New Life From Ashes II: A Tale of Burnt Brush[1]

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Now, about that burn on Queen Creek... can't you just smell that smoke? Well, you just about have to catch the wind right. You got it now? That fire flickered out long ago, but you're a smart feller now... can't you just ***smell*** *it in those old ashes? Them Indians was mighty smart. Knew what they was doin' right along. You got to hand it to 'em bein' able to take a patch of that dry sponge of a desert and wring so much livin' from it.* — The Old Timer

Just how the Hohokam manipulated pristine Sonoran desert vegetation has been a well concealed secret. We have long been aware that the plants once growing in anciently cultivated fields within the Sonoran Desert and in nearby desert margins left their name tags behind in the form of durable, recognizable pollen types which were downright peculiar in the proportions in which they were recovered from prehistoric context. Just as a rainbow carries a spectrum of colors, a sample of soil contains a spectrum of different pollen types in characteristic frequencies. Pollen spectra from old Hohokam fields are unusual in having high frequencies of insect pollinated types like Globemallow (*Sphaeralcea*), Spiderling (*Boerhaavia*), and *Kallstroemia*. Such plants produce small numbers of large, sticky pollen grains which in combination with brightly colored petals and nectar glands attract insects. One might expect that the numerous, small, dry pollen grains of inconspicuous blossoming wind-pollinated plants like Bursage (*Ambrosia*) should dominate the desert record in the past, just as today. Early Hohokam farmers must have been doing something different to their fields, and perhaps to the surrounding desert as well, to alter the proportions of insect and wind carried pollen.

Until recently, hints as to the nature of Hohokam disturbance have been locked in pollen records still preserved in sediments beneath prehistoric water reservoirs and along former canal margins which were part of the Salt-Gila Aqueduct Central Arizona Project Archaeological Data Collection Studies near Queen Creek. The reservoirs were used for domestic water supplies and possibly for pot-irrigation (Crown, 1984:101). Pollen Sample "9g" was obtained by excavating deeply within a well-like feature that was part of the reservoir at the archaeological site known as AZ U:15:98, and deeper than the prehistoric surface prior to reservoir construction. When Suzanne Fish, the project's pollen analyst, tabulated the pollen from stratum 9g, some of her expectations of a near normal pollen rain were met. The pollen spectrum resembles undisturbed vegetation in the study area today by having the wind pollinated *Ambrosia* type pollen as the most frequent (37.5%), and with only small amounts of the insect pollinated types of Creosotebush (*Larrea*), Paloverde (*Cercidium*), and Mesquite or Ironwood (*Prosopis/Olneya*). Spiderling (*Boerhaavia*) pollen at 11.5% seemed compatible with some disturbance (Fish, 1983:602). Although the proportions of *Ambrosia* pollen in the prehistoric spectrum are high relative to the other pollen types, the frequency is still significantly lower than values one obtains today from modern surfaces in analagous locations, such as 74% from the modern surface beside a former canal at Frogtown.

The lowermost reservoir sediments were investigated for charred organic remains with no results. The technique used is called flotation; it capitalizes on the observation that heavy soils sink in water while the more bouyant or-

[1]The title "A Tale of Burnt Brush" is a play on words relating to the author's prior "Tale of the Burnt Bush" in *Desert Plants* 5 (3):122–124.

ganic matter rises to the surface and can be skimmed off. However, floating the next 8 cm layer produced charcoal of creosote, paloverde, and white thorn acacia as well as carbonized grass stems. Samples taken above the first sample regularly contained charcoal of Desert Broom (*Baccharis sarothroides*) or Seepwillow (*Baccharis glutinosa*), species liable to become established on ditches and canals from natural waterways. They also contained a token scatter of carbonized seeds of plants of disturbed ground: Tansy Mustard (*Descurainia*), Globemallow, Prickly Poppy (*Argemone*), Brittlebush (*Encelia farinosa*), *Plantago*, and Dropseed Grass *Sporobolus* (Miksicek, 1983:607).

Miksicek proposed that the movement of burned material into the reservoir could be accounted for in a variety of ways including: 1. Charred remains from fields and canals cleared by fire could have been secondarily transported into the reservoir. 2. Charred material exterior to the fields could have been transported by surface run-off to the reservoir. 3. Floodwater debris deposited on fields could have been burned in place and moved secondarily to the reservoir.

