

Cultural responsibility in the preservation of local economic plant resources

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Understanding the relationships between indigenous people and their threatened economic plants can aid the conservation effort on many levels. Understanding ethnic perceptions of the taxon is critical to *in situ* and *ex situ* conservation projects and enhances the accompanying educational effort. Examples are discussed from the experience of a grassroots conservation group in southwestern United States, Native Seed/SEARCH. Four levels of economic plant vulnerability are examined among 1) wild-harvested plants, 2) husbanded wild plants, 3) domesticates, and 4) wild relatives of domesticates. Legal interpretations of endangered husbanded and domestic plants are discussed, and further documentation encouraged. Genetic dynamism of threatened indigenous crops is examined and the concept of Systems Conservation (i.e. the plant/human interactive systems) is introduced. Guidelines are offered for incorporating better cultural responsibility into *ex situ* conservation strategies. The concept of Biocultural Restoration is introduced with an example from an O'odham community. Examples are given of ways indigenous peoples and their knowledge can assist in the conservation effort.

Keywords: agricultural systems conservation; threatened domestic plants; indigenous agriculture; landrace; wild crop relative

Introduction

The conservation of threatened *wild* plants, encompasses the natural habitats and the human influences that effect those natural habitats. When we consider saving threatened *domestic* plants, this includes complex, coevolved human/plant systems.

This paper seeks to promote the importance of cultural understanding and participation in the process of saving both wild and domestic threatened economic plants. Using examples drawn from the North American Southwest, where a few indigenous peoples continue to practice traditional agriculture, and where the work of a grassroots seed conservation organization, Native Seeds/SEARCH (NS/S), is having some influence, this paper will emphasize the rapid disappearance of domestic land races.

It is hoped that these ideas, which stray from pure botany or traditional institutional roles, may prove useful to conservation programmes in botanic gardens, governmental agencies, and conservation or educational institutions in areas where the economic plants of indigenous people are at risk.

Methods related here for saving economic plants really involve sociology, anthropology, historical studies, health and nutrition, economics, psychology and ethics, methods that must take into account human communities, lifestyles, global communications, fads, cash economies and rapidly changing awareness (Nabhan, 1985).

Native Seeds/SEARCH – its organization and working methods

NS/S began as a grassroots group in 1977, evolving out of a rural nutrition programme called Meals for Millions, Inc. and becoming a registered non-profit organization in 1983. As of 1993 there are over 3700 supporting members (memberships are \$10 US and up). There are 17 part-time employees (the equivalent of 10 full-time, including student interns) with Native Americans well represented on the staff. Approximately 40 percent of the funding comes from private institutional and individual grants, and 30 percent from sale of seeds and crafts. Donations and membership fees cover about 25 percent of the funding. NS/S members receive a quarterly newsletter with updated information on propagation, pest management, new collections, and the indigenous people themselves.

A stated goal of NS/S is to make available traditional seeds free of charge to Native American farmers or gardeners. During the first 9 months of 1992 there were over 1000 packets of heirloom seed (grown out by NS/S staff and others) given upon request to indigenous people.

On the mailing list are some 33 600 people, the majority of whom are growers of 'heirloom' seeds ordered from the annual seedlist. The NS/S seed collection is focused on the threatened domestic folk varieties and wild crop relatives of the arid Southwest of the USA and consists of over 1200 accessions.

Threatened seed storage is a totally 'low tech' operation, and is considered short term or 'flow through' seed banking. In well sealed glass containers the separate accessions are stored in air-conditioned rooms, in food refrigerators, or in domestic freezers. Accession samples are also sent to USDA banks or other cooperating seed banks and seed exchanges.

NS/S's mission, the conservation of indigenous regional heirloom crop genetic resources, is accomplished using a full range of techniques including *ex situ* and *in situ* measures on a case by case basis plus educational outreach. Great effort is put into dealing with both the general public and tribal people, the media, schools, publications, commercial and non-commercial growers.

Ex situ preservation is accomplished by continued propagation with yearly germination testing and multiple site cultivation under similar climate and horticultural regimes as the site of origin. Everyone, professional or amateur, ordering seeds or volunteering as grow-out gardeners, is given full instructions (as far as are known) for keeping the stock pure. *In situ* preservation, growing out endangered crops in their area of origin, is exciting, complex and difficult. NS/S has become involved in cultural restoration as well as conservation. *Ex situ*, *in situ* and restoration efforts will be described in case studies.

