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EMERGING DESERT LANDSCAPE IN TUCSON*
E. GREGORY McPHERSON and RENEE A. HAIP

ABSTRACT. Early in the twentieth century thousands of trees were planted in Tucson, and the city became an arborescent oasis. By the midcentury population boom planting had declined. Mechanical cooling reduced the need for tree shade, and golf and tennis replaced gardening as the preferred leisure-time activities. Perceived water shortage has spurred the adoption of a new desert landscape marked by stone mulch and arid-adaptive plants. This landscape may have precedence for other cities similarly facing water shortages.

IN 1875 there were only three trees growing in Tucson, Arizona. By 1910 thousands of exotic trees had been planted in an effort to transform the desert city into a garden spot of the Southwest. An equally dramatic change is now occurring throughout the city: the lush green vegetation of trees is being replaced by desert landscaping. The transition from a desert city to a garden city and the current return to the former reflect shifting attitudes of the populace toward the environment. What compelled this change, and what are the implications for urban dwellers in the future? Is the emergence of desert landscaping another example of history repeating itself, or does it express an evolutionary process that points to a more symbiotic relationship between man and nature? In this essay we examine urban vegetative changes in Tucson with the goal of answering these questions. We focus specifically on the geographical processes and natural-resource constraints that influenced attitudes toward tree planting and house landscaping during the past century.

Urban vegetation reflects both the cultural milieu and the physical environment. In Tucson vegetative patterns are linked to climate, water resources, cultural heritage, urban morphology, and the values of the population. Tucson is located in a Sonoran Desert basin surrounded by four mountain ranges. Average annual rainfall of eleven inches arrives during two seasons, summer and winter. The seasonal rains and hot, arid climate support abundant and diverse native desert flora that include many arboreal species such as saguaro cactus (Carnegiea gigantea), paloverde (Cercidium microphyllum), and mesquite (Prosopis velutina). Many plants from temperate and humid subtropical climates thrive with consistent irrigation. Hispanic

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1 Arizona Daily Star, 25 October 1908.


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culture is an important aspect of the city's heritage, because nonnative Tucson originated as a Spanish settlement along the Santa Cruz River in 1775. As in many other western American cities, the horizontal, low-density developmental pattern reflects the post–World War II population expansion and the importance of the automobile as the dominant mode of transportation. The population of the city tripled between 1950 and 1970. Currently more than 650,000 people live in metropolitan Tucson, and the population is projected to reach 1.6 million by 2025.³

The portion of Arizona in which Tucson is located became part of the United States through the Gadsden Purchase in 1854. By then the vegetation of the small town was a mixture of native American species and Spanish-Mexican imports. After the Gadsden Purchase Anglo settlers arrived, and the adobe townscape expanded. The form of this Spanish-Mexican townscape consisted of buildings with facades directly on the narrow streets so that little space was available for trees (Fig. 1). The central portions of blocks were left vacant for domestic animals and gardens. Plants were located in interior courtyards similar to the mission style. Although shade trees were not abundant, plantings did include chinaberry (*Melia azedarach*), Mexican paloverde (*Parkinsonia aculeata*), Arizona ash (*Fraxinus velutina*), and peppertree (*Schinus* ³PAG Population Handbook: 1987, Pima Association of Governments, Tucson, 1987.)
Civic leaders like Sam Hughes and Hiram Stevens were among the first to plant trees in Tucson circa 1875. (Reproduced courtesy of the Arizona Historical Society, Tucson)

Most trees in early Tucson were probably volunteers that settlers nourished rather than intentionally planted.

By 1875 Tucson was still a desert city, although civic leaders began planting trees to shade their houses and to beautify the city (Fig. 2). The greening of Tucson began a year later when a handful of Bermuda grass (*Cynodon dactylon*), brought from San Diego, turned a dusty corner lot into a cool, verdant oasis.

The late 1870s marked the beginning of great horticultural experimentation and effort to transform Tucson from a dusty desert city into a garden oasis. The amelioration of the inhospitable desert climate and the enhancement of the place as a winter health resort were driving forces behind a forty-year-long afforestation effort. Abundant water supplies made possible this change.

