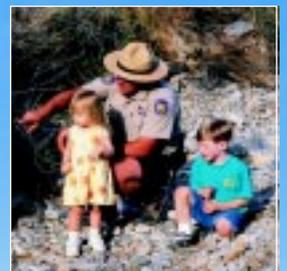
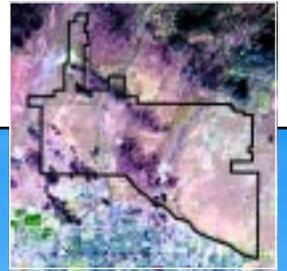


Sonoran Preserve Master Plan

An Open Space Plan for the Phoenix Sonoran Desert



City of Phoenix

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An Open Space Plan for the Phoenix Sonoran Desert

City of Phoenix Parks, Recreation and Library Department
February 17, 1998

Herberger Center for Design Excellence
Arizona State University



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Executive Summary

The Sonoran Preserve Master Plan has been prepared by the City of Phoenix Parks, Recreation and Library Department (PRLD) in cooperation with the Phoenix Sonoran Preserve Committee. This plan was presented to all interested City of Phoenix urban village planning committees, as well as the Environmental Quality Commission, and it received enthusiastic support. On January 22, 1998, the Parks and Recreation Board and the Phoenix Sonoran Preserve Committee both unanimously approved the plan at a joint meeting. The City Council unanimously approved this plan on February 17, 1998. Driving this effort is the fact that we live amid some of the most beautiful and biologically rich desert in the world and this valuable resource is being threatened at an increasing rate. With sensitive planning, a commitment to maintaining our quality of life, and quick action, we can accommodate quality growth and preservation of the Sonoran Desert. This Sonoran Preserve Master Plan builds on the Desert Preserve Preliminary Plan prepared in 1994, citizen involvement, and a database and ecological inventory prepared by the Parks, Recreation and Library Department in conjunction with Arizona State University.

The planning process for the Sonoran Preserve incorporates traditional planning techniques (inventory and analysis) with landscape ecological theory. Past open space preservation efforts have been primarily designated by only three criteria: slope, visual prominence, and land ownership. The Sonoran Preserve Master Plan attempts to develop a system that functions biologically—maintaining species diversity and ecological processes—while providing a recreational resource. We want to avoid the oversights of the past that created “sky islands” with miles of walls separating the mountain preserves from the greater community and the larger natural environment. The plan includes approximately 21,500 acres in north Phoenix. Additional lands also recommended for preservation include 1,000 acres adjacent to South Mountain Park. Several key goals were used to develop the plan.

Acquire a Diversity of Lands

The preservation of rich vegetation mosaics will help the desert flora and fauna survive and flourish. The goal is to contribute to preserving biodiversity. Lands to be included in the Sonoran Preserve should span the spectrum from creosote-bush flats and washes to beautiful saguaro-studded hillsides.

Preserve Natural Hydrological Processes

The water courses or washes are the most biologically diverse and ecologically significant component of the desert landscape. This goal envisions preserving the floodway (actual sandy wash from bank to bank), the definable 100-year floodplains, and sufficient buffers to allow wide enough corridors for wildlife movement and natural meandering of the wash course to occur over time. This represents a significant change in development practices and will ensure long-term preservation of washes, expand the land area within the preserve, and capture a diversity of vegetation communities.

Integrate a Preservation Ethic into the Overall Urban Form

Public ownership is only a part of the objective. In the broadest terms, the preserve system should be made up of municipal recreation lands (major mountains, washes, and transition lands), flood control infrastructures (secondary and minor washes that could be county owned or privately held and maintained for nonstructural flood control), trails, scenic corridors, utility corridors, and privately held natural open space. This will integrate the desert into the urban fabric rather than preserve a series of isolated remnants of natural open space.

Maintain Internal and External Connectivity with the Sonoran Preserve System

The Sonoran Preserve should connect with other public open space; for example, schools, parks, and other municipal lands that contribute toward preserving the natural environment. Creating viable connections for the movement of people and wildlife will greatly enhance both the ecological health of the preserve and recreation opportunities for the public. Lands that contribute to this effort include lands which are identified for preservation by the Maricopa Association of Governments, lands owned or managed by Maricopa County Parks Department, United States Forest Service, United States Bureau of Land Management, United States Bureau of Reclamation, Flood Control District of Maricopa County, City of Scottsdale, City of Peoria, Town of Cave Creek, and Town of Carefree.

Eighty percent, or 16,800 acres, of the lands recommended for preservation are owned by the Arizona State Land Department. Of these lands, approximately 15,000 acres are

within the city limits. These Trust Lands will require acquisition through the Arizona Preserve Initiative. Twenty percent, or 4,700 acres, are privately held lands. This ratio of state trust lands to private lands is approximately equivalent to the proportion of land ownership in the area and not a function of targeting either party. It is recommended that privately-owned lands targeted for preservation will be acquired primarily through the development process.

The master plan recommends three major access points that will include parking, picnicking, outdoor education, and visitor services. These will be similar in size and scope to Squaw Peak Park, Dreamy Draw Recreation Area, and North Mountain Park. An outdoor environmental education center is planned for one of these major gateways. Also recommended are a minimum of eight secondary entry points that will consist of parking lots on the edge of the preserve linking interior trails to the larger community. Multiple neighborhood access points are recommended to accommodate and focus walk-in use as well as alleviate congestion and degradation of the minor and secondary access points and the preserved lands. A detailed trails plan will need to be prepared in the near future.

This master plan creates a framework for a preserve system that builds on Phoenix's history of setting aside significant Sonoran Desert land for recreation, open space, environmental education, and preservation of native flora and fauna. The successes and mistakes of the past are used as building blocks for the development of this plan and the designation of the preserve boundaries. Changes to existing city ordinances relating to floodplain management and subdivision development are recommended to support the goals of the plan.

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Introduction

The City of Phoenix is distinguished by its stunning, instantly recognizable desert skyline. Our desert mountains and flatlands captivate visitors and bring perpetual joy to residents by offering beautiful vistas and invigorating outdoor adventures. The Sonoran Preserve Master Plan sets forth a blueprint for preserving this special landscape. The plan seeks to protect the plants and animals that inhabit the Sonoran Desert while creating access to these lands for the people who love them. In two unanimous actions on January 22, 1998, the City of Phoenix Parks and Recreation Board endorsed this master plan and agreed to ask the City Council to submit an application to the Arizona State Land Department for the acquisition of 15,000 acres under the Arizona Preserves Initiative. On February 17, 1998, the Council also voted unanimously to adopt the master plan and to move forward in acquiring this open space. In doing so, the Council continues a time-honored precedent for protecting and preserving desert open space within the city and for ensuring recreational access for our citizens.

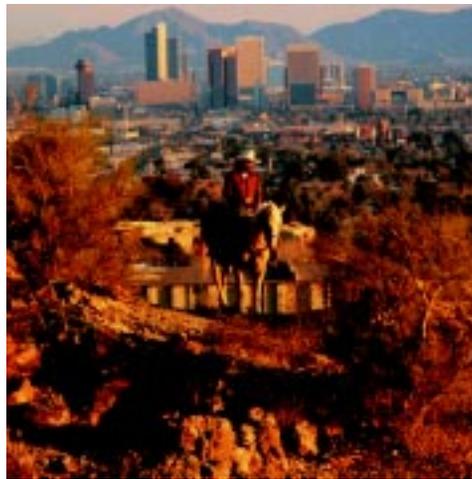
Beginning 75 years ago, Phoenix citizens and elected officials have taken numerous actions to create the Phoenix Mountain Preserves, South Mountain Park, and other preserved desert open space. Forward-looking city leaders secured the 16,500-acre centerpiece of the preserves—South Mountain Park—well in advance of the neighborhood development that now encompasses it. In its first year, 1924, some 36,000 people visited the park; in 1997, an estimated three million visitors accessed the park’s many trails and picnic areas. In 1960 the city was able to secure just 350 precious acres at the top of Camelback Mountain, a landmark that was already encircled by private homes. Then, in 1972, the public voted to expand the Phoenix Mountain Preserves by 10,500 acres with the addition of the North Mountain range. This addition increased opportunities for the city’s rapidly growing population to commune with our desert environment. The Phoenix Parks, Recreation and Library Department staff continues to address open space issues, seeking to maintain a respectful balance between neighborhood security and privacy while ensuring public access.

It is now time to prepare for the next stage of the city’s growth, to set forth on the path of implementing the Sonoran Preserve Master Plan. By creating a process for the identification and acquisition of public open space in advance of the impending development, the plan will serve as a model for growth that serves the interests of neighborhood residents by providing excellent public access to outdoor spaces.

The Parks and Recreation Board has been privileged to work with the superb staff of the City of Phoenix Parks, Recreation and Library Department, other city departments, the citizen members of the Phoenix Sonoran Preserve Committee, Mayor Skip Rimsza, members of the Phoenix City Council, and Arizona State University. Their participation in the development and support of this plan has been invaluable. We look forward to working toward its realization for the residents of the City of Phoenix—those living here today and those who will be among us in the decades to come.

Florence Eckstein, Chair
Phoenix Parks and Recreation Board

Chapter 1



A
harmonious relation to
land is more intricate, and of
more consequence, than the
historians of its progress
seem to realize.

Aldo Leopold
A Sand County Almanac, 1949

Context

The City of Phoenix has a long and proud history of preserving significant desert open space. In the 1920s, the Heard family and others persuaded the United States Congress to sell us South Mountain Park when it was seven miles outside the city limits. In the 1960s, the City acquired the Papago Buttes. Senator Barry Goldwater and other valley leaders led the way to preserving the landmark Camelback Mountain. In the 1970s, Margaret Hance, Dottie Gilbert, Ruth Hamilton, and others convinced Mayor Driggs to preserve the Phoenix Mountains. That is their legacy—it is now time for our generation to step forward and establish our legacy in setting aside the Sonoran Valley Preserves for future generations.

Skip Rimsza, Mayor of Phoenix, 1998

A. History of Preservation Efforts

The Sonoran Desert environment of central and southern Arizona is our region's most defining characteristic. The City of Phoenix (COP) has a long tradition of preserving large tracts of land with Sonoran vegetation, specifically the paloverde-saguaro communities found on bajadas (coalesced alluvial fans that form a gently sloped apron around the base of a mountain) and mountain slopes (Figure 1.1).

In 1920, Phoenix covered only 5.1 square miles and had a population of 29,033 (Figure 1.2). City leaders had a vision and acquired what they believed to be the last prime recreation site for picnicking, horseback riding, and hiking near the city. This desert mountain region, located seven and three-quarter miles south of the city limits, was called the Salt River Mountains and included the Gila-Guadalupe and Ma Ha Tuak ranges, with Mount Suppoa as its highest peak (2,690 feet). Prominent community leaders whose names we recognize, such as Dobbins, Heard, and Mather, with the help of United States Senator Carl Hayden, encouraged President Coolidge to sell 13,000 acres to the city for \$17,000. In 1925 the first patent for South Mountain Park was secured by presidential decree. South Mountain Park, now 16,500 acres, is the largest municipal park in the country and is considered by policy a part of the Phoenix Mountain Preserve System (Parks, Recreation and Library Department [PRLD] 1989).

In 1935, the National Park Service developed a master plan for the park with riding and hiking trails, scenic drives, a museum, picnic areas, and overlooks, all designed with a rustic regional character. The facilities in the park were primarily constructed by the Civilian Conservation Corps in the late 1930s based on this plan. With the 1,200-foot elevation gain along the five-mile stretch of summit road and 22 miles of hiking trails, the park has become increasingly popular. Visitation has soared from 36,000 a year in 1924 to over 3,000,000 a year in the 1990s (Burke 1997). In 1989 a new master plan was prepared for South Mountain Park by P&D Technologies (PRLD 1989).

By 1959 Phoenix had expanded to 187 square miles and had a population of 437,000. The city leaders dedicated themselves to the acquisition of 1,100 acres of unique landforms owned by the State of Arizona (Figure 1.3). The City of Phoenix acquired the land for \$3,529 and began improvements immediately with \$1 million from the 1957 bond election (PRLD 1996b). They envisioned the development of a premier recreation area, and in 1964 Papago Park was established. Today, the park contains the Phoenix Zoo, the Desert Botanical Garden, picnic areas, urban fishing lakes, and one of the best affordable golf courses in the country (Whitten 1996). Visitation exceeds two million annually. In 1997 the PRLD prepared an inventory of the park's past master plans, historical improvements, cultural resources, and a calendar of annual events (PRLD 1997). In 1998 the environmental consulting firm SWCA Inc. completed a wildlife and habitat inventory and in March 1998 the PRLD completed a master plan that included recommendations for the future development, management, and operations of Papago Park (PRLD 1998).



Figure 1.3 Papago Park circa 1940

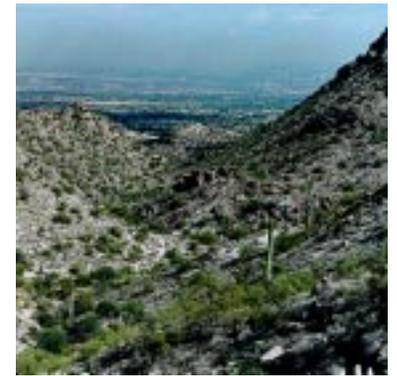


Figure 1.1 South Mountain Park

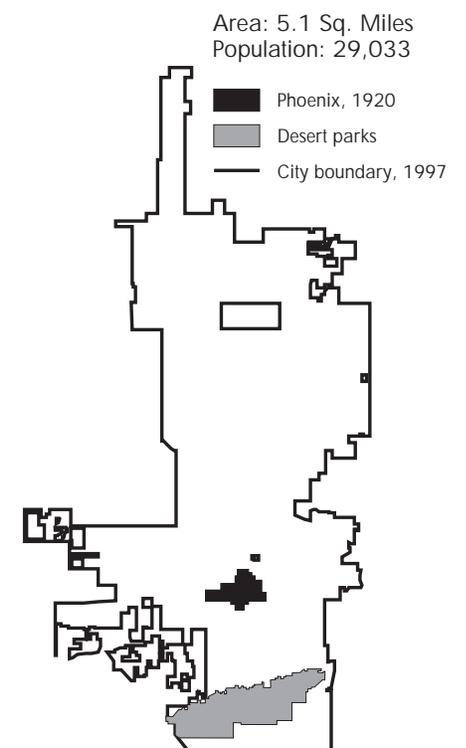


Figure 1.2 Phoenix, 1920

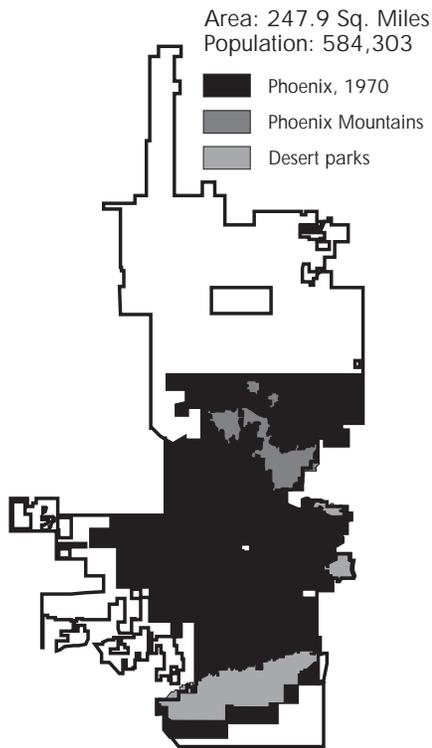


Figure 1.6 Phoenix, 1970



Figure 1.8 Phoenix, 1997

The late 1960s saw the preservation of a regional landmark when U.S. Senator Barry Goldwater, Lady Bird Johnson, and other community leaders teamed up to acquire 350 acres of Camelback Mountain (Figure 1.4). The Save Camelback Foundation promoted the acquisition and preservation of land above the 1,800-foot elevation. In 1971 the city acquired 76 acres on the north side of Camelback from local architect Joe Lort for the development of a trailhead in Echo Canyon. The Camelback Summit Trail is the second most popular trail in the PRLD system with an estimated 350,000 users per year. In the 1980s a second trail access point, Cholla Trail, was acquired at the east end of the mountain.



Figure 1.4 Camelback Mountain circa 1920

On a spring day in 1970, a group of valley horsemen took the Phoenix Mayor and City Council members on a breakfast ride in north Phoenix to demonstrate the beauty and potential of the Phoenix Mountains (Figure 1.5). With development encroaching up the southern slopes of Squaw Peak, activists were concerned that access for horseback riding would be lost and that home sites would scar the ridgelines. After a detailed master plan was completed by Van Cleeve and Associates in 1971, the City Council adopted Resolution No. 13814 and established the Phoenix Mountain Preserve in January 1972 (PRLD 1971). To preserve the skyline and provide open space and recreation to a growing city, which now boasted 584,303 people in 248 square miles (Figure 1.6), 9,700 acres were targeted for acquisition. Today the 7,500-acre preserve (acquired for over \$70 million) includes features such as Shaw Butte, North Mountain, and Dreamy Draw Recreation Area, which annually attract 1.5 million visitors to their trails, parks, and picnic areas. The Phoenix Mountain Preserve also contains the Squaw Peak Summit Trail, the most popular summit trail in the country with over 500,000 hikers per year (Burke 1997).

The City of Phoenix currently operates and maintains over 27,000 acres of mountain preserves and desert parks (Figure 1.7), which host many recreational and outdoor activities—hiking, mountain biking, horseback riding, picnicking, outdoor education, bird watching, and biological field studies. Since World War II, the City of Phoenix has been witness to explosive growth in population and land area. As the city has expanded, the mountains that once rested on the urban

fringe surrounded by plains of creosotebush and bursage have become isolated. They are now islands of Sonoran Desert within a sea of urban development (Burke 1997).

The city is now nearly 470 square miles and is home to 1,204,689 residents (Figure 1.8). Phoenix ranks as the sixth largest city in the country and has consistently been in the top ten cities in the nation for rate of growth. While the amount of dedicated open space has continually increased within the city and Maricopa County, the acreage per capita has decreased (Morrison Institute for Public Policy 1997). As growth continues, dedication to preserving our most unique asset, the Sonoran Desert, must increase accordingly if we are to maintain the long-standing tradition of desert preservation that has established our identity and so significantly affected our quality of life.