NS/S interprets threatened taxa in a broad sense. In some cases the landraces or folk varieties are grown by a tribal group within a broad area and in other cases are grown only by one indigenous community or family in a single locality. The goal is, therefore, the conservation of not only the regional gene pool (which includes the wild relatives of the same genus found in the indigenous area), but also conservation (where possible) of the indigenous cultivation methods. By sale of native crafts in a harvest catalogue, NS/S encourages indigenous farmers to stay on the land. Where that is not possible, NS/S is helping to document the traditional farming practices for the future. In other words NS/S is attempting something I refer to as 'Systems Conservation'. In Systems Conserva-

tion we may distinguish the plant/human interactive system and the overlapping wild/cultivated plant interactive systems.

Those seeking more detailed information about NS/S may write c/o 2509 N. Campbell Ave, Tucson, AZ 85719, USA (telephone (602) 327-9123).

Concepts and examples of economic plant vulnerability

For discussion I would draw distinctions between four categories of economic plants:

- 1) truly wild-harvested plants (collected for food, fibre, medicine, etc.),
- 2) husbanded, encouraged or semi-cultivated plants not genetically manipulated (There is a continuum from wild-harvested to obligate domesticates.),
- 3) cultivated, domesticated indigenous crops, annual and perennial, and
- 4) wild relatives of cultivated plants in which there is actual or potential out-crossing with domesticates; these are 'economic plants' in the past or future sense, i.e. with unknown genetic potential for plant breeding.

Wild-harvested economic plants. In the case of wild-harvested plants, US government agencies under the Endangered Species Act and volunteer interest groups, such as Arizona Native Plant Society are already dealing with the status of these plants and taking measures to protect them. NS/S's role in assisting with conservation of these has been as communicator and educator. For example, the diminutive red-fruited cactus *Mammillaria thornberi* known to some natives of the Mexico/US borderlands as 'the little rat's pitaya – sweet fruit', is harvested in summer as a snack food. Tohono O'odham people have willingly discussed the rarity of this cactus with NS/S staff and have begun to take measures to protect individual plants from trampling by cattle. I saw a Tohono O'odham gardener transplant a plant found on his own land into a more protected garden site. We find a positive response to protecting rare plants among people who are still close to the land; when shown the importance to themselves they become active participants in conservation.

Wild harvested eelgrass (*Zostera marina*) is a large nutritious grain which grows in shallow marine muds. The Seri people of the desert coast of Sonora, Mexico, have traditionally harvested the wheat-like grain in spring when it washes ashore as flotsam (Felger and Moser, 1973). Although not endangered, it is threatened locally by the rapid destruction of coastal habitats and pollution in the Sea of Cortez. Work by ethnobotanist Dr Richard Felger and linguist Mary Beck Moser (1985) and Mahina Drees, a NS/S founder, serves as an example for supportive work in saving wild-harvested plants. With knowledge of the native language, they have documented the collecting, cooking and processing of *Zostera* and have encouraged the continuation of this Seri tradition. The new NS/S programme of recognition called 'Arizona Regis-Tree' may prove effective in raising community awareness of wild harvested plants. With the simple act of a brass plaque ceremony and publicity, important wild stands where traditional people have harvested plant materials can be distinguished and honored.

Husbanded wild plants. There remains little question about the need to take quick action to save endangered wild plant species, economic or not. The rub comes when the idea arises that a plant taxon has somehow been modified by the hand of humankind. The controversy over interpretation of this point in Arizona and within the Southwest branch

of the US Fish and Wildlife Service (the governmental branch charged with enforcing the Endangered Species Act) has been heated.

If a plant taxon has been 'created' by human selection, manipulation, transplanting or tending, does it have equal status or standing as a plant species that evolved naturally? According to Sue Rutman (pers. comm. USFWS) many of the electorate and legislators think they do not. The Endangered Species Act as presently interpreted does not cover any endangered plant known to have once been cultivated and manipulated by man.