It is not widely known that the primary impetus for pumping groundwater in Tucson was to irrigate decorative landscapes. Around 1880 the first

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windmill was imported from Indiana to provide water for an experimental
garden. Its introduction alleviated the burden of drawing water by hand
from the fifty-foot-deep well. Several years later new steam-powered water
pumps were installed, and the storage capacity was enlarged to irrigate a
double-row planting of cottonwoods (*Populus fremontii*) that extended a half
mile along both sides of the Southern Pacific Railroad track. The purpose
was to create an attractive entry for visitors. The new plantings were not
always successful. An unusual shortage of irrigation water resulted in the
loss of transplants throughout the city in 1892. That year stress-tolerant
species like the chinaberry or the mulberry (*Morus alba*) were recommended
as the best shade trees for the region, and planting of the water-thirsty
cottonwood was discouraged.

City leaders actively promoted tree planting. In 1888 the city council
negotiated a contract with the local utility, Tucson Water, to provide free
water for street trees. Local plant enthusiasts and botanists associated with
the University of Arizona and the Carnegie Desert Laboratory generated
increased interest in horticulture through exemplary gardens and articles
written for the local newspapers. The former provided an important medium
for the dissemination of ideas and information about urban vegetation. For
example, in 1907, "it has been declared by several local botanists and tree
experts that it is impossible to grow oak and eucalyptus in this vicinity with
any degree of success. A trip to the home of A. R. MacDonald in the north
eastern part of this city, will, however, soon disprove of that thought."

The editors of the *Arizona Daily Star* and other respected civic leaders
mounted a citywide street-tree-planting campaign during the last part of the
nineteenth century. Tree planting was considered a civic duty and was
promoted on the basis of shading and beautifying streets. Furthermore, one
editor encouraged public participation by extolling the healthful effects of
trees on urban climate and air quality. He noted that tree planting "will
result in greatly reducing the temperature of the summer months, as vege-
tation absorbs the heat, and more growing trees absorb many kinds of poi-
nxious gases and thus they are not liable to be inhaled by the people."

The passage of Arbor Day legislation by territorial lawmakers in 1901
fueled the tree-planting movement. Arbor Day was specifically geared toward
education, so "that children may be trained to take an interest in the planting
and caring for gardens and trees." Editorials exhorted residents to celebrate
Arbor Day, and Tucsonans responded by planting trees (Fig. 3). According
to the *Arizona Daily Star*, residents planted 10,000 trees in 1907 and 1908, or

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8 *Arizona Daily Star*, 18 April 1893.
9 *Arizona Daily Star*, 21 December 1892.
13 *Arizona Daily Star*, 7 February 1902.
approximately one tree for every other resident. A politician was quoted as saying, “The people in the east have an idea that all the vegetation that can survive in Arizona soil is cactus and soap weed, but I expect to see the day
when there will be no other city in the country that will be beautified with trees as will the Old Pueblo."\textsuperscript{14}

New architectural styles and developmental patterns influenced the transformation from desert to garden city. In March 1880 the railroad reached Tucson, and people with their eastern and midwestern landscape images and values as well as access to different building and plant materials began arriving. Residents abandoned traditional Sonoran architectural and landscape styles for the ones imported from the east. The structure of residential neighborhoods changed dramatically as setbacks for houses resulted in large front and back yards as well as space for planting trees along streets.\textsuperscript{15} Planting yards with Bermuda grass and winter rye (\textit{Lolium} sp.) created an aesthetic setting for houses. Foundation plantings were used to soften the harsh environment and to embellish the architecture (Fig. 4). Exotic species were collected from around the world. For example, in 1895 "several palms, magnolia trees, and varieties of shrubbery, arrived at the depot yesterday for the university, from Riverside, Cal."\textsuperscript{16} The ornamental qualities of exotic species such as oleanders (\textit{Nerium oleander}) and roses (\textit{Rosa} spp.) were important in these new horticultural plantings.