B. Benefits of Urban Preserves

Preservation of natural areas within a city can have a profound effect on the entire community. Preserved natural lands provide visual and emotional relief from the day-to-day stresses of living in an urban setting (Spirn 1984; Hough 1989). Natural areas or preserves provide the necessary space for passive outdoor recreation and environmental education. They preserve the indigenous flora and fauna and help maintain biological diversity, which benefits wildlife and humans alike. The preservation of large natural open space systems has also been proven to positively affect residential and commercial property values and development patterns (Correll et al. 1978; Shaw 1992; Fausold and Lilieholm 1996). Proximity to preserves is also a consideration in corporate relocation, economic vitality, and tourism. These benefits can be seen where residential and resort properties adjacent to the existing mountain preserves are considered prime locations. The *Desert Preserve Preliminary Plan* (PRLD



Figure 1.5 Breakfast ride in the North Mountains, 1970

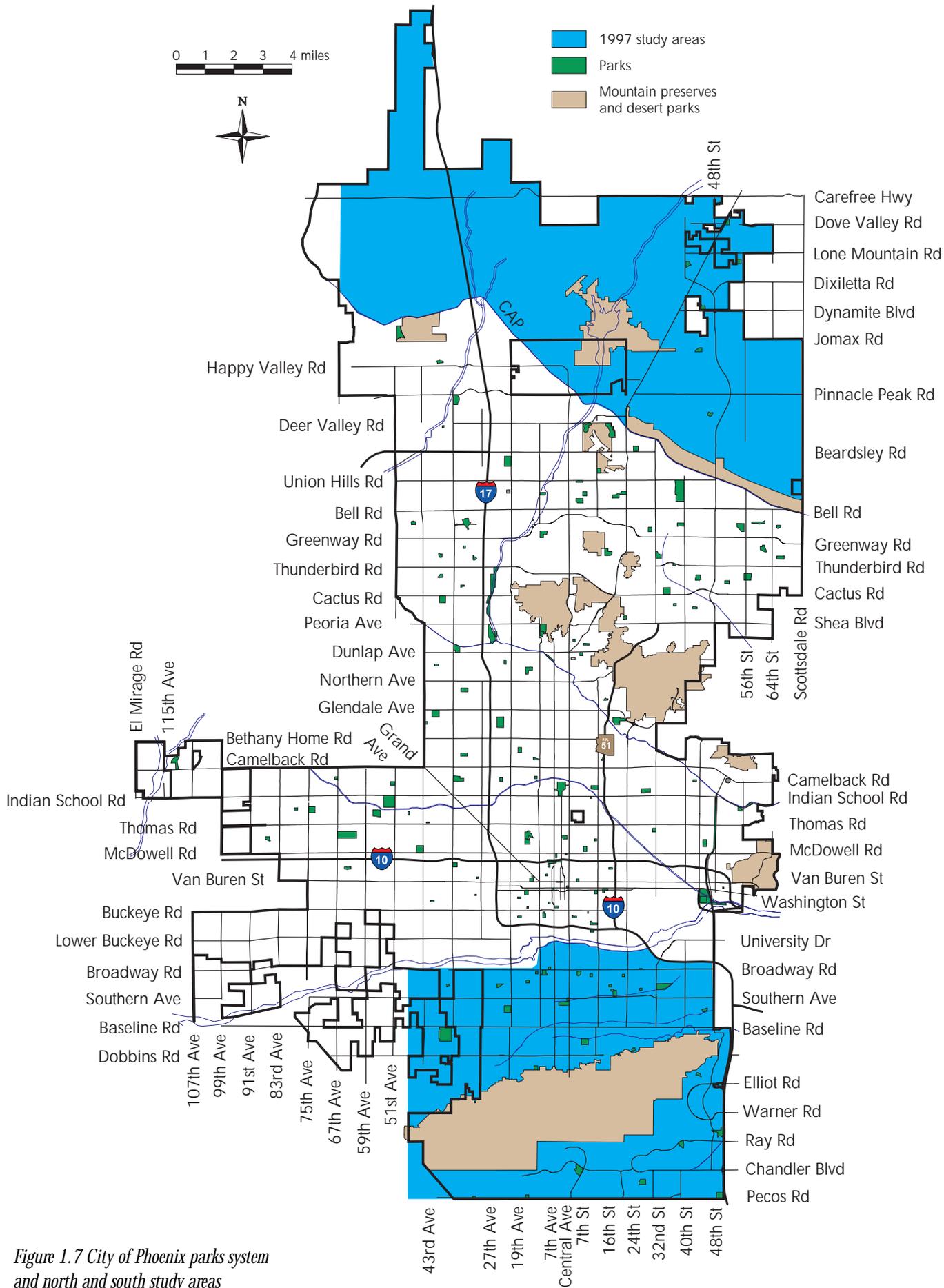


Figure 1.7 City of Phoenix parks system and north and south study areas

A city's quality of life is more important than purely business-related factors when it comes to attracting new businesses, particularly in the high-tech and service industries.

1994) identified benefits of urban preserves which are included in the following list.

Property Values

According to *The Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors*, the amenities that open space and parks provide often result in greater economic vitality (National Park Service 1992). The value of amenities such as natural and cultural resource preservation, convenient educational and recreational opportunities, attractive views, and wildlife enhancement can be seen in increased real property values and increased marketability for property located near open space and parks. Even without doing extensive local research, it is clear that South Mountain, Camelback Mountain, the McDowell Mountains, the Phoenix Mountains, and Indian Bend Wash have had positive impacts on adjacent land values.

Business Relocation and Stability

The Joint Economic Committee of the U.S. Congress reports that a city's quality of life is more important than purely business-related factors when it comes to attracting new businesses, particularly in the high-tech and service industries (National Park Service 1992). Parks and open space affect quality of life issues including convenient access to natural settings and recreational and cultural opportunities. Corporate benefits of healthy and happy employees are increased efficiency and decreased health insurance claims.

Commercial Impacts

Open space and parks can provide opportunities for businesses; locations for filmmaking, television, and advertisements; and other commercial activities. Areas along a preserve can provide visitor services including special events, food, recreational equipment sales and rentals, lodging, and sales of convenience items.

For example, unique Sonoran Desert settings are in demand for a growing film industry. The economic impact of film production in metropolitan Phoenix in 1994 was \$26.3 million, in 1995 was \$35.8 million, and in 1996 reached a record \$47.1 million (Film Office 1997). The City of Phoenix Motion Picture Coordinating Office (PRLD 1994) states:

The exposure that Phoenix receives from film, television, and print production not only increases its visibility to the industry but to the audience as well. It familiarizes viewers with the Valley, piques their curiosity, ultimately boosting tourism.

The interdependent relationship between Phoenix area resorts and hotels and the desert environment is promoted in nearly every brochure and advertisement. The Phoenix preserves contribute to the outdoor experience of visitors. For example, many local resorts offer horseback riding that is accommodated on trails within the preserves. According to the University of Arizona Cooperative Extension study, *The Economics of the Horse Industry in Arizona*, Arizona's pleasure horse industry accounts for \$196 million in output, \$76 million in Arizona income, 4,000 jobs directly, and an additional 2,120 jobs indirectly (Gum et al. 1990).

Tourism

Tourism is the second largest industry in Arizona. Many economists feel that by 2000, tourism will be the top industry in the state. Tourists spend \$5 billion in the Phoenix area each year with 175,000 local jobs directly related to tourism (Phoenix and Valley of the Sun Convention and Visitors Bureau 1998). Tourists come to Phoenix primarily to enjoy the Sonoran Desert, Native American history and culture, Western history and culture, recreation, and the resort atmosphere. A desert preserve system offers residents and visitors recreational activities such as horseback riding and hiking in an undisturbed area. It preserves the desert ambience that has lured so many people to Phoenix over the years.

Expenditures by Residents

Leisure time activities, educational pursuits, and recreation expenditures can account for substantial portions of family spending. This can include educational courses, scientific study, and recreational pursuits such as special events, walking or running, hiking, bicycling, photography, equestrian uses, and driving for pleasure.

Agency Expenditures

The major agencies involved in acquiring and managing land support the local and regional economy by providing jobs and purchasing supplies and services to develop, operate, and maintain parks and related improvements. Numerous nonprofit and community groups focusing on environmental quality also affect the economy. Employment generated by open space programs can be targeted to benefit particular needs of the community, such as youth employment and opportunities for the physically challenged.

Relief from Population Stress

In Maricopa County, the population is expected to double from roughly 2.3 million to 4.1 million by 2020. By 2040,

the Valley's population will be close to 6 million people. The projection that the population of the county will nearly double by 2020 and triple by 2040 has staggering implications. Much of this growth will take place in the city of Phoenix (MAG 1997). How Phoenix manages this growth will determine its success or failure. The mountain parks and preserves are being "loved to death" by the current population. The Phoenix Mountain Preserve is an example of an urban preserve that provides urban dwellers much-needed places to recover from mental fatigue associated with increasingly urban lifestyles (Kaplan and Kaplan 1989). Additional preserves need to be set aside to meet the needs of the next century.

Recreation, Special Events, and Programs

A substantial and cohesive desert preserve system can offer a wide range of recreational opportunities. Activities such as bike riding, hiking, and horseback riding would make the best use of a linear, connected open space. Activity areas can provide desert settings for family outings and picnics.

Environmental Education

Direct contact with nature is the most effective way to nurture stewardship of the land. Perhaps the most important legacy a desert preserve system can provide is a respect for the land and living things and a responsibility to be guardians of the land, keeping it for future generations to enjoy.

Wildlife and Vegetation

Urban preserves and corridors provide ecological and environmental quality. They help maintain biological diversity on a local scale. Preserves also hold scientific value. If a sound knowledge base exists, wildlife, vegetation, and other natural resources can effectively be managed for their multiple benefits and values.

Phoenix's Reputation for Leadership

Since Phoenix won the Carl Bertelsmann Prize for being one of the two best-managed cities in the world, calls and letters have been coming from governments worldwide, wanting to know how Phoenix works so effectively. The city must build on this reputation with farsighted land-use plans. If the city does not look ahead to the long-range benefits of preserving pristine or near pristine desert, the future will hold no more prizes. Phoenix should be the premier desert city, not another example of urban sprawl failure.

Sociocultural Benefits

All citizens and visitors would benefit from a better historical awareness and appreciation of our own and past cultures of the

Sonoran Desert. Throughout the City of Phoenix, significant prehistoric and historic resources exist. An urban desert preserve would provide readily accessible opportunities for family cohesion through outdoor recreational activities and educational programs. With researched information presented in programs and interpretive exhibits, the preserve system has the potential for increasing pride in our local culture.

The benefits of desert open space reach beyond those who live adjacent to or near preserve lands. According to a 1993 Trust for Public Land study addressing open space needs and opportunities in America's cities, open space and recreational resources are increasingly being viewed on a regional basis. This perspective is crucial for recognizing the significance of large-scale open space systems such as greenways, watersheds, airsheds, trail systems, flood-prone areas, scenic corridors, and wildlife corridors. A regional approach usually benefits core cities, which can share the fiscal strength of their regional partners.

C. Phoenix Sonoran Preserve Master Plan Study Area

The *Desert Preserve Preliminary Plan* (PRLD 1994), a precursor to the *Sonoran Preserve Master Plan*, focused on two geographic areas within the city, the North Study Area (NSA) and the South Study Area (SSA). These areas were selected because the opportunity to preserve undisturbed desert lands is a matter of urgency in these portions of the city. Once fragile desert lands have been damaged, their restoration is costly and often impossible. These two areas represent the least disturbed desert lands within the city. While properly placed emphasis is on undisturbed lands, it is important to note that disturbed lands within the developed areas of the city can make an important contribution to the overall ecological health and recreational potential of the city's open space system. Obvious examples include the Salt River and the canal system, which could both make significant contributions in creating a connected system of currently isolated islands of natural open space as well as providing additional opportunities for hiking, biking, and walking (Fifield et al. 1990; Cook 1991; MAG 1995). Disturbed lands within the urban core are not the focus of this effort, although it is recognized that they can play a significant role in protecting the ecological health of the preserve.

Metropolitan Phoenix lies within the Sonoran Desert, where ecosystem processes are closely linked to precipitation patterns. Most vegetation growth occurs in the spring following winter rains; however, some growth occurs during the sum-

Direct contact with nature is the most effective way to nurture stewardship of the land. Perhaps the most important legacy a desert preserve system can provide is to teach a respect for the land and living things and a responsibility to be guardians of the land, keeping it for future generations to enjoy.

mer monsoon season. These bimodal rainy seasons enable the land to support diverse and rich plant communities, making the Sonoran Desert the most lush desert in the world. The Sonoran Desert is classified into six categories defined by natural factors such as temperature, precipitation, geology, and soils (Shreve 1951; Brown and Lowe 1982).

The majority of metropolitan Phoenix is located within the subdivision referred to as the Lower Colorado River Valley or the microphyllous desert. This area is the largest and most arid subdivision of the Sonoran Desert. Low annual precipitation and high temperatures support relatively sparse vegetation. The average annual precipitation reported for the City of Phoenix is 7.51 inches (Sellers et al. 1985). Characteristic species include blue paloverde (*Cercidium floridum*), creosotebush (*Larrea tridentata*), and bursage (*Ambrosia*). South Mountain Park, Camelback Mountain, Squaw Peak, and the vast majority of developed areas within the city are located within this subdivision.

In contrast, the northern extent of the city is located in the transition zone between the Lower Colorado River Valley and the Arizona Upland subdivision of the Sonoran Desert. The Arizona Upland subdivision is the most lush and watered desert scrub in North America (Brown 1982). The nearby town of Cave Creek, located adjacent to the northeast edge of the NSA, reports average annual precipitation of 12.25 inches (Sellers et al. 1985). The result of this increase in moisture is an increase in both vegetation diversity and stature, which enriches the aesthetic and wildlife habitat value of north Phoenix (Figures 1.9, 1.10).

South Study Area

Several areas were reviewed for possible inclusion in the park in order to enhance the ecological health of South Mountain Park, the largest management unit within the PRLD System. The wash area between the park and the Western Canal off 35th Avenue and Carver Road, wash and rock outcrops off 32nd Street and South Mountain Avenue that provide potential connection to the Highline Canal, and all of the area between the park boundaries and the proposed South Mountain Freeway alignment (35th to 51st Avenues) were considered in the *Desert Preserve Preliminary Plan* (PRLD 1994) (Figure 1.11).

North Study Area

The study area for the northern portion of the *Phoenix Sonoran Preserve Master Plan* is bordered by the City of Scottsdale, City of Peoria, Town of Cave Creek, and the Town of Care-

The Arizona Upland subdivision is the most lush and watered desert scrub in North America.

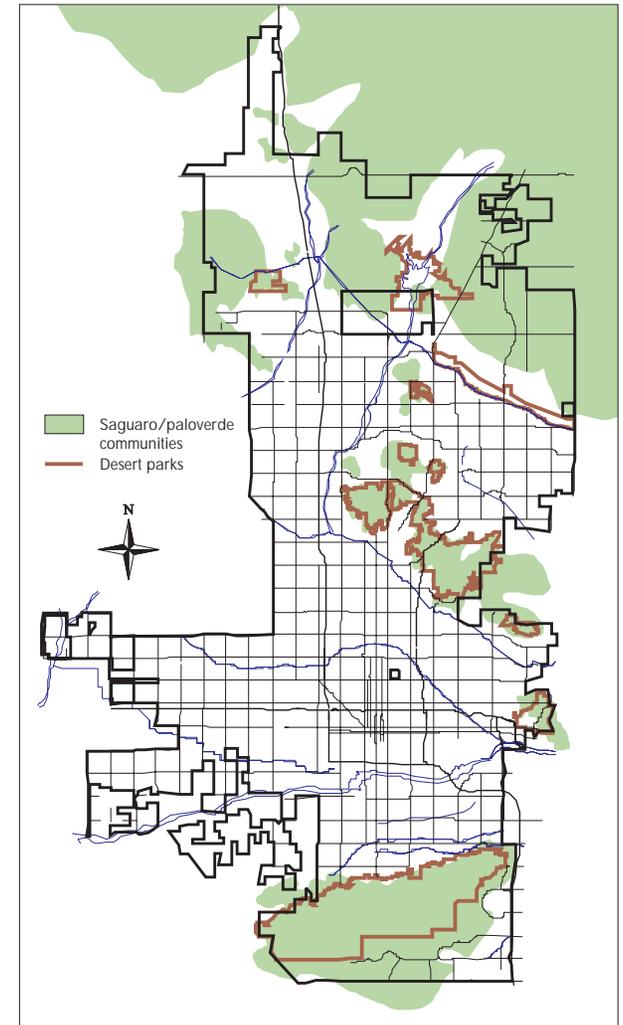


Figure 1.9 Saguaro/paloverde communities in the northern portion of the city define the transition from the Lower Colorado River Valley to the Arizona Upland subdivisions of the Sonoran Desert



Figure 1.10 Saguaro/paloverde community characteristic of Arizona Upland subdivision, near Pyramid Peak

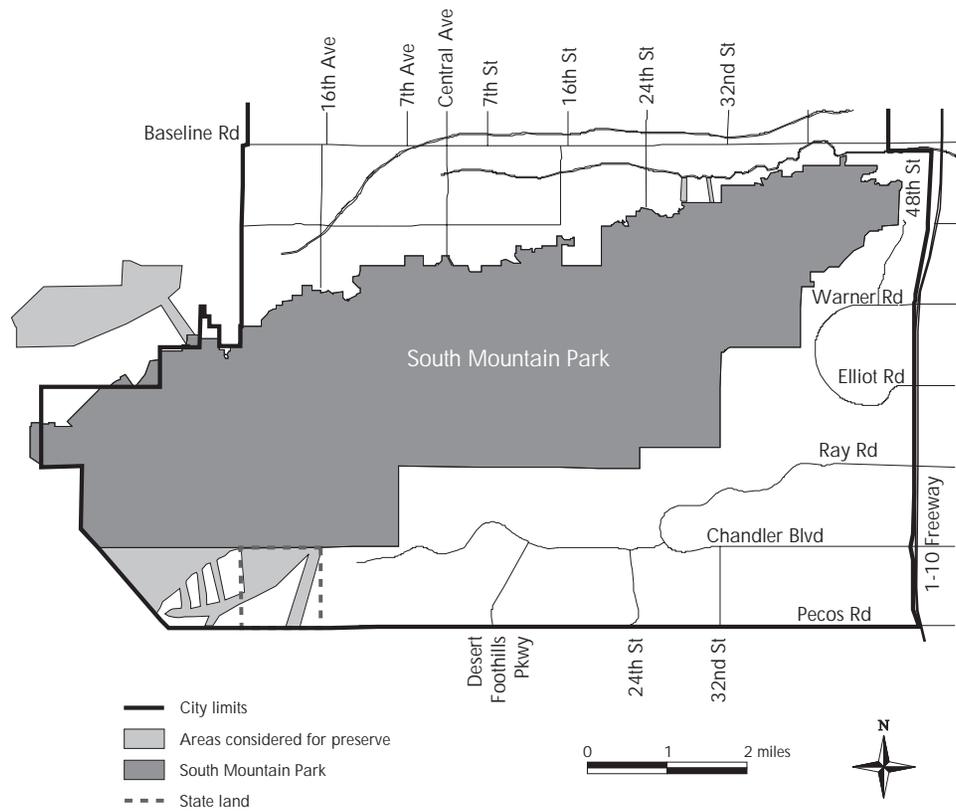


Figure 1.11 South Study Area

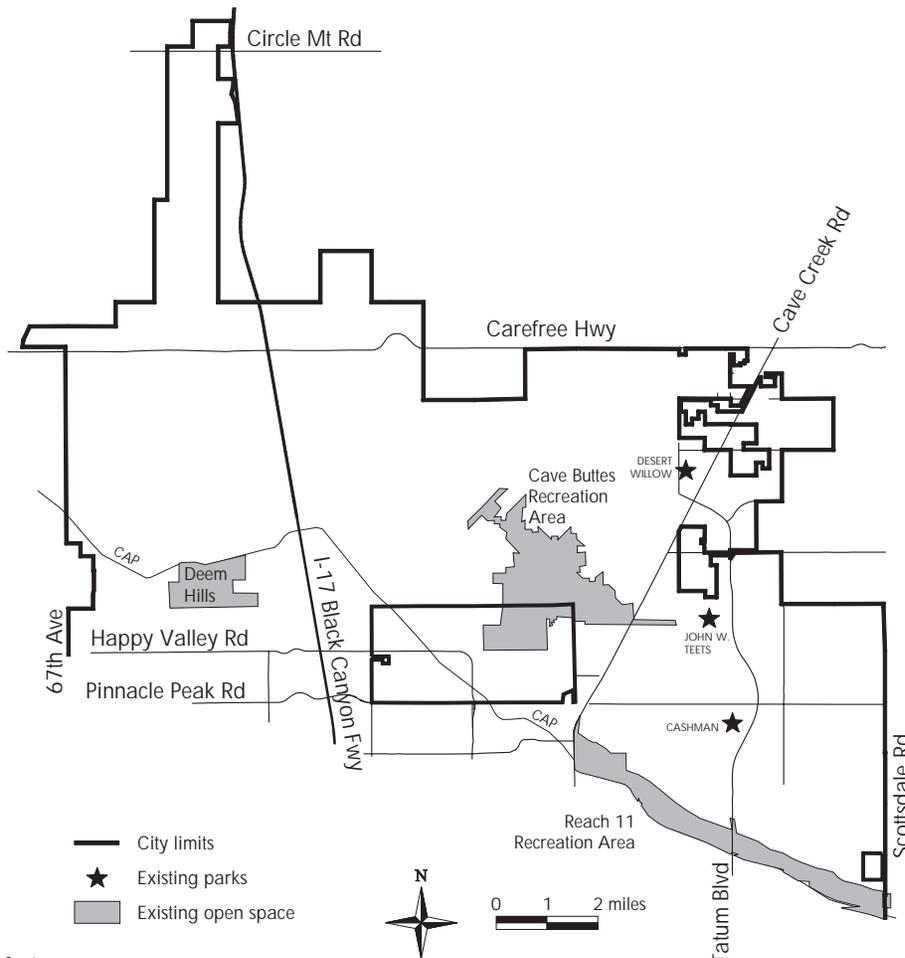


Figure 1.12 North Study Area

The natural beauty of our horizon, our close-in mountain slopes and natural areas—this is the very substance of the natural environment that has been so instrumental in the population and economic growth of this region. The grand scale and rugged character of these mountains have set our lifestyle, broadened our perspective, given us space to breathe, and freshened our outlook. These mountains are the plus that still overweighs the growing minuses in our environmental account.