The endangered Murphey's century plant, *Agave murpheyi* (Agavaceae), is a major focus in the controversy. After being listed, surveys have located only 60 clones. As fieldwork progressed it became obvious that *A. murpheyi* clones were always associated with archaeological sites (Hodgson *et al.*, 1989), which prompted archaeologists to recently discover large-scale prehistoric agave cultivation (Fish *et al.*, 1985). Because no wild populations have been found completely unassociated with human habitation, there is rising pressure to de-list this rare agave from the Endangered Species Act. Sue Rutman (pers. comm.) observed that if any individual wild plants were found it would be legitimized. *Agave murpheyi* is a unique taxon, but apparently in its recent evolutionary history there has been a component of cultural history as well. Where do we draw the line at the edge of 'natural history' where native, indigenous peoples have been in contact with the plants surrounding them for hundreds or thousands of years? Do we define a natural ecosystem without *Homo sapiens* in areas where indigenous people have clearly been a part? Those interpreting the US law at present are implicitly defining it just so. An implied corollary is that if an indigenous culture dies, any plant taxon dependent upon that culture for survival somehow deserves to go extinct. In the USA taxa of both husbanded and domesticated plants are not protected by national law.

At local level, there are governmental districts that could adopt legislation to protect at-risk husbanded or domestic folk taxa of plants within smaller areas. There is at least one tribal government, the Akimel O'odham Nation Gila River Indian Community of southern Arizona, that has enacted an ordinance protecting an endangered locally husbanded plant: *Peniocereus greggii*, a night blooming cereus cactus (W. Hodgson, pers. comm.). The Navajo Heritage Programme, one of the most complete natural protection programmes on tribal land, surprisingly does not take into account its own rich diversity of domestic plants. Including folk taxa or husbanded plant taxa as part of native plant protection ordinances could be an effective option for all tribal lands in the US (Sue Rutman, pers. comm.). Efforts should be taken to alert and encourage tribal governments to take this local action for the well being of their cultures as well as for the preservation of genetic information that their ancestors may have helped to select.

On questioning tribal people as to whether to enact tribal ordinances to protect rare cultivars or other plant taxa on their reservations, thus far there has been a negative response. Tohono O'odham tribal leader Daniel Preston, San Xavier District Vice Chairman (pers. comm.) feels that laws should not be necessary. According to Preston, that is not the O'odham way. Their traditional cultural way promotes the cherishing and protection of all natural things. Implicit in the making of a particular plant protection law would be that other non-named plants would somehow be 'fair game' or not worthy of respect as well. Herein is a fine point of cultural responsibility – the importance of hearing other cultural views of the endangered species problem in a context that is broader than one's own so-called modern cultural bias. This is a virtually impossible goal, given that human thought and expression is culturally moulded early on. Preston

stated (pers. comm.) that young O'odham are not learning the traditional ways, and have not learned the cultural respect for living things from their elders. When dollars are seen as the short term reward for exploiting a living resource (cutting the dwindling population of live desert trees to sell as firewood, for example) some O'odham people are selling their own community inheritance. 'To me,' says Preston, 'everything [natural] is now endangered. Our elders remember when it was green all over. With harvesting green trees how long before it is all gone?' Preston's seven-generation concept of endangerment is far more sobering than any present-day botanical or legal definition.

Another example of husbanded plant species at risk because of habitat destruction is the large-seeded salt grass *Distichlis palmeri*. A very nutritious grain, it was known to be harvested and encouraged by natives of the Colorado River Delta region (Castetter and Bell, 1951). With damming of the river since the last century, the marshy habitats it once populated are now all but obliterated. For many years it had been forgotten until it was relocated by Drs Richard Felger and Nicholas Yensen. Dr Anita Alvarez de Williams is currently documenting traditional knowledge of this plant by Cocopa Indian elders (1987). Its potential importance as a crop for poor saline soils has been recognized (Felger, 1979), and Yensen has developed strains responsive to modern agricultural technology and has introduced it to Third World food programmes (Yensen, pers. comm.). NS/S has encouraged sale of his product, domesticated from *D. palmeri*, in an attempt to increase awareness of this rare, formerly husbanded plant.

Cultivated, domesticated crops. To the general public the very concept of *domesticated* plants ever being at risk is somehow unconsidered. Lack of recognition or protection of domesticated plant taxa under the US Endangered Species Act is one of several factors promoting their vulnerability. Indigenous families or communities that no longer practice farming on a regular basis are unwittingly eroding the gene pool of their heirloom cultivars. Most of the indigenous communities that NS/S staff have worked with have only one or very few families consistently growing their traditional crop varieties. And those varieties must be staggered by years so as not to cross pollinate. Cultural change, limited seed viability, and decreasing gene pool size will have led to a critical bottleneck in the survival of many landraces. Because of the nature of domestic plant propagation many taxa, including maize, being totally dependent upon human intervention, the time frame for decline from healthy gene pool or population to total extinction can be a matter of just a few years, or even one year at the extreme.

