer classification systems have demonstrated such depth of knowledge regarding subspecific variation patterns. Finally, the region's institutions have fostered unique collaborations between ethnobiologists, environ-

mental educators, cultural rights activists, and grassroots community organizations. In many ways, Sonoran Desert research has helped make ethnobiology a household word.

Mountain islands in the Hohokam Sea: Overhunting mesofauna? *Paul S. MARTIN, Christine SZUTER, University of Arizona; and David W. STEADMAN, New York State Museum.*

Over half of the native terrestrial vertebrates on islands of the South Pacific disappeared in recent millennia. Waves of land-bird and sea-bird extinction swept eastward from Melanesia and Micronesia to Polynesia on the heels of prehistoric colonization. Mountain islands of the U.S.-Mexican borderlands resemble oceanic islands in harboring terrestrial vertebrates confined to an isolated habitat. Ecologists model extinctions of montane populations of tree squirrels, marmots, pikas, and other mammals in terms of some 12,000 years of habitat shrinkage. Is that the answer, or, as in the case of the South Pacific, did prehistoric foragers also force mountain island extinction?

Managed and cultivated plants in the Sonoran Desert archaeological record: *Suzanne K. FISH and Paul R. FISH, University of Arizona.*

A basic suite of cultivars has long been recognized in the archaeological record of Sonoran Desert farmers. Recent research shows that almost the full suite was cultivated by the time of initial ceramic phases. The list of plants in addition to the basic suite that are known or suspected of having been managed, tended, or cultivated has grown rapidly in the last decade. The evidence for these additional species is discussed, including the discovery of surprisingly prominent roles for them in prehistoric subsistence systems of the region.

Staying sickness, mammalian biogeography, and the origins of northern Pimans: *Amadeo R. REA, San Diego, California.*

Staying sickness, a disease unique to northern Pimans (O'odham), is caused by violations of the "strengths" of certain plants, animals, objects, or ceremonies. Most of these are mammals. But why some and not others? Of 32 northern Piman mammal folk generics, 13 cause staying sickness, while 19 are "safe." Seven "dangerous" mammals are from northwestern Tepiman country while 14 "safe" mammals range throughout the Tepiman corridor. Five widespread "dangerous" mammals can be explained by strong cultural factors; 5 apparently "safe" northwestern mammals are unexplained. I propose that as northern Pimans expanded out of a core Tepiman area between A.D. 1450 and 1650, they endowed the new and strange species of mammals they encountered in the northwest with sanctions associated with staying sickness.

Peoples of the Gulf of California: Abundances and limitations of marine and terrestrial resources: *Richard FELGER, Drylands Institute; and Felipe MOLINA, Native Seeds/SEARCH.*

Resources of the shores, islands, and river deltas of the Gulf of California were rich but highly varied. Peoples of the river deltas were agriculturalists. All relied on wild animals and plants, but those living away from riverine systems were exclusively hunters and gatherers relying on the desert and the sea. Major resources included sea turtles, fish, mollusks, sea grain, and terrestrial animals and plants. Differences in distribution and types of resources led to greatly different lifeways. Fresh water continues to be the single most limiting factor for the cultures of the region.

Where have all the Mayo gone? *David A. YETMAN, University of Arizona; Thomas R. VAN DEVENDER, Arizona-Sonora Desert Museum; Rigoberto LOPEZ-E. and Ana Lilia REINA GUERRERO, Universidad de Sonora.*

In tropical deciduous forest south of the Sierra de Alamos in southern Sonora formerly

Mayo Indian towns now support *mestizo* (mixed-ancestry) populations. In villages to the west in coastal thornscrub and to the south in Sinaloa the Mayo culture is more intact. The extensive ethnobotanical knowledge of the Mayo appears to be assimilated or lost differentially. Here, as throughout rural Mexico, the ethnobotanical knowledge of the *mestizo* cultures is rich, a mixture of information derived from local indigenous groups with the sum of plant uses and names gleaned from three centuries of previous cultural interchanges. Although the general knowledge of many plants continues after acculturation, the intimacy of Mayo subsistence farmers with the plants in their natural habitats is rarely achieved by the recent, livestock-based *mestizo* cultures.

Reconstructing indigenous diets as a means of planning dietary interventions: the Native Seeds/SEARCH diabetes and desert diet projects: Gary Paul NABHAN and Angelo JOAQUIN, Jr., *Native Seeds/SEARCH*.

Many indigenous peoples have recently questioned whether their communities receive any tangible benefits of ethnobiological, biomedical, and ethnohistoric research. Native Seeds/SEARCH staff has spent the last five years directing attention to ways in which a better understanding of historic *O'odham* diets can lead to the prevention and control of adult-onset diabetes mellitus. Prior to 1940, when traditionally gathered and harvested foods still dominated *O'odham* diets, there was virtually no expression of diabetes. Government health workers and pathologists virtually dismissed the indigenous diet as a major factor in controlling diabetes. We have determined that historic diets were extremely rich in substances which control blood sugar and insulin levels. We have educated more than 3000 health workers, teachers, and community leaders about the value of incorporating traditional foods as a culturally and nutritionally appropriate intervention strategy for diabetes sufferers.