Preserve advocate
in Luckingham 1989

The North Study Area includes much of the picturesque landscape for which the Sonoran Desert is best known.

free. The study area is bounded by the Central Arizona Project (CAP) Canal on the south, Carefree Highway on the north, Scottsdale Road on the east, and 67th Avenue on the west. Also included in the study area is a corridor along the western edge of Interstate 17 (I-17); this corridor ends at approximately Circle Mountain Road (Figure 1.12).

The NSA includes much of the picturesque landscape for which the Sonoran Desert is best known. This relatively dense vegetation is dominated by creosotebush and bursage. Other significant species are ironwood (*Olneya tesota*), foothill paloverde (*Cercidium microphyllum*), and saguaro (*Carnegiea gigantea*). Wildlife in the area includes birds such as red-tailed hawk (*Buteo jamaicensis*), Gila woodpecker (*Melanerpes uropygialis*), and cactus wren (*Campylorhynchus brunneicapillus*); small mammals such as black-tailed jackrabbit (*Lepus californicus*), rock squirrel (*Spermophilus variegatus*), and Merriam's kangaroo rat (*Dipodomys merriami*); reptiles and amphibians such as desert tortoise (*Gopherus agassizi*), Gila monster (*Heloderma suspectum*), and Colorado River toad (*Bufo alvarius*); and a limited number of large mammals such as javelina (*Dicotyles tajacu*) and coyote (*Canis latrans*) (Ewan et al. 1996).

Three large parcels of PRLD land already exist within the NSA. The first, Cave Buttes Recreation Area, is a 2,200-acre flood control facility owned and operated by the Flood Control District of Maricopa County (FCDMC) in cooperation with the U.S. Army Corps of Engineers. The City of Phoenix became the local recreation sponsor in 1996, so recreation activities are managed by the PRLD. The recreation area is located at Jomax Road and Cave Creek Road. The second area is the 640 acres of Deem Hills the city acquired from the U.S. Bureau of Land Management (BLM) in October 1981 through the Recreation and Public Purposes Act. Deem Hills is located between 35th and 51st Avenues at Jomax Road. Reach 11 Recreation Area is 1,500 acres owned by the U.S. Bureau of Reclamation (BOR). The primary function for this area is to provide flood protection for the CAP Canal and the adjacent communities of Scottsdale, Paradise Valley, and Phoenix. In 1986 the City of Phoenix entered into a recreational land use agreement with the BOR for public recreation, management, and development of Reach 11. A master plan was approved by the Phoenix Parks and Recreation Board in 1987 and 1995.

The PRLD is currently engaged in the process of developing an environmental impact statement and updating the master plan for approval by the BOR. These three parcels are a beginning for the open space system in the NSA. All three of these

parcels are classified by the PRLD as desert parks. Cave Buttes Recreation Area and Reach 11 Recreation Area have district park components within their boundaries and Deem Hills has a community park within its southwestern border.

Major washes in the NSA are Cave Creek Wash, running from the CAP Canal north through the city limits, and Skunk Creek from Happy Valley Road to Cloud Road. These two washes are significant xeric-riparian areas and are mostly undisturbed. Secondary wash corridors include Apache Wash, Buchanan Wash and its tributaries northwest of the CAP Canal and I-17, Deadman Wash, and the northeastern tributaries of Skunk Creek. The unnamed washes in Tatum Ranch, Tatum Highlands, and the Desert Ridge communities that run southwest from Scottsdale to the CAP Canal are also included in the NSA.

Mountains in the NSA include Union Hills, Deem Hills, Pyramid Peak, Middle Mountain, Ludden Mountain, and Hedgepeth Hills. These landforms are typical of the basin and range province. The mountains generally run parallel in a southeast-to-northwest direction. Between mountains lie outwash plains. These landforms are relatively low-lying with the greatest elevation change occurring at Pyramid Peak (2,283 feet) and the highest point occurring in the Union Hills near the Carefree Highway (2,461 feet).

The NSA contains two designated growth management areas—Desert Ridge/Paradise Ridge and the North Black Canyon Corridor (Planning Department 1997a, 1997b). Currently there are few improvements in these areas. The few residential communities that have begun to develop in the area are adjacent to or east of Cave Creek Road. Two rezoning applications in the I-17 corridor have been reviewed and approved in this area. In addition, two power line easements traverse the NSA. A 69-kilovolt power line runs east-to-west, south of the Happy Valley Road alignment. A 230-kilovolt power line runs northwest-to-southeast from the intersection of Pinnacle Peak and Scottsdale Roads, crossing the Carefree Highway between 24th and 32nd Streets.

D. General Philosophy for the Sonoran Preserve
Identifying pristine and near pristine desert land throughout the City of Phoenix presents a challenge because much of the developed portions of the city have all but erased any trace of the natural environment. In these areas, restoration rather than preservation is more appropriate. The low-density development pattern that has evolved in Phoenix provides an opportunity to reestablish natural areas within the urban environment (Cook 1991).

However, desert restoration is more costly than preservation since natural processes alone take decades to reestablish flora and fauna. Tests done at the Desert Experimental Range in Utah indicate that once damaged, desert plants may take 30 years to improve from poor to good condition and some species never recover (Ginsberg 1976). Because of the inherent value of undisturbed Sonoran Desert lands and the costs associated with restoration, the Sonoran Preserve focuses on the relatively undisturbed land that lies within the NSA and SSA (Figure 1.13).



Figure 1.13 Undisturbed Sonoran Desert, the Union Hills

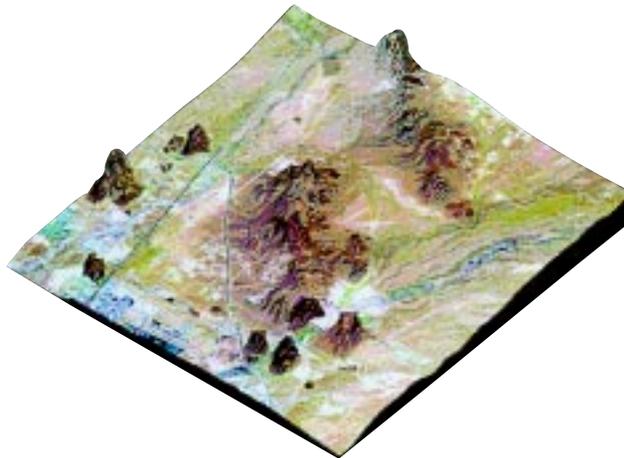
Growth pressures, urban sprawl, inappropriate use, and air and water pollution increasingly threaten the remaining undisturbed areas within the city of Phoenix. While the 110 square miles of the NSA are under development pressure, the area is still relatively undeveloped. This presents an important opportunity to identify, plan for, and protect natural areas prior to development. The lands included in the study area encourage the preservation and linkage of native habitats and areas of physical, cultural, and/or historic value. The master plan addresses currently annexed areas of Phoenix and considers significant lands adjacent to the city boundaries. The preliminary criteria used to define the lands that should be part of the preserve system included:

- Biological and ecological significance
- Scenic quality
- Public recreation, education, or interpretation potential
- Historic, cultural, and/or archaeological significance
- Proximity to existing or potential scenic corridors
- Linkage to mountains and/or planned or existing public open space
- Sufficient public access via roads or trails
- Unique natural features such as canyons, saguaro stands, springs, and rock outcrops
- Proximity to existing or planned major or secondary drainageways
- Adjacent to existing or planned utility corridors and/or easements

The Phoenix Sonoran Preserve will benefit wildlife, define the urban setting, positively impact human health and well-being, and have significant recreational value. It will also complement the city's existing Mountain Preserve System and build on its success by adding additional types of lands that are of ecological significance. Preserving undisturbed Sonoran Desert is the basic premise of the master plan. Preserving a diversity of lands in addition to the mountains, which have long been protected within the Phoenix Mountain Preserve System, is envisioned to provide a system of unique natural open space that offers the community tremendous opportunity for outdoor recreation, contact with the natural environment, and habitat for wildlife.

The preservation of a diversity of lands is envisioned to provide a system of unique natural open space that offers the community tremendous opportunity for outdoor recreation, contact with the natural environment, and habitat for wildlife.

Chapter 2



If we are to
create a sustainable world—
one in which we are accountable to the needs
of all future generations and all living
creatures—we must recognize that our present
forms of agriculture, architecture, engineering,
and technology are deeply flawed. To create
a sustainable world, we must transform these
practices. We must infuse the design of
products, buildings, and landscapes
with a rich and detailed
understanding of ecology.

Sim Van der Ryn and
Stuart Cowan, 1996

Sonoran Preserve Planning and Analysis

Since 1985, research and planning projects have been conducted in the north Phoenix area. This chapter offers a brief synopsis of the specific studies relevant to preservation. Discussion of these projects is included to illustrate the depth, intensity, and evolution of the Sonoran Preserve planning process. Results from the ecological studies have been used to help select land for inclusion in the preserve. Previous planning efforts have also contributed by building a framework for developing the master plan components.

A. General Plan for Peripheral Areas C and D

In 1985 four peripheral areas were identified for special study in the Phoenix General Plan. Two of these areas, designated as Areas C and D, constitute the 110-square-mile annexed region of north Phoenix delineated by the Carefree Highway to the north, Scottsdale Road to the east, the CAP canal and Jomax Road to the south, and 67th Avenue to the west. A general plan was developed for the area in 1987. The open space and trails plan generally designates mountains and the 100-year flood zone as areas recommended for use as public open space. Significant components of open space were identified in the plan including mountains, regional stormwater retention sites, major washes, desert land, and archaeological sites (Figure 2.1).

The total open space areas represented approximately 17,500 acres, or 25 percent of the total land area (Planning Department 1987). The mountains were discussed for incorporation into the Mountain Preserve System. Major washes were identified as an environmentally fragile resource appropriate for open space, but when the plan was adopted including these and other nonmountainous areas was generally not considered. Instead, washes and low-lying desert lands with high visual quality were recommended for low-density development rather than incorporation into a preserve system. Washes were considered primarily for drainage and for use within a larger trail system (Planning Department 1987). However, this plan was completed before ecological inventories and analyses were conducted, so it did not accommodate for preserving a diversity of land types.

B. South Mountain Master Plan

In 1989 the *South Mountain Park Master Plan* was prepared by P&D Technologies for the PRLD. Three primary initiatives were identified to secure South Mountain Park as a recreational

and natural resource by developing strong programs in restoration, management, and environmental ethics (PRLD 1989). A 15-year phasing plan was developed as part of this plan. The plan includes restoration of all Civilian Conservation Corps structures, recognizing that they contribute to the unique character of the park as well as offer an opportunity for interpretation. In addition to restoring historic structures, revegetation of damaged lands within the park is emphasized over investment in new facilities. The plan also established a hierarchy for trailheads and a trail system that adds 37 miles of multi-use trails to the 22 miles of existing trails. Priority is placed on rehabilitating the existing trails prior to new trail construction. To date, much of the rehabilitation has been completed and a new environmental education center is open.

C. Desert Preserve Preliminary Plan

In 1993 the City Council approved a new policy establishing a desert preserve for the northern growth areas of the city. This policy recommended that a system of environmentally sound open space lands be preserved that would include all indigenous plant communities and habitat types. This concept was refined and developed with citizen participation through the established boards and commissions, as well as committees established to develop policies on specific issues. The Desert Preserve Citizen Advisory Committee, appointed by the Parks and Recreation Board, was charged with preparing a report defining which lands were to be included in the desert preserve system. The committee submitted a preliminary plan recommending 11,000 acres of primary and secondary washes, scenic corridors, and utility corridors for the program (Figure 2.2). The committee did not address mountains and foothills. These areas were considered the charge of the Mountain Preserve Citizens Advisory Committee. The *Desert Preserve Preliminary Plan* was approved by the Parks and Recreation Board and City Council in 1994 (PRLD 1994). The Parks and Recreation Board designated this new preserve initiative as the Phoenix Sonoran Preserve System.

The plan was based on initial environmental inventories and analysis. The PRLD used United States Geological Survey (USGS) 7.5 minute maps for a base sheet. Maps were prepared to show slope characteristics at five percent slope intervals, proposed streets, the general plan for the area, planned trails and bikeway systems, natural systems and features, and

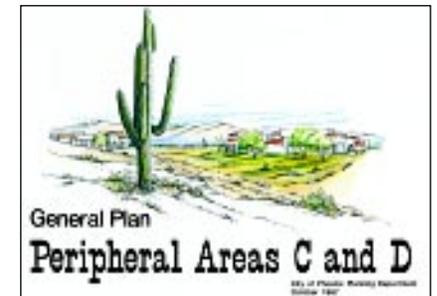


Figure 2.1 General Plan Peripheral Areas C and D, 1989

Previous planning efforts have also contributed by building a framework for developing the master plan components.

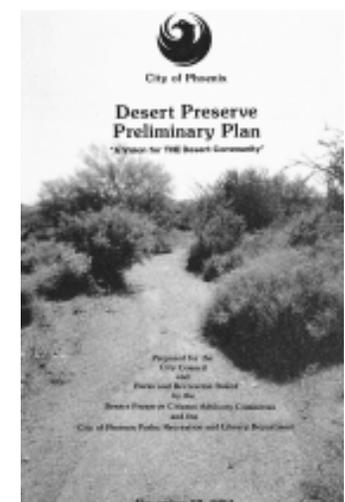


Figure 2.2 Desert Preserve Preliminary Plan, 1994

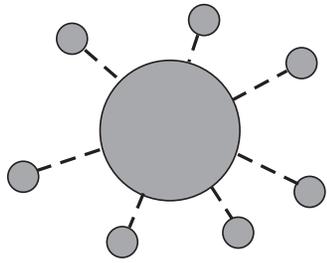


Figure 2.3 Concentrated concept

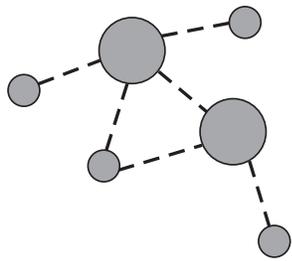


Figure 2.4 Semiconcentrated concept

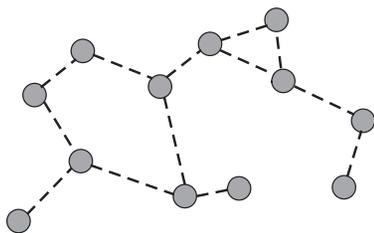


Figure 2.5 Dispersed concept

potential archaeological sites. Seven categories of desert lands are identified in the preliminary plan: major washes and floodplains, secondary washes, utility corridors, view corridors, mountains, open space linkages, and scenic corridors.

The goals developed in the *Desert Preserve Preliminary Plan* have been adopted as resolutions into the recreation element of the *General Plan for Phoenix 1985–2000* (Planning Department 1994). These goals provide the philosophical foundation of the *Sonoran Preserve Master Plan*. These goals are to:

- Connect significant public open spaces, utility corridors, canals, freeways, and recreation areas already owned or proposed by city, county, state, or federal agencies
- Preserve wildlife corridors and significant desert ecosystems along drainageways by preserving the natural desert wash characteristics such as low velocity, sedimentation, and dispersed flows
- Provide passive recreational opportunities for wildlife viewing, nature study, picnicking, outdoor interpretation, and education
- Provide alternative transportation corridors for walking, commuter and recreational bicycling, and horseback riding
- Preserve significant views, cultural resources, and visual landmarks such as large tree bosques, rock outcroppings, historic features, and archaeological sites
- Establish management, maintenance, acquisition, and funding guidelines that respond directly to these increased open space standards and encourage public/private partnerships
- Encourage, to the greatest extent possible, the inclusion of land and specific sites that allow access for people of all abilities to appreciate and enjoy the Sonoran Desert

The work done as part of this plan represents a significant departure from previous planning efforts that considered the natural environment but focused preserve efforts on visually prominent lands that were less suitable for development. The goals listed above demonstrate a desire to balance aesthetic, social, economic, and ecological concerns.

D. North Study Area Concepts and Public Review Process

In 1996 the PRLD developed three concepts for the Phoenix Sonoran Preserve to illustrate several ways that the approximately 12,000 potential preserve acres in the NSA could be configured. Since the planning at this point was conceptual, a precise acreage was not designated. The three concepts demonstrate a range of approaches to open space acquisition and built onto open space lands already owned or controlled by the PRLD.

All three concepts identified major and secondary access points with the appropriate level of development recommended for each. Development included ramadas, drinking fountains, parking lots, trailheads with signs, interpretive signage, and environmental education facilities. There were three major access points identified—off Jomax Road in the Cave Buttes Recreation Area; at the base of the Union Hills and intersecting the Apache Wash; and west of I-17 north of the Deem Hills. These would provide regional access, have the focus of recreational activities such as picnicking, and include interpretive centers. There were eight secondary access points positioned around the preserve to allow for local parking and trailhead access. Through the development review process, provision is expected for neighborhood access points at quarter-mile intervals along the preserve perimeter to ensure easy access for pedestrians and bicycles. The three concepts that went through the public review process were general configurations of possible preserve forms.

Concentrated

The concentrated concept contains the preserve in one large contiguous parcel that maximizes habitat and wildlife benefits (low perimeter/area ratio). This idea is most analogous to South Mountain Park, and the area would function as a regional park. This concept lessens the emphasis on the recreational access and creates the greatest opportunity for isolated natural areas. Preserve visitors may have to travel longer distance to get to the preserve (Figure 2.3).

Semiconcentrated

The semiconcentrated concept holds a middle ground between the other two concepts. It has significant areas set aside for conservation while allowing for reasonable recreational access from adjacent developments. All habitat/vegetation types are included (moderate perimeter/area ratio) (Figure 2.4).

Dispersed

The dispersed concept integrates the preserve into developed areas, allowing a great number of users access from home and work. This could be called a “backyard approach,” creating a greater potential for negative impact on wildlife and habitat (highest perimeter/area ratio) while increasing neighborhood pedestrian and bicycle access (Figure 2.5).

In November and December 1996, the three concept plans for the Sonoran Preserve were presented to the Parks and Recreation Board, nine village planning committees, and the Environmental Quality Commission. A presentation for the Planning Commission was held on January 8, 1997.

In early December 1996, the PRLD held a coordinating meeting with representatives from the adjacent Cities of Peoria and Scottsdale, Maricopa Association of Governments, Arizona State Land Department, Arizona Game and Fish, U.S. Forest Service, U.S. Bureau of Land Management, Flood Control District of Maricopa County, and other municipal parks and recreation departments. The intent of the meeting was to provide an exchange of information about the Phoenix plans and to foster long-term cooperation and coordination with other local open space efforts.

Open lines of communication have been maintained with these organizations as well as with the Towns of Cave Creek and Carefree, Arizona Department of Agriculture Plant Services Division, U.S. Department of the Interior Fish and Wildlife Service, and Desert Foothills Land Trust. In May and June 1997, the PRLD continued information exchange efforts with the neighboring cities and organizations. Maintaining open communication is an ongoing activity.