Two pollen samples obtained from the same drainage as the reservoir but lower, on each side of a canal that served the prehistoric hamlet of Frogtown (AZ U:15:61) help to evaluate several of the proposed explanations (Fish, 1983:592). This is the same place where *Ambrosia* pollen dominates the modern spectrum with frequencies of 74%. Once the trenching exposed deeper sediments from the irrigated or field side of the canal, Suzanne Fish again analyzed a series of soil samples at various depths for their pollen content. The trench (no.197) at levels 40–80 cm below the surface contained pollen spectra with *Ambrosia* values from 13–17% while cheno-ams (Chenopods or Goosefoot plus Amaranths or Pigweed) never rose above 12%. Values of insect pollinated types like Spiderling (*Boerhaavia*) ranged from 24% to 28%, and high-spine Compositae never exceeded 13%. Flotation from the same trench between 40–60 cm (Miksicek, 1983:617) resulted in single examples of Paloverde and Desert Broom charcoal, burned grass stems and one of Maize, confirming the existence of a cultivated field, and a burned cultivated field at that. If a field was periodically burned, and disturbed through cultivation, some plant species like Spiderling, might thrive and leave an exceptional pollen record. But wait.

Another pollen sample was taken from a trench dug outside the irrigated field on the upslope or desert side of the canal (Trench 183, 10–30 cm. below surface; Fish, 1983: 593). *Ambrosia* pollen was significantly higher (9–46%) than the field samples but Spiderling (*Boerhaavia*) values were highly erratic 10–30 cm below the surface. Some dipped as low as 5% and some climbed as high as 37.5%. Wind pollinated cheno-ams and insect pollinated high spine Compositae remained below 12%, similar to the field on the opposite side of the canal. Fortunately flotation samples were obtained from the same trench (Miksicek, 1983:617). Paloverde, Mesquite, and Creosotebush charcoal, carbonized grass stems, a carbonized seed of Bursage (*Ambrosia*) and a Desert Hackberry seed (*Celtis pallida*) support the surmise that this was desert vegetation. But we now know that it was desert vegetation modified by fire. The numerous carbonized seeds representing *Plantago*, Prickle Poppy, Globemallow, Pigweed, Goosefoot, and Umbelliferae (Miksicek, 1983:617,618) testify to the disturbed ground that produced them. How many times was a ditch bank burned to control the weeds before sparks ignited a dry tangle of grass or herbs and spread from there? Or maybe it wasn't just an accident. Some of those same plants were valued for edible seed. For example, carbonized seeds of *Plantago*, Pigweed (*Amaranthus*), and Goosefoot (*Chenopodium*) appear on the floors of many houses of prehistoric Frogtown (and elsewhere in the Hohokam area), and have been esteemed to the present day as sources of food. But that is another matter worthy of discussion later. However, when the two complementary records of macrofossils and pollen are combined from the reservoir and each side of the canal the resultant vegetative pattern would seem to have been produced by clearing fields, ditches, and broad patches of the desert by fire.

So much of what we know of fire ecology in the desert fits the evidence (Table 1). When the desert burns it is hit-or-miss: it forms a swiss cheese pattern of surviving vegetation. Paloverde, Bursage (*Ambrosia*) and Cholla will be reduced, but *Plantago* will thrive (Table 1). If Bursage is reduced, it follows that its pollen production will be less. Prehistoric Bursage pollen frequencies near 40% are significantly less than those found in modern surface samples. People may have burned the reservoir area as an aid to hunting and gathering in the desert before they ever initiated agricultural activities and may have continued to do so periodically afterward. The increase in herbs of disturbed ground following fire promotes populations of seed predators such as pocket mice and kangaroo rats (Bock and Bock, 1978). Prickly Pear Cacti with spines burned off attract rabbit and deer predation (Martin, 1983:608), possibly protecting other vegetation from being eaten. One way or another food resources are enhanced. It may come as no surprise that hunting among agricultural people adds to the diversity and stability of the food base. The Hohokam used hoofed mammals to supplement a steady supply of rabbits, hares, and small rodents (Szuter, 1984:168). Vegetation modified by fire was one way to attract these creatures.