Ironically, while Tucsonans were planting a host of exotic trees, the natural riparian woodland was being destroyed as the water table was lowered, as land was cleared for farming, and as timber was harvested for fuel. Flow in the Santa Cruz River became intermittent prior to 1890, and between 1886 and 1890 floods cut a deep channel and washed away vegetation.\textsuperscript{17} The water table continued to drop as pumping increased and smaller amounts of runoff recharged the groundwater. Thus the creation of a mythical Arcadian garden at Tucson occurred at the expense of its natural riparian forests. Today riparian woodlands and mesquite bosques that lined the Santa Cruz River and other watercourses in Tucson account for less than 10 percent of their original abundance.\textsuperscript{18}

During the initial two decades of the twentieth century, public participation in tree planting remained high. Residents planted trees to improve the quality of their environment; however, interest in the activity gradually diminished. In 1916 Arbor Day was no longer a school holiday.\textsuperscript{19} An editorial in the \textit{Arizona Daily Star} early in 1920 recommended that the day be dropped as a state holiday because people planted trees anyway.\textsuperscript{20} Although interest in tree planting waned, the urban forest created by one generation was a legacy (Fig. 5). "Now there are thousands of street trees, several parks,
hundreds of homes beautified with plant life of all kinds, so that Tucson today, seen from a nearby mountain looks like a young forest where 30 years ago there were but three trees.”

**Sun-Drenched Oasis**

By the early twentieth century, Tucsonans had created an oasis in the desert. Having established a new image for the city, the business community began promoting it as a winter resort. The Sunshine Climate Club was established in 1922 to advance tourism. Furthermore, the mild winters attracted the health industry. The construction of a principal veterans’ hospital in 1928 brought additional residents.

Landscape design became an important means of enhancing the image of the city as a winter-resort community. For example, a professor at the University of Arizona proposed that a new boulevard be lined with plantings of “palms, peppers, olives, and oleanders ... illustrating the semitropical climate of Tucson to our visitors.” Landscape-design experts recommended

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 overseeding winter lawns with Australian rye grass and using evergreens such as pyracantha (Pyracantha sp.), eucalyptus (Eucalyptus sp.), African sumac (Rhus lancea), and silk oak (Grevillea robusta) to accentuate the illusion of a subtropical climate. After 1950 the few new residential areas with tree-lined streets had species like sour orange (Citrus aurantium) and palms symbolic of a subtropical climate rather than deciduous trees that connoted the bleak, cold winters that winter visitors were fleeing.

At the same time that Tucsonans were maximizing winter sun and promoting tourism, the advent of evaporative cooling reduced the need for summer shade. Sweltering summertime heat was the impetus for planting trees and escaping to the nearby mountains. Tree shade was a necessity because summers were spent outside prior to the availability of mechanical cooling. However, effectively engineered evaporative cooling was developed in the early 1930s, and by 1940 “the average home and workshop on the

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desert are more comfortable places in June and July and August than the dwellings in milder zones where air-cooling has not been accepted as essential.\textsuperscript{26} Abundant energy supplies fueled the postwar boom of the air-conditioned desert and the gradual demise of tree-lined sidewalks and streets.

A tremendous surge in housing demand after World War II resulted in many subdivisions laid out beyond the city corporate limits. Building codes and zoning ordinances were not implemented in Pima County until the mid-1950s, and the first general landuse plan was approved in 1960.\textsuperscript{27} Tract houses were typically ranch-style buildings surrounded by Bermuda-grass lawns. Foundation plantings were infrequent, although developers sometimes planted fruitless mulberry or elm trees on each parcel.\textsuperscript{28} Extensive landscaping was not characteristic of the suburban tract developments that arose east and north of the city center between 1940 and 1975. Hence the horticultural landscape was replicated as the city expanded, but fewer street and front-lawn trees were planted than previously. It was estimated that more than half of the new houses constructed after 1950 had no shade trees in the front yard.\textsuperscript{29}

New streets were added and existent ones widened to accommodate the growing number of motorists. Main streets that were once lined with trees became starkly bare when they were widened or when old trees were removed and not replaced (Fig. 6). Although medians of new boulevards were planted with pines, eucalyptus, palms, and grass during the 1960s, roadsides were seldom landscaped.