The three concepts were presented at two open houses hosted by the PRLD on December 3 and 11, 1996. Notices were mailed to a list of interested citizens, including organizational contacts for the Mountain Preservation Council, the Mountaineers, the Sierra Club, the Audubon Society, the Central Arizona Homebuilders Association, the Realtors Association, and the Valley Partnership. Although attendance was light, the 99 questionnaires received have been very useful. Those in attendance were enthusiastically supportive.

Respondents ranked the three concepts in order of preference from most to least preferred. The concentrated concept was selected as the most preferred by 61 percent of the respondents, followed by the semi-concentrated concept, selected by 32 percent of the respondents as being most preferred. Only five percent of the respondents most preferred the dispersed concept (Table 2.1). Many of the respondents articulated that preserving the health of the environment should be of the utmost importance.

Master Plan Concepts

	1	2	3	No Response
Concentrated	61%	18%	5%	15%
Semiconcentrated	32%	46%	1%	20%
Dispersed	5%	4%	60%	30%

Ranked in order of preference with #1 being most preferred and #3 being least preferred.

Table 2.1 Master plan concepts

E. Desert Spaces Plan

In 1995 the Maricopa Association of Governments (MAG) Regional Council adopted the *Desert Spaces* plan for the 9,200- square-mile region of Maricopa County (Figure 2.6). In 1996 the Phoenix City Council adopted the plan. The concept of the plan was to preserve, protect, and enhance the mountains and foothills, rivers and washes, canals and cultural sites, upland vegetation, wildlife habitat, and existing parks and preserves. The intent of this plan was to provide a nonregulatory framework directed toward establishing a regional open space network (MAG 1995). The plan defines regionally significant mountains, rivers, washes, and upland desert. The scale of this effort was not specific to Phoenix, but the plan does identify regionally significant open spaces within the city limits.

Lands identified within the developed portions of the city include the Agua Fria and Salt Rivers and the canal system. While these lands play an important role in creating an interconnected network of open space, they are almost entirely disturbed lands and not the focus of this planning effort. However, the PRLD is involved in multiple projects relating to lands associated with the rivers and the canals, including habitat restoration along the Salt River, the Tres Rios project, and several demonstration projects along the canals.

The *Desert Spaces* plan identifies the following NSA lands for conservation, and describes them as having outstanding open space value: Union Hills, Deem Hills, Pyramid Peak, Middle Mountain, Ludden Mountain, Hedgepeth Hills, Skunk Creek, and Cave Creek Wash. The majority of undeveloped lands, primarily north of Happy Valley Road, not recommended for conservation in the NSA are identified for retention. Retention is defined as lands with high open space value. Several areas adjacent to South Mountain are identified for conservation and retention, the largest area being the undeveloped lands south of the park boundary and north-east of the Gila River Indian Reservation.

Specific policy recommendations were made for protection of mountains, rivers and washes, upland Sonoran Desert, historic and archaeological sites, canals and trails, and community buffer zones. The *Desert Spaces* plan was considered in developing the Sonoran Preserve and is a valuable tool for continuing the PRLD's commitment to cooperation and coordination with other local open space efforts. Several of the policy recommendations that have a direct relation to the Sonoran Preserve are listed below.

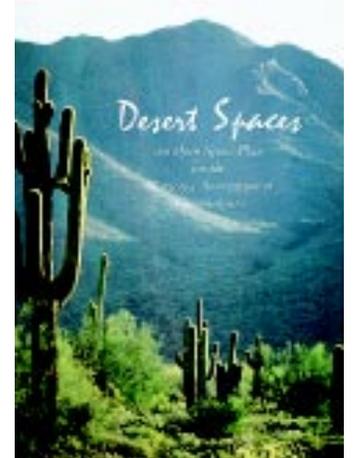


Figure 2.6 Desert Spaces, 1995, prepared by DesignWorkshop, Inc.

The intent of the meeting was to provide an exchange of information and to foster long-term cooperation and coordination with other local open space efforts.

Basing preservation boundaries on ecosystems rather than topography or land ownership is new to Phoenix.

Discourage Development within the 100-Year Floodplain

This effort will minimize the negative impacts on fragile xeric-riparian habitats and maximize the protection of diverse natural vegetation associated with washes.

Protect Upland Sonoran Desert Vegetation

Areas not protected as open space should be developed sensitively. For example, mass grading should be discouraged and the use of native plant materials should be required.

Protect Ridge Lines as well as Terrain and Foothills

This effort will protect the pristine character of our region as well as provide buffers for preserved open space, mountain preserves, and wildlife areas.

In considering landforms, open space was recommended for conservation above the 12 percent slope. It is important to note when considering landforms in the entire county, significant topographic features exist. For example, the White Tank Mountains rise above the valley floor in excess of 2,800 feet. South Mountain rises over 1,500 feet above the valley floor. However, caution should be used when considering slope as a limiting factor. Using a standard slope to determine development limits does not guarantee that enough of a hill or a mountain will be preserved as significant open space. Slopes in the NSA are relatively gentle in comparison to all landforms in Maricopa County. The greatest elevation change in the NSA is at Pyramid Peak. From valley floor to the highest point is less than 700 feet. Since *Desert Spaces's* 12 percent slope recommendation took into account landforms throughout the county, then slope restrictions in the NSA should exceed MAG's countywide recommendations to adequately preserve the area's mountains, hills, and peaks.

F. North Phoenix Wash Preservation Boundary Studies

In 1996 the City of Phoenix commissioned ASU's School of Planning and Landscape Architecture (SPLA) and ASU West's Life Sciences Program to study Cave Creek Wash, a major drainage identified in the *Desert Preserve Preliminary Plan* and the *Desert Spaces* plan. A team of ecologists, landscape architects, and planners worked together to evaluate the plant communities within and along the wash corridor (Figure 2.7). Based on field samples of the vegetation, the team classified four plant communities and developed preservation boundary recommendations that included a mosaic of the vegetation types. Basing preservation boundaries on ecosystems rather than topography or land ownership is new to Phoenix. In the past, boundaries did not reflect the ecological systems inherent



Figure 2.7 Faculty and students from the ASU School of Planning and Landscape Architecture survey vegetation along Skunk Creek

in the landscape and so the impact of preserve size, shape, and constitution on plant and wildlife habitats were not considered nor well understood. The *Cave Creek Wash Preservation Boundary Study* was presented to the City Council and the Parks and Recreation Board in fall 1996 (Ewan et al. 1996).

In 1997, the SPLA continued the study. This phase includes Apache Wash, Skunk Creek Wash and its tributaries, and Deadman Wash. This study was completed in November 1998 and complements the Cave Creek Wash report. Within both reports, the following recommendations were made and were considered in developing the Sonoran Preserve plan (Ewan et al. 1996; Ewan and Fish Ewan 1998):

1. *Preserve as large an area as possible*
With the preservation of land and habitat, the diversity and population of species increase while the chances of their being decimated by natural or human forces decreases.
2. *Minimize isolation and fragmentation of habitats*
The greater the habitat fragmentation and isolation from nearby natural areas, the fewer species will be sustained within the preserve; therefore, minimizing isolation will help maximize species diversity.
3. *Minimize contact with adjacent developed areas*
Irregularly shaped preserve boundaries increase native species contact with developed areas, which can lead to habitat isolation, fragmentation, and species decline.
4. *Maintain a diversity of animal habitats and species*
Since different animal species require different habitats and some animals require several plant communities to survive, preserving plant community diversity can maximize animal habitat and species diversity.
5. *Preserve areas representing mosaics of vegetation types*
Preserving mosaics of vegetation types will help maintain animal species diversity, since many animals require different vegetation types to survive. The degraded burn site in the Skunk Creek study area may be an exception.

6. Maintain the cliff areas

The cliffs along the washes provide habitat for a variety of cavity-nesting animals. These areas allow animals to remain undisturbed (Figure 2.8).



Figure 2.8 Cliffs along Cave Creek Wash

7. Maintain stock tanks and surrounding vegetation

Although the tanks are a cultural artifact and not purely natural, they function as semiperennial wetlands. Great blue heron have been observed at tanks in the north Phoenix area. The tanks maintain thick bosques of mesquite and stands of blue paloverde that provide bird nesting sites and shade. They could also be used as interpretive elements for teaching about previous land uses, particularly cattle grazing (Figure 2.9).



Figure 2.9 Skunk Creek Tank

8. Preserve beyond the 100-year flood zone

The Federal Emergency Management Agency–defined 100-year flood zone does not include all vegetation types; therefore, to maximize species diversity, preservation boundaries must go beyond the 100-year flood zone. This would also guarantee all wash edge vegetation would be preserved. Wash edges contain dense populations of large trees that serve as prime habitat.

9. Prohibit grazing within the preserve

Livestock grazing has changed the vegetation composition in the area. Native species, such as tobosa, may reestablish if grazing is discontinued.

10. Maintain the integrity of the watershed

The quality of the entire watershed can affect flora and fauna within the preserve; therefore, maximizing preservation of the watershed will lessen the impacts of off-site pollutants flowing into the preserve (Figure 2.10).



Figure 2.10 The effects of grazing

G. Geographic Information Systems and Computer Modeling

The NSA presents a challenge because of its scale and the large amounts of graphic and descriptive information that have been assembled. At 110 square miles, the NSA approaches the size of Tucson, Portland, or Albuquerque. Computer applications are becoming prevalent and necessary in planning for such large sites. Since July 1996 the PRLD has been working with ASU on the Multidisciplinary Initiative in developing a Geographic Information System (GIS) database and a modeling program for the NSA (Brady et al. 1998).

The first step of this process was to develop a database. The geographic database is substantially complete. Information necessary for park and preserve planning was identified and then developed into a GIS format. The completed themes of information include:

- Aerial map (2.11)
- Hillshade analysis (2.12)
- Aspect model (2.13)
- Geology (2.14)
- Slope analysis (2.15)
- Soil associations (2.16)
- Utility corridors
- Village boundaries
- Existing utilities
- Digital terrain model
- Elevation
- Vegetation
- Visual quality
- Floodway boundaries
- General plan
- Existing land use
- Archaeological sites
- LANDSAT imagery
- Washes
- Ownership

The quality of the entire watershed can affect flora and fauna within the preserve. Maximizing preservation of the watershed will lessen the impacts of off-site pollutants flowing into the preserve.

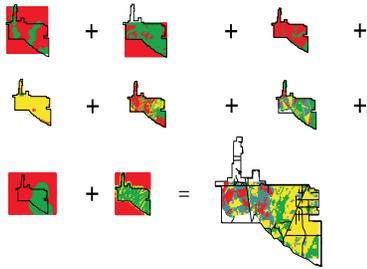


Figure 2.17 Suitability model

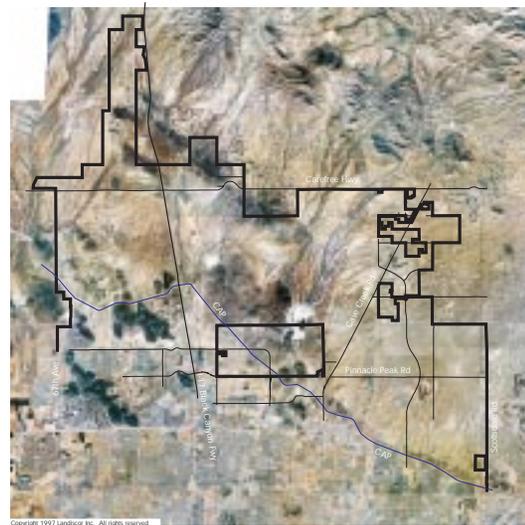


Figure 2.11 Aerial map of North Study Area

The GIS database integrates both graphic and descriptive information and is a valuable tool that can be updated as new data becomes available.

A suitability model was developed by the SPLA, the Environmental Resources program within the SPLA, the City of Phoenix GIS lab within the Information Technology Department, and the PRLD (Figures 2.17, 2.18). Criteria for the suitability model were developed by the PRLD. The model will help inform more subjective preserve planning methods and will also provide a rich bank of ecological data in a GIS environment, which will be useful in the design development phase of the preserve. The criteria were based on analyses of natural factors, goals developed in the *Desert Preserve Preliminary Plan*, and input received from the PRLD outreach efforts.

H. Visual Analysis

A visual analysis was compiled for the NSA using the BLM Visual Resource Management (VRM) system. The BLMVRM system is an analytic process that quasi-objectively identifies visual qualities that should be maintained. The visual analysis ranks areas based on three principles: 1) landscape character is determined by four visual elements—form, line, color, and texture; 2) the greater the influence or impact of these elements the greater the visual interest; and 3) the greater the visual interest in the landscape the more aesthetically pleasing the landscape (PRLD 1995).

The Parks Development Division of the PRLD prepared the inventory and analysis of the area. Landscape architects were assigned sections of the study area and spent several days in

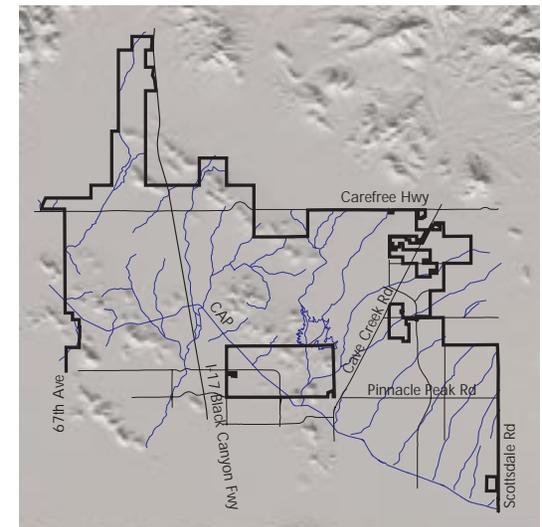


Figure 2.12 Hillshade analysis

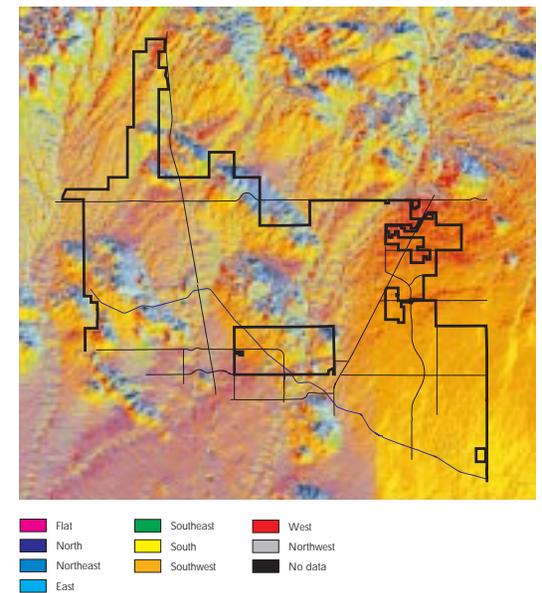


Figure 2.13 Aspect model

the field driving the few dirt roads, photographing the area, and noting significant features. The area was also toured on several occasions by the Phoenix Sonoran Preserve Committee and their planning subcommittee. These visits and those conducted by the PRLD, the Arizona State Land Department, and the primary landowner in the area, provided a thorough inventory of the visually significant features in the study area. These findings were documented and were incorporated into a suitability model.

I. Wildlife Study

The ASU SPLA Environmental Resources program is conducting a wildlife study for the NSA. The study is funded for the first year of a three-year period and includes an inventory

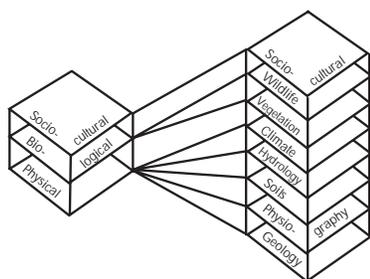


Figure 2.18 Layer cake model
Adapted from Steiner 1991.

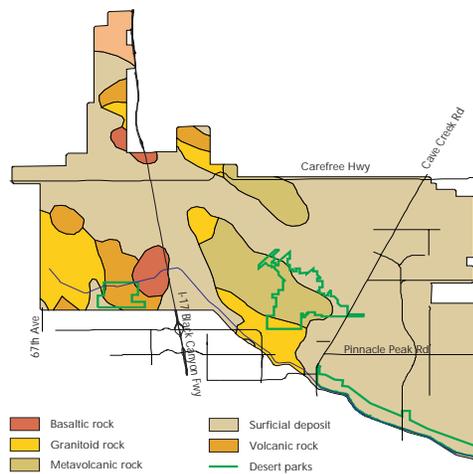


Figure 2.14 Geology

From Brady et al.'s 1998 interpretation of ALRIS data.

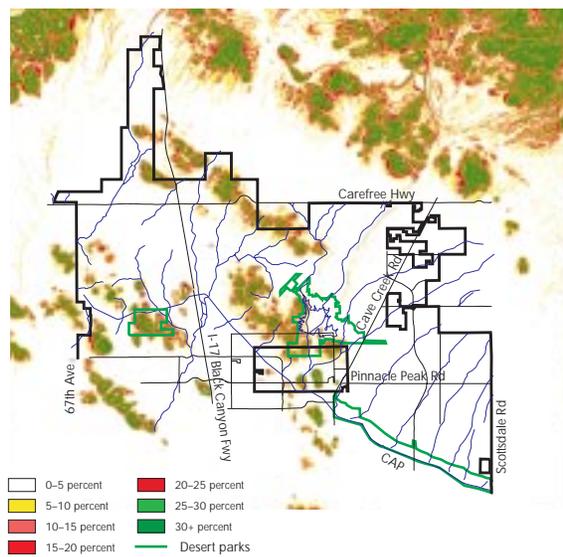
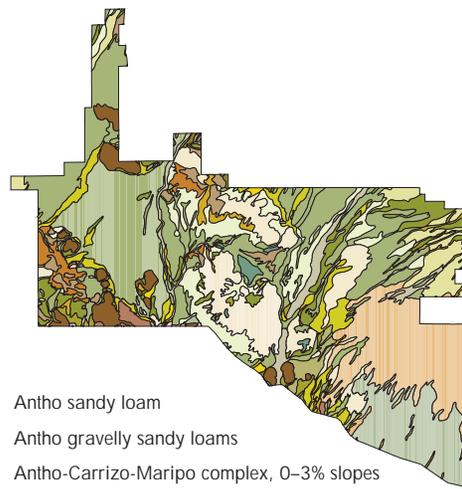


Figure 2.15 Slope analysis

of small and large terrestrial mammals, bats, and avian species (Figure 2.19). The first phase of the study that began in October 1997 is focused on Cave Creek Wash and Skunk Creek Wash. The second and third years of the study will consider secondary washes as well as other physiographic features (e.g., hillsides and creosote bush–bursage flats). The final report will include information on species composition, abundance, richness, and diversity. The data will help inform the continuing refinement of the preserve plan as well as provide baseline data for future evaluation of the ecological health of the preserve.



- Antho sandy loam
- Antho gravelly sandy loams
- Antho-Carrizo-Mariposa complex, 0–3% slopes
- Antho-Carrizo-Mariposa complex, low precipitation
- Anthony-Arizo complex
- Brios-Carrizo complex, 1–5% slopes
- Carefree cobbly clay loam, 1–8% slopes
- Carefree-Beardsley complex
- Cherioni-Rock outcrop complex, 5–60% slopes
- Cipriano very gravelly loam
- Contine clay loam
- Contine clay
- Eba very gravelly loam, 1–8% slopes
- Ebon very gravelly loam, 1–8% slopes
- Estrella loams
- Gachado-Lomitas-Rock outcrop complex, 7–55% slopes
- Gila fine sandy loams
- Gilman loams
- Glenbar loams
- Gunsight-Cipriano complex, 1–7% slopes
- Gunsight-Rillito complex, 1–25% slopes
- Mohall loam
- Mohall loam, calcareous solum
- Mohall clay loam
- Mohall clay loam, calcareous solum
- Momoli gravelly sandy loam, 1–5% slopes
- Pinaleno-Tres Hermanos complex, 1–10% slopes
- Pinamt-Tremant complex, 1–10% slopes
- Quilotosa-Vaiva-Rock outcrop complex, 20–65% slopes
- Rillito loam, 0–3% slopes
- Schenco rock outcrop complex, 25–60% slopes
- Suncity-Cipriano complex, 1–7% slopes
- Tremant gravelly sandy loams
- Tremant gravelly loams
- Tremant-Gunsight-Rillito complex, 1–5% slopes
- Tremant-Rillito complex
- Vado gravelly sandy loam, 1–5% slopes
- Vaiva very gravelly loam, 1–20% slopes
- Valencia sandy loams

Figure 2.16 Soil associations

Adapted from Brady et al.'s 1998 interpretation of ALRIS data.



