

ARID LANDS NEWSLETTER

January 1984 No. 20



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PAPAGO MAN-IN-THE MAZE

depicting symbolically the figure of a man (representing the Papago people as a whole) seeking the deeper meaning of life itself — the center of the circle — which he can achieve only by passing first through his particular social structure and all its struggles.

COVER: Baboquivari Peak [in Papago called 'Waw Kiwulk' — Cliff-Drawn-in-the-Middle], sacred to the Papago Indians as the legendary home of I'toi, the Papago Creator. This picture shows a section of Arizona State Highway 86 angling northwest of 7730' Baboquivari, from Covered Wells to Sells, with the waters of storm-filled *charco* reservoirs spotted here and there.

—photo © by Peter Kresan, used with permission

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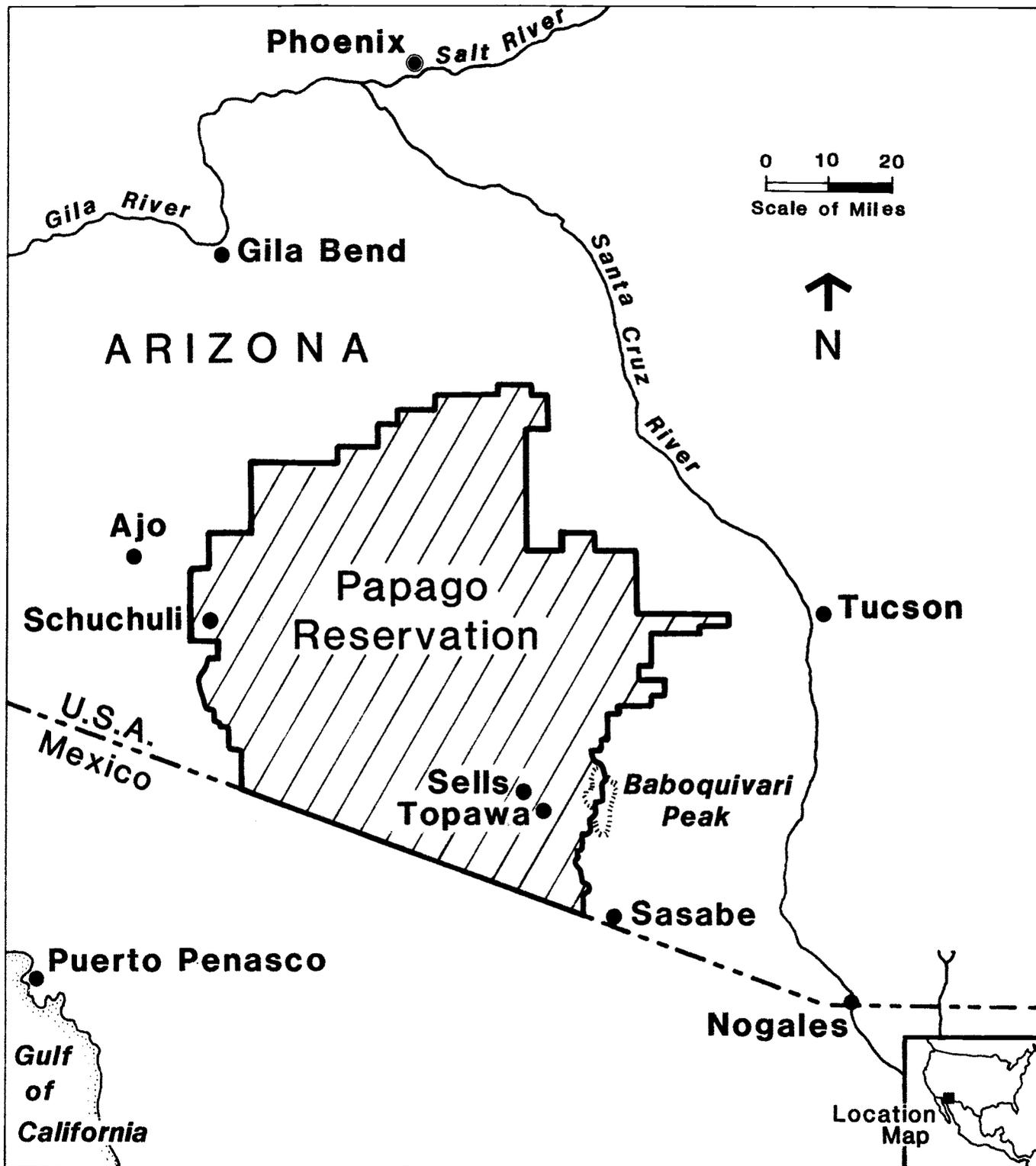


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Papago Indian Reservation



Cartography: Billie Jo Lobley

PAPAGO INDIANS — A PASTORAL SOCIETY IN TRANSITION

This special issue of *Arid Lands Newsletter* is, except for continuing features, dedicated to information about the Papago Indian Reservation, an area of nearly three million acres southwest of Tucson, Arizona, where some 15,000 Papagos live in the Sonoran Desert. Because of their potential for illustrating in a dynamic way the transition from a pastoral society to one capable of self-determination in a growing technical society represented by the presence of Kitt Peak on the Reservation, and an increasing technological urban society in adjacent Tucson, we felt that this exposition might serve as a model for other pastoral societies worldwide, in transition, too.



Preamble to the Constitution and By-laws of the Papago Tribe:

We, the members of the Papago Tribe of Sells, Gila Bend, and San Xavier Reservations, in the State of Arizona, in order to build upon our established laws and customs and form a tribal organization; to establish justice; to insure tranquillity and liberty; to conserve our tribal property; to develop our common resources; and to promote the best welfare of the present generation and our children in education and industry, do ordain and establish this Constitution and By-laws.

PAPAGO TRIBAL GOVERNMENT

In 1937 Papagos voted to organize themselves under the terms of the 1934 Indian Reorganization Act and the current Papago government system was created.

A tribal constitution was adopted in that year and it created eleven political districts on the reservation: San Xavier, Gila Bend and nine districts on the main reservation.

The Papago Tribe of Arizona is governed by a tribal council and an elected chairman and vice chairman. Each district sends two representatives to the tribal council. The districts also have their own district councils made up of village representatives.

THE PAPAGO TRIBAL COUNCIL'S CHAIRMAN SPEAKS FRANKLY TO ARID LANDS NEWSLETTER

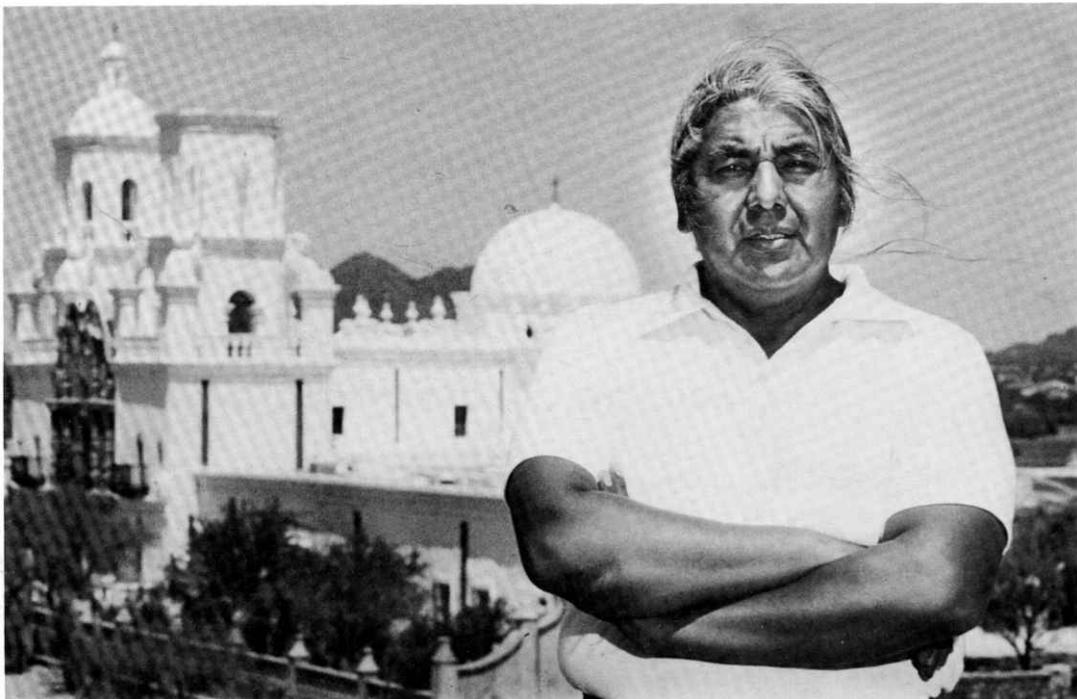
PP: As you assume the leadership of the Papago Tribe through your election to the Chairmanship, what do you identify as the most critical issues to be studied and acted upon? education? medical services? out-migration of young Papagos? reconciliation between traditional cultural attitudes and the benefits to be achieved through introduction of modern technology?

Moore: All of these, certainly, and perhaps others. But I believe I can speak for the Tribe as well as old and young Papagos alike when I put education at the top of your list, for without this underpinning of understanding of a society of which we are a part, even though we are different, the coming generations of Papagos will be handicapped intellectually and vocationally. To enjoy the 21st Century as well as contribute to it, in the unique ways our Tribe can do, we must emphasize this aspect of our development and support it in all ways.

To survive to enjoy that future, however, we are determined not to neglect the medical services that we already have the good fortune to be served by, but to improve them and make sure that they are extended to all members of the Tribe, no matter how remote their villages. Specific problems with diabetes, for instance,

have been recognized and are being studied. Mental illnesses caused by cultural conflicts as young Papagos come face to face with unfamiliar attitudes and their exposition are not yet widespread, but even one instance is one too many. We want very much to provide an awareness of values inherent in being a Papago to support those in need of such values. There are some advantages, perhaps, in outmigration, though we like to think that eventually some will return, bringing with them skills and knowledge that can benefit the Tribe. Reconciliation is a good word; I am glad you used it, because I truly believe that *learning is learning is learning*, and that there is no need for conflict between Papago - Anglo education.

PP: While I do not want you to dwell on failures, could you speak briefly about such past 'happenings' as the solar experiment? I remember with what joyous expectations I published a note in *Arid Lands Newsletter* nearly three years ago calling the arid world's attention to ' . . . the world's first solar-powered village at Schuchuli, deep in the Papago Indian Reservtion in the Sonoran Desert.' What happened?



Josiah Moore, Chairman, Papago Tribal Council, San Xavier Mission background.

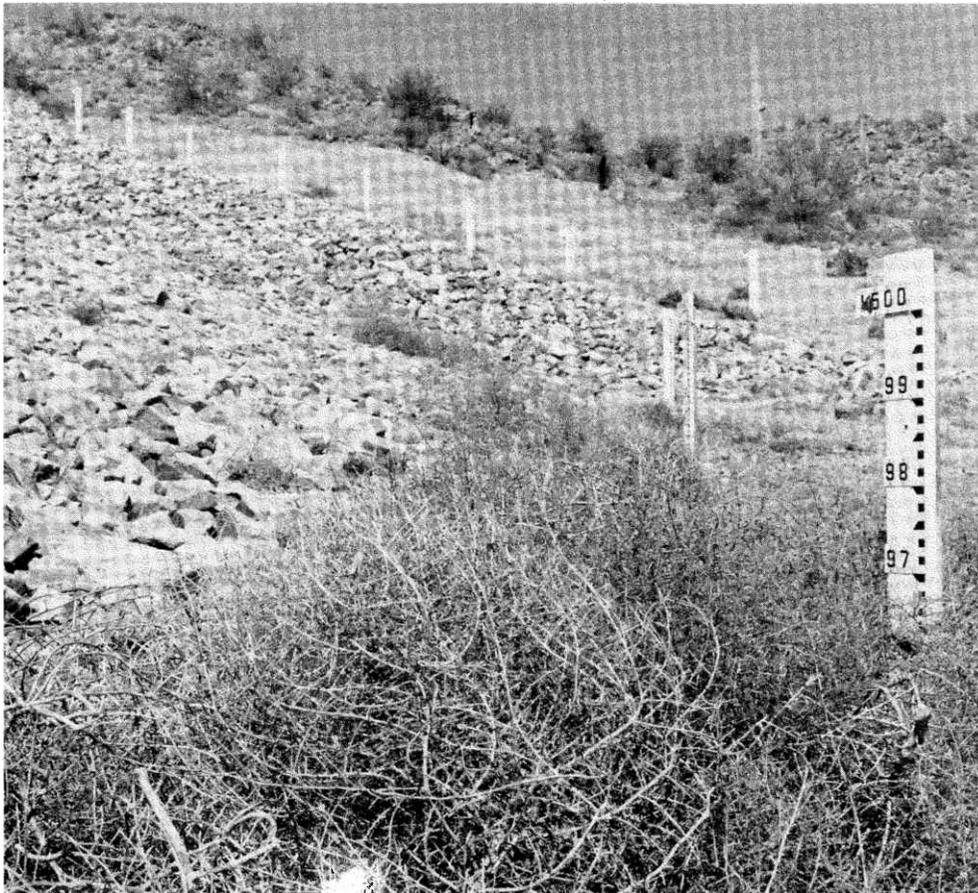
—photo reprinted courtesy of the *Tucson Citizen*

Moore: First, let me assure you that it is not a 'failure.' Its development is delayed because, as in so many LDCs elsewhere in the desert world, *too much high-tech dumped on people without proper preparation can create an indifference to its benefits.* Give us some time and you will find us taking advantage of what it has to offer in ways best suited to our needs. We require more patient explanations of what has been done and how such actions can be helpful. The solar business is going forward, with modifications, as we are able to extend its application to specific needs with the support and understanding of those to be served.

PP: I am glad to hear this, and will try to be patient for a more upbeat report later. But, and this is a big one, what about the Tat Momolikot Dam? I was amused recently to read a 'Letter to the Editor' of the *Arizona Daily Star* [Tucson] after the recent flood of early October from a reader in Quincy, Illinois, inquiring ' . . . if the dam did what it was supposed to do?' The Editor's note, following, quoted a BIA official who affirmed that it did indeed do what it was supposed to do. I think I'd be more comfortable with such an affirmation from you.

Moore: Well, if it hadn't been empty before the flood, yes, floodwater might have spilled over the dam, in which case I suppose we might say it was 'functional.' But I will not affirm that that dam is in any respect of value to the Papagos. We are trying legally to claim its benefits from the BIA and those other agencies that dreamed it up, spent many millions on it, and left us with less than nothing. It is Papago land, it is ours, and we will never give up trying to recover our rights and our benefits. The land was transferred as an outright gift, based upon false pretenses — the promise of lakeside recreation revenue and irrigation water, none of which will accrue to the Tribe. Yes, Tat Momolikot is a failure, *but it is not a Papago failure.* And only we can reclaim and reestablish what its construction cost us in ways having nothing to do with money.