By about 1950 there was little public interest in tree planting, and a concern for shade and other functional uses of plants was virtually absent. A maturing urban forest covered older neighborhoods, and horticultural plantings in new subdivisions were ornamentally symbolic of the sun-drenched oasis. However, between 1950 and 1970 an increased number of residents began converting their horticultural plantings to desert landscapes. This shift was attributed to a change in the value of leisure time and a heightened appreciation of the natural environment of the region.\textsuperscript{30} Tucsonans were participating in a countrywide recreational mood. Golf, swimming, and tennis became more popular than gardening as leisure-time activities. Upper-class Anglos were the first to install desert plants, stone, and Mexican paving instead of grass lawns in the front yards. Desert-landscape precedents existed in the foothills and in a midtown subdivision called Colonia Solano, where lower-density development was accompanied by the preservation of existent vegetation (Fig. 7).


\textsuperscript{28} Personal communication from David Taylor, City of Tucson Planning Department, 14 April 1988.

\textsuperscript{29} Hecht, footnote 25 above.

Although many residents began to appreciate the natural beauty of the desert and to incorporate its elements in garden design, the impetus for
desert landscaping came when most Tucsonans perceived water scarcity as a problem. Tucson is wholly dependent on groundwater, and since approximately 1950 more of it has been pumped than has been naturally returned to the aquifer. However, a comparison of identical surveys administered in 1971 and 1977 revealed that not until 1977 did most residents consider the falling water table to be a serious problem. This increased awareness coincided with a period of growing national concern about environmental issues as well as intense local debate and media coverage regarding water supply. Declining groundwater supplies, increased water prices, and water-conservation programs have spurred an astonishingly rapid change in the city landscape. The traditional greensward and lush plantings have been replaced with rock mulches and low-water-use species at a steady rate since the late 1970s. Tucson began to shed its green mantle as the desert city reemerged.

Water conservation began to be a concern for many Tucsonans when the severe drought struck in 1974. For several days portions of the city at highest elevations were without water because pumping capacity did not meet demand. In 1976 a recently elected city council levied a 22 percent water-rate increase in July, one of the heaviest periods of water consumption. Four

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council members were eventually recalled, but the rate was never returned to its previous level.\textsuperscript{32} Because 50 percent of the typical monthly water bill during summer can be for landscape irrigation, many homeowners replaced lawns and trees with rock and cactus. The local water utility successfully combined increased rates with conservation preachments to reduce demand. In 1976 the utility initiated a peak-demand-reduction program. Because landscape irrigation accounted for 30 to 50 percent of peak municipal demand, it hoped to promote water-efficient landscaping. A study was conducted to compare change in irrigated lawns and water use for two periods. Results of the study showed that a 1972-to-1976 trend of 1.7 percent increase in irrigated lawns was reversed to a decrease of 17.5 percent between 1976 and 1979. The largest change was on front lawns. Municipal water consumption decreased 20.6 percent in that period. Per-capita water use declined from 204 gallons in 1974 to 148 gallons in 1979.\textsuperscript{33} Desert landscaping, which had been fashionable for some during the 1950s, became an economic necessity for others during the 1970s.

An unlikely coalition of business people and environmentalists joined the local utility in promoting water conservation and desert landscaping.\textsuperscript{34} The Southern Arizona Water Resources Association (SAWARA), largely directed and funded by the business community, advocates desert landscaping, that is, xeriscape, through an annual design competition and educational conference. Many of its members view water scarcity as a threat to the continued growth of the region. Tucsonans are encouraged to conserve water so that there will be enough for its booming population, which is expected to reach one million before 2025. In contrast, local environmental organizations like the Arizona Native Plant Society advocate water conservation for ethical reasons. They believe that water conservation is an important mechanism for growth management and that both are needed to bring Tucson back to harmony with its natural desert environment. From their perspective, desert landscaping reflects a new ecological sensitivity toward the surrounding natural environment. Hence conservationists regard desert landscaping as the manifestation of a new environmental ethic, while business leaders regard it as an economic necessity. Although their ultimate objectives vary, the combined voice has resulted in the wide acceptance of desert landscaping for water conservation during the past two decades.