Figure 2.19 Kangaroo rat

Chapter 3



Public policies for outdoor recreation are controversial. Equally conscientious citizens hold opposite views on what is and what should be done to conserve its resource base. Thus the Wilderness Society seeks to exclude roads from the hinterlands, and the Chamber of Commerce to extend them, both in the name of recreation. Such factions commonly name each other with short ugly names, when, in fact, each is considering a different component of the recreation process. These components differ widely in their characteristics or properties. A given policy may be true for one but false for another. . . . It seems timely, therefore, to segregate the components, and to examine the distinctive characteristics or properties of each.

Aldo Leopold
A Sand County Almanac, 1949

Master Plan for the North Study Area

A. Introduction

The intent of this section is to present the fundamental principles of the master plan, delineate the physical configuration, and identify appropriate uses for the Sonoran Preserve. The City of Phoenix has a long and successful history of preservation beginning in 1924 with the acquisition of South Mountain Park. On a daily basis, physical and visual access to large parcels of open space positively affects our quality of life. Today, not unlike the 1970s, growth of the city has required that we act to preserve what has drawn many of us to live in the Valley of the Sun—the beauty of our environment. In keeping with the tradition of preservation, the magnitude of our actions today must be in proportion to the enormous growth the city has and will continue to experience. From 1990 to 2020 the valley is projected to attract two million residents and develop 344 square miles of land (MAG 1995). It is in the spirit of Phoenix's long-standing tradition of preservation that this master plan for the Sonoran Preserve has been developed. It reflects the recent planning efforts, studies, and scientific research presented in the previous chapter. In particular, the plan:

- Responds to the Desert Preserve Citizens Advisory Committee's recommendation to focus on undisturbed or near-pristine desert land
- Responds to the key resources identified to be preserved in the *Desert Preserve Preliminary Plan*, as well as the inventory process that began with the advisory committee and continues today with the wildlife and wash preservation studies
- Responds to the seven goals identified in the *Desert Preserve Preliminary Plan*
- Incorporates public concerns and comments generated by the three conceptual plans (concentrated, semiconcentrated, and dispersed) developed in 1996, which explored how the preserve could be configured
- Responds to the recommendations and lands identified for conservation in the *Desert Spaces* plan developed for MAG—all lands identified in this plan are included in the Sonoran Preserve in an effort to contribute to a regional open space network that benefits Maricopa County as well as City of Phoenix residents
- Responds to the recommendations and concepts affecting the built and natural environment identified in the *General Plan for Phoenix 1985–2000* and amendments, the *Cave Creek Wash Preservation Boundary Study*, and the *Findings of the North Sonoran Land Use Character Charrette* (McCarthy et al. 1995)

- Responds to the GIS suitability model developed by the City of Phoenix and ASU. This model has been a valuable tool used to manage the enormous amount of data generated in the planning of the NSA

In 1970 the population of Phoenix was 584,000, and with the addition of the planned Phoenix Mountain Preserve (Figure 3.1), approximately 81 percent or 34 square miles of paloverde-saguaro vegetation communities within the city limits had been included in the PRLD system in the form of desert parks or mountain preserves. This equated to a service level of one square mile of desert parks or mountain preserves per 17,000 residents. Given the 1996 population of 1,168,000, an additional 25,000 acres of desert parks and mountain preserves would be required to have a comparable service level. Significant areas have already been acquired. Deem Hills is 640 acres and is recommended for inclusion in the preserve system (Figure 3.2). Cave Buttes Recreation Area (2,200 acres; Figure 3.3) and Reach 11 (1,500 acres; Figure 3.4) are both district parks and represent 3,700 acres of parks that will be predominantly desert in character. This indicates an additional 20,660 acres of desert parks and mountain preserves would be an appropriate goal for the Sonoran Preserve based on the 1996 population. More important than the number of acres is the social and ecological value of the preserve and configuration of the lands to be included in the PRLD system.



Figure 3.1 Aerial view of the Phoenix Mountains



Figure 3.2 Deem Hills



Figure 3.3 Cave Buttes Recreation Area

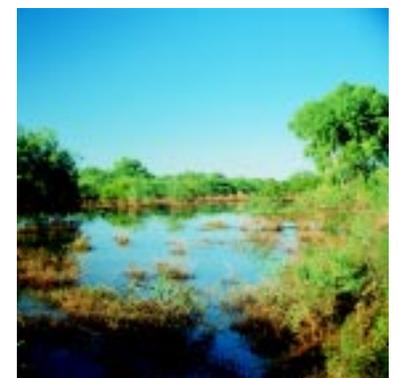


Figure 3.4 Reach 11 Recreation Area

The Sonoran Preserve Plan includes 21,500 acres in the NSA (Figure 3.5). This represents 28 percent of the 110-square-mile NSA. Approximately three-quarters, or 16,800 acres, of the lands recommended for preservation are owned by the Arizona State Land Department. Approximately one-quarter, or 4,700 acres, are privately held lands. This ratio of state trust lands to private lands is approximately equivalent to the proportion of land ownership in the area and not a function of targeting either party (Figure 3.6).

The plan incorporates ecological principles regarding preserve design and ecosystem health and sustainability. This will enhance the ability to maximize ecological integrity and minimize the degradation of the landscape. These principles are briefly discussed in the following section. The plan only includes new lands in the NSA since specific lands in the SSA have been identified in the 1994 *Desert Preserve Preliminary Plan*. Figure 3.7 illustrates one of the guiding principles of the preserve, connecting the preserve to other significant open space within and beyond the city limits. Utilizing existing wash corridors and existing infrastructure corridors can provide both ecological benefits as well as greater recreational opportunities for the public.

B. Ecological Principles

The structural pattern of landscapes are composed of three types of elements which can be found in any urban, rural, or natural landscape.

Corridor: A strip of a particular type that differs from the adjacent lands on both sides. Corridors can be wide or narrow, straight or curved, and connected or with gaps (Cook and van Lier 1994). Examples of corridors include a hedge of creosote, a small arroyo, a street, a major wash, or a river.

Patch: A relatively homogeneous nonlinear area that differs from its surroundings. A patch may be large or small, rounded or elongated, and smooth or lobed (Dramstad et al. 1996). Examples of patches include a neighborhood park, a planned community, South Mountain Park, or the entire Salt River Valley.

Mosaic: The composition and spatial organization of components (Forman 1995). For example, the region where hillslopes, creosote bush–bursage flats, tanks, wash bottom, and wash edge meet along Apache Wash is an important area because its diverse composition of vegetation types gives it both rich wildlife value and high visual interest. It represents a particularly dynamic landscape mosaic.

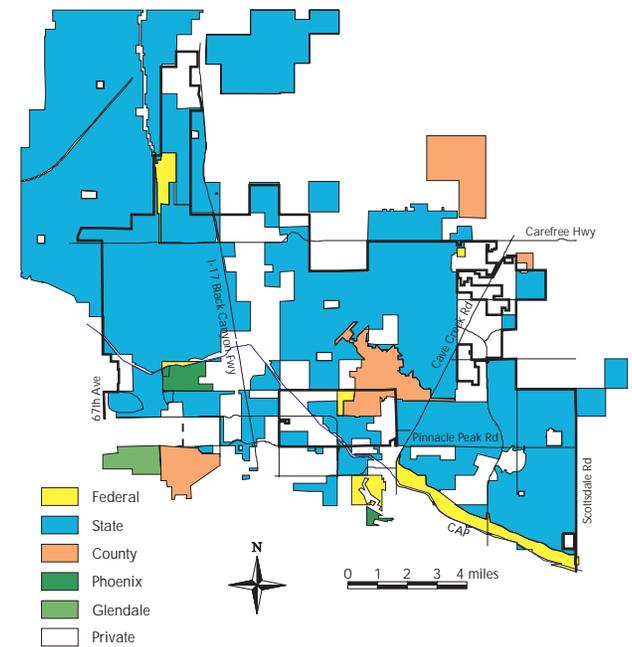


Figure 3.6 Land ownership

The plan incorporates ecological principles regarding preserve design and ecosystem health and sustainability. This will enhance the ability to maximize ecological integrity and minimize the degradation of the landscape.

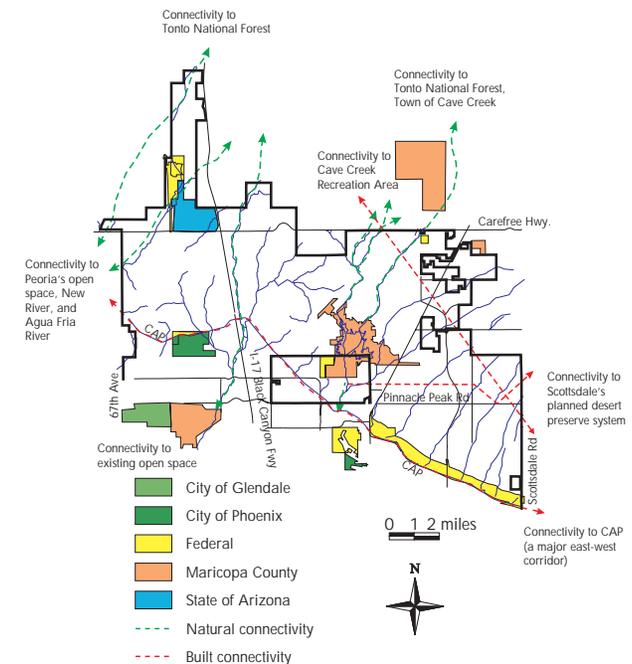
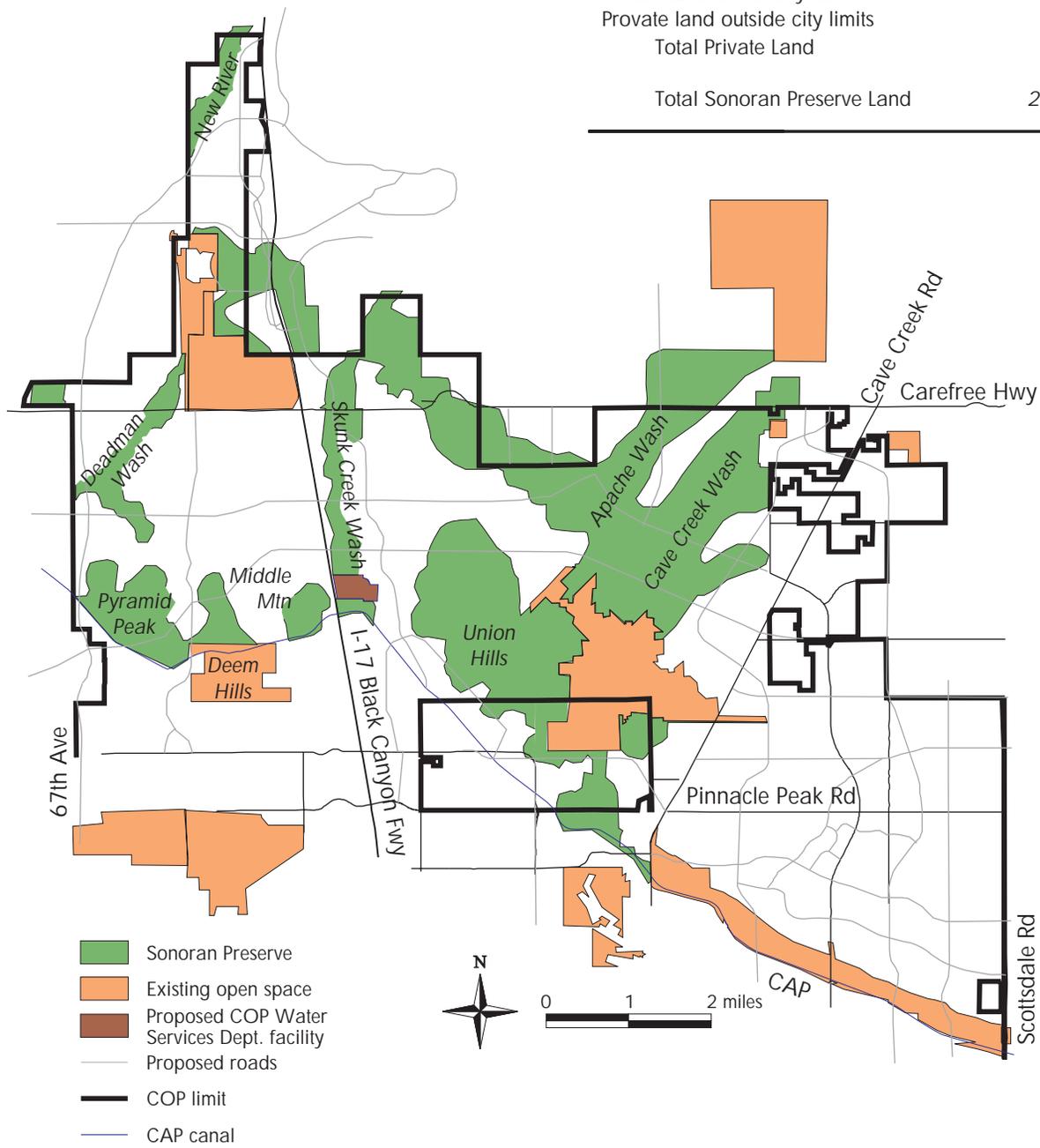


Figure 3.7 Openspace Connectivity

Sonoran Preserve Land Ownership and Location

	In Acres
State land within city limits	14,800
State land outside city limits	2,000
Total State Land	16,800
Private land within city limits	2,800
Private land outside city limits	1,900
Total Private Land	4,700
Total Sonoran Preserve Land	21,500



The deserts should never be reclaimed. They are the breathing-spaces of the west and should be preserved forever.

John Van Dyke
The Desert, 1901

Figure 3.5 Sonoran Preserve Master Plan



Figure 3.8 Lookout Mountain, now completely surrounded by development, illustrates the loss of connectivity

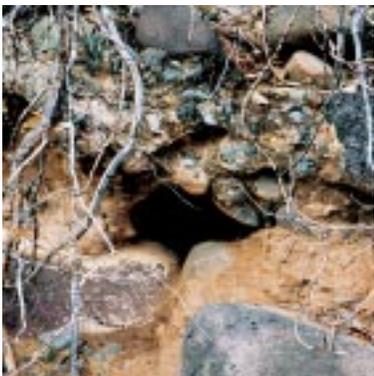


Figure 3.9 Cliffs along Skunk Creek Wash provide valuable locations for burrowing wildlife



Figure 3.10 Tin Can Tank provides a unique experience for preserve users and an important resource for many species of wildlife

The following principles for landscape ecological planning are fundamental to developing the structure and content of a preserve with ecological integrity:

1. Hydrologic processes should be maintained

Watercourses should remain unfragmented and corridors should be as wide as possible.

2. Connectivity of patches and corridors should be maintained

This supports wildlife survival and movement (Figure 3.8).

3. Patches should be as large as possible

Patches provide numerous ecological benefits that include ameliorating microclimates, providing habitat, and absorbing rainfall. A few large patches should be included in a preserve system (Forman 1995).

4. Unique and interesting mosaics of landforms and vegetation types should be included in the preserve

The *Cave Creek Wash Study* identified mosaics as important physical conditions for wildlife species diversity (Ewan et al. 1996). They are also visually interesting, which is important for public use. While mosaics are not marked on the plan, the principle was considered in selecting land to be included in the preserve. Examples include the cliffs along Cave Creek and Skunk Creek and the tanks that are found throughout the NSA (Figures 3.9, 3.10).

5. Diverse mosaics should be integrated into the developed human environment

This expands the mobility and available area for wildlife. It also facilitates contact with nature, which is beneficial to human ecology.

6. A preserve should be considered at multiple scales

The function and vitality of a preserve cannot be sustained within a vacuum, especially when preserved land is located in an urban area. For example, at a regional scale, the preserve's connectivity to other significant undisturbed desert lands should be considered (Cook 1991; Cook and van Lier 1994; Forman 1995).

C. Landforms

Major Washes and Floodplains

Floodways and floodplains for major washes should be included in the preserve. Floodplains plus buffers should be recognized as the limit of development and define the minimum boundary for washes identified for preservation. Cave Creek, Apache Wash, Skunk Creek Wash, and Deadman Wash should all be part of the Sonoran Preserve system (Figures 3.11, 3.12, 3.13, 3.14). These washes should not be fragmented and efforts should be made to maintain the natural hydrologic conditions within the preserve and further upstream.

The following discussion on the value of wash preservation is included because this is the first extensive effort to preserve wash systems within the City of Phoenix. Major washes and floodplains were identified in the *Desert Preserve Preliminary Plan* for inclusion in the preserve. *Desert Spaces* (MAG 1995), the ASU north area wash studies (Ewan and Fish Ewan 1998; Ewan et al. 1996), and the *State Standard for Watercourse System Sediment Balance* (Arizona Department of Water Resources [ADWR] 1996) all recommend against development within floodplains. Much of the lush vegetation associated with washes lies in the floodplains as well as on the edges of floodways. Natural desert washes and drainageways provide diverse and abundant plant and animal life. They act as nesting areas and travel corridors. In the NSA, land associated with washes often contains areas with rich archaeological and historic significance because they were often the sites of human migration and settlement. While drainageways and floodways are already regulated in the city because of the potential danger associated with flooding and storms, floodplains are not afforded the same regulation.

Floodplain boundaries are not fixed and over time a wash may shift or migrate. This natural process is called lateral migration. Lateral migration is a commonly observed occurrence in the southwest where the soils associated with washes tend to be erodible (ADWR 1996). Eroding soils in combination with ephemeral and often violent precipitation events necessitates the need for buffers where natural washes are to be preserved. Without a buffer, a wash that naturally migrates in a developed area can jeopardize private property. Thus, if wash migration is not considered in the land planning phase, the eventual and often necessary solution is to structurally stabilize the banks of the wash. Once a structural solution is implemented in one portion of a wash, increased velocities result and downstream degradation often occurs (ADWR 1996). Channelization speeds runoff, but also increases the peak discharge, often necessitating further downstream extension of the artificial channel section. And so each action creates the need for further construction and more concrete. (Dunne and Leopold 1978)

To effectively preserve washes, stormwater management must be considered based on complete hydrologic systems and not on a site-by-site basis.

Mountains

The mountains in the NSA should be included in the preserve. The minimum amount of land associated with preserving mountains should be defined by slopes greater than



Figure 3.11 Cave Creek Wash



Figure 3.12 Apache Wash



Figure 3.13 Skunk Creek Wash



Figure 3.14 Tank along Deadman Wash

ten percent. Hills and mountains to be included in the preserve are identified on the plan and include Union Hills, Pyramid Peak and its associated hills, and Middle Mountain (Figures 3.15, 3.16, 3.17). Other mountains that contribute to the network of open space in the area include Buffalo Ridge, Deem Hills, and Ludden Mountain. These landforms maintain gradual slopes almost in their entirety, so relying on steep slopes to limit development as a preservation tool would be relatively ineffective in this area. Hillside preservation should be based on the local landscape physiography rather than standardized hillside development controls.

All of the studies mentioned in the previous chapter recommend preservation of the mountains. Whether or not to preserve mountains is not the issue. How much of the mountains to preserve is the more difficult challenge. Unless the hillsides and mountains are included in the preserve, they will eventually become developed. Land adjacent to mountains is some of the most valued land in the Valley for residential development. Hillside development controls intended to protect public health, safety, and welfare are not well designed to accomplish preservation. Traditionally, mountain preservation has been defined by property lines and slopes not suitable for development. For large landforms like South Mountain and the North Mountains, this leaves substantial land available as open space. For small landforms, this process leaves small islands of limited visual, recreational, and ecological value.