PP: Desert housing happens to be a special interest of mine, so I was happy to see that the Tribe has established a Papago Housing Authority. I see all kinds of new houses here in Sells as we drive back and forth, but they look like Tucson, or Phoenix, or Ajo, nothing distinctive or typically Papago. Is the 1978 attempt to reintroduce some old techniques that made housing more environmentally comfortable still alive? Has any progress been made?



Tumbleweeds around the base of the next-to-lowest water depth gauge behind Tat Momolikot Dam, Santa Rosa Wash, Papago Indian Reservation, Arizona. 'Reservoir' is called Lake St. Clair.

—photo by John P. Schaefer

Moore: I am familiar with your interest, having read yours and Ken Clark's *Desert Housing* book, and was intrigued by the many desert housing problems endemic throughout the world. I hope we can all help each other in this field. It is true that many of the houses here you have noted are suburbia bedroom-type, here again because Federal funds through the Department of Housing and Urban Development [HUD] simply imposed this type upon us without any reference to our particular architectural needs. We are attempting to address this now so that housing, under Tribal Authority, will be more responsive to the indigenous architecture of the area. Certainly we recognize that other desert societies have design we could adapt without sacrificing our own traditional and cultural preferences — as we hope some of those might be useful to our friends in faraway desert places. The Papago Tribal Utility Authority is doing a splendid job in this field in support of the Tribal Housing Authority, and it is our expectation that together we can provide adequate comfortable housing for all in need.

PP: Having spent time on several occasions in Israel to study that country's dynamic responses to various desert problems, it occurs to me that perhaps their concept of the kibbutz might interest you. I am thinking about isolated communities or settlements creating a neighborhood arrangement for the autonomous sharing of activities by which the whole community benefits — farming, range management, educational services, water distribution, sewage disposal, etc. Is the corollary of such arrangements already 'in place' on the Papago Reservation? Does it work?

Moore: To a limited extent, mainly through livestock management, with the employment of a District brand, for instance. As an extension of the idea, I might mention the participation of the entire community on traditional ceremonial occasions, the rodeo, for one, the celebration of St. Francis on December 2nd, certain feasts on special days. The important aspect of such community undertakings is the fact that they are all-inclusive, that the management of such celebrations is transitional in

nature, i.e., the incoming managers work closely with the outgoing crew to provide a smooth transfer of experience. The continuity of meaning has great value for our people, and the sharing of these celebrations in common have great meaning to Papagos, as I am sure they do elsewhere with societies such as ours. Further evidence of this sharing, of course, is the way in which our society functions as a whole, with the transitional aspect of our government displayed daily in *the path decisions travel: from village to District to Council.*

PP: There are many of us beyond the Reservation who admire and respect the O'odham, and who want to share your problems with you. You, as Chairman, will be too polite to say to me directly that we should mind our own business, but do you honestly believe there are ways in which we can contribute to solutions for some of your problems, rather than aggravating them as we have so often done in the past? I am not trying to tell you anything you do not already know, but I'll say it again anyhow: We have as much to learn from you as you do from us.

Moore: You are helping in many ways, as you should know as a representative of the University of Arizona. The operation of your monthly outreach clinic for Sells residents in cooperation with Good Samaritan Hospital in Phoenix, is an example of efforts to introduce rehabilitation programs to our Tribal government. And your promise to work toward the day when we may have a Papago director of this program is perhaps the best way to let us know that you believe in our commitment to self-determination.

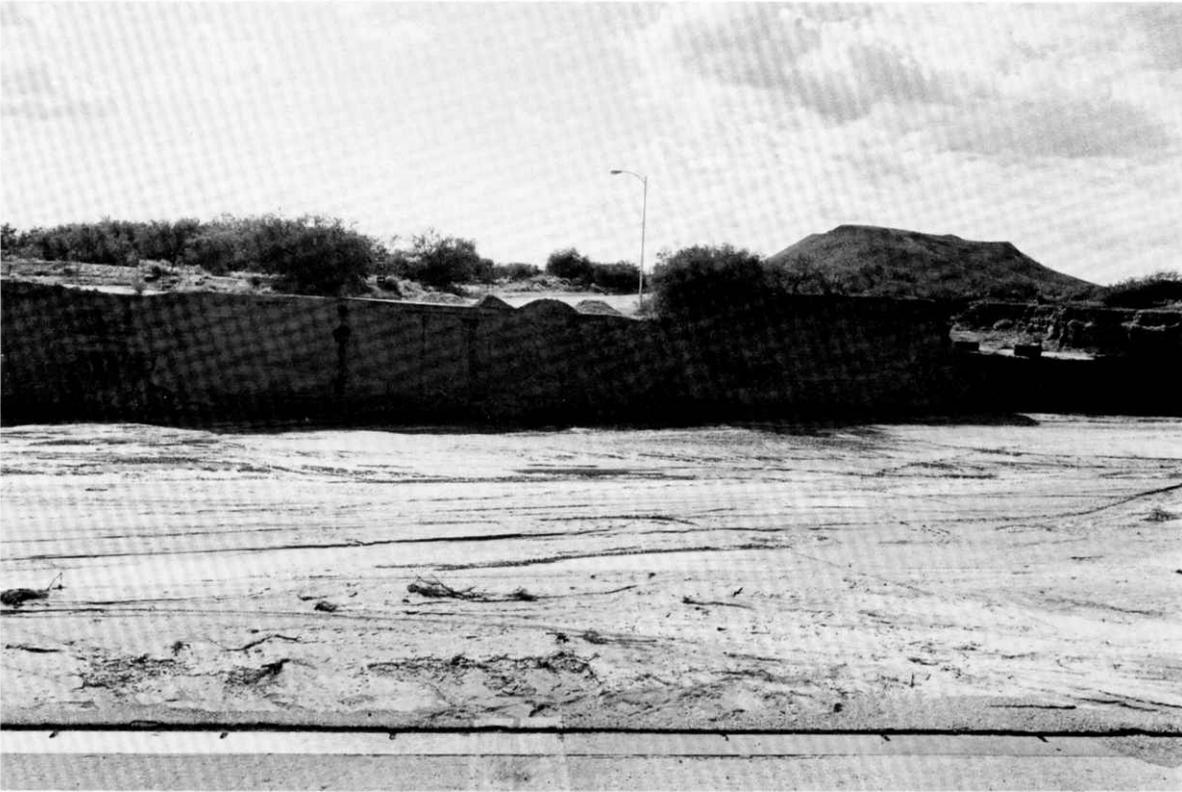
PP: Mr. Chairman, I think you ought to know as I say thanks and goodbye that I was born on the edge of the Mescalero Apache Reservation, grew up with the Yavapais, but now I feel that I have 'come home' in this heartwarming association with Papagos. I hope you will take me in.

—Patricia Paylore

QUOTE

' . . . The wolfish feathered warrior who represents the Indian in popular art has become as standardized as the eagle on the coin, whereas the nonfighters have remained almost unknown. These peaceful Indians, who had something to live for when war was abolished on their remote mesas and in their desert valleys still carry on, beneath their modern externals, a life based on other ideals than ours and aimed toward other goals.'

—Ruth Underhill, *Singing for Power: The Song Magic of the Papago Indians of Southern Arizona*. 1938. Reprinted by University of California Press, 1968.



Looking south-southeast toward Black Mountain from the edge of a washed-out bridge over the Santa Cruz River, San Xavier Indian Reservation, Arizona, November 8, 1983.

—photo by John P. Schaefer

A Visitor's-Eye View of Papago Tribal Council Staff Meeting

Monday, December 12, 1983

Dr. Allyn Spence and your Editor were privileged to sit in on a staff meeting of the Tribal Council in mid-December, presided over by the Chairman, Josiah Moore. A number of topics were brought up for review and discussion, such as:

- impact of various mining enterprises cutting back or closing down, due to declining price of copper
- flood relief following the 'event' of early October. We were encouraged to learn that the State of Arizona will extend the washed out San Xavier bridge to the Reservation bank. It was heartening to learn, too, that other Indian tribes of Arizona, not affected by the flood, had loaned equipment for the repair of damage to Papago roads
- certain revisions to the Constitution recommended to the Council by various Districts
- the possibility of modifications by the Agency Health Service for certain medical procedures, particularly relating to dialysis

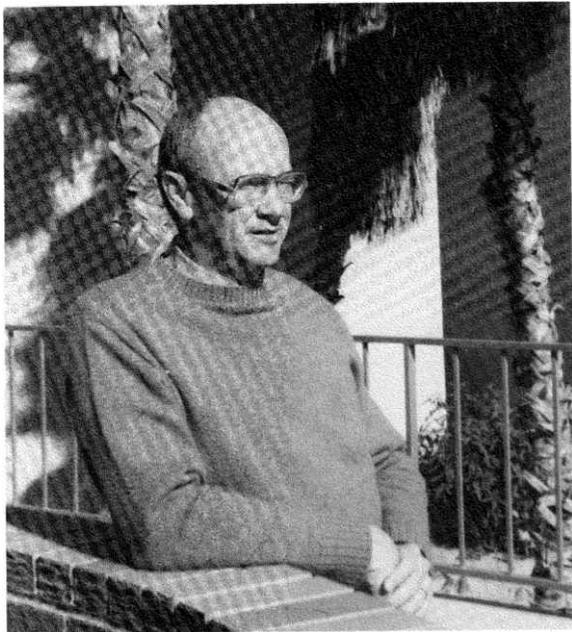
Following the business discussed, various personnel made announcements relating to activities coming up for the Christmas holidays, including a Papago arts-and-crafts show, being mounted in the library [we went over later to marvel at the displays of Papago creations].

Meeting adjourned at 10:30 a.m.

—pp

DEVELOPMENT PROPOSAL FOR THE SAN XAVIER INDIAN RESERVATION: A Clash in Value Systems

Bernard L. Fontana*



Bernard L. Fontana

History

The San Xavier (Papago) Indian Reservation was created by Executive Order of President U.S. Grant on July 1, 1874. Its approximately 71,000 acres were withdrawn from public entry and reserved for the exclusive use and occupancy of the Papago Indians of Arizona. The lands within the reserve's boundary, like those within most reservations in the United States, were, and are, held in trust for the Indians by the federal government. The Bureau of Indian Affairs, a bureau within the Department of the Interior, is the federal agency responsible for administering that trust.

When the reservation was created in 1874, its lands were held in common by all Papagos. The uses they made of the land for farming, grazing, gathering, woodcutting, and housing were determined by Papago custom. Nearly all residents of the reservation, some 400 of them, were related either by blood or marriage and interpersonal relationships were mediated through the rules of kinship behavior.

Further, in 1874 the fledgling non-Papago community of Tucson, Arizona, lay about nine miles from the

Throughout the world, when they come into prolonged contact there is an inevitable clash of value systems between peoples whose cultures are characterized by a rural subsistence pattern and those whose world view is conditioned by an urban setting and an industrial, expanding cash economy. As more people crowd into cities, adjacent lands climb in monetary worth. Historically, the owners of occupants of such lands have tended to be farmers, fishermen, or pastoralists, people relatively unsophisticated concerning the complex cash economy upon which urban centers depend.

In increasing numbers, rural peoples find themselves set upon by entrepreneurs who are outsiders to their communities, urging them to become partners in schemes to create a steady cash flow from the earth. Property that was once farmland, grazing land, or land for small littoral settlements becomes conceptualized as "real estate," a commodity to be sold, leased, and "developed" for whatever uses might generate the most money. This process is one that has been going on for many years in the United States where urban centers have been growing next to lands contained within Indian reservations. A typical example concerns the San Xavier (Papago) Indian Reservation lying within the bounds of the Sonoran Desert in southern Arizona.

residential area of the reservation. Tucson was a shopping center for Papagos and a place they could go to sell or exchange farm produce, earthenware pottery and baskets made by Papago women, cattle, and mesquite wood used as fuel. Those who chose to do so could also exchange their labor for cash. The relatively few non-Papagos who went to the reservation did so to visit Mission San Xavier del Bac, a magnificent late Mexican Baroque church of the eighteenth century and which continues to provide a tourist attraction. Reservation lands, completely rural, were surrounded by lands equally rural.

In 1887, the United States Congress approved a piece of legislation variously known as the General Allotment Act, the Dawes Act, the Severalty Act, of the Individual Allotment Act. It had been decided upon by the Congress that the greatest impediment to the "progress" (i.e., cultural assimilation) of the American Indian had been tribal — as opposed to individual — ownership of land. The Dawes Act authorized the President of the United States to divide reservation lands into 80-acre farming

*Field Historian, University of Arizona Library, Tucson, Arizona 85721.

parcels or 160-acre grazing parcels and distribute them to individual heads of households. Single males over the age of 18 got half that amount; married females whose husbands were living got none. Lands remaining unallotted when the process was completed were declared "surplus," continuing in tribal ownership until they could be disposed of by sale, with the proceeds going to the trust fund of the tribe.

The expressed hope of the Congress was that at the end of a 25-year period, during which time the title to the allotment would remain in federal trust, the allottee could be given title in fee simple, the land would go on the tax roles (lands held in federal trust are not taxable), and its now-civilized owner could do with it as he chose in the manner of any non-Indian owner of land.

The federal allotting agent arrived at San Xavier in 1890. He counted 363 Papagos as being residents at the time of his visit, not realizing some of them were seasonal visitors from the desert to the west nor realizing some San Xavier residents were away at the time. When he finished the counting and parceling of lands on a map of the reservation, there were 94 adult family heads with 160 acres each, the acreage being divided into non-contiguous units of farmland, timber (mesquite) land, and so-called "mesa" land good at the time for nothing more than grazing. Single persons received either 40 or 80 acres of mesa land, some of it being deemed to be so poor that two acres were assigned for one. There were 71 wives of heads of families and children who got nothing.