City service departments began advocating desert landscaping through example and by providing informational materials. In the mid-1970s the parks-and-recreation department converted median strip plantings along

main streets from lawn and large shade trees to desert landscaping (Fig. 8). The state Groundwater Management Act now prohibits watering of plants that are not low in water use along public rights-of-way. In 1979 the city planning department released a publication entitled Landscaping in the Desert. In 1988 the city adopted a water-conservation landscape ordinance that restricts the use of turf and mandates planting of low-water-using species for required landscaping on private nonresidential properties.

The emerging desert landscape in the city bears little resemblance to earlier desert landscape. Now many plants are drought-tolerant exotics from Australia and South Africa instead of native volunteers. Homeowners rake decomposed granite instead of sweeping packed earth, and they use sophisticated subterranean irrigation systems instead of buckets of water. Moreover, the emerging desert landscape contains relicts of the Arcadian oasis that were not present in the original desert landscape. Giant Aleppo pines (*Pinus halapensis*) and Italian cypress (*Cupressus sempervirens* 'Stricta') silhouette the skyline as testaments to a bygone era.

**Closing Comments**

After more than a century, Tucsonans are changing to plantings that are compatible with the natural environment. Once the change began, the rapidity of its acceptance is striking. This rapid shift from horticultural to desert landscape illustrates how strong sociocultural traditions like a grassy front lawn can be modified if people are presented the right combination of
incentives, mandates, and educational materials. The new landscape appearing in the city abandons the features of the Arcadian horticultural garden with its profligate waste of water, its illusion of subtropicality, and its monotonous anonymity. The new desert landscape has immense potential for both good and bad. It can strengthen a sense of place by creating a direct link between the urban environment and the natural desert contact. It can foster a greater appreciation of the city’s history and cultural diversity by assimilating features symbolic of previous times. It can nurture growth, both personal and collective, by making the city a more livable and attractive place.

The ecological role of vegetation is more important today than during the previous desert landscape, when the environment was not so befouled with the by-products of a highly consumptive urban populace. Urban trees are one of the most cost-effective ways to reduce carbon-dioxide emission from power plants because their shade lowers the demand for cooling energy. Urban plantings can also reduce storm-water runoff, noise along principal streets, and atmospheric pollutants. Generally these ecological benefits increase as the amount of plant biomass increases. With continued growth of tourism in the city and with environmental quality an increasingly important issue, need for urban vegetation will expand.

For this study we sampled land-cover change by using aerial photographs from 1953, 1971, and 1983. The results indicate that vegetative cover in Tucson decreased from 37.3 percent to 28.6 percent between 1971 and 1983. Desert landscaping appears to be associated with an overall reduction in the amount of vegetation in the city. Additionally, because the mature size of most desert trees is less than that of the removed exotics, the potential amount of future tree-canopy cover is less for desert landscapes than for the replaced horticultural ones.

Are the goals of conserving water and increasing urban vegetation mutually exclusive? The answer is likely to be yes, if landscaping policies and ordinances continue to address only water conservation rather than the broad goal of managing the urban vegetative resources to make the city more livable. Homeowners in several urban places near Tucson receive landscape rebates if their designs meet water-conservation criteria. The ultimate water-conserving landscape is the zeroscape of decomposed granite devoid of plants, and it qualifies for the rebate. This landscape is not only unattractive and biologically sterile but also is a hot spot that increases demand for cooling energy by 20 to 30 percent. If city government and other community leaders

do not actively promote appropriate desert landscaping, zeroscapes may become the rule, not the exception.

The evolution of the new desert landscape in Tucson will be informative for other cities that may soon face similar water shortages. Inevitably the rising cost of water will prompt additional abandonment of the luxury of verdure. Tucson is likely to become a hotter, drier, and dustier place than it has been previously. On the other hand, residents might be persuaded to reforest the city with desert-adapted species. A new spirit of environmental stewardship may arise as individuals take action to improve local environments and begin the long-term process of ongoing care for the vegetative resource. Collectively they can emphasize the nurturing milieu. The transformation from a garden city to a desert city may well be completed by the twenty-first century. Whether the new landscape will make the city more livable will be determined in the future.