We are just beginning to learn how vegetation is and was modified by fire in the Sonoran desert. Only in the last five years have we measured how high the mortality rate of Saguaro cactus really is, for it takes some years for these giant cacti to die (Rogers, 1985). I am aware of no studies of the effect of fire on *Agave* populations. If the effects are severe, it might be one reason the Hohokam cultivated the plants in southern Arizona (Fish et al., 1985). And it might be an equally good reason to transplant Cholla near dwellings in hamlets, as Fish (1984:120) suggests, so their flower buds would be available as a spring vegetable. Cholla pollen frequencies are as abnormally high in hamlets as they are abnormally low around farmsteads (Fish, 1984: 134–135) where fire as an agricultural tool would be as much respected as a digging stick. It would be interesting to know how populations of the annuals of disturbed ground so commonly eaten by the Hohokam (Gasser, 1981) would respond to fire. It's just a hunch that the nutlets of prostrate *Kallstroemia* would resist burning because of their tough coat and would be expected to multiply as a result. Patchy burns in the desert with skips of cacti, trees, or shrubs (typically low pollen producers) or in cultivated fields seems compatible with the prehistoric irregularly high frequencies of pollen of Globemallow (*Sphaeralcea*), *Kallstroemia*, and the Four O'Clock family. In the fields, the relatively low ground cover formed from prostrate stems of *Kallstroemia* and Spiderling would offer shade and thus some protection of the soil from moisture loss. The fire-orange petals of Globemallow flowers would attract bees long before (and after) squash blossoms appeared. Such plants could be tolerated then and might be tolerated once more in desert gardens today.

Sonoran desert plant communities have not been thought capable of supporting fire because of inadequate fuel loads. However, the growth of winter annuals can produce the maximum potential fuel load found in desert grasslands (McLaughlin and Bowers, 1982:247). Others would argue that no fire in the Sonoran Desert has been natural since the introduction and spread of exotic annuals (Rogers and Steele 1980). Perhaps. Or argue that the frequency and intensity of fire may have increased (Ibid). And that may have been true during the early history of Arizona (Bahre, 1985). But is is also highly probable that prior to domestic grazing the greasses played a far greater role in creating a potential fuel load after summer rains. In the Salt Gila Aqueduct study at the Siphon Draw Site (a hamlet or village of the Gila Butte chronologic phase) the archaeobotanical assemblage seems to reflect the kind of vegetation found in the project area today better than any other site, *except for the abundance of grass stems recovered* (italics mine; Miksicek, 1984:70). Because 68% of all flotation samples at Frogtown (a Santa Cruz and Sacaton Phase hamlet or village site) produced grass stems, Miksicek (1984:76) suggested an abundance of summer rainfall for the growth of perennial grasses. If burns were not at too close intervals, and as long as the rains returned, so did the grasses. Or so it was when the Hohokam lived there. My own studies of the prehistoric site of La Ciudad in central Phoenix (Bohrer, 1987) revealed that people collected grain of native grasses that thrived upon disturbed ground. When Miksicek (1984:60) compared local boundary survey records with modern vegetation, he found that both Bursage and Creosotebush had increased since 1869. The loss of competing grasses and forbs with overgrazing and the subsequent lack of fuel to burn the Bursage and Creosote are factors very similar to the ones that fostered the spread of shrubs in the Desert Grassland (Humphrey, 1958).

Some evidence suggests the Pima and Papago once used fire to manipulate plant growth. Burning was thought to increase the fertility of the soil (Castetter and Bell, 1942:125). Heavy growths of vegetation were cleared from proposed fields by burning (Ibid.). At the oasis of Quitovac, Sonora, the Papago regularly burned stands of Cattail, Bullrush and Fan Palm (Rea, et al., 1983:8). The Pima formerly conducted communal hunting drives with the help of fire, but away from the villages and fields in shrub-dominated areas where *Atriplex*, *Ambrosia*, *Lycium* and coarse grasses might be found (Rea, 1979). I believe if successful burns could be carried out on a broad enough scale in areas of the desert where Bursage now grows, both the shrub itself and the pollen it produces could be suppressed and Bursage pollen rain would be as low as that recorded in soil samples prior to Hohokam reservoir construction and in sediments on the non-irrigated side of the Hohokam field discussed earlier. Modern Pima and Papago fields are no longer managed in a way that even approximates the prehistoric pollen rain. Modern Papago fields have a pollen rain characterized by a predominance of cheno-am types (Goosefoot and Amaranth families combined) with much lower freequencies of Spiderling, Globemallow and *Kallstroemia* (Fish 1983:596). Globemallow (*Sphaeralcea*) will multiply regardless of the form of disturbance and so evidently will Spiderling (*Boerhaavia*), for we recognize them as agricultural weeds (Parker, 1958). Suzanne Fish thinks that turning the soil by plow has much to do with the proliferation of cheno-ams in modern fields, and I agree that exposure to light probably stimulates the germination of many seeds of these two families. However, two discrepancies between the prehistoric and modern pollen rains are not readily accounted for by the modern phenomenon of plowing. One is the very low frequencies of *Ambrosia* pollen even when cheno-ams do not "swamp out" the *Ambrosia* counts. The other is the peculiarly high prehistoric *Kallstroemia* counts from former fields. Now we realize that fire will supress Bursage, apparently the chief contributor to *Ambrosia* in the pollen spectrum. Former use of fire in hunting