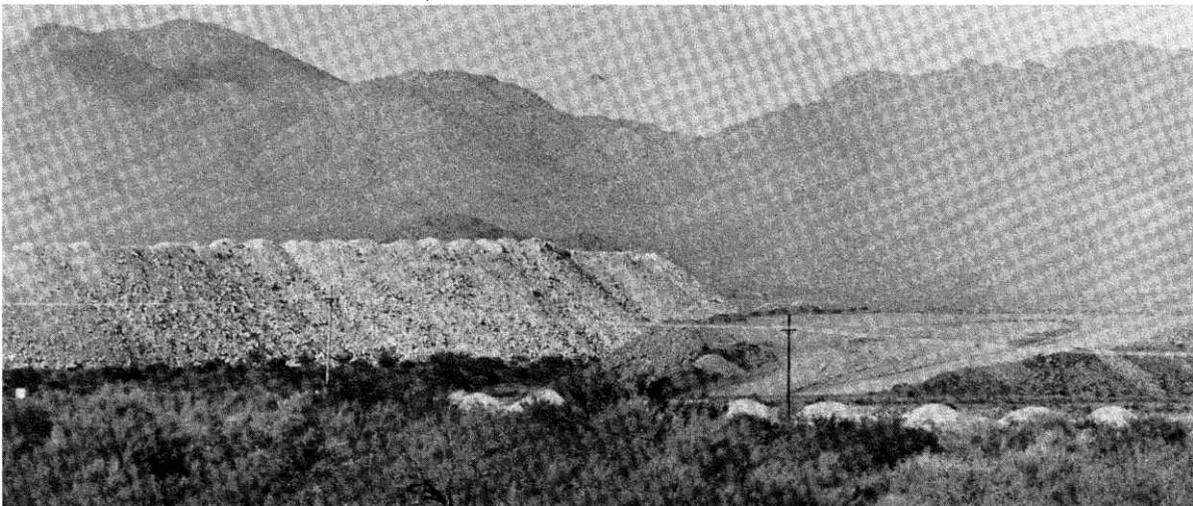
When the allotting process was completed, there were 41,622.25 acres of allotted lands and 29,467.75 that remained in tribal ownership. The 25-year trust period

for the allotments at San Xavier was extended in 1915, and the Indian Reorganization Act of 1934 kept them in trust status. Only one allotment at San Xavier has been alienated from Indian ownership since 1890, and that was done with full approval of the federal trustee.

Mining

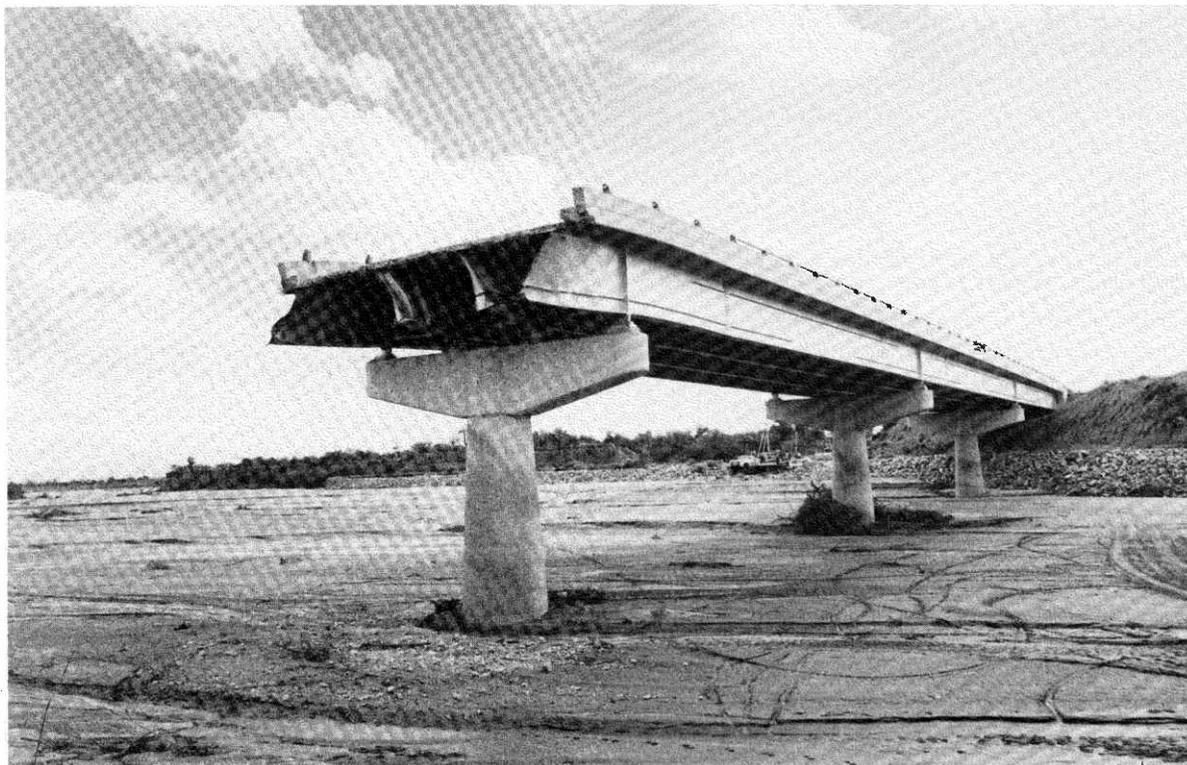
In 1957, the American Smelting and Refining Company paid a little more than a million dollars to heirs of some of the 1890 allottees for the exclusive right to explore for minerals with an option to mine on 24 sections (15,360 acres) of reservation land. This resulted eventually in lands toward the southern end of the reservation being leased for open pit copper mining as well as for areas upon which to dump overburden from adjacent, off-reservation open pit operations. It also resulted in very uneven proportions of royalty payments and land lease moneys going to the allotments' owners. This unevenness results from the fact that when an allottee dies intestate — as most Papagos do — his heirs are determined in accordance with the succession laws of the State of Arizona. Although the lands themselves are not divided, the compensable interest of the allottees in those lands is. The result has been unbelievably fractionated ownership. As long ago as 1964 a common denominator of 8,870,400 had to be used to calculate the interest of one allottee in an allotment to which he had fallen partial heir.

The mining leases on the San Xavier Reservation brought about a realization on the part of Papagos that their lands had hidden values. It also made them conscious of the potential value of allotments as well as of the



American Smelting & Refining Company overburden dump, southern end, San Xavier Indian Reservation, Arizona, November 1983.

—photo by John P. Schaefer



Looking south at the washed-out northbound span of I-19 over the Santa Cruz River on the San Xavier Indian Reservation, November 8, 1983.

—photo by John P. Schaefer

element of pure chance in benefiting from those values. By 1957, as now, a great many allottees were not resident on the reservation and took no active part in community life. Indeed, some people had become allottees through marriage and were not even Papagos. Moreover, many Papago residents either were not themselves allottees or they had no lands in the leased areas of the reservation.

The San Xavier Planned Community

In 1880, the non-Indian population of the entire Territory of Arizona was barely 40,000. At the beginning of 1983, the population of the greater Tucson area was more than a half million people, not counting seasonal visitors who take advantage of the Sonoran Desert's mild winter climate. And if in 1874 the San Xavier community was nine miles from Tucson, in 1983 the southwestern Tucson city limits were contiguous with the northeastern corner of the reservation and non-Indian housing developments and mobile home parks abutted the reservation along parts of its northern, northwestern, and eastern edges. Values of \$10,000 for vacant one-acre lots next to reservation lands were not uncommon.

In May 1983, it was announced in the Tucson newspapers that James J. Rothschild, Jr., president of Santa Cruz Properties, Inc., with headquarters in Cathedral

City, California, was negotiating with Papago Indians for a long-term lease of approximately 18,000 acres of San Xavier Reservation lands for a development that would include a golf course, condominiums, a large resort hotel, and residential and commercial facilities — all eventually to result in a non-Papago community of some 110,000 people. The proposed agreement called for a 65-year lease with a 25-year renewable option. Annual rent was set at \$50.00 per acre for the first year of the lease, dropping to \$10.83 for the next two years and climbing slowly upward in succeeding years until the fifteenth year would bring a \$50.83 return to heirs of allottees. By the end of the 65th year of the lease, rents were pegged at \$433.33 per acre.

News of this proposed development caught the vast majority of some 900 Papago allottees in the development area and the approximately 1,000 residents of the San Xavier Reservation by complete surprise. Although Santa Cruz Properties, Inc. had been negotiating with the San Xavier District Council, a locally-elected body of seven persons, for nearly three years prior to May 1983, word of these negotiations had not spread through the community. They had not been carried out in secret, but apathy with respect to district council matters has been the order of the day at San Xavier for many years and meetings are poorly attended. Too, the negotiations had

occurred with the full knowledge of the federal trustee, the Bureau of Indian Affairs, but the Bureau had made no concerted effort to keep allottees informed on negotiations as they were being conducted.

After local newspapers announced the proposed lease, three meetings were held in the San Xavier District headquarters between the developer and interested Papagos. These meetings consisted of line-by-line readings in English and translation into Papago of the proposed lease agreement. Some time was left at the end of each day for questions from the audience. The sessions became acrimonious and frequently turned into shouting matches. Papagos who were immediately involved either as allottees of as San Xavier residents, Papagos who felt they were involved simply because they were Papagos, Indians who were non-Papagos, and non-Indians quickly got into the fray on either side of the fence, some arguing in favor of the lease and others bitterly opposing it. Press conferences were held; letters were written; advertisements were taken out in the *Papago Runner*, the Papago Reservation's monthly newspaper; and petitions were circulated. Some of the District Council persons who favored the lease even asked the local priest to hold a special Mass of conciliation for the community, praying that people would continue to love one another regardless of the outcome. The priest complied with the request.

Values and the Land

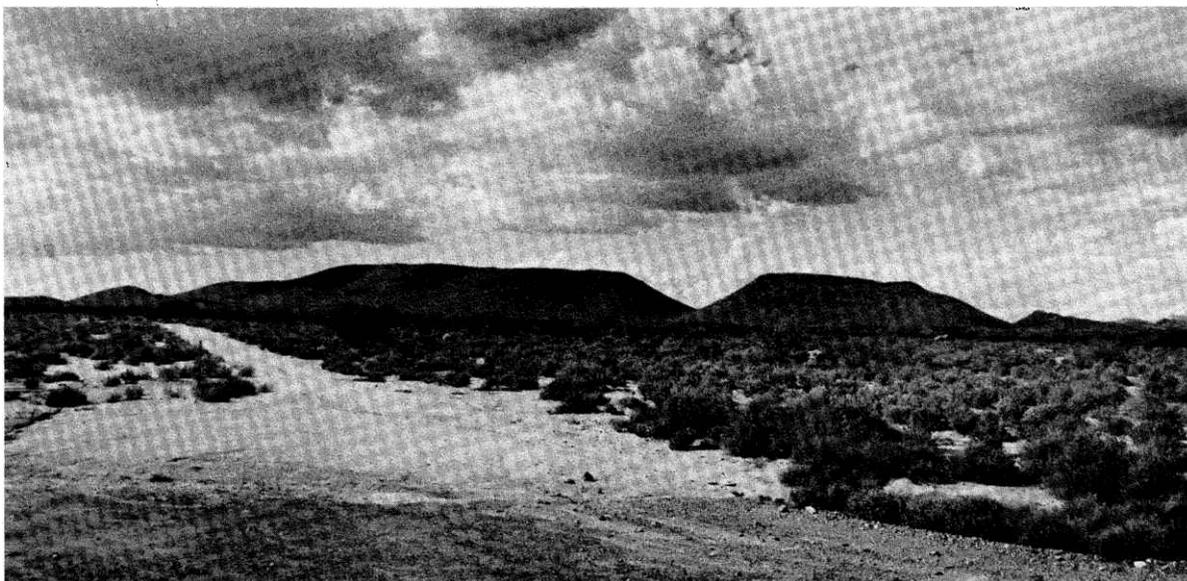
While an urban-dwelling entrepreneur whose life is wholly dependent on cash economy speaks of "land

values" as being equivalent to their cash values, many rural people whose relationships to land is of a different order are inclined to think of land values in a broader sense. Some opponents of the "planned community" for the San Xavier Reservation regarded the long-term nature of the lease as being essentially a sale of the land. "The development will provide jobs at the expense of losing our lands," said one. "If you have land without a job you may still end up walking the streets." Another argued that the 18,000-acre development "will bring the problems of the city of Tucson to the reservation. Both crime and traffic problems within the district will increase." And still others worried about the impact on natural resources, particularly on water and mesquite.

One of the more eloquent opponents of the lease wrote

To sign away some of this Holy Land to foreigners who see it only as a way to make money, is a breach of holy compact, a blasphemy before God ... This land is holy land, entrusted to Papagos by God; and [it is the] Papago responsibility to be guardians and caretakers of this sacred earth for the future generations ... I have committed my grandchildren to being raised as Papagos and to being part of the Papago Tribe. My life would thus come to nothing at the end of my days if my great grandchildren went the way of the Agua Caliente Indians [who leased their lands at Palm Springs, California.]

Those who favor the development argue it will generate jobs for Papago individuals and income for the tribe



San Xavier Indian Reservation, looking west toward Black Mountain from the Junction of I-19 and Papago Road, November 8, 1983.

—photo by John P. Schaefer

and district. They point out the proposal is for a lease rather than for a sale; that it will allow for the planned development of the reservation's land rather than piecemeal development; that it will forestall the probability that some allottees may bring pressure on the Bureau of Indian Affairs to give them title in fee simple thus allowing them to alienate the land from the reservation.

One allottee, not a resident of the San Xavier community, asserted that the development means progress. "If they understand it, they'll accept it. Those who can't accept it aren't progressive. They'd rather hold on to the land no matter what."

The dilemma for San Xavier residents and allottees is a very real one. Few would argue they fully understand all the provisions in the 53-page proposed lease agreement. Even fewer had any significant role in devising plans for the development. As has been the case in Papago history in the past 70 years or more, Papagos are being asked to respond with a "yes" or "no" to a proposal designed and submitted by non-Papagos. They have never been meaningful partners in planning long-range projects on their own lands.

The elders in the San Xavier District discussed the project, and a spokesman informed the *Papago Runner* of their discussion:

"After the first meeting, they said their grandparents had told them a long time ago that white people were going to move on to the land. But they are surprised to think the time is here now.

"Most say if it goes though, okay; if it doesn't, that's okay too.

"They are sad about the loss of their culture. They say the young people have learned Anglo [non-Indian] ways; they no longer live in mud homes, and they no longer speak Papago.

"Some of [the elderly] said, 'We need money nowadays to live on.' They wonder if maybe the

people saying all we want is money are educated people who don't need it. They said, 'Maybe they don't have to live on one check a month like us.'

"And they say white people are attracted to the land because it's empty.

"It's just the idea — any land doing nothing, white people see it and want it."

The Larger Context

Regardless of one's views toward projects being carried out on the San Xavier Reservation, the inescapable fact is that the surrounding off-reservation urban center of Tucson is likely to continue its expansion. Pressures to "do something" with the San Xavier lands will increase whether the Santa Cruz Properties proposal is accepted or not. There is the added attraction at San Xavier that the reservation has been guaranteed by the United States government 60,000 acre feet of water to be delivered annually to the reservation commencing in 1992. Failure on the part of the government to do so will result in enormous penalties having to be paid the tribe and district. Should the water be ready for delivery on time and Papagos are not ready to use it in some productive way, they will lose the dollar value of the water. Water has always been a powerful magnet in the desert; it continues to be so.