One approach to defining the limit of a mountain is to analyze surface features, such as vegetation and soil types, associated with its physiography. Hillside vegetation extends well below 20 percent slopes—a common limit for hillside development—which indicates that restricting development based on slope does not respond to ecological conditions.

An Open Space Plan for the Phoenix Mountains hypothesized that “the Phoenix Mountains should be preserved as nearly as possible in their natural state for the enjoyment of all the people and for preservation of the special quality of Phoenix urban life to which they contribute” (PRLD 1971). Since the 1970s, the city land area has more than doubled; mountain preservation needs to increase as the city continues to expand.

Studies done by the PRLD illustrate the amount of land that would be preserved in the Union Hills at various slopes (Figure 3.18). Preserving only the lands above 20 percent slopes yields a series of small disconnected islands. These islands



Figure 3.15 Union Hills

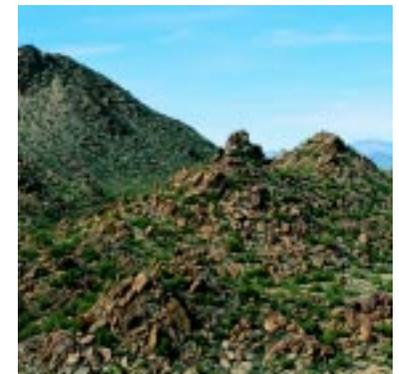
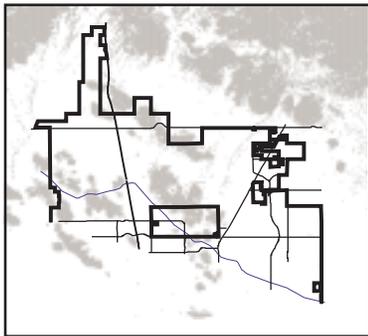


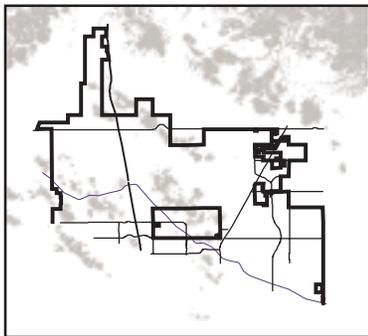
Figure 3.16 Pyramid Peak



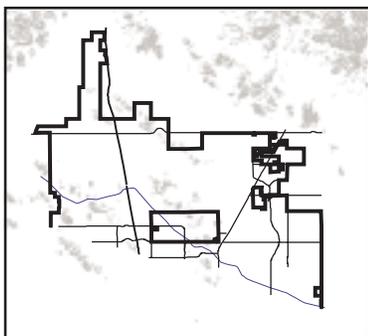
Figure 3.17 Middle Mountain



Connected pattern of land preserved at 10% slopes and steeper.



Disconnected pattern of land preserved at 20% slopes and steeper.



Insignificant parcels of land preserved at 30% slopes and steeper.

Figure 3.18 Slope analysis

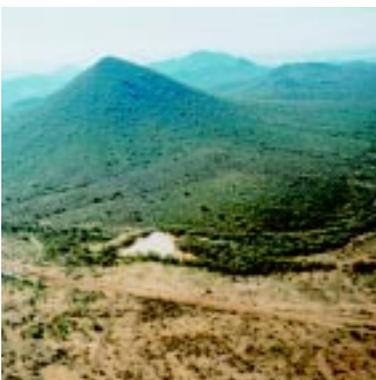


Figure 3.19 The close proximity of Creosote Flats, Apache Wash, the Union Hills, and Tin Can Tank provides a rich mosaic of vegetation that is beneficial to wildlife

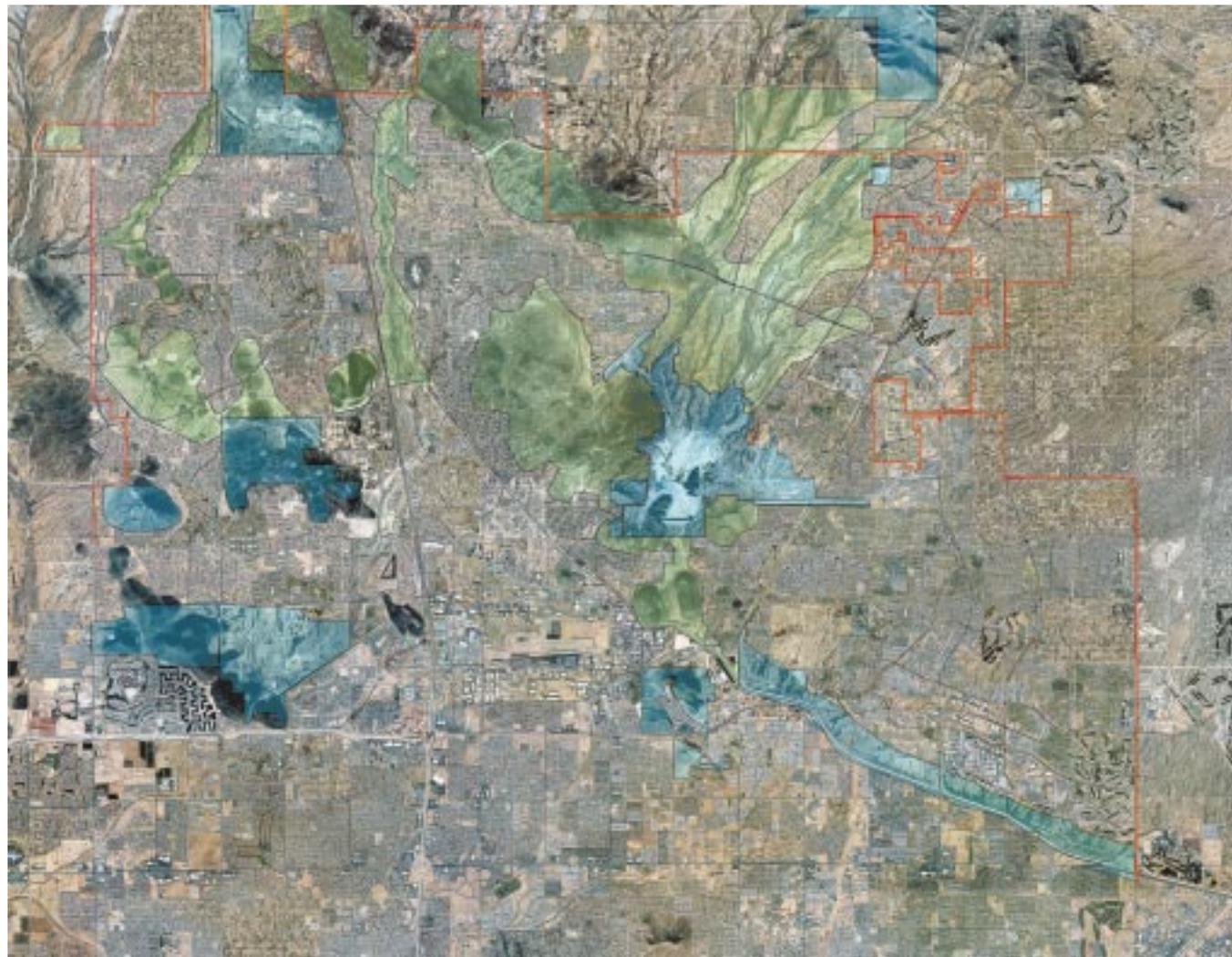


Figure 3.20 North Study Area with Sonoran Preserve

have limited value as open space. Not until the development is restricted to slopes of less than ten percent is a preserve created in the Union Hills that maintains connectivity. While limiting development to slopes of ten percent or less will decrease the amount of land available for development, this approach will increase the amount of land available for development that is adjacent to the Sonoran Preserve as well as increase the visual, recreational, and ecological value of the lands preserved. Mountains also represent ecological patches and, as such, would have greater wildlife value if larger parcels were preserved rather than small fragmented hilltops.

Linkages and Transition Lands

Mountains and washes are two types of significant lands identified for preservation. Landscape ecologists increasingly stress the need for providing connectivity (Dramstad et al. 1996; Forman 1995; Cook and van Lier 1994). Therefore, maintaining linkages between different forms is integral to the health of the Sonoran Preserve.

The transition area from mountains to creosote bush-bursage or washes is often called the *bajadas* or foothills. These areas contain a rich diversity of flora and fauna. They are often the sites of the greatest archaeological significance. Where washes and mountains are in close proximity, these transition lands have been incorporated into the preserve (Figure 3.19). Creosote bush-bursage between washes is another important transition area. As hunting and breeding grounds, these areas play an important role in the life cycle of many wildlife species. Where washes are separated by relatively small amounts of land, the creosote bush-bursage flats have been incorporated into the preserve. Other transition lands include small valleys surrounded by mountains. These areas offer a unique opportunity for users to be visually separated from the city. These areas greatly enhance the visitors' outdoor experience and where small valleys occur with significant enclosure, these lands have been incorporated into the preserve.



Figure 3.21 North Study Area without Sonoran Preserve

Transition lands and linkages contribute to preserving all types of lands present in the NSA. They also offer a greater diversity of terrain, increase the visual interest of the preserve, and provide areas of greater accessibility. Not all trail users want the challenge of climbing Squaw Peak—many prefer more gentle terrain which would be provided in the transition areas. These zones also offer appropriate locations for picnic areas, passive play areas, access points, and environmental education centers.

SWCA, Inc., an environmental consulting firm, worked with the Parks, Recreation and Library Department to develop two scenarios that illustrate how the NSA might develop. The first scenario assumed the Sonoran Preserve to be in place while the second scenario was based on open space being dedicated to the city through typical development practices. The scenarios are based on land uses and densities from the *General Plan for Phoenix 1985–2000*. Aerial imagery of existing developments within the City of Phoenix are used to illustrate how growth in the NSA would appear in the future.

Figure 3.20 shows the NSA with the Sonoran Preserve. The preserve, shown in green, plays a significant role in defining the urban and suburban development. Mountains, hillsides, and washes are preserved as well as the transition and flatlands, creating a connected and accessible open space system. Recreational opportunities for the public and habitat requirements for wildlife are greatly enhanced by the inclusion of the diversity of vegetation types and landforms that exist in the area.

Figure 3.21 illustrates how the NSA might develop without the Sonoran Preserve. Only the steepest slopes are left undeveloped, leaving a series of small, disconnected peaks of open space. The washes are developed to the edge of floodways to maximize the amount of land available for development. Ultimately, many of the washes in this scenario would require concrete lining or other structural flood control measures. Opportunities to be in a natural desert setting without the visual impact of urban and suburban development does not exist. Access to open space is limited and trails and other recreational opportunities is greatly compromised.

Mountains, hillsides, and washes are preserved as well as the transition and flatlands, creating a connected and accessible open space system.

connected



Figure 3.22 Appropriate preserve uses provide opportunities for passive recreation, conservation, and environmental education



Figure 3.24 Multi-use nonmotorized trails



Figure 3.25 The existing CAP Canal provides the opportunity to make regional trail connections

D. Public Use

Appropriate Uses

The Sonoran Preserve will be available to the entire community as well as visitors and will provide a broad range of functions for diverse groups of users emphasizing passive recreation, conservation, and environmental education. The following significant public uses are appropriate within the preserve.

Recreational use

Recreational use in the Sonoran Preserve will be similar to that of the mountain preserves. Uses appropriate for the preserve include hiking, bicycling, horseback riding, nature studies, picnicking, children's playground, sand volleyball, horse-shoes, and other passive recreational activities (Figure 3.22).

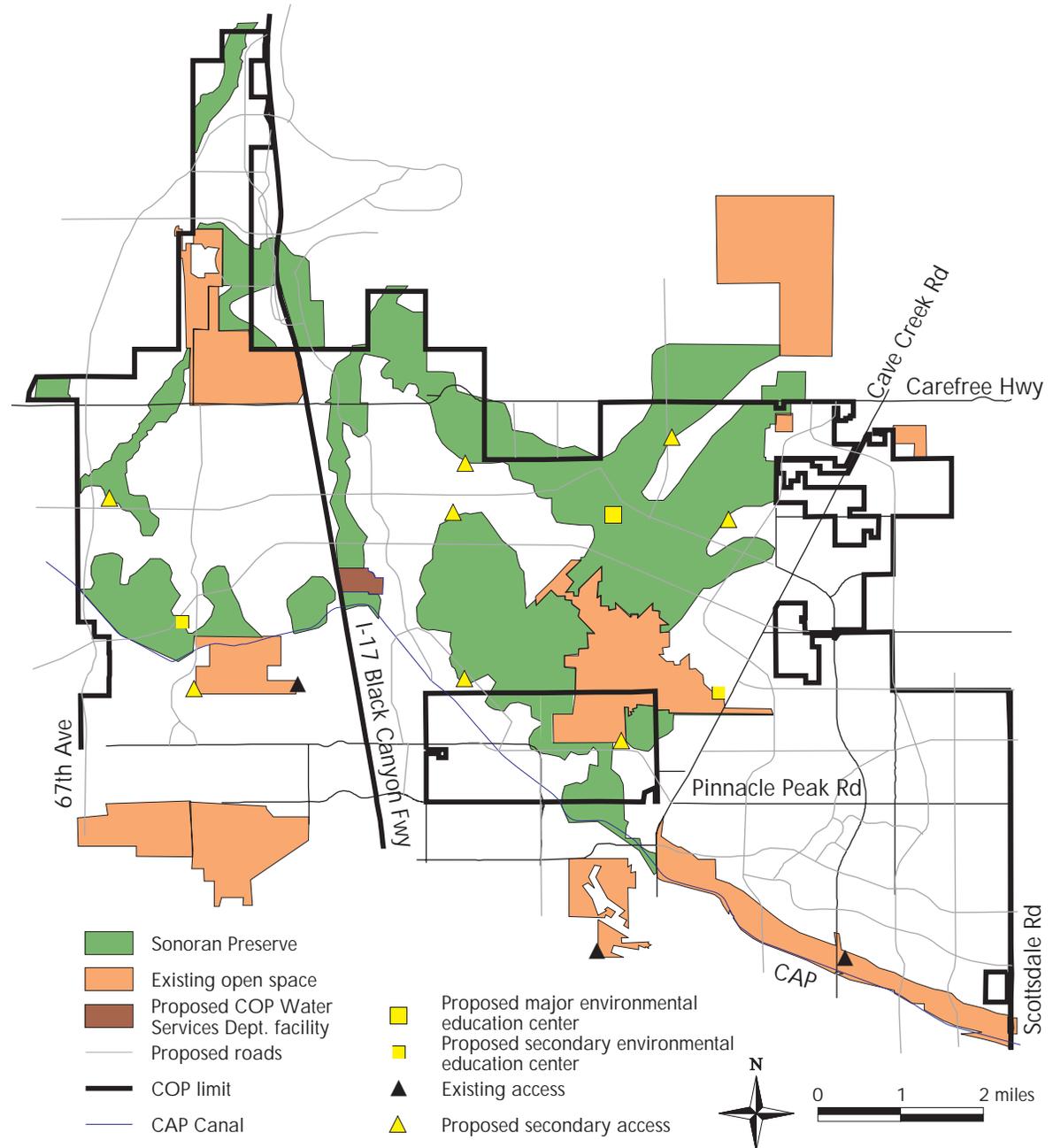


Figure 3.23 Access points

Access

A hierarchy of entrance points has been developed to facilitate access to the Sonoran Preserve. In addition to facilitating access, developed entrance points will prevent potential problems of overuse and resource degradation currently experienced in the Phoenix Mountain Preserve system by concentrating access and use to designated areas (3.23).

Three major access areas have been planned for the Sonoran Preserve. Each site will be approximately 15 acres in size. Programmed elements may include sand volleyball, horseshoes, a playground, picnicking (family and group picnicking areas with ramadas), restrooms, drinking fountains, bicycle parking, informational signage, trailheads, parking lots, transit linkages, environmental education facilities, ranger station with dedicated parking, and interpretive trails, though every element may not be in every major access area.

A minimum of eight secondary access areas are planned for the Sonoran Preserve. Each site will be three to five acres. Programmed elements may include picnicking (family and group picnicking areas with restrooms and ramadas), trailheads, parking lots, transit linkages, secondary environmental education facilities, and ranger station.

Local walk-in trailheads will provide an important link to the community. Sites should be approximately one-quarter mile apart. Planned access for adjacent neighborhoods is required to avoid trailblazing between major and secondary access areas. It also encourages nonvehicular access to trailheads. Programmed elements may include standard signage, seating, drinking fountains, and bicycle parking.

Trails

Trail use is the number one outdoor recreational activity for Arizona residents. Trails have a minimal impact on the natural environment and are relatively inexpensive to build. The *Desert Preserve Preliminary Plan* recommended multi-use nonmotorized recreational trails to best accommodate hiking, running, mountain biking, horseback riding, and interpretive education (Figure 3.24). In the NSA, the natural flow characteristics of the drainage provide an opportunity for major northeast to southwest trails. Mountains generally follow a northwest to southeast alignment accommodating additional trails. These natural features, combined with built features in the NSA (the CAP Canal and existing utility corridors), provide a structure for a trails plan (Figures 3.25, 3.26). MAG's *Desert Spaces* plan identified several existing and proposed trails that should be incorporated into the trail

network to provide regional connectivity. Other trails within the Sonoran Preserve can then link to this regional system. A comprehensive trails plan will need to be developed.

Interpretation

The major environmental education center proposed for the Sonoran Preserve will be located west of Apache Wash. Programmed elements include indoor and outdoor educational facilities; interpretive exhibits and demonstration areas to highlight the ecology, prehistory, and history of the area; permanent and revolving exhibits; interpretive trails; meeting rooms; restrooms; administrative offices; and parking, kitchen, and concession areas. The center will be approximately 13,000 square feet on a site about four acres in size. This center is modeled after the environmental education center recently constructed at South Mountain Park (Figure 3.27).

Two secondary environmental education facilities are proposed for the Sonoran Preserve. Their siting is primarily based on providing equitable service and access in the preserve as well as giving consideration to environmental and cultural factors appropriate for interpretation. These facilities are smaller in scope than the environmental education center. Programmed elements would include multi-use meeting rooms, space for indoor/outdoor exhibits, interpretive trails, restrooms, parking, and staff offices. These centers will be 1,000 to 4,000 square feet on sites approximately two acres in size.

Interpretive centers provide places for children and adults to take field trips to learn about the Sonoran Desert ecology (Figure 3.28). Special guided walks and research would enhance lessons dealing with environmental awareness and conservation, understanding of natural processes and species diversity, and an understanding and appreciation of human dependency on the natural environment. Local cultural and natural history would be interpreted through exhibits and activities.

In the NSA many infrastructure improvements are necessary to support adjacent urban development. Roads, water transmission mains, and sewer interceptors will need to cross the preserve in some locations in order to service development. Crossings should be minimized and, when absolutely necessary, infrastructure improvements should be combined into common corridors to minimize disturbance. Right-of-way shall be acquired separately with funds other than those allocated for preserve acquisition. Where lands are disturbed in the preserve, restoration costs shall be accommodated by the responsible party per guidelines provided by the PRLD.