Perceiving the genetic scope of a landrace population

In order to aim at conserving the complete set of genomes represented in an endangered folk variety we must broaden our scope to include the crop genetic resources available within an entire region. One dimension is an understanding of the broader genetic dynamics of landraces, i.e. the season to season interactions of the growing cultigen with other crops planted nearby and with wild relatives with which it might outcross. Second is an understanding of the human inputs in the landrace's success, i.e. farming methods, trade, cultural taboos, experiments, whims and hunger pressures. A good example is disease resistance conferred by outcrossing with a conserved wild relative. Tepehuan farmers of Mexico's Sierra Madre region spare the weed grass teosinte (*Zea mays* spp. *mexicana*) when it grows near their maize fields because they recognize that it makes their cultivated landraces '*mas fuerte*' stronger (B. Burns, pers. comm.). In fact, in some cases there is

a fine line, or no line at all, between domestic crop resources and wild genetic resources within the same genus. The conservation concept should include both ends of the scale as a system. That is, some are obligate domesticates such as maize, others are in process of genetic selection such as *Proboscidea parviflora* (Black devil's claw fibre) which is used by O'odham basket weavers. During late prehistoric or historic time (probably the last 500 years), weavers began selecting for longer and longer claws from plentiful wild populations, and growing them in summer desert gardens where crossing with wild populations has continued through time (Nabhan *et al.*, 1981). Selection is still in process by indigenous gardeners, with multiclawed sports becoming more common in recent decades.

Perceiving the genetic potential of a landrace taxon

Any conservation effort benefits from an understanding of the cultural significance attached to the endangered landrace. For example, the colour of maize selected and kept pure by Hopi farmers matters deeply in their yearly rituals and ceremony, with each colour representing a cardinal direction and having importance in prayer and symbolism. The kernal type of each Hopi landrace of maize determines exactly how the Hopi will prepare it to be eaten; some styles of kernal are for grinding, some for parching, some for popping, some for stewing as hominy, some for eating fresh, some for roasting and drying for later steaming; and of the kernals to be ground, some are for sweet tamales, some are for paper piiki, etc. (Denise Masayesva, pers. comm.). Knowing these traditional uses, or helping elders teach the uses to the decision-making public, can enliven the conservation effort.

Being sensitive to cultural uses of folk taxa can help bring to light the valuable genetic adaptations they hold. There is a relatively rare folk variety of orange speckled lima bean (*Phaseolus lunatus*) grown by the Hopi and used in the ceremonial kachina bean dance performed to bring rain. The colourful limas are sprouted with warmth in dark underground chambers called kivas. The giant bean sprouts signify renewal. Their selected adaptations to the dry climate and poor sandy soil of the Southwestern plateaus are 1) storage of high energy (higher carbohydrate and protein than other varieties of *Phaseolus*) for a good headstart in germination and root formation when rain comes, and 2) rapid response time to sporadic rain episodes.

The cultural way with Tohono O'odham tepary bean (*Phaseolus acutifolius*) is a similar case in point. Traditional planting is done just before the coming of monsoonal storms in the low desert. Timing of planting and watering is critical to the successful cultivation of tepary and exemplifies its genetic adaptations. When stressed for water, teparies channel nutrients into seed production, concentrate protein (as much as soybean), and pods are more abundant per plant (G.P. Nabhan, pers. comm.). Our awareness of the genetic potential of the rare cultigen is enhanced and better defined by understanding cultural practices.

Documentation and the issue of ownership

There is a need for threatened folk taxa to be more fully documented and described taxonomically. Limited time and funds, plus higher priorities in the areas of field collection and propagation, have precluded the taxonomic work. We have encouraged and continue to encourage botanists to make use of our collection for documentation purposes. Kent Whealy (Seed Savers Exchange, Decora, Iowa, USA) (pers. comm.)

suggests as a first step in non-destructive documentation to photograph the grown-out accessions alive against a gridded background sheet (analogous to an herbarium specimen).