Events occurring on the San Xavier Reservation in the future will ultimately have an impact on the non-Indian population in the entire Santa Cruz Basin. Those events, it should be pointed out, are not likely to be generated by Papagos but by outsiders who do, indeed, see Papagos' lands and water as potential sources of income for themselves. The toll such pressures exact on rural peoples adjacent to urban metropolitan areas remains to be measured. The price they pay — and ultimately the price all of us may pay in an overcrowded desert — is likely to be very high indeed.

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'OUT THERE' RIGHT HERE: The Anomaly

Perhaps nowhere is our characterization of the Papagos as a 'pastoral society in transition' more dramatically illustrated than by the presence on their Reservation of Kitt Peak National Observatory, site of the largest collection of optical telescopes in the world.

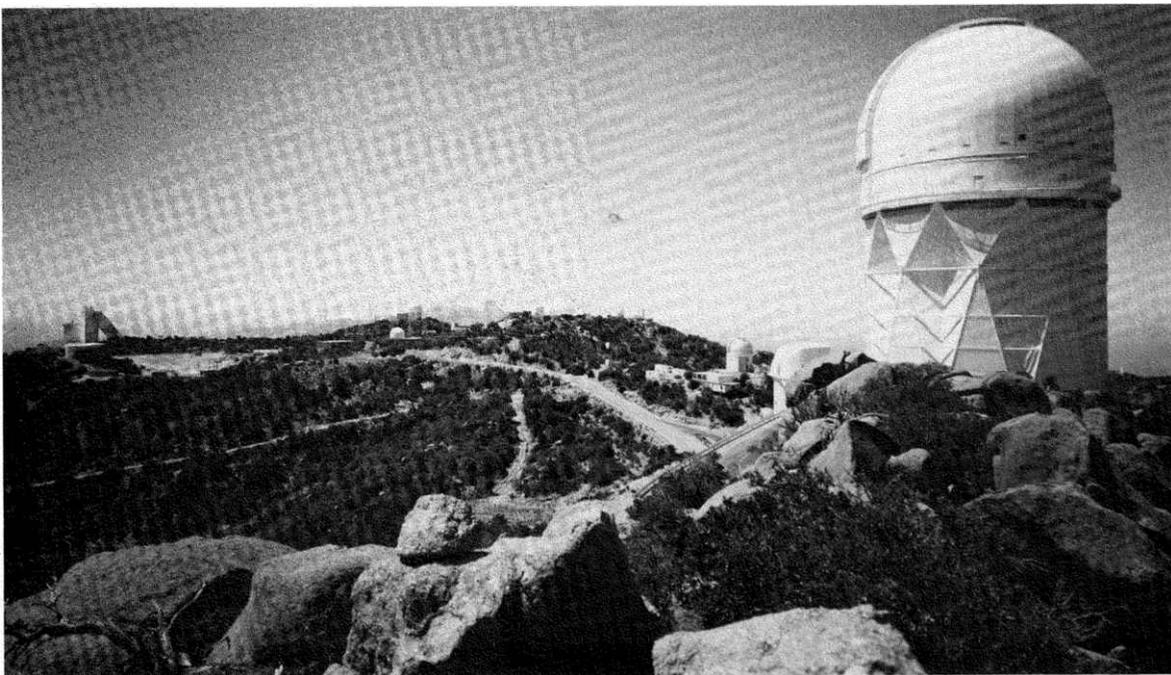
Kitt Peak, rising to 6,900 feet in the Quinlan Mountains of the Sonoran Desert, was leased by the Papago Tribe to the National Science Foundation so that an observatory could be built, a lease valid indefinitely as long as scientific research facilities are maintained at the site. The negotiations with the Tribe ended an extensive three-year site survey covering more than 150 mountain ranges across the United States. Kitt Peak was selected for its combination of clear weather, minimal air turbulence, remoteness from bright lights, vegetative cover, height and suitable summit area. Surrounding Kitt Peak is the Papago Indian Reservation, spreading some 90 miles across Pima County, Arizona, the second largest Indian reservation in the U.S.

The Tucson-based Association of Universities for Research in Astronomy (AURA) entered into a contract with the National Science Foundation to build and

operate the Observatory, and subsequently has been responsible for its construction, development, and continuing operation.*

Kitt Peak is the national center for ground-based optical astronomy in the continental U.S., its telescopes used by scientists from the U.S. and abroad to carry out research on the planets, solar system, our galaxy (the Milky Way), and the Universe as a whole. Among its telescopes is the McMath, the world's largest solar telescope. From all over the world, astronomers come to study solar phenomena: its sunspots, atmosphere, magnetism, chemical composition, brightness, and a host of other particulars. It is also a valuable tool for studying the moon, planets, and brighter stars. In addition to the McMath, Kitt Peak also houses the Mayall 4-m (158-inch) telescope, a giant optical housed in a building 19 stories high; and the 2.1-m (84-inch) telescope, the first built for nighttime observations on Kitt Peak, now used in many different ways by astronomers carrying out research on stars and galaxies. Not only is work done in optical wavelengths but studies are also carried out in the infrared.

*AURA also manages the Cerro Tololo Inter-American Observatory in La Serena, Chile, as well as the Sacramento Peak Observatory in New Mexico, and the Space Telescope Science Institute, Baltimore, Maryland.



Panorama of Kitt Peak National Observatory site, Mayall Telescope right foreground, McMath far left. Center horizon Baboquivari Peak (elevation 7,730), 13.5 miles south of Kitt Peak.

—photo Kitt Peak National Observatory [#07000]. c/o AURA, P.O. Box 26732. Tucson, AZ 85726.

DESERT VOICES

Each Friday noon, Papagos throughout the Reservation, as well as the many who live in and around Tucson, tune in to the University of Arizona's KUAT-AM station to listen to Danny Lopez or one of his occasional substitutes broadcast Reservation news in the Papago language, followed by briefs in English.

It is believed that this radio broadcast is the only programming in the country devoted exclusively to such information in an Indian language. Danny, a native-born Papago, initiated the broadcasts in 1979, funded originally by a Federal grant to train Papago college-age students in audio production and broadcasting. It has evolved from musical recordings only to its present format which is the most up-to-the-minute source of Papago news to many remote Reservation settlements, and one which serves as a communication link to a tribal society which shares in a close-knit way many of its traditional customs and activities.

The weekly program comes on the air with a recording of Papago music,* although Danny himself often performs, too, singing the chants and accompanying himself with the rattle [left, in picture], a typical musical 'instrument' usually made of a Mexican gourd filled with small

*One recording used is 'An Anthology of Papago Traditional Music,' collected and recorded by J. Richard Haefer, and reproduced by special permission by Canyon Records [No. C-6084], Phoenix, AZ 85012.

pebbles. In such a way the broadcast serves more than one purpose, for Danny is not shy about his commitment to help preserve in whatever ways he can not only the traditions of his people but their language as well.

Sitting in the broadcasting booth behind the glassed soundproof studio, we heard Ofelia Zepeda, a Papago Ph.D. candidate in linguistics and an instructor in the University of Arizona's Department of Linguistics, take over for Danny one Friday noon just before Christmas. Foregoing Danny's rattle, Ms. Zepeda gave details in Papago for a busy week of Reservation activities, beginning with a post-education seminar for Papago students preparing for entry to higher education opportunities, then announcing a Christmas mass at St. Elizabeth's Church, Santa Rosa, to be followed by dancing; then reporting on the traditional Posada procession at Sells' St. Mary's Parish church; then news of a crafts sale at St. Nicholas Center where stuffed animals, flowers, quilts, crocheted pillows, and other miscellaneous handmade objects would be raffled off for prizes. Except for the first item, this perhaps was not a typical broadcast, explained by the time of year and the substitution of celebrations for the usual notices of business meetings, Council deliberations, etc.

But the message, Danny's or Ofelia's, is one that conveys a sense of community, that being a Papago is good, that there is a place for Papagos in the modern world without sacrificing Papago language, ceremonials, or traditions.



Danny Lopez broadcasting 'Desert Voices' from the University of Arizona's KUAT-AM station.

—photo by Jim Davis, reprinted by permission *Arizona Daily Star*

THE PAPAGO INDIAN RESERVATION AND THE O'ODHAM:

An Overview by an Observer

Allyn Spence*



Allyn Spence

The population of the Papago Reservation today includes most of the people who refer to themselves as the O'odham. Although there are various estimates of just how many Papagos there are, the Indian Health Service patient enrollment has more than 16,000, of which there are more than 9,000 mailing addresses on the Reservation itself. Many

others, however, live in urban areas like Tucson or Phoenix, with still others in Los Angeles and large cities where employment can be obtained. The Tribal Council's Papago Education Committee's yearlong survey of villages noted that many new faces appear over the course of a year, people who have returned home, for a visit or for good. Regardless of its population, nevertheless, we do know that the Papago Reservation is the second largest for American Indians in the U.S., nearly three million acres for the main Reservation and two other smaller reservation areas: San Xavier near Tucson, and Gila Bend southwest of Phoenix. The Sand Papagos, living on traditional areas west of but not [yet] part of the main Reservation, have identified almost 2,000 displaced Papagos who want a homeland reservation established for themselves.

Papagos have several major dialects and many cultural variations focusing on the village traditions of the eleven districts comprising the Reservation. At present, under the chairmanship of Josiah N. Moore, there is a strong effort under sanction and approval by the people to develop an effective central government at Sells. Tribal government, established in the late 1930s under legal sanction by Federal law [the Indian Reorganization Act of 1934], has not always received consistent strong support by the people. In fact, district power in the 1970s, following the untimely death of Chairman Thomas Segundo in 1971, rapidly increased, often at the expense of the central tribal council authority. Now that seems to be changing, in large measure due to local village perception that the future survival of the O'odham people is at stake and there is need for a strong effective single voice.

In the past, one could find many Council meetings held with English as the major language. Now Papago prevails as the major language of the Papago Tribal Council. An air of seriousness has permeated the whole of Council activities including issues facing the Council and its new Chairman that will set the life patterns of these ancient desert dwellers for the foreseeable future:

- . . . water settlement and water use opportunities from the Central Arizona Project
- . . . small business development for income, by Papagos themselves
- . . . possible large Government research projects that could bring in continuous funds for tribal revenue as well as family income
- . . . school construction
- . . . mining ventures
- . . . large land leasing for development of outsider communities on Papago land on the San Xavier Reservation just south of Tucson

With the final stages of the Federal Government's retreat from paternalism among American Indians, with the enactment of the Indian Self-Determination Act (Public Law 93-638), Papagos are facing a rapid turnabout, from obedient wards-of-the-state to an able force in Arizona life.

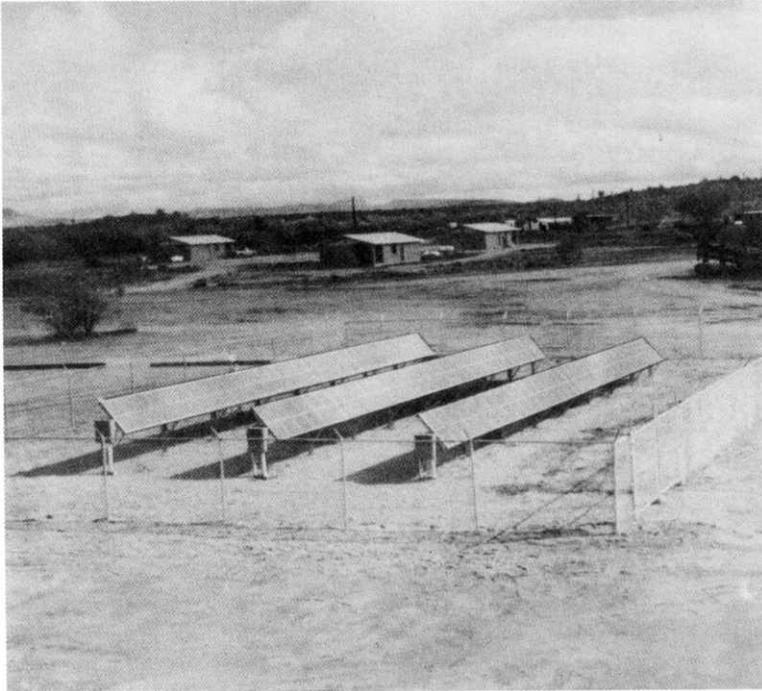
In dealing with the transitional issues of self-government, Papago leaders are aware of the dichotomy of past Federal activities, where some succeeded, some failed. The U.S. Government, for instance, through several large and very expensive programs, has attempted to bring economic opportunity to the O'odham through the infusion of money, a total of \$110,000,000 in 1974 by the Bureau of Indian Affairs' Papago Agency alone. What has survived from this massive cost of various programs? What has survived is what has been viewed as practical and useful, such as the charcos, the water holes, built in all areas of the Reservation, and maintained today to form a water source for Reservation cattle and wildlife. And the Papago Tribal Utility Authority is an outstanding success, one of the best of its kind in the U.S., based largely on the O'odham view of its essentially. And what has failed? A large lake site, with a proposed real estate and tourism development on the north side of the Reservation, is now a monument to the Sonoran Desert,

*Research Associate, University of Arizona, Office of Arid Lands Studies.

a home for desert plants. And the large so-called Papago Farm, originally encompassing about 50,000 acres, is now dwindling down, having only about 5,000 acres farmed today. The solar electric panels, built by NASA and the U.S. Public Health Service, sit in the desert collecting sunlight, unused.

A central problem facing the new administration is the lack of trained personnel, in areas ranging from business management to many professional areas of health and administration of new programs.

To older Papagos who perceive events in the perspective of history, modern challenges represent only one of



Photovoltaic village power project, Schuchuli, Papago Indian Reservation, Arizona

—NASA, Lewis Research Center

- Questions face the new leadership that frame the current action of the tribal government. Those include: How to best combine the needs of traditional life and language with the economic opportunities of the outside world; and, how to best prepare for those changes, including manpower training and cultural evolution, to include centralized government where none existed in ancient tribal life. As in most traditional communities in the world, Papago villages provide a continual interface of communications within the village. Waking in the morning, cooking out-of-doors, working during the day and visiting during the evening hours, village people keep current about events. The ties and links between the villages and the central government are being strengthened. Because decision-making is a consensus approach to closure on important questions, there must be agreement before action occurs. The Chairman is conscious of this fact and has maintained ties with villages to double-check with people where they might like to act next. From the election process, where the Chairman listens to village feelings about needs and O'odham thought about directions for his administration, Josiah Moore has gone forward, basing his plans on directions given him by the people.

many faced by the Papago people. A part of a large prosperous society in ancient times, from the large Hohokam civilization centered in what is now Tucson and south of Phoenix, during a time of wetter climates and heavy rainfall, to a drier time with contacts with the Spanish missionaries, like Padre Kino, an Italian priest who came into the area in the very late 1600s, to the Mexican government with the rise of the raiding Apache tribesmen in the 1800s, to the Anglos, a name for the Americans, who came in the mid 1800s, the Papagos have seen much. Tucson, derived from a Papago word, Chuksón (by the base of the black mountain), has remained a part of their territory. Today, with the water settlements, gained from the federal and state and local governments by court decree for pumping water from Papago water aquifers, Tucson will continue to have the O'odham mark on it from the ancient desert people who founded it and named it.