Figure 3.26 Existing utility corridors provide opportunities for regional trail connections



Figure 3.27 South Mountain Park's new environmental education center



Figure 3.28 Park ranger teaching children about Sonoran Desert plants



Figure 3.29 Wash corridor lined with concrete provides minimal benefit as open space to either wildlife or the public



Figure 3.30 The erosive impact of a structural flood control solution on the natural vegetation downstream



Figure 3.31 Eminent loss of existing native vegetation along a wash due to upstream development

Inappropriate Uses

Due to their negative impact upon the preserve, many uses are inappropriate and shall not be allowed within its boundaries. These uses negatively impact natural resources because of their spacial needs or land use intensity. They include such elements as large museums, golf courses, recreational vehicle parks, developed overnight camping, agriculture, stables, active recreation, mining, grazing, and all-terrain vehicles. These uses should be prohibited. In addition, uses or activities already prohibited by city ordinances in parks and preserves will be prohibited in the Sonoran Preserve. Fires, except where designated in picnic areas, cause potential hazards to people and the preserve. Irrigation ditches and canals create long continuous barriers within the preserve and destroy the natural environment. Negative visual impacts to preserves are caused by communication antennas, towers, and overhead telecommunication and power lines—these should be minimized in the preserve.

While these uses are inappropriate within the preserve, some may be very appropriate for adjacent lands. For example, when located adjacent to the preserve, golf courses, schools, and neighborhood and community parks increase the quantity of open space, help preserve views and wildlife corridors, and provide services to the public that need not be replicated in the preserve. Appropriately located and designed residential development can help instill a sense of public ownership, create a safer and more secure site, and allow for integration of the desert.

E. Preserve Ethic

The boundaries of the Sonoran Preserve need not be the extent of the effort to preserve the natural environment within Phoenix. Historical examples exist that demonstrate the integration of human values with ecological values. For example: Village Homes in Davis, California; Frederick Law Olmsted's Emerald Necklace in Boston; The Woodlands outside Houston, Texas; Frank Lloyd Wright's Taliesin West; and Paolo Soleri's Cosanti in Paradise Valley. Adjacent land use practices can contribute to Phoenix's preservation efforts, particularly with regard to treatment of secondary washes, scenic corridors, and the preserve edge. These resources were identified in the *Desert Preserve Preliminary Plan*. PRLD will continue to participate in the development review process and work with Development Services Department and the Planning Department to help ensure sensitive lands outside the preserve are developed appropriately. Specific recommendations follow.

Secondary Washes

Washes not included in public ownership can still contribute to the preserve and are a valuable part of the hydrologic process. Degradation of these washes will ultimately have a negative impact on the major washes included in the preserve (Figures 3.29, 3.30, 3.31). These smaller washes, when left in a natural condition, prevent erosion, filter pollutants, and provide connection to the preserve for humans as well as wildlife.

Tucson residents have long realized the significance of stormwater, and in 1988 began a stormwater management study. Citizens had concerns about flooding as well as the preservation of natural washes. The city investigated the feasibility of nontraditional solutions—solutions other than the typical lining of wash banks with concrete. Of 77 miles of washes surveyed, 98 percent of the riparian habitat was recommended for preservation as naturally vegetated watercourses. A variety of approaches were recommended, but what is most significant is that the City of Tucson Department of Transportation has estimated a savings of \$413 million over the next 30 years due to a shift from an emphasis on structural solution to nonstructural solutions (Department of Transportation 1996).

In light of this forward-thinking precedent, the following principles are recommended along secondary washes outside of the preserve:

- Washes should be left in their natural state and buffered to ensure long-term preservation
- Nonstructural solutions should be considered for their economic as well as ecological benefits
- Policies or standards should be developed to protect wash corridors in developed areas

Scenic Corridors

The additional rights-of-way, easements, and/or building setbacks associated with scenic corridors and drives can provide necessary desert linkages between desert and mountain preserve areas and other open space. The scenic quality along roadways often paints the most memorable image of a city to both residents and visitors. Scenic corridors and drives are currently proposed for roadways in the NSA.

Cave Creek Road provides an example of a linear corridor that contributes toward desert preservation. In 1992 the City Council approved a general plan text amendment extending the southern end of the Desert Foothills scenic drive from Pinnacle Peak Road to the northern edge of the CAP

Canal. In the same action, it approved a change to the transportation plan map of the *General Plan Peripheral Areas C and D*, adding a category of “Designated Scenic Corridor,” and deemed Cave Creek Road as such (Planning Department 1987). The general plan amendment encourages a 205-foot setback from the roadway centerline. However, the City Council recognized that this width may not be feasible for all land parcels. In June 1997, the City Council adopted scenic corridor design policies for the Carefree Highway (Planning Department 1997c). Pinnacle Peak Road and Scottsdale Road are also designated scenic corridors per the transportation plan.

Generally, the scenic corridors identified in north Phoenix provide a network of north-south and east-west corridors. The scenic corridors as shown in the *Desert Preserve Preliminary Plan* differ somewhat from the transportation plan maps but match those approved by the Desert View Tri-Villages Planning Committee, with the exception of one alignment. The routes approved by the village planning committee include Tatum Boulevard, existing and proposed extensions of Happy Valley Road, 51st Avenue, Cave Creek Road, and a section of Dixiletta Road.

No established citywide scenic corridor guidelines have been approved by the City Council. To truly integrate scenic drives into the preserve, these guidelines must be established. The scenic corridor concept should be expanded to include other uses such as trail corridors, wildlife habitat, and view corridors (Figure 3.32).

Adjacent Land Use and Edge Treatment

Dramstad et al. (1996) describe the edge as the outer portion of a patch where the environment differs significantly from the interior of the patch. Considering the preserve as a patch, the edge will frequently be formed by urban development. This edge requires careful attention due to the potential impact adjacent development can have on the health of the preserve. Invasive species can encroach into the preserve and have a detrimental impact on the native flora and fauna.

Another possible detrimental effect is the edge becoming a barrier to users and wildlife (Figure 3.33). For users, access into the preserve should be convenient and readily identifiable and not obstructed by continuous private development. This often occurs where residential lots back up to the open space edge with no accommodation for public access. Possible solutions to this scenario include developing streets that form the edge of the preserve, thus providing physical and visual access. Other solutions could include designing

cul-de-sacs ending at the preserve edge to allow physical and visual access (Figure 3.34). For wildlife, the edge should not be abrupt. One method of accomplishing this is to use native vegetation in developments adjacent to the preserve, thus creating a gradual transition.

The edge of the preserve is a critical point of interaction between the built and natural environments and requires sensitive consideration. In the past, many edges of open space in the Valley have been defined by political, administrative, or legal boundaries and not the natural factors that motivated preservation in the first place. Design guidelines need to be developed for adjacent development and edge treatment.

Roads, Wildlife, and Users

One million vertebrates per day are killed on roads in the United States. The species affected include deer, wolves, and bats (Forman 1995). In 1997, road kills within the city of Phoenix averaged 194 per week. While statistics are not available differentiating the total domestic from native species, native wildlife roadkills within the city limits include coyotes, javelinas, rattlesnakes, and blacktailed jackrabbits. White-tailed deer, mule deer, and javelina roadkills have been reported to the Arizona Game and Fish Department along the City of Phoenix portion of the Carefree Highway. Of the many techniques developed to respond to this problem, reflectors, mirrors, repellents, various fencing types, lighting, and wildlife crossing signs all show moderate or no success (Forman 1995). Underpasses, tunnels, and overpass designs have been developed and tested for use by animals in many countries including the United States. The wildlife friendly underpass solution should be combined with the need for grade-separated wash crossings and safer pedestrian crossings.

The physical configuration of the plan takes into account the ecological principles set forth in this chapter as well as the considerations for public access and appropriate edge treatment. The 21,500-acre preserve includes hills, washes, and transition lands representing a contiguous and diverse area of open space. The remainder of this document outlines management and land acquisition strategies necessary for realizing the plan.



Figure 3.32 One residential lot on a hillside can have an enormous negative visual impact on an entire community



Figure 3.33 Residential development adjacent to open space can create a barrier for the public and wildlife



Figure 3.34 For commuters the visual experience provided by the preserve has a positive impact on our daily quality of life

Chapter 4



Conservation is getting nowhere
because it is incompatible with our
Abrahamic concept of land. We abuse land
because we regard it as a commodity belonging
to us. When we see land as a community
to which we belong, we may begin
to use it with love and respect.

There is no other way for land to survive
the impact of mechanized man, nor for us to
reap from it the esthetic harvest it is capable,
under science, of contributing. That land is a
community is the basic concept of ecology,
but that land is to be loved and respected
is an extension of ethics. That land yields
a cultural harvest is a fact long known,
but latterly often forgotten.

Aldo Leopold
A Sand County Almanac, 1949

Acquisition Plan

A. Introduction

This strategic analysis is intended to provide a framework from which decisions regarding the acquisition of land for desert preserves can be made. This chapter discusses the various methods of acquiring or protecting land for the Sonoran Preserve, potential funding sources, estimated amounts of funding available, timing of funding sources, and scenarios that explore the implications of different acquisition strategies. For a more complete discussion of this analysis, see the separate report prepared by the Planning Department titled *Desert Preserve Acquisition Strategic Analysis* (DPASA) (Planning Department 1998). This analysis refines the issues presented in the *Desert Preserve Preliminary Plan* (PRLD 1994) and provides an outline for the very complex process of acquiring property for preservation.

In developing the DPASA, which focused on the NSA, data on the land's physical features, property ownership, development growth trends, and financing options were all studied. In order to accomplish this, physical data were mapped using a GIS. A computer model was developed which could take the available physical data and, using funding scenarios and growth assumptions developed by the PRLD and the Planning Department, evaluate which land could potentially be acquired under each alternative. Because time is a critical factor affecting the opportunity to preserve undisturbed desert lands, the acquisition computer model was developed prior to the final development of the *Sonoran Preserve Master Plan*. A goal of acquiring 25,000 acres within the study area was used for this analysis. As stated previously, the Sonoran Preserve is planned for 21,500 acres.

There are many steps and decision points in the implementation of an ambitious public acquisition effort. This chapter does not describe every aspect of such an effort but provides a basis for understanding the steps of the acquisition and implementation process.

B. Real Estate Process

Land ownership is an important attribute affecting the preserve acquisition process. Currently there is significant private and public property in the NSA. Each type of ownership has its own unique characteristics and restrictions that must be understood. Private landowners and the Arizona State

Land Department (ASLD) are the two types of landowners of principal concern for preserve acquisition.

Private landowners are protected by the United States and State of Arizona Constitutions from takings by local or state governments. In some cases, private lands can be contributed to the city through the zoning or site plan review process. Parcels can also be acquired through a negotiated purchase or condemnation action at market value. There are no provisions under state law to acquire privately held lands for public use other than at market value.

The ASLD owns the majority of land in the study area. In the NSA, the ASLD owns three-quarters of the lands proposed for the Sonoran Preserve (Figure 4.1). Trust land must be designated for sale by the land commissioner under one of the categories provided for by law, then sold or leased at market value for the highest and best use. Trust lands cannot be donated. The recently approved Arizona Preserve Initiative (API) provides a new category for designation of land for disposal, making conservation lands a possible option. The value of land considered suitable for conservation under the API is still based on market value for highest and best use.

In the SSA, the ASLD owns one section of land adjacent to the south side of South Mountain Park. Because this land has been previously planned for urban development, it is excluded from consideration under the API. The city could acquire some of this section of land during the zoning or site plan review process. Once a specific parcel is approved for acquisition by the Phoenix City Council, the real estate division will take the lead in the acquisition process. They will handle preserve acquisitions as they do any other land purchase.

C. Acquisition Techniques and Financing Options

The *Desert Preserve Preliminary Plan* identified a number of financing options and acquisition techniques. Building on that study, the DPASA looked at each option and technique in more depth. In this analysis, the term *acquisition techniques* includes both purchase and protection through government regulation. Several acquisition techniques, enumerated below, were considered.

Time is a critical factor affecting the opportunity to preserve undisturbed desert lands.

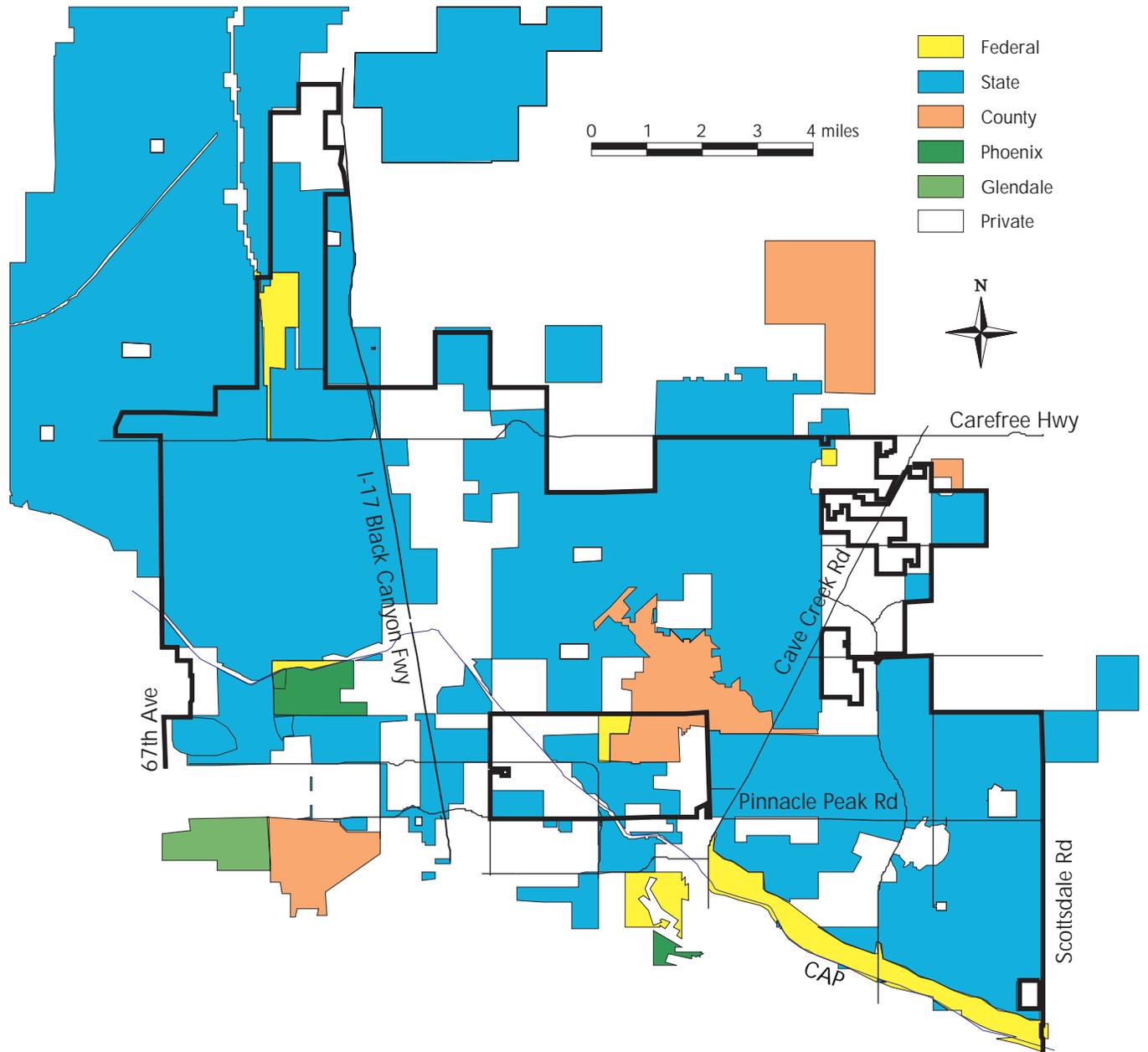


Figure 4.1 Land ownership

City Acquisition Techniques

- Fee simple purchase
- Purchase of development rights (PDR)
- Purchase of rights-of-way/easements
- Leases
- Condemnation/eminent domain
- Donations and gifts

Governmental Regulation Protection Techniques

- Transfer of development rights (TDR)
- Planned community district (PCD)
- Planned residential district (PRD)
- Hillside ordinance
- Special overlay district
- Design guidelines
- Performance zoning
- Dedications/exactions

The DPASA determined that fee simple purchase and transfer of development rights are the most viable acquisition techniques.

Fee Simple Purchase

The city uses funds to purchase property available for sale. The source of funds can vary and may include the general fund, sales tax, bonds, impact fees, grants, or loans. Of these potential sources, sales tax, bonds, and impact/infrastructure fees were considered the most relevant due to the scope of acquiring 20,000 to 25,000 acres of land.

Transfer of Development Rights

Owners are allowed to transfer development (housing units) permitted by vested zoning to another parcel which has been designated as suitable to support the increased development. Arizona state law does not permit TDR in the true sense, but many communities are finding means for accomplishing the intent. This can be done through the rezoning process with two contiguous parcels either under the same ownership or with two owners jointly filing a rezoning request. This method does not require funds other than those needed for city staffing to implement and monitor the program.

Implementation and monitoring of TDR programs are staff-intensive activities. It would take a change in the city ordinance to do true TDR. If policy changes are made, TDR has the potential to acquire significantly more preserve lands, although as densities are transferred, increased densities result elsewhere. Potential financing options considered in the DPASA include:

- General purpose taxes
 - Sales
 - User
 - Property
- Bonds
- Impact infrastructure fees
- Grants
- Fund-raising program
- Government coordination
 - Land exchange
 - Preferential tax treatment
- Voluntary landowner participation/nonprofits
 - Conservation easement
 - Preservation easement
 - Land trusts

The DPASA determined that three basic public financing options are available to the City of Phoenix: dedicated sales tax, general obligation bond funds from property tax, and desert preservation impact/infrastructure fees.

Sales Tax

Fluctuations in the economy can directly affect voter generosity. As with bond programs, bringing a sales tax increase to the voters has risks. A negative public vote on this issue would be detrimental to the program. Public opinion polling can lessen but not completely alleviate this concern. Sales tax increases do not have to be approved by the voters. The City Council can simply vote for a sales tax increase; however, this may not be politically acceptable. Estimates were prepared for a 1/10-, 1/4-, and 1/2-cent sales tax. The estimated annual funds generated would be approximately \$19,000,000; \$47,000,000; and \$94,000,000, respectively.

Bonding

Phoenix voters have generally exhibited a willingness to approve bond measures. Floating such a bond proposal is not without risk. A negative public vote on this issue could be detrimental to the entire program. Risk can be assessed to some degree by public opinion polling prior to beginning public discussions of the bond. The City of Phoenix has no available general obligation bonding capacity for property tax-supported capital improvement programs. It is estimated that additional capacity will not be available until 2000. Work should begin sooner to prepare for a successful bond election.

A preliminary capacity analysis prepared by the finance department in April 1997 showed that the current secondary property tax rate would support \$150 million in property

Fee simple purchase and transfer of development rights are the most viable acquisition techniques.

tax-supported bonds. Assuming no change in the current tax rate, there would be approximately \$4,400,000 available for the 2000–2005 Capital Improvement Program (CIP). A ten-cent property tax rate increase would increase this amount to \$8,900,000. A 20-cent property tax rate increase would raise the amount to \$12,600,000 for the 2000–2005 CIP.

Infrastructure/Impact Fees

Infrastructure fees can be levied on development based on the use or potential benefit to subject properties. Infrastructure fees can only be used to pay for impacts directly related to new development. These development-related fees will only address approximately 15 percent of the total cost of a preserve acquisition program. Preservation would need to be added to the city infrastructure fee program. Funds made available through impact fees are dependent on the timing of development.

The analysis illustrated that there are a few acquisition techniques and funding options that will be absolutely vital to the success of this program due to the goal of acquiring a significant amount of land. A general purpose sales tax is the only technique that can readily achieve this goal itself. All other techniques are inadequate when considered alone. Combinations of acquisition techniques and financing options will be the most cost effective way to acquire the large acreage required to realize the master plan. Secondary sources such as grants, donations, and exchanges should be sought or utilized if available. For example, a lease may be appropriate to hold a property until it can be purchased. However, this example would add costs to the program.

D. Acquisition Modeling

In order to assess the effectiveness and implications of different acquisition strategies and growth scenarios, a simple model to simulate the desert preservation land acquisition process was developed. The Preservation Acquisition Model (PAM) is a simple goal-seeking model based on a modified desirability rating and resource allocation. PAM's basic goal is to acquire as much highly desirable land for preservation as possible, while considering specific resource constraints. PAM is structured to quickly test the allocation of resources resulting from scenarios utilizing different financing options and acquisition techniques. Risk analysis is then used to assess and evaluate the results of multiple acquisition strategies.