Documentation also sets much needed precedence in defining a pre-existing, genetically manipulated plant product as either public domain or tribal property for plant patenting cases. Some conservationists are of the opinion that a tribe whose ancestors were responsible for domesticating and preserving a given folk taxon should hold legal rights, or more appropriately intellectual property rights, to it (D. Soleri, D. Cleveland, pers. comm.). Native Seeds/SEARCH as an organization is not currently participating in this political debate. In the experience of NS/S collectors, the indigenous people themselves growing the endangered crops have no idea of the issues on the national or global level nor of their potential monetary value to commercial breeders or multinational corporations (K. Dahl, pers. comm.). NS/S believes in free access of the seeds to all people and corporations (K. Dahl, pers. comm.). Thus far the seeds collected have not come with stipulations about further use. The NS/S stance is pragmatic in that there is no way to prevent use of these seeds once they have been purchased via the seedlisting catalogue. In fact it is a tacit honour if a given heirloom is considered useful in plant breeding; it endorses the effort of saving the genetic material for the future. As for ownership, or more accurately stewardship, of NS/S accessions, the organization has provided in its by-laws for a Seed Will: in the unlikely event of dissolution of NS/S, the collections will go into the care of Seed Savers' Exchange, Decora, Iowa. We stress the need for any organization, particularly small ones, or individuals dealing with rare plant material, to create a Seed Will to provide for continued stewardship in the hands of at least one responsible, established organization.

Ex situ conservation of indigenous crops-NS/S strategies

Where a threatened domesticated genome is found or collected and where no traditional culture or indigenous farmer has continued the tradition, the *ex situ* conservation work of NS/S is straightforward: to multiply the seed in as close to the assumed conditions of origin as possible. We set priorities based upon how rare or endangered we perceive the accession to be. Anecdotes or seed savers' stories are logged. Records are kept regarding source, treatments in grow-out, etc. With staff and volunteers seed grow-out plantings are planned for keeping stock pure. Pollination of maize, for example, is designed according to crossing plans by Dr Peter Bretting, USDA maize expert to maximize the preservation of genetic diversity. Where necessary, bagging of tassels or seed heads, caging of outcrossing plants, or distance planting are performed.

In the mid-1980s, NS/S inherited a collection of Mojave, Pima, Paiute, Yaqui and other maize varieties, originally collected by a prospector in 1868 and passed along by a series of conscientious seed savers/gardeners who kept the genomes viable. NS/S felt it culturally responsible to publish the *ex situ* conservation story along with the seed saving process itself (Burns, 1987). When shown the heirloom Prima variety, Prima farmers responded that it had not survived in their own tribal community (M. Drees, pers. comm.).

At present on the national level, an integrated strategy for *ex situ* conservation of indigenous crops does not exist for the USA. NS/S founder Gary Nabhan represents the issue on the National Academy of Science as a committee appointee. A similar committee of the USDA Plant Genetic Resources Board appointed by Congress has been

disbanded. Ethiopia's national programme for *ex situ* conservation of indigenous crops (coffee, barley etc.) may prove a good example for a broad based strategy (D. Soleri, pers. comm.).

Extrapolating from NS/S experience, I would suggest that any integrated strategy for *ex situ* indigenous crop conservation should consider at least the following: 1) an approach, both in terms of the taxa to be conserved and of the action area of the working groups, 2) empowerment of those people closest to the threatened taxa, 3) a sense of the greater botanical and cultural contexts – systems conservation and biocultural approach, 4) documentation and a choice for ownership if it exists, 5) install open, flexible communications networks and create opportunities for traditional people and individual seed savers, 6) use of the profit motive – encouraging a cottage industry based on endangered heirlooms could save genetic resources and cultural knowledge, 7) multiple site cultivation increases chances of plant preservation, 8) use of all possible groups that might be interested in the conservation effort for any reason – self-promoting or altruistic (such as schools, universities, seed banks, botanical gardens, tribal groups, computer networks, agricultural extension, village communities, garden clubs, native plant societies, corporations, municipal water departments, rural health offices, community food banks, etc.) and 9) elevation of indigenous farmers/plantspersons into advisory and educator positions (teacher/counsellor for workshops, lectures, video programmes; committee member/advisor in conservation planning groups, government agencies). Strategies for horticultural maintenance and multiplication of seed are well covered in other publications, but integrating such conservation techniques within a cultural context using the type of guidelines mentioned above may mean better leverage for the conservation effort, or even make the difference between ultimate success and failure of the effort.

In situ conservation of indigenous crops – NS/S strategies

The Native American Farmers' Network, initiated in 1991 by NS/S, seeks to form a communication link among the traditional farmers still practicing today in the American Southwest (NAFN Newsletter 1992). This is a first step to give farmers an opportunity to share ideas and offer each other mutual support. NS/S intends to act as facilitator and then drop out when the network is in the hands of the native farmers themselves.

The Hopi people of northern Arizona are among the most secure in terms of their continuing culture and agriculture. Research by Daniela Soleri and David Cleveland (pers. comm.) updating the records of traditional Hopi crops being grown in the 1930s (Whiting, 1939) was made possible by their unobtrusive approach to information gathering. They are gardeners themselves and in discussing rare crops and traditional methods with Hopi farmers they could speak with knowledge and empathy. Such an approach is critical in developing a rapport with people who may collaborate in saving threatened plants.

Biocultural restoration – a NS/S example

In addition to *in situ* and *ex situ* conservation, NS/S has been involved in an effort analogous to restoration ecology. It has restored endangered domestic plants and a lost farming tradition. It might be more appropriately termed 'Biocultural Restoration'. The Tohono O'odham people are inhabitants of the San Xavier District, southern Arizona. Being close to the Tucson metropolitan area, the San Xavier people have been influ-

enced by city jobs and economics, and by the Bureau of Indian Affairs (BIA) heavily regulating their agriculture. Members of the Farm Cooperative Board have begun to recognize many cultural difficulties brought about by government handouts of money or non-traditional commodity food, lease payments to the tribe from mines on reservation lands, and BIA land allotment regulations. The Farm Board decided to try returning to traditional agriculture for a variety of cultural reasons – to get youth off the streets and into active community participation, to inspire and endorse elders, to reintroduce healthier foods at no cost, and to circumvent cash economics. The Board found no one left in the native community who could offer traditional instruction on indigenous O’odham agriculture and no one who had traditional seeds. There was a two-generation gap in traditional knowledge and seed saving, in effect a local extinction of the local gene pool of an unknown number of folk varieties, and the local extinction of a cultural tradition.

The Board went to government agents seeking advice on growing traditional crops. They were informed by the Central Arizona [water] Project and the US Department of Agriculture Cooperative Extension Service that nothing but cotton or alfalfa could be grown with the available water (Preston and Pablo, pers. comm.). In a final attempt they came to NS/S which had offered traditional seeds in the past and had presented traditional food programmes at tribal health fairs. NS/S provided seed of every available accession from O’odham farmers in its collections and also acted as a networker providing names of the few remaining traditional O’odham farmers available for guidance. The O’odham brought elders to bless the seed in traditional style. They brought elders and young people together to plant with traditional sticks in time for the summer rains. Hoeing and harvest became a community activity. Traditional grown tepary, fast-maturing tamale corn (*Zea mays*), O’odham pumpkin (*Cucurbita argyrosperma*) and heirloom yellow watermelon (*Citrullus lanatus*) from two summers’ harvests are now feeding children in the mission school and the elderly (Pablo and Preston, pers. comm.). The San Xavier project is working and goes far beyond the conservation of threatened crops.

Wild relatives of cultivated plants. NS/S has taken an unprecedented step in saving the habitat of a wild crop relative, the chiltepin pepper (*Capsicum annuum* var. *aviculare*) known in southern Arizona only from two main localities. It is a favoured spice plant and is heavily exploited by indigenous peoples and mestizos in Arizona and northern Mexico. NS/S is working with the US Forest Service to have the Chile Reserve officially set aside and fenced against grazing livestock, and is even running eco-tourism visits into the area to raise public interest. The levels of cultural responsibility serve as a model of bringing agencies and individuals together in working toward a common conservation goal (Nabhan, 1990).

Education and cultural responsibility

Educational outreach can play an important role in conservation efforts. In helping to educate the dominant modern culture or populace we focus our presentation to the needs of the urban community. With heirloom varieties in the gardens they can save water, use less fertilizer, apply less hazardous pesticides, eat healthier food, and support a worthy effort at the same time.

Enlisting Native American elders as teachers or teaching partners has been a very

rewarding method. To elevate the traditional gardener or cook to their rightful position as expert outside their own community in a teaching context, honours the tradition and the rare folk varieties they discuss, and to the audience gives a sense of experiencing a rare opportunity. Empathy with a native person is, we find, the quickest and most lasting way for a plant-illiterate urban dweller to become conversant about and to appreciate plants in general, rare plants in particular.