Outsiders are often angry at Papagos for what is termed a lack of initiative. But the real problem lies in the differences between industrialized and nonindustrialized ways of existing on this earth. Time to Papagos is associated with doing something. It is done until it is gone. To outsiders, it is attention to a clock and calendar.

The Papago calendar, seen in the old ancient calendar sticks, is a series of events that Papagos perceive as vital to their evolution as a people: Apache raids, a range war between cattlemen, a vision by an honored medicine man.

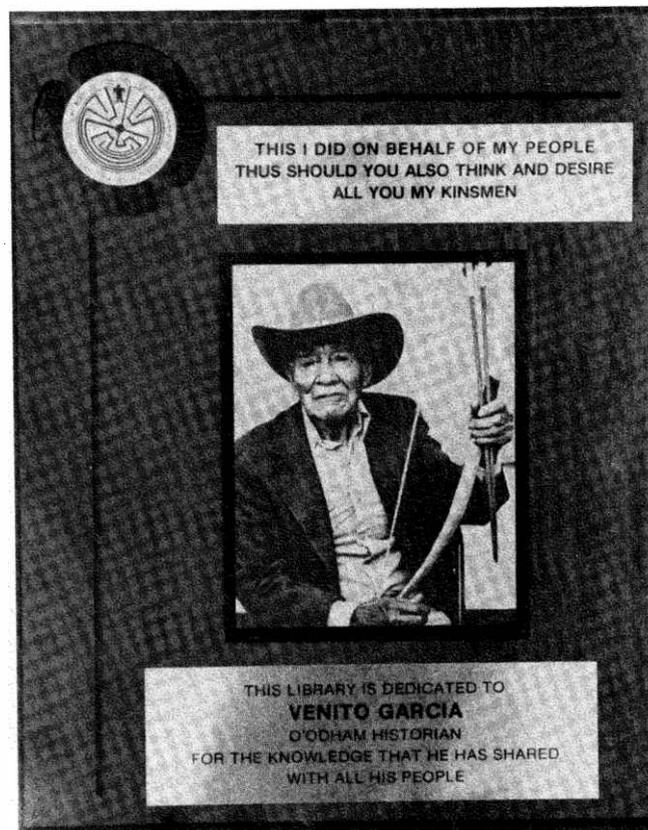
Another point of contention between outsiders and the O'odham is the word leadership and what it means to each. Leaders to outsiders are people who 'tough-it-out' by making the 'hard decisions,' even though people are against them or do not understand. To the Papagos, leader is a person who facilitates and is a spokesman for the consensus of the O'odham. He is neither a forcer, nor enforcer, nor a politically powerful person. He is a persuader and a facilitator, one who helps by giving

wisdom in carefully chosen advice. He is not separated from the people, a lone wolf. He is a part of the people, the embodiment of the people's desires and concerns, as well as an advisor. Perhaps more than any other American Indian tribe, the Papago frustrates the Anglo-American politician. But the Tribe moves forward in its own special way.

When Josiah Moore 'came home' to become the Tribe's Chairman, he listened to his people and what they were saying, and he translated those wishes into forms that relate to outside opportunities for them. What is going on today is an effort to gear an ancient life to modern economics.

And it is being done by the O'odham themselves.

Older Papagos still occasionally practice a custom dwindling away, the celebration of the death of a person. A special place is set for him, with all his favorite foods. Remembered events in his life are recounted — riding horses, gathering Saguaro cactus fruit, telling stories around a fire, why he had a special nickname — or times are recalled like the annual pilgrimage to Magdalena, Sonora, to the burial place of Franciscan priests Father Kino and Father Xavier, who worked to build the mission later called San Xavier on Papago land near Tucson. The deceased person is not fearfully viewed as dead but a spirit that is alive and well. All Saints Day, usually observed on the 27th of October, is celebrated in this spirit, when *candelarias* (candles in paper bags) are lit in the cemeteries in honor of those gone. The departed are spoken of in Papago in the present tense, as vital spirits, and thus the past, present, future become one.



Plaque in Tribal Media Center

HOW IT LOOKS FROM WHERE I SIT



Francisco José

Francisco José, Vice Chairman, Papago Tribal Council, talked at length with us concerning his views on critical issues facing the Tribe as the new administration begins its tenure in earnest. Immediate problems arising from the unprecedented floods of early October created emergency actions that set other long-term needs aside temporarily, but he felt that

most damages had been repaired and that the Tribe's major issues could now be addressed. High unemployment is being experienced, though opportunities requiring technical skills are still available. Education for such jobs, and the willingness to commit the job-seeker to long-term employment — a career, in other words, — are prime objectives.

One problem of recurring concern is that of the Sonoran Papagos whose dual citizenship needs to be solved with the Mexican government. Those who live along the international border are first of all Papagos, under the Tribe's umbrella, but the trend has been to push them north onto Arizona's Reservation land. It is an issue not easily resolved, as traditional thinking on both sides, not only of the physical matter of the border but the deeper sense of belonging, is one that will require compromise, negotiation, understanding.

When I suggested, half-jokingly, that perhaps the Tribe could solve part of its Sonoran Papago problem by buying the town of Sasabe, which I understood was now for sale, thus providing an anchor at the border for those living nearby, José took me seriously, thought it was a good suggestion and said the the Council had indeed

already discussed it. He thought a more urgent hope was that through negotiation with the Federal Government the Tribe might acquire that part of Baboquivari Peak itself which remains outside Reservation boundaries. The line is drawn at present right through the middle of the Peak so the entire east side is off bounds. This, too, is under discussion by the Council.

José reminded us that the question of the Sand Papagos, who were not included within the original Reservation boundaries, now wish to have land they have occupied on the western edge be included as Reservation land. Whether this can be achieved through land trade with such Federal agencies as the Bureau of Land Management or others is yet to be determined. 'Since as Indians we are entitled to sovereignty,' he pointed out, 'although still controlled by the Federal government, we hope that some solution that will bring us together as Papagos can be worked out.'

'To a great degree, the Tribe's direction in the long-term sense, is or has been determined by outsiders. We believe sincerely that we ourselves must take over this function and present our people with alternatives for the future. This is why education is so important, so that when options are laid out for them, they have a feeling that what they may be giving up will be balanced by what they will be gaining. When you attempt to force Papagos, without an understanding of all facets of a situation, they are apt to reject. They believe that Papagos themselves want policies established that will use their own capabilities to the fullest, and that those policies express their involvement in the establishment thereof. It is not that we may not be willing to give a policy decision a chance to work, but we will use such a temporary acceptance as a crutch, so to speak, and if it doesn't work, long-term, in the sense that we achieve a sense of self-fulfillment, we'll discard it.'

O'Odham Education Now and In the Future

Bernard Siquieros, Director of the Papago Tribe's Education Department, underlined the emphasis placed on education by all Tribal officials we have met. He pointed out the diversity of educational opportunities offered by the Early Childhood/Headstart facilities in Sells, the several District schools including secondary and middle schools, Bureau of Indian Affairs schools, and Mission schools. The Education Department's programs cover higher education and employment assistance, and administers the libraries in Sells, Pisinemo, and San Xavier. Parents throughout the Reservation are given an active voice in shaping Reservation educational programs; and health education, nutrition, and mental health services are provided through the Early Childhood/Headstart activities. To insure children's protection, both legal and physical, the Tribe has established a Children's Court, and a Papago Children's Home, as well as a Day Care Center. There are off-Reservation efforts, as well, particularly through the Johnson-O'Malley Act for supplemental programs for Indian students, to preserve the cultural background and heritage often at risk of loss once the student and his family leave the Reservation.

**UNIVERSITY OF ARIZONA HONORS ITS
FIRST PAPAGO GRADUATE:**

Christine Garcia

On October 24, 1981, the University of Arizona had a special 'Homecoming' event to honor all Indian alumni of the University. Conceived and organized by Gordon Krutz, Coordinator of Indian Programs, and Arline Hobson, American Indian Student Advisor, the meeting was attended by some fifty alumni, with special presentations to the alumna who had acquired the most degrees, Dr. Alice Paul, Papago, presently a professor of education at the University; and a posthumous award to her aunt, Christine Garcia, Papago, the first known Indian graduate of the University. On this fiftieth anniversary of her graduation, a plaque was presented to Dr. Paul representing her family, which included an account of her professional life, as well as recalling her athletic prowess in baseball and hockey. Although she received no outside support for her college education, she was recognized for her attainments with a Board of Regents scholarship of \$100 during her senior year, prior to being awarded her bachelor's degree in home economics in the spring of 1931 — a considerable sum in those depression years.

On the occasion of his accompanying Spence and me to Sells one time this winter, Mr. Krutz talked with feeling of Christine Garcia's accomplishments, pointing out that ' . . . her deep motivation and dedication to her work had a profound influence not only on her students during her later teaching career, but on her relatives and Reservation friends. Always held up as a model, many followed in her footsteps by attending college, some earning advanced degrees.' When she retired, she went back to work, this time for Head Start. A second retirement was followed by participation in the Elderly Medical Program (interestingly, she always remained dedicated to traditional Papago medicine).

A very special person.



Christine Garcia shown here as a member of the UA Honor Hockey Team, 1931.



Dr. Alice Paul, Christine's niece.



Floodwater field in Ge Oidag village. Left, Gary Nabhan; right, Delores Lewis, farmer, with grandson Daniel Lewis, center.

—photo by Paul Mirocha

SOIL FERTILITY RENEWAL AND WATER HARVESTING IN SONORAN DESERT AGRICULTURE:

The Papago Example

by Gary Nabhan*

There is currently considerable interest worldwide in better using the surface runoff following brief desert storms to provide irrigation water for crops (Hutchinson, Dutt, and Anaya-Garduño, 1981). Recent efforts in 'water harvesting' have emphasized the reduction in the ratio of catchment area to cropped area through the use of salt, wax, or plastic treated catchments (Dutt, 1981) to increase the runoff yield per unit area. The Papago and Sonoran tradition *de temporal* runoff agriculture offers another option — the use of larger untreated watersheds, where not only water but nutrients are harvested. The following discussion outlines the value of this time-tried tradition, and Papago folk science related to it.

Desert soils are characteristically so poor in nitrogen and associated organic matter that these factors may limit plant productivity in arid lands almost as much as does water availability (Romney et al, 1978; Folker and Clark, 1980). Soils in deserts are typically described as containing 'excesses of certain constituents, such as lime or gypsum mixed with other salts,' as being 'notoriously low in organic matter,' and 'if organic matter is low, so is nitrogen' (Fuller, 1975: 14).

Desert soil fertility may be further diminished by bringing land into cultivation. Cox and Atkins (1979), in documenting changes in soil structure, organic matter and nutrients that occur with bringing land into cultivation, have concluded that regardless of nutrient replenishing by weathering, nitrogen-fixing symbionts of crops and weeds, '... agricultural harvest is a major route of nutrient depletion ... Replacement of nutrients from sources outside the agricultural system is therefore absolutely essential to the maintenance of original productivity levels.' Woodbury and Ressler (1962) hypothesized that increasing soil salinity and alkalinity, if not directly responsible for the abandonment of Hohokam fields, at least became serious limiting factors to maize cultivation during the late Hohokam periods. These arguments point to the importance of any agricultural management practices which tend to maintain or renew soil quality favorable for crop production through time.

Castetter and Bell (1942: 172) observed that 'fertilization of the soil was not practiced aboriginally by either Pima or Papago,' nor have I observed the regular use of chemical fertilizers or intentional transport of manure to fields by Papago farmers today. Their fields' soils, therefore, are either being depleted or they are being renewed in ways other than those by which conventional agriculture counters fertility loss and harmful mineral accumulation.

Assuming that soil processes in the new (less than 30) remaining Papago fields are similar to or at least remnants of those which once involved thousands of cultivated hectares on and near the Papagos' homeland, let us consider the following possibilities:

Runoff Delivery and Water Chemistry

Papago fields are usually located in torrifluent soils on alluvial flats, fan aprons and fan skirts of ephemeral washes where storm runoff from larger watersheds (30-300,000 ha in size) become concentrated (Figure 1). Although the fields themselves are located at various sites which receive anywhere from 125-300 mm of rainfall per year, some of the headwaters of contributing watersheds are in mountain zones receiving as much as 600 mm per year (Figure 2). It is not known how much water actually enters any given Papago field per growing season, but this runoff has long contributed enough soil moisture to satisfy the needs of the Papagos' rapidly maturing drought-hardy crops such as domesticated devil's claw, tepary beans, 60-day flour corn and cushaw squash (ARSP, 1982). Strategically placed brush weirs serve to spread floodwaters, reducing erosion (Figure 3).