Data Coverages

Potential lands that would be desirable to incorporate into a Sonoran Desert Preserve were mapped using the city's GIS

and input into the PAM. The natural and existing features defined in DPASA include: slope, washes, floodways, floodplains, archaeological sites, and proposed features that included activity centers and access points.

Each land feature or attribute was given weighting to determine the priority for acquisition (Table 4.1). Some parcels may have more than one attribute and, therefore, a higher cumulative weight. The result of this exercise produced a prioritization of parcels for preservation. Other information used in the analysis included property ownership and the general plan.

Weighting for Land Features

Property Attribute	Weighting
Slopes greater than 10%	60
Slopes greater than 5%	45
Slopes less than 5%	30
Major washes	45
Secondary washes	30
100-year floodplain	15
Near-term potential development	30
Proposed activity center/access point	10
Archaeological site	10

Table 4.1 Weighting for land features

From this information, the Planning Department developed three additional maps for use in the acquisition model. First, the Planning Department analyzed the study area and determined areas where development was likely to occur in the near-term, intermediate-term, and long-term to derive a development potential map. Second, development potential was considered with the desirability of specific parcels to develop a development priority map. Third, the Planning Department considered the physical features of the land to generate a preservation priority map.

Growth Assumptions

Two growth scenarios were tested in the DPASA. The current growth scenario assumed that growth would continue at about the same rate that has been experienced during the past several years. Accelerated growth assumed a growth rate of double the current growth rate. The accelerated growth assumes much of the current development south of the CAP Canal would move north as land becomes available.

In both cases, the study period extended over 40 years. For modeling purposes, the 40 years were broken into eight five-year periods. Several funding sources were incorporated

The analysis illustrated that there are a few acquisition techniques that will be absolutely vital to the success of this program. A general purpose sales tax is the only technique that can readily achieve the goal of acquiring a significant amount of land.

into the model that included sales tax, bonds, and infrastructure fees. The sales tax amount used in the model is based on a 1/10-cent sales tax. The bond amount assumes there would be no increase in property taxes. The infrastructure fees were assumed to start in the first period but would not accumulate a significant amount for acquisition until the second period.

Land Costs

Monthly sales databases (Kammrath and Associates 1993–97) were used to determine appropriate land values. The real estate division was consulted on the variety of factors influencing land values. The most significant factor was development timing. The value of land is typically influenced by the proximity of infrastructure, zoning, and the presence of surrounding development. If any or all of these factors are not in place or not expected in the near future, land values are low. If all of these factors are in place or expected in the near future, land values are high. With this understanding, assumptions on land values were developed (Table 4.2).

Land Costs

Projected Development Timing	20- to 100-Acre Acquisitions
1 to 5 years	\$45,000/acre
5 to 10 years	\$25,000/acre
10 to 15 years	\$10,000/acre
More than 15 years	\$10,000/acre

Table 4.2 Land costs

Land Acquisition Modeling Results

The modeling analysis was not intended to be a definitive prescription for actual acquisition of any particular property. The information is intended to be used to make strategic decisions and be further refined as additional studies are completed and more detailed information is available. Two scenarios, high support and low support, were tested with the above data and assumptions using accelerated and current growth assumptions.

The 1/10-cent sales tax for 10 and 20 years acquires more land in both scenarios, approximately 9,000 to 24,000 acres. TDR is the next most effective financing option, acquiring about 2,000 to 6,000 acres. Bonds acquire about 2,000 acres and infrastructure fees acquire about 1,000 to 2,000 acres, as they are directly proportional to the amount of development occurring (Table 4.3).

Acquisition Technique Summary

Technique/Fund	Cost (000,000)	Acres (000)
Infrastructure Fee	\$16 to \$31	1.0 to 2.0
Bonds	\$27 to \$36	1.8 to 3.3
TDR	\$40 to \$120	2.0 to 6.0
Sales Tax	\$190 to \$380	9.0 to 24.0

Table 4.3 Acquisition technique summary

The pace of development and its location can influence what land is acquired for preservation. Some property is desirable for development, some for preservation, while other property is desirable for both. Where there is competition between development and preserve acquisition, having the ability to acquire the property before it becomes considered for development is essential for highly desirable properties (Figure 4.2).

Risk Analysis

All of the acquisition scenarios were compared to determine which parcels with high preservation value are at the greatest risk of being developed. The acquisition scenarios were weighted according to an analysis of their likelihood to occur. It is assumed that the current growth scenarios are more likely to occur as well as the scenarios with a ten-year sales tax, bond, TDR, and infrastructure fees.

The risk analysis examined how the different scenarios meet the preservation goals (Figures 4.3, 4.4, 4.5, 4.6). Risk scores for parcels in each scenario were added together to determine a final risk score. The scores were then normalized into a 0 to 100 scale (the higher the number the higher the risk that a parcel will not be acquired). Output from the analysis illustrates which parcels, desirable for preservation, face the greatest risk of *not* being acquired for preservation (Figure 4.7).

Three significant results were produced by the risk analysis. First, areas with imminent development (a Planned Community Development has been or probably will soon be filed with the city to acquire zoning) or that are expected to develop soon represent the greatest risk for not being acquired for the preserve. Development could occur in these areas before a funding source is available to acquire the land.

Second, land with 5 to 10 percent slopes, mountain buffers, and wash buffers have the next greatest risk of not being acquired. These properties are desirable for future development as well as preservation. TDRs will have limited success in these areas for securing land for preservation due to the development potential of these lands.

Where there is competition between development and preserve acquisition, having the ability to acquire the property before it becomes considered for development is essential for highly desirable properties.



Figure 4.2 Land lost to development

With faster growth rates, the need to have readily available funds increases because it enables the purchase of land desired for preservation that might otherwise be developed.

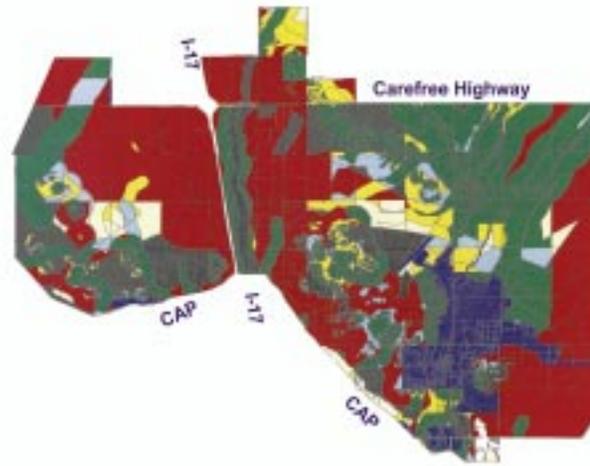


Figure 4.3 Acquisition scenario: fast growth/high support

Third, areas such as major washes (Skunk Creek, Cave Creek, Deadman, and Apache Washes) and mountaintops (steep slopes) are almost always acquired for preservation but also have limited or no development potential.

The highest risk assessment is the result of the timing of development and availability of funding. When development is occurring faster than acquisition resources become available, lands desirable for preservation could be lost to development pressure. The risk analysis identifies potential areas where special consideration may need to be taken in order to secure these parcels.

E. Funding Implications

The following conclusions were reached during the course of the acquisition analysis.

Growth rates affect what land can be acquired and in what manner it is purchased. With faster growth rates, the need to have readily available funds increases because it enables the purchase of land desired for preservation that might otherwise be developed. This makes funding techniques that can be available quickly, such as bonds or sales tax, more critical.

Each of the different funding sources provides different opportunities and constraints. Sales tax and bonds can provide funds for acquisition earlier in the program. A 1/10-cent sales tax could acquire approximately 23,000 acres over a 20-year period based on the projections used in the acquisition analysis. Sales tax produces significantly more funds than either bonds or impact fees.

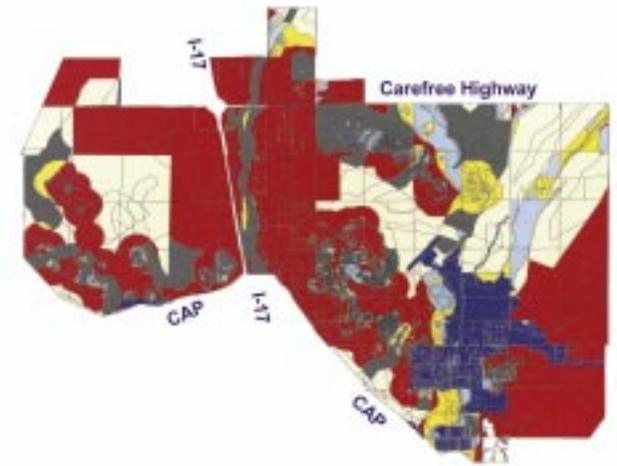


Figure 4.4 Acquisition scenario: fast growth/low support

Bond funds could acquire approximately 2,000 acres. Impact fees only accumulate as the area develops and are directly proportional to the amount of development. Impact fees could acquire up to 2,000 acres. In order to use impact fees, a desert preservation category would have to be added to the existing impact fee program. This would require City Council action.

TDR can acquire a significant amount of land, but cannot meet the entire goal by itself. Theoretically, TDR could ultimately acquire approximately 18,000 acres. However, the target density of 4.44 dwelling units per acre significantly exceeds the greatest density in any existing village in the city and is thus unlikely to occur. Under the scenarios used in this study, TDR acquired a maximum of about 10,000 acres. As a primary acquisition technique, TDR can lower the cost of acquiring the preserve. However, densities in the NSA will increase as will the risk of losing some of the land desirable for preservation.

Secondary and alternative funding options, such as grants, donations, or coordination with other acquisition programs, should be sought based on their availability. These funds could be especially useful for unique sites such as those with archaeological significance or other special characteristics. Coordinating with the FCDMC for purchasing floodplains could acquire approximately 3,000 acres for both incorporation into the preserve and flood control.

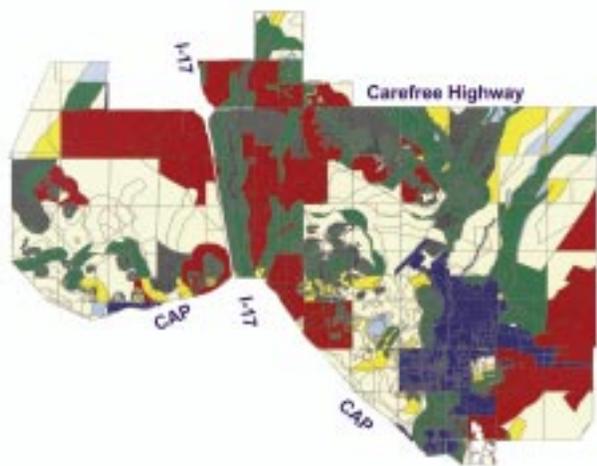


Figure 4.5 Acquisition scenario: slow growth/high support

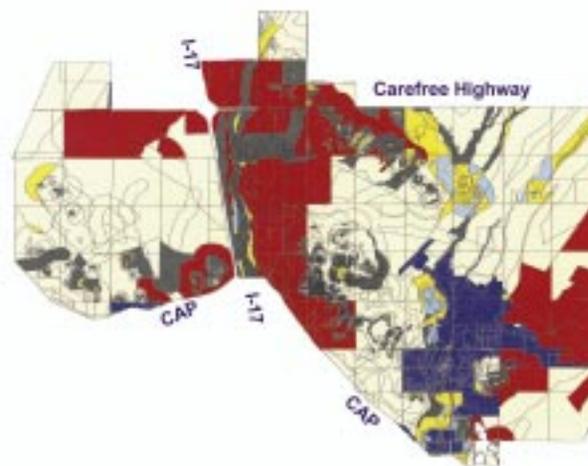


Figure 4.6 Acquisition scenario: slow growth/low support

- General obligation bonds
- Impact fees
- Sales tax
- Density transfers
- Existing public lands
- Not developed/acquired
- Development

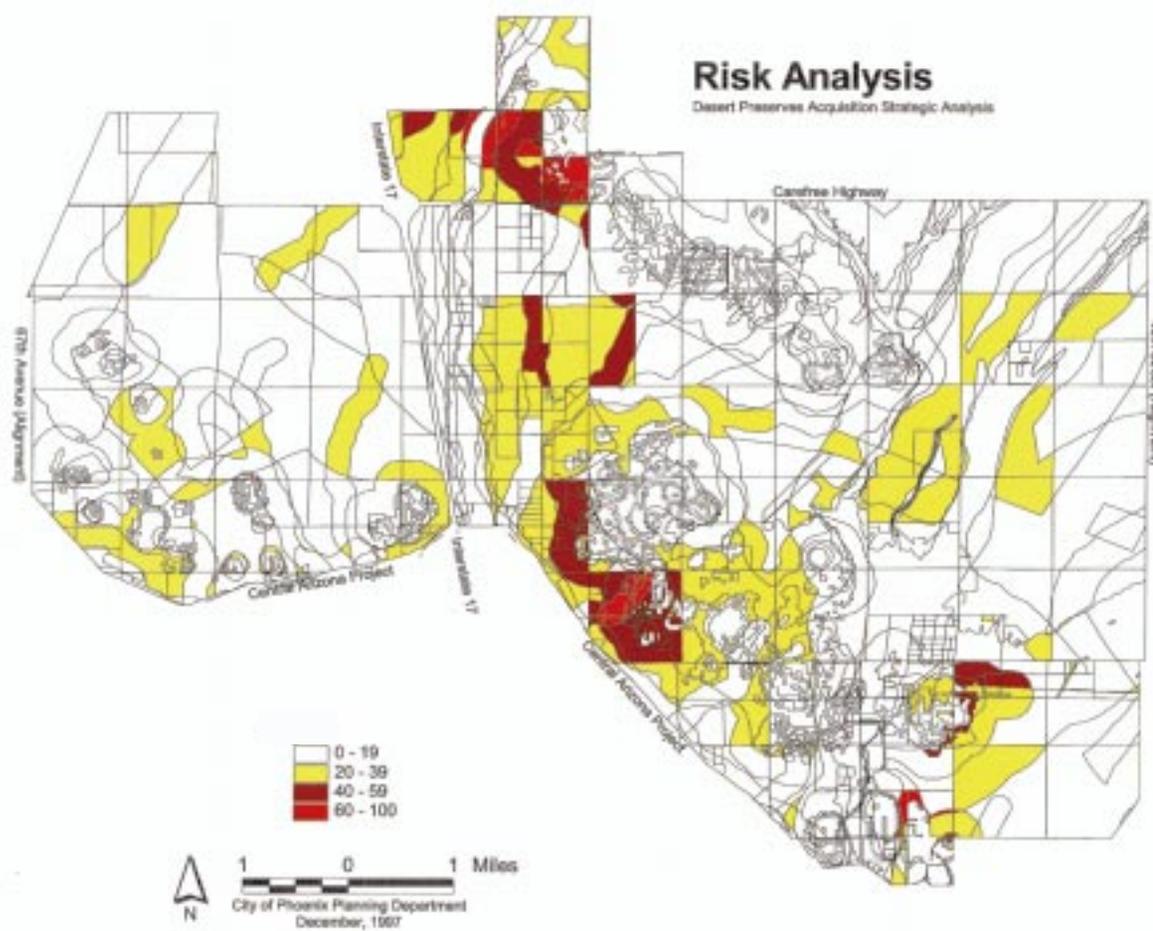


Figure 4.7 Risk analysis

Chapter 5



Acquiring
the preserves was the easy part,
developing community support, approving the
bonds, and buying the land is simple and fun.
Your challenge will be to manage all of the
conflicting demands for use of the land—
this may not even be possible.

Charles Christiansen to incoming
Parks, Recreation and Library Director
James Colley in 1979

Design Guidelines, Operations, and Management

A. Philosophy

The management philosophy for the Sonoran Preserve is to meet the recreational and open space needs of residents while ensuring that the natural and cultural resources are protected and maintained. Conflicts between resource management and public use are recognized, but can be minimized with sound management practices. The Preserve System provides an opportunity to promote an environmental ethic as part of the recreational visitor experience (Figure 5.1).

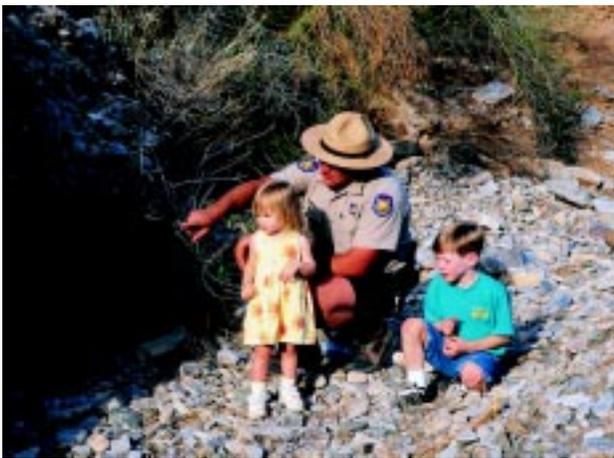


Figure 5.1 Promote environmental ethics through recreational experience

To implement this philosophy, the city and community should develop a partnership to address required resources, regulations, volunteers, and adjacent development. Special tasks include:

- Provide the necessary financial and physical resources to plan, develop, staff, equip, manage, and acquire preserve lands. To adequately meet the needs of preserve users and protect this valuable resource, operations funding must be linked to acquisition funding. Figures 5.2 and 5.3 illustrate the immediate need for protection of these resources.
- Enforce rules, regulations, and city ordinances which provide for the security and protection of natural and cultural resources, visitors, and facilities. Rules and operational procedures shall be consistent with those of the Mountain Preserve.
- Expand existing programs that actively enlist the support and commitment of volunteers and educate citizens of all ages on the Preserve System, its proper use, and the value it provides to our society and the environment.

- Ensure that development adjoining the preserve is designed to complement the objectives of the preserve.

B. Plan Implementation and Development

The Planning Department has projected that the NSA may take more than 40 years to develop. To acquire the entire Sonoran Preserve and fully develop facilities could take even longer. To maintain the quality and consistency expected in such an ambitious open space preservation effort, design standards are needed. Consistency and quality of facilities within and adjacent to the preserve should be maintained.

Design Standards and Guidelines

Design guidelines are necessary to establish standards for the preserve where planning and development is in harmony with the surrounding natural environment. In addition, these guidelines should promote water and energy conservation. For example, the use of indigenous plant material should be required. The general intent of design guidelines developed for the Sonoran Preserve should be compatible with the goals identified in the *Sonoran Preserve Preliminary Plan*. The design and construction of facilities within the preserve offer opportunities to reinforce as well as demonstrate the dedication to preservation. The South Mountain Environmental Education Center illustrates an architectural solution that is sensitive to our desert environment (Figure 5.4). Proper orientation, responsible material selection, and sensitivity to the desert's aesthetics will all be considered. The following are currently under development by the PRLD:

- Guidelines for access areas that include major activity areas, secondary access areas, and local or neighborhood access trailheads



Figure 5.4 South Mountain Environmental Education Center

This should be our challenge in the future: Can we learn to be good stewards as opposed to merely owners and consumers of the environment? To live creatively, rather than destructively—this is the choice of each individual as well as society as a whole.

We must choose wisely.

Calvin Straub 1983



Figure 5.2 Illegal dumping

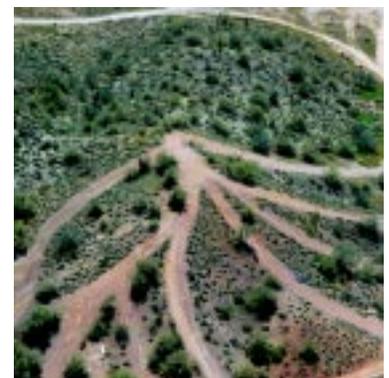


Figure 5.3 Trailblazing

The guidance and support of many boards, committees, foundations, and individuals has played a significant role in the success