Table 1. Comparison of the archaeological plant record along Queen Creek with Sonoran Desert fire ecology

Hohokam Plant Record	Remarks on Fire Ecology
Supressed *Ambrosia* pollen production	Bursage (*Ambrosia deltoidea*) easily killed by fire (McLaughlin and Bowers, 1982:247).
Evening primrose (*Oenothera*) typical of irrigation ditches (Fish, 1983:587). No apparent response to moisture by perennials on Frogtown ditches Fish, 1984:127).	Burning irrigation ditches encourages growth of annuals of disturbed ground.
Globemallow (*Sphaeralcea*), Spiderling (*Boerhaavia*) and *Kallstroemia* consistently part of field spectra and are sporadically abundant.	*Sphaeralcea ambiqua* recovers from burning in the same year (Cave and Patten, 1984). Seeds of both *Boerhaavia* and *Kallstroemia* protected by additional fruit coat. Fires leave islands of vegetation (McLaughlin and Bowers, 1982).
Cholla cactus pollen (*Opuntia*) rare near farmsteads, very common near hamlets. Prickly pear pollen abundant at Jones Ruin farmstead (Fish, 1984:135)	Cholla easily reduced in number by fire (Cave and Patten, 1984:494.) Lower percentages of Prickly Pears are killed by fire than Cholla (Reynolds and Bohning, 1956:772)
Salt-Gila Aqueduct samples contain less total pollen of creosote bush (*Larrea*) than might be expected from surface samples. (Fish, 1983:129) Jones Ruin)	Creosote bush is easily shoot-killed by fire, though it resprouts (McLaughlin and Bowers, 1982:247).
Az U: 15:98 Reservoir had charcoal of Desert Broom, Paloverde, Acacia, and Creosotebush and charred seeds of Tansy Mustard (*Descurainia*), Dropseed (*Sporobolus*), *Plantago*, Globemallow were present. (Miksicek, 1983:607)	Burning Sacaton Grass (*S. wrightii*) stimulates growth of other grasses and herbs (Bock and Bock, 1978). *Plantago insularis* and *P. purshia* stimulated by fire (Cave and Patten, 1984). Paloverde easily injured by fire and has high mortality rate (Ibid). "The relationship between annual plants and fire requires analysis" (Rogers and Steele, 1980:18)
Az U:15:98 Reservoir had one burned seed of Brittlebush (*Encelia*) (Miksicek, 1983:608).	Brittlebush was 83% reduced by fire and within 9 mo. increased to 762% above preburn status on control site. (Cave and Patten, 1984:495)

practices of the Pima could account for that. My guess is that fire also accounts for the proliferation of *Kallstroemia* as well.

Reconstructing fire histories where people used various burning techniques presents special problems. It is difficult to deduce the seasonality and frequency of burning, the scale of burning, the intesity of firing, and ways in which fires were set or excluded (Lewis 1980). Just how and when the land was fired so as to encourage the durable triumvirate that the Hohokam were able to perpetuate throughout most of southern Arizona : Spiderling (*Boerhaavia*), *Kallstroemia* and Globemallow (*Sphaeralcea*) is just one more mystery that needs unraveling.

In the final volume of the Salt-Gila Aqueduct Project Patricia L. Crown summed up environmental findings this way:

> *The Hohokam modified their environment to such an extent, and so enhanced it in the doing, that plants derived from a strictly natural environment cannot be separated from those derived from the modified environment. Yet, a considerable proportion of the plants documented in the pollen and macrofossil records are not cultivated plants, either. The Hohokam utilized the environment they had modified, apparently to a significant extent, and their role in changing the environment of the Salt Gila Basin cannot be viewed as having been detrimental to their survival.* (Crown, 1984:95–96)

Just like the old timer says, you have to hand it to the Hohokam for wringing a living from the desert near Queen Creek. And if the wind is from the right direction, you can just about ***smell*** old fires smoldering under their skilled hands.

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