Castetter and Bell (1942) suggested that flash floods fertilized Papago fields, but provided no supporting data for this hypothesis. When I set out to sample water in washes leading to Papago fields during the summer cropping seasons of 1980-1982, I was present and able to collect samples from Papago watersheds only five times during floods (Table 1). Sampling was done opportunistically during these flood events, within a half-hour of peak flows at the sites. I also collected samples from two

*University of Arizona, Office of Arid Lands Studies

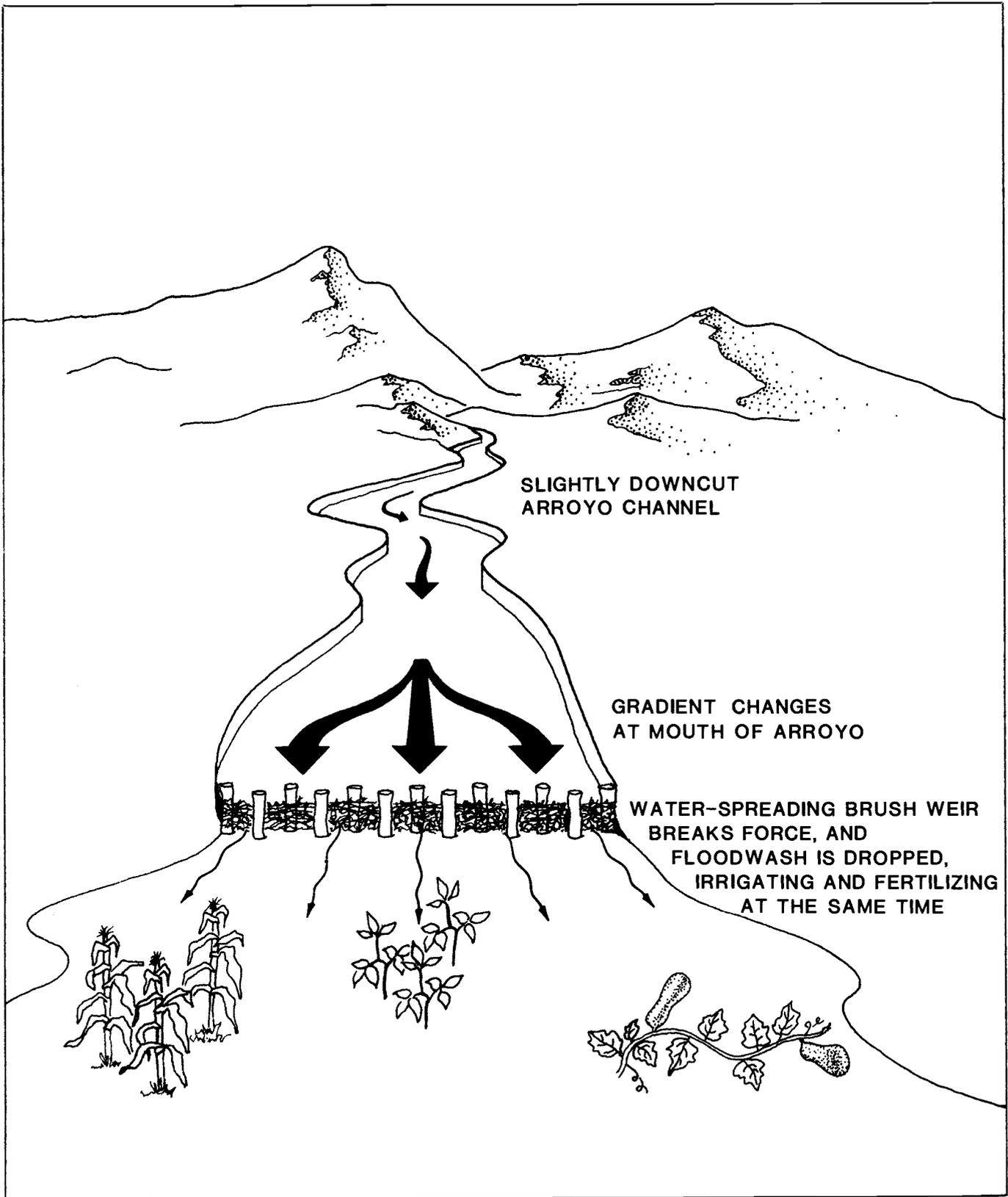


Fig. 1: Floodwater control weirs (*ṣai'ijda koli*) in Papago fields.

floodwater reservoirs and from springs utilized by Papago farmers. Despite small sample sizes, differences are apparent between two sets of samples: 1) the moving floodwaters (and the recently flood-filled reservoir at Ali Cukson), and 2) the standing waters at Quitovac springs and the Queenswell *charco* reservoir.

In particular, pH is considerably lower for the floodwaters, but because these waters are applied to soils which typically have pH values above 7.2 — where calcium carbonate reactions are the active buffering system, they probably do not serve to neutralize alkaline soils to any extent. The floodwaters are generally lower in electrical conductivity, total soluble salts, sodium (and sodium absorption ratios), chloride, bicarbonate, iron and nitrate than are the springwaters. Differences between the moving floodwater mean values and those of the reservoir waters are generally small. Floods observed in Sells Wash carry tremendous amounts of dark suds and foam with their first crests, and phosphates are no doubt rich in these materials.

Both nitrate and phosphate levels in floodwaters appear to be related to rapid leaching of suspended particles in dynamic equilibrium with the waters themselves. McConnell (1968) has observed high concentrations of phenolic compounds in a flood-filled reservoir in southern Arizona, due to the dissolution of oak litter washed off the watershed during flashfloods. It is necessary, therefore, to evaluate such suspended materials as an additional factor potentially contributing to field soils.

Chemical Contribution of Floodwashed Organic Detritus

The suspended materials carried by floods on the Papago reservation include beer bottles, tires, plastic bags, styrofoam coolers, and other flotsam of the 'civilized' world. The bulk of the suspended materials, however, are silt-coated partially decomposed organic remains of plants and animals, considerably rich in a number of nutrients (Table 2). From materials retrieved

KITT PEAK – LITTLE TUCSON WATERSHED AREA

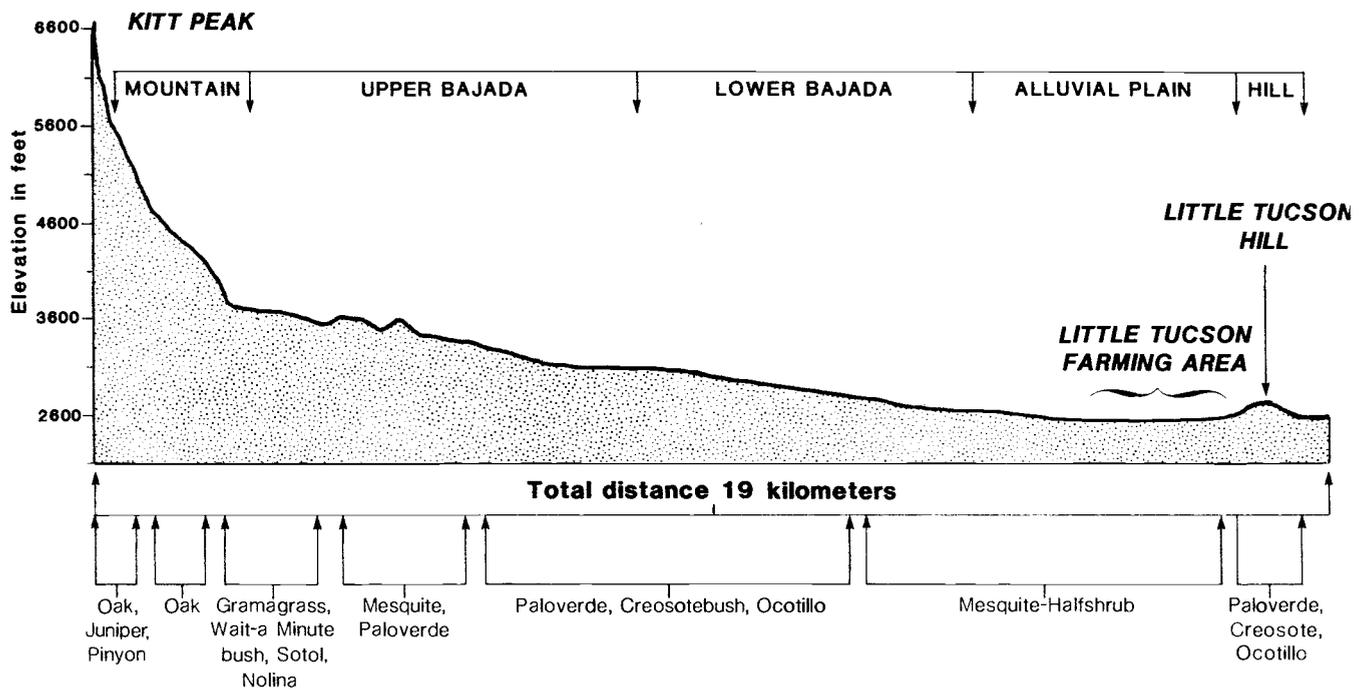


Fig. 2: Elevational profile of the study area showing the gradient from Kitt Peak to the village of Little Tucson where several Papago fields are located.

as they were floating in a wash at Topawa on June 27, 1981, we have identified fragments of mesquite, bursage, ironwood, creosotebush, palo verde and hackberry leaves, stems and seeds, as well as rabbit and rodent dung. This floodwashed detritus is the same material which Papago farmers term *wakola*.

Wakola, translated here as 'floodwater detritus' or simply 'floodwash,' is also occasionally used to refer to 'windblown debris' by contemporary Papago. It is not simply 'driftwood' as Mathiot (1973) defined it, since pithy stems, leaves, partially decomposed organic litter, feces, and silt may be individually pointed out by Papago as what 'comes into the field' (D.S., Ge Oidag). The term is not used to include floodwaters themselves, however,

nor the nutrient-rich foam associated with flashfloods:

When [there is] so much water, it brings *wakola* and white foam. We could see it rolling this way. When it gets to the plants, it covers them. . . . Yes, my father like it, don't throw it away, pile it. We can put it back in the holes [scoured rivulets made in the fields by floods were pointed out]. He thinks it's good for the *jewed* (L.K., Topawa).

It is also clearly associated with decomposition: '[It is] all different kinds of things [that] get rotten and broke down and whenever the rain comes, it washes away. It falls and runs over the *aki*' (D.L., Ge Oidag).

Table 2. Pennsylvania State University analyses of floodwashed detritus.

	Queenswell—Field	Queenswell—Field	Topawa—Field	Topawa—Pasture	Topawa—Field	Topawa—Field	Topawa—End of Fan	Choulic—Field	Suvuk—Wash	Mean	Standard Error
Soil pH	7.2	7.2	7.2	7.1	6.9	6.7	7.1	7.3	7.5	7.1	±.1
% Organic Matter	3.5	5.0	3.8	2.8	3.5	4.7	2.8	4.9	4.7	4.0	±.3
Soluble Salts ppm	28000	140	50000	10000	15000	160	65000	63	85	18716	±2689
NO ₃ ppm	116	112	72	359	374	185	155	26	58	162	±14
K ppm	168	975	366	246	347	427	296	242	316	376	±26
Mg ppm	168	984	384	277	312	348	288	252	336	372	±26
Mn ppm	220	202	197	123	237	227	155	130	72	174	±6.3
FE ppm	14.7	53.3	3.7	10.0	4.1	4.8	11.7	8.1	36.7	16.3	±1.9
Cu ppm	1.30	.50	1.1	2.2	1.7	0.8	2.8	1.6	1.3	1.5	±.7
Zn ppm	6.4	3.0	3.9	6.7	7.6	7.4	6.3	3.0	8.4	5.8	±.2
Na ppm	38.2	32.9	41.8	39.3	38.8	40.7	35.6	29.9	34.8	36.9	±.4
Al ppm	2.0	2.0	.10	1.0	1.0	1.0	2.0	3.0	4.0	1.7	±.1
Pb ppm	2.7	2.0	2.7	3.8	2.7	2.1	3.0	1.0	1.3	2.4	±.1
Ni ppm	1.8	1.3	0.8	0.8	1.6	1.0	1.3	0.6	1.2	1.2	±.1
Cd ppm	0.3	.14	.14	.19	.35	.31	.25	.12	.07	.21	±.01

Of interest is that the idea of rotting or microbial decomposition is implicitly part of the Papago concept of soil. Their native term for 'soil,' 'dirt,' or 'land' — *jewed*, is related to the verb *jewaḍ*: 'to rot, ferment' (Mathiot, 1973: 417).

Wakola is sometimes deposited within certain fields on larger alluvial fans in great quantities. Between July 12 and October 28, 1980, roughly 25-30m³ of floodwashed detritus washed onto the surface of one hectare of a field at Topawa (ARSP, 1982). This estimate was calculated from the average length, width, and depth of 10-15 irregularly shaped *wakola* drifts which we measured on October 28. Farmers had already cleaned some of this material away from crops, or where its bulk largely overburdened crop seedlings, it had been plowed under, and in some cases crops were replanted within it. Drifts this extensive and deep have been observed only at a few fields, however. Often a flood deposits no more than a few mm of materials on the soil surface. Elsewhere, moderately substantial drifts are immediately plowed under when they arrive at the start of a season; they rapidly decompose, and are hardly observable after a brief period of time. In short, the quantity of floodwashed detritus contributed to fields is impossible to document, is spatially as well as temporally variable, but is of underestimated importance in *de temporal* agriculture.

To interpret the data on floodwashed detritus chemistry (Table 2) it must be emphasized that these materials are rapidly incorporated into the field soils upon which they are deposited. Particularly in the summer, these materials rapidly decompose, and some of their nutrients are volatilized, washed or leached away, to be lost from the field ecosystem, although they likely contribute to the 'islands of fertility' that exist on alluvial fans within legume-dominated desertscrub ecosystems (West, 1978: 303). When soil moisture is favorable, such sites exhibit a flush of plant growth which has been related to localized soil fertility (Shreve, 1964; West, 1978). The following analyses will provide evidence to test the hypothesis that sites where floodwashed detritus periodically accumulates are richer than other desert soils. The effects of cultivation on soil fertility will also be mentioned.

Soil Fertility: Papago Field vs. Uncultivated Floodplains

Papago farmers have frequently been told by agricultural advisors that they need to fertilize their crops to make them more productive. While this may be true for new garden sites located away from alluvial fans, there has been little data with which to evaluate this assumption for traditional fields on alluvial fans. Have centuries of use depleted soil fertility?

With the cooperation and permission of Papago families, I have sampled soils from nine Papago fields to



Fig. 3: Water-spreading weir in Papago field, with deposited floodwashed detritus at its base.

- 2) There has been virtually no salt accumulation within this system of runoff through-flow 'irrigation,' in part because of leaching through the soil profile
- 3) *Except for a few micronutrients, Papago field soils have levels of soil fertility adequate for the production of most kinds of annual crops sown in the densities that Papago farmers typically plant*
- 4) Floodwashed organic detritus and waters probably serve to maintain pH and macronutrients near their present levels, but micronutrient levels are more dependent on the mineral content of rock types within respective watersheds
- 5) Organic matter, important in the moisture-holding capacity of soils, varies dramatically even within the same locality, due to different deposition condi-

tions and management practices. Though relatively poor compared to ideal agricultural conditions, the majority of sites sampled in this study are richer in organic matter than most arid and semiarid soils (Figure 5). Inflowing organic detritus is responsible for sustaining the productivity of certain Papago runoff fields through augmenting the moisture-holding capacity and macronutrients upon which crops are dependent

While these fields have been vulnerable to historical land use and watershed quality changes upstream from them (Cooke and Reeves, 1976), this form of agriculture continues to be *ecologically* viable. The Papago people must decide whether or not they have the time, energy, and interest to keep it culturally and economically viable.