Another culturally conscious programme undertaken by NS/S is the 'Diabetes Prevention with Desert Foods Project'. Brand *et al.* (1990) and Nabhan (1991) showed that many traditional foods, including rare landraces of tepary, limas, chia (*Salvia* spp.) have properties that help balance blood sugar and are effective in treating and even preventing Type II Diabetes. Some Native American communities in the Southwest now are experiencing adult-onset (lifestyle and diet-induced) Diabetes Mellitus at epidemic rates. Over 40% of Pima Indians over age 35 are diabetic (Cowen, 1990). With modern processed foods and sedentary lifestyles the number afflicted is increasing and the age of onset decreasing. The costs in medical treatment and social tragedy are alarming. The message, that traditional desert foods could help allay the disease, is significant. It is a positive message which adds personal and cultural impetus to the folk-plant conservation movement.

Organizational effectiveness and cultural responsibility

A grassroots conservation effort such as that of the non-governmental organization Native Seeds/SEARCH, finds its energy and impetus from the bottom upwards. An NGO has the distinct advantage of high energy, impetus, enthusiasm and creative skill at the soil and seed level where the real work must ultimately get accomplished.

With a grassroots effort there are far fewer politics to deal with, fewer bureaucracies, fewer monetary constraints, and fewer decision-making steps all of which would serve as barriers to wise or timely action. With an NGO a community wisdom can be achieved, melding this perspective with local cultural truths and ways, and achieving a consensus about implementation. Thus a grassroots or NGO effort can prove far more efficient in terms of time, human energy, and money expended, more sensitive to cultural needs, and at the same time preserve the contextual integrity of the conservation project at hand.

Concluding statement

Experience of the grassroots conservation group Native Seeds/SEARCH shows that conservation of endangered economic plants entails understanding and preserving complex, evolving systems of plants and cultures. Reintroduction of threatened cultigens involves reestablishing an appropriate cultural context. Cultural responsibility includes not only a deep understanding of the indigenous cultures that traditionally have used the plants but also required considering the modern public, and securing their support and interest.

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References

- Alvarez de Williams, A. (1987) Environment and edible flora of the Cocopa. *Environ. Southwest*, **519**, 22–7.
- Brand J.C., Snow B.J., Nabhan G.P. and Turswell A.S. (1990) Plasma glucose and insulin responses to traditional Pima Indian meals. *Am. J. Clin. Nut.*, **51**, 416–20.
- Burns B.T. (1987) Homer Owens. *Seedhead News*, **17**, 2.
- Castetter E.F., and Bell W.H. (1951) *Yuman Indian Agriculture*. Albuquerque, New Mexico: University of New Mexico Press.
- Cowen R. (1900) Seeds of protection. *Science News*, **137**, 350–1.
- Felger R.S. (1979) Ancient Crops for the Twenty-first Century. In *New Agricultural Crops (AAAS Selected Symposium 38)* (G.A. Ritchie, ed.) pp. 5–20. Boulder, Colorado: Westview Press.
- Felger R.S. and Moser M.B. (1973) Eelgrass (*Zostera marina* L.) in the Gulf of California: discovery of its nutritional value by the Seri Indians. *Science*, **181**, 355–6.
- Felger R.S. and Moser M.B. (1985) *People of the Desert and Sea*. Tucson, Arizona: University of Arizona Press.
- Fish S.K., Fish P.R., Miksicek C. and Madsen J. (1985) Prehistoric agave cultivation in southern Arizona. *Desert Plants*, **7**, 107–12.
- Hodgson W., Nabhan G. and Ecker E. (1989) Conserving rediscovered agave cultivars. *Agave*, **3**, 9–11.
- Nabhan G.P. (1985) *Gathering the Desert*. Tucson, Arizona: The University of Arizona Press.
- Nabhan G.P. (1990) Conservationists and forest service join forces to save wild Chiles. *Diversity Mag.*, **6**, 47–8.
- Nabhan G.P. (1991) Desert legumes as a nutritional intervention for diabetic indigenous dwellers of arid lands. *Arid Lands Newslett.*, **31**, 11–13.
- Nabhan G.P., Whiting A., Dobyns H., Hevly R. and Euler R. (1981) Devil's claw domestication: evidence from southwestern Indian fields. *J. Ethnobiol.*, **2**, 135–64.
- Whiting A. (1939) *Ethnobotany of the Hopi (Museum of Northern Arizona Bulletin No. 15)*. Flagstaff, Arizona: Northern Arizona Society of Science and Art.