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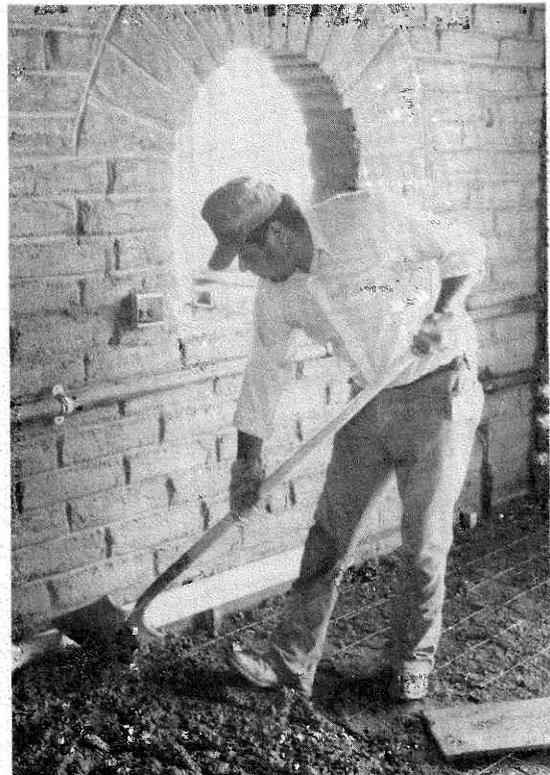
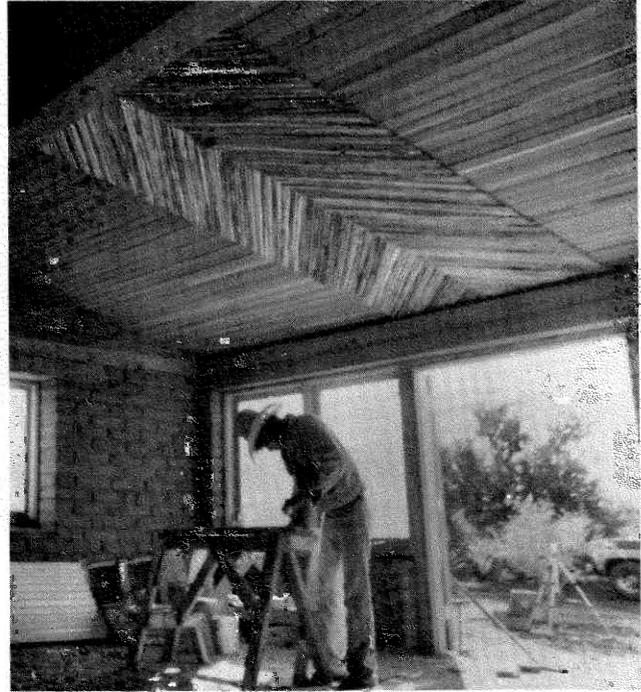
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PAPAGO HOUSING: OLD BUT NEW

This office/kitchen/meeting hall structure at Topawa, erected recently as headquarters for the Baboquivari District, was designed by Richard (Rocky) Brittain and Matts Myhrman, Brittain from the University of Arizona's College of Architecture; Myhrman, from the Department of Soils, Water and Engineering. They also functioned several days each week during the construction phase as "working foremen." Sun-dried adobe bricks, made on the Papago Reservation at Pisinemo, were used throughout. The passive solar design incorporates a south wall with a considerable area of glass to let in the winter sun and a brick floor to absorb the incoming solar radiation for release at night. Efficiently designed fireplaces provide infrequently needed backup heating. A calculated amount of roof overhang shades the south wall during the summer and the east and west walls feature rigid foam insulation sandwiched between two ten-inch thick adobe walls to reduce heat transfer into the building during the hot months. Saguaro ribs, a traditional Papago building material, form part of the interior ceiling in the meeting hall. Above this is fiberglass insulation topped with plywood decking and a low-maintenance corrugated steel roof with a baked-on red paint.

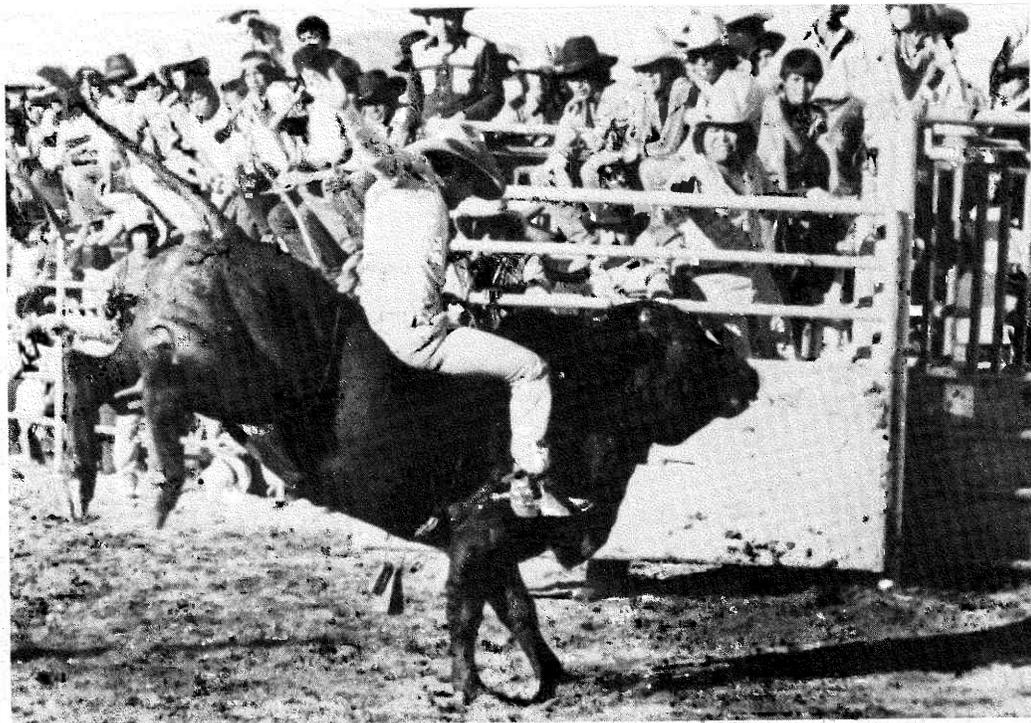
Shown here, lower left, on the ground, is Ed Kisto, the Papago who managed the project for the District, and lower right, Simon Lopez, a Papago crew member from Topawa, creating the concrete slab floor in the kitchen space. Paid for with Tribal money allocated to the

District and constructed almost entirely by Papagos, the building provides a successful example of independence from Federal involvement.





The grand entry opens the Rodeo show.

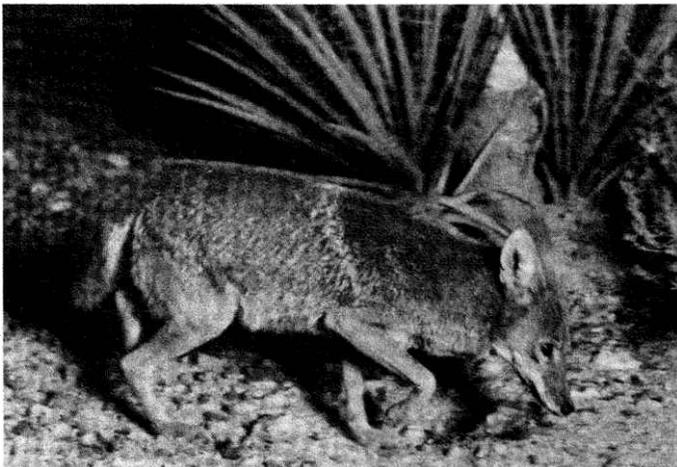


Local rodeo skills demonstrated before an admiring crowd.

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*Extensive references are given in the Fontana citations, above, for 1974 and 1983.



Flash trap camera took this picture of a young coyote, traditionally known to Papagos as their 'woolly comrade.'

—photo by Laurence M. Huey
Special Collections, University of Arizona Library

??? HAVE YOU SEEN ???

AGAVE, vol. 1, no. 1, Spring 1983. Quarterly magazine of the Desert Botanical Garden, 1201 N. Galvin Parkway, Phoenix, Arizona 85008. Membership at \$15.00 annually for individuals includes a subscription to Agave.

This introductory issue features an article by Howard Scott Gentry, 'an Agave-watcher of nearly 40 years speculating on the many kinds of species in Agave', flowering periods for desert plants by W.G. McGinnies, and a botanical reconnaissance from the Rio Grande to the Colorado by Lt. William Emory well over a century ago.

Arab Gulf Journal of Scientific Research, vol. 1, no. 1, 1983 Arab Bureau of Education for the Gulf States, P.O. Box 3908, Riyadh 11481, Saudi Arabia. Cable: Tarbish; Telex: 201441 Tarbia SJ. US\$30 (organizations), US\$20 (individuals).

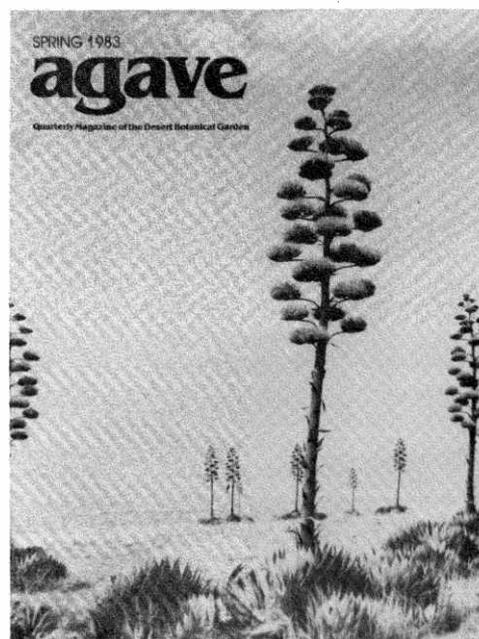
A new biannual journal dealing with original works in pure and applied sciences concerning the Arab Gulf area. Coverage in applied sciences will include agricultural sciences and applied microbiology; basic sciences cover botany, chemistry, earth sciences, mathematics, physics, zoology.

Behr, Richard A., et al (1981) Design program: Improved structural systems for earth sheltered housing. Texas Tech University, Lubbock, Texas 79409, Civil Engineering Department. 141 p.

Includes section on market factors in earth sheltered housing such as dynamics in the housing market, and market environment analysis for such home building in the Southwest U.S. The specific project environment covers a regional description, climate, site specifications, and design objectives. Particular attention is devoted to design of thin shell concrete residential structures, with special details of design of interior space. Many drawings, floor plans, details of solarium, atrium, barrel vault design, as well as flat-roofed, greenhouse, etc. Tables.

CILSS/Club du Sahel AID (1983) Procèdes du seminaire sur l'agroforesterie au Sahel. SECID (South East Consortium for International Development), 400 Eastowne Dr., Chapel Hill, N.C. 27514, USA. Projet AID/ETMA (698-0437), Contr. No. AFR/C 1697. 2 v.

v. 1: Syllabus et documents d'appui; v. 2: Exposes d'introduction. This latter volume includes background papers on 'Utilisation des espaces ruraux,' 'Desertification: Bilan programme forestier CILSS/Club,' 'Ecologie - biogéographie du Sahel,' 'L'agroforesterie au Sahel [Haute Volta, Niger, Tchad], 'La formation forestière au



Sahel.' There is a detailed description of the project's activities in English, plus tables, figures, list of participants, and recommendations.

Faggi, Pierpaolo (1983) Stato e progetti di sviluppo nel Terzo Mondo: il caso di Al-Sheykh Wali (New Valley, Repubblica Araba d'Egitto). Istituto di Geografia, Università di Padova, *Materiali* 2. 39 p.

Discusses development strategies in Egypt's New Valley area, west of the Nile, including El-Kharga, el-Dakhla, el-Farafra, el-Bahriyya, Qattara, and Siwa. It focuses on demographic and occupational as well as agricultural structures, and social response on the part of new owners, merchants, traditional owners with large holdings, small holdings, and Musta'jirin. Agencies involved include New Valley Development Authority, the Ministry of Agriculture, as well as the Ministry of the local government. References, maps, figures.

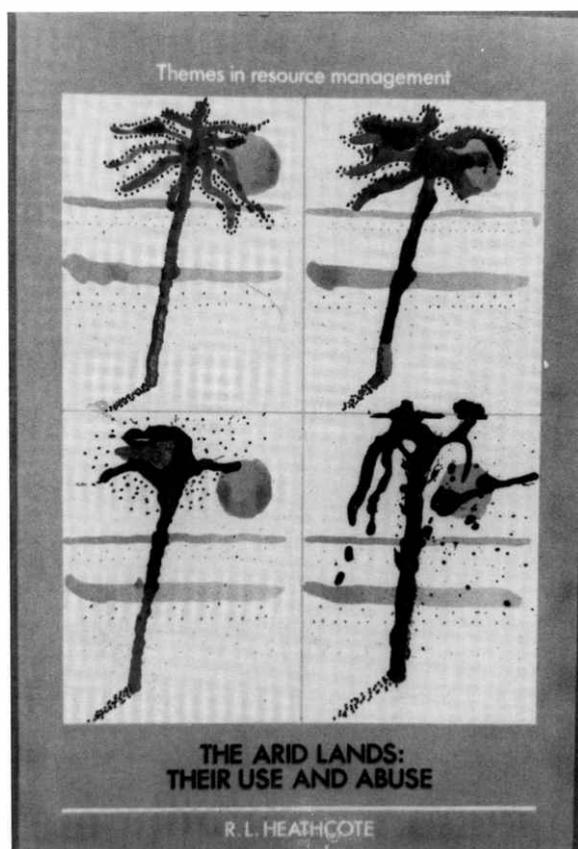
Hornaday, William T. (1983) Campfires on desert and lava. With an introduction by Bernard L. Fontana. University of Arizona Press, Tucson. 362 p. \$10.95.

A photographic reproduction of the 1908 edition of the original Scribner's Sons work, with photographic illustrations by Daniel Trembly MacDougal, John M. Phillips, and Hornaday; maps by Godfrey Sykes. In Fontana's introduction, he has located and gives in bibliographic detail the other subsequent classic works on the Pinacate since Hornaday's original account of the

famous expedition. Fontana also gives sketches of the members of the expedition, and takes pains to point out that the Papagos and their prehistoric predecessors were knowledgeable about the area long, long before Hornaday's expedition. 'The verity is that "discoverers" are generally the first to write about finding something but rarely those who make an initial observation.' Index.

Heathcote, R.L. (1983) The arid lands: their use and abuse. Longman Group, Ltd., 5 Bentinck St., London W1M 5RN. £7.95. ISBN: 0-582-30048-7. 323 p. (Themes in Resource Management).

In the context of arid resource management, the author details resources of arid lands (plant, water, animal, energy) and addresses the evolution and impact of human resource use (nomads, ranching, marginal land use, irrigation, mining, urbanization). His conclusions deal with the problems of arid land management such as different systems of land ownership, conflicting philosophies of resource allocation and political jurisdiction, and reflect his perception of varying human views of the global arid lands and their role as resources, what he calls 'contrasts and ambiguities.' References, photos, charts, tables, figures.



ITTC Review, No. 45, January 1983. International Technical Cooperation Centre, 200, Dizengoff Rd., P.O.B. 3082, Tel Aviv 61 030, Israel. ISSN 0047-1216.

This publication, sponsored by the Association of Engineers and Architects in Israel, includes arid lands information in each issue, but the January 1983 issue, noted above, is devoted almost exclusively to problems applicable to desert environment: 'Concepts for the Future in Irrigation Planning' (India), an in-depth article on 'Economic Growth, Values and Physical Planning' as applied to settlements for which a model design is included, and a comprehensive annotated bibliography on 'New Communities,' covering managing, planning, financing, staffing, organizing, and building large-scale development. *Development Topics* include a description of agricultural research in Latin America, *Development Notes* include information on such arid lands as Argentina, Chile, India, Israel, Jordan, Mali, Pakistan, Senegal, Somalia, Tunisia, and Yemen.

International Hill Land Symposium, April 1983, Oregon State University (1983) Foothills for food and forests. International Scholarly Book Services, P.O. Box 1632, Beaverton, Oregon 97075. \$34.95 + \$2.00 shipping and handling.

The integrated development of foothill lands for grazing and forestry represents the greatest opportunity for increasing production of both food and fiber in the world, a prospective that is enhanced by its lack of competition with present productive land use. It is felt that grazing is especially important on hill lands because animals are the only practical means of harvesting and marketing the forage. A quiet revolution has been underway in the U.S., Australia and New Zealand which now opens these steep slopes to economically and environmentally sound production. It is hoped that by assembling and publishing this information, it will become more readily available to research scientists and to farmers, ranchers and foresters in a position to implement the principles of this developing technology.

Mann, H.S./Prakash, Ishwar (1983) Halting the march: Eco-development in the Thar. India Dept. of Environment/World Wildlife Fund (India), Environmental Services Group, B/1, LSC (First Floor) J Block Saket, New Delhi 110017. 36 p.

Building on a concept of three factors: 1) climatic changes, 2) pressure of increasing human population, and 3) pressure of increasing livestock populations, this paper outlines the processes of each: 1) establishment of aridity, droughts; 2) cultivation of marginal lands, increase in irrigation cropping, and exploitation of woody biomass; and 3) overgrazing, and proceeds in an orderly way to describe the consequences of each of the processes that proceed from the basic factors. Maps, tables, photographs, references.

International Conference on Jojoba and Its Uses, 5th, 1982, Proceedings (1983). Edited by Anna Elias-Cesnik. University of Arizona, Tucson, College of Agriculture, Office of Arid Lands Studies. 295 p. \$20.00.

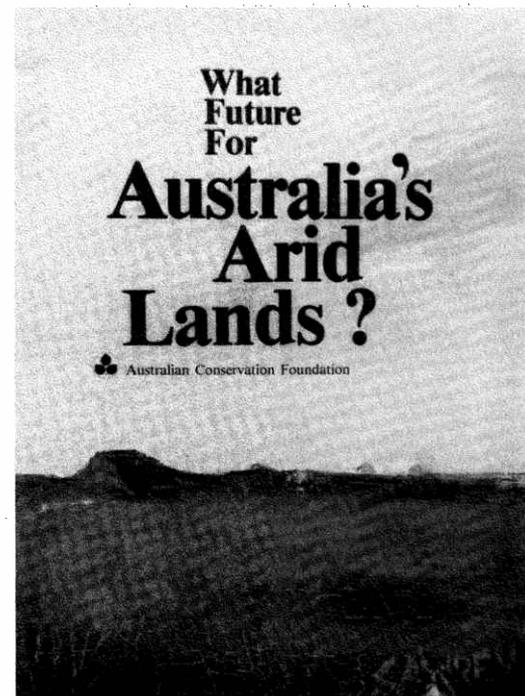
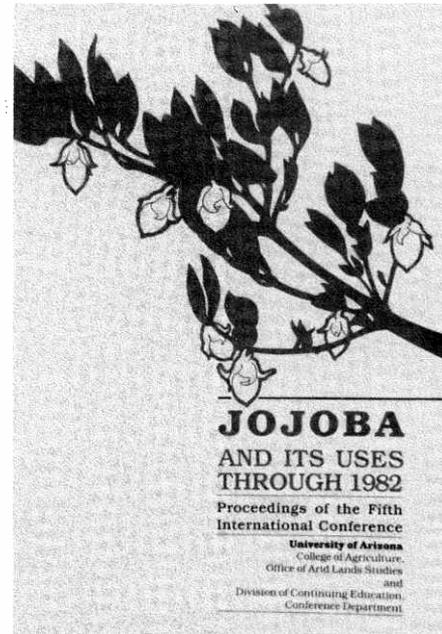
Commemorating the 10th anniversary of the first jojoba conference, held at the University of Arizona in 1972, this collection includes a number of technical papers and case studies, as well as additional papers on cultural practices, plantation costs and financing, sources for genetic materials, known yields, harvesting, processing and marketing, and jojoba product uses. A few papers in Spanish. Charts, tables, photos, references, author index. Publication of these papers brings us up to date on what Noel Vietmeyer in his keynote address calls the 'jojoba phenomenon.'

Messer, John/Mosley, Geoff, eds. (1983) What future for Australia's arid lands? Proceedings of the National Arid Lands Conference, Broken Hill, New South Wales, May 21-25, 1982. Australian Conservation Foundation, 672B Glenferrie Rd., Hawthorn, Victoria 3122. 206 p. ISBN 0-85802-074-2.

Covers in depth the status of the arid lands environment (soils and vegetation, animals, dunes, erosion, fire), current land use and cultural environment (pastoralism, aboriginal lands, parks and reserves, tourism, land release), factors affecting the use of the land and its resources (land use economics, research, public policy), future land-use trends and possibilities (pastoralism, parks and reserves, mining, planning), and includes brief reports on the seven workshops held in connection with the conference and the concluding plenary session. The editors hope that the dialogue presented here will create mutual understanding of differing perspectives, attitudes and approaches with the common goal of developing wise long-term national politics. Maps, photos, charts, references, list of participants.

Myers, Norman (1983) A wealth of wild species: Storehouse for human welfare. Westview Press, Boulder, Colorado 80301. 274 p.

The author points out compellingly that like Earth's most precious minerals, the planetary gene pool is a valuable natural resource vulnerable to irreversible harm. Wild species of plants not only contribute to medical properties valuable to human welfare, but also hold the promise of revolutionizing agriculture as well, worldwide; and their uses as foods, sources of new chemicals for pest control, and even new kinds of contraceptives are resources increasingly ripe for investigation. Wild animals likewise have made great and often little known



contributions to mankind. The author, while presenting a vast range of examples of how humans have benefitted from wild species, goes beyond, to remind us that for every wild species lost, we have lost the potential to deal as well with yet-unknown problems of the future. That we do not wish to live without wild beings is only one side of the coin. That perhaps we *cannot* live without them is a vastly more important reason for preservation. Photographs, references.

Pasternak, D., comp. (1983) The use of saline water for the production of crops in arid lands. First annual report, May 1982-January 1983. Cooperative Arid Lands Agriculture Research Program, United States-Egypt-Israel. Ben-Gurion University of the Negev, r&d Authority, Applied Research Institute, Beer-Sheva, Israel. 22 p.

This initial period was devoted to planning, establishment of the experimental setup in the field and greenhouses, and conduct of preliminary trials. In the field the salt response curve of eight vegetables was established, with broccoli and kohlrabi showing outstanding salt resistance, green peppers and groundnuts proving to be very salt-sensitive. A novel setup to study interactions of nitrogen and salinity under greenhouse conditions has been constructed, with the first experiment with a melon crop under way. Included in this report are briefs on a genetic approach to saline culture of tomato, and fertilizer and water management under irrigation with brackish water.

Permaculture, No. 12 (May 1983), the Journal of the National Permaculture Association. Permaculture, 37 Goldsmith St., Maryborough 3465 (Victoria), Australia. Overseas subscription \$12 Australian money order or bank draft, or \$14 in national currency.

This issue of 39 pages includes stories on 'Design Notes for Desert Dwellers,' 'Desert Sustenance Without Agriculture,' 'Sustainable Agriculture,' 'Chinese Desert Strategy,' 'Cuttings to Grow From,' as well as detailed information on international Permaculture Association members and allied groups, seed exchange, tools, films, slides, books/leaflets. The overall aim of permaculture design is 'to produce an efficient low-maintenance productive integration of plants, animals, structures, and man; with the ultimate result of on-site stability and food self-sufficiency in the smallest practical area.' Enough said!

Schowengerdt, Robert A. (1983) Techniques for image processing and classification in remote sensing. Academic Press, N.Y., London. 249 p. \$25.00.

Since the advent of the Landsat series of satellites in 1972, digital image processing and classification has become an increasingly important aspect of remote sensing, and this work is an excellent introduction to these techniques. A discussion of digital scanners and imagery and two key mathematical concepts for image processing and classification, spatial filtering, and statistical pattern recognition are presented, followed by a comprehensive descriptive survey of image processing and classification techniques widely used in the remote sensing community. This book is useful as a primary source in an introductory image processing course, or as a supplementary textbook in an intermediate-level remote sensing course. Numerous figures and references.

El Tayeb, Galal El Din/Lewandowski, Anne M. (1983) Environmental degradation in Gedaref District. Sudan Environment 3 (1): 1-7.

Indicators of environmental degradation in the southern part of Kassala Province, Sudan, include decreased agricultural productivity, overgrazed pasture land, deforestation, soil degradation, extensive areas devoid of vegetative cover, rapidly increasing rural-urban migration, and social transformation of traditional livelihood systems — classic symptoms worldwide. Local blame is assessed in this brief on mechanized farming which has induced many subsistence farmers to give up their land. The frightening statistics show an increase in population over a 40-year period from 7,000 to 200,000 in the town of Gedaref itself where there is a severe housing shortage, lack of health services, water supply, schools, teachers, with concomitant urban crime. Beyond, however, is the belated recognition that profits from the imposition of mechanized farming are not reinvested to improve the natural resources of the area but are transferred outside. Much of the dura produced in the District, for instance, goes to international markets. The project investigating these conditions is continuing, with findings expected to be refined. Refs., tables.

Weber, Fred/Hoskins, Marilyn (1983) Agroforestry in the Sahel. A concept paper based on the Niamey Agroforestry Seminar, 23 May-9 June 1983. Jointly sponsored by CILSS, AID, SECID. Virginia Polytechnic Institute, Blacksburg, Virginia 24061. 102 p.

A succinct brief on agroforestry, 'one of the more recent buzz-words in the development world,' that covers traditional Sahelian systems, modern techniques, situation analysis, and a proposed agroforestry strategy. An annex of technical details for Sahelian techniques include dune stabilization, windbreaks, live fences, village woodlots, vegetation strips, reforestation of depleted farmland, and others. References, charts of types of 'intervention,' both traditional and introduced, covering rainfall range, major species, secondary species, and purpose (production, conservation, restoration).

Weber, Fred/Hoskins, Marilyn W., eds. (1983) Soil conservation technical sheets. University of Idaho, Moscow, Idaho 83843, Forest, Wildlife and Range Experiment Station for USAID/USDA. 94 p.

An expanded and updated version of working papers originally prepared for CILSS (Cape Verde Islands, Chad, the Gambia, Mali, Mauritania, Niger, Upper Volta, Senegal) technicians, the present publication represents various conservation techniques to serve training, information, and extension needs of field technicians across the Sahel. Topics include methods of increasing organic matter, revegetation, erosion control, and surface water conservation. Table of acronyms, glossary, some references.

MEETINGS — ANNOUNCEMENTS

April 25-28, 1984:

Association for Arid Lands Studies meeting in conjunction with the Western Social Science Association, Convention Center and Holiday Inn-Embarcadero, San Diego, California. *Contact: Robert H. Schmidt, Jr., Program Chairman, Dept. of Geological Sciences, University of Texas at El Paso, El Paso, TX 79968. Telephone: (95) 747-5559/5501.*

May 13-18, 1984:

International Rangeland Congress, 2nd, Adelaide, South Australia. Sponsored by the Australian Rangelands Society, Australian Academy of Science, and UNESCO's MAB program. Topics will include grazing, ecophysiology, mining and rangelands, conservation and wildlife, management of grazing systems, man and the biosphere, primary producers, fire. *Contact: Congress Secretariat, c/o CSIRO, Private Bag, Post Office, Deniliquin, NSW 2710, Australia.*

May 16-31, 1984:

United Nations Environment Programme Governing Council, 12th, Nairobi, Kenya. Two days will be devoted to consideration of the General Assessment of Progress of Implementation of the Plan of Action to Combat Desertification, adopted by the UN General Assembly in 1977. There will be an examination of what progress, if any, has been made in combating desertification over the last seven years since the 1977 Nairobi Conference. In view of the disappointing results so far in financing the Plan of Action, it is probable that a renewed call will be made to the international community to increase efforts to combat the progress of desertification threatening one third of the world's arable and grazing land, and the livelihood of over 600 million people. *Arid Lands Newsletter* will deal with this in more detail after the May 1984 meeting.

June 18-22, 1984:

Groundwater Hydrology Short Course, Northern Arizona University, Flagstaff, Arizona. A one-week course intended for persons in private or public organizations dealing with groundwater but who have had little or no formal training in groundwater. The course provides a basic understanding of the occurrence, movement, collection, recharge, contamination, and protection of groundwater, and of land subsidence and fissuring due to groundwater overdraft. Principal lecturer is Dr. Herman Bouwer, Director of the U.S. Water Conservation Laboratory at Phoenix, Arizona, and Adjunct Professor in groundwater hydrology, Arizona State University. *Contact: Dr. Charles C. Avery, School of Forestry, Northern Arizona University, Flagstaff, AZ 86011. Telephone: (602) 523-3031.*

July 23-27, 1984:

Kew International Conference on Economic Plants for Arid Lands, cosponsored by ICASALS, Texas Tech University, Lubbock, will be held at the Royal Botanic Gardens, Kew. *Contact: Dr. G.E. Wickens, Organizing Secretary, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, England.*

October 1-5, 1984:

International Symposium on Remote Sensing of Environment, 18th, Paris. Organized and conducted jointly by the Centre National d'Etudes Spatiales (CNES) and the Environmental Research Institute of Michigan (ERIM). The Symposium will address state of the art capabilities and techniques, emphasizing current and future capabilities for remote sensing from space. Topics include current techniques and operational applications, advanced techniques and methodology, socio-economic considerations, and future earth observation from space. *Contacts: Alain Gaubert, CNES, 42 rue Cambronne, 75015, Paris. Telephone: 1.306.26.40; Jerald J. Cook, ERIM, P.O. Box 8618, Ann Arbor, MI 48107. Telephone: (313)994-1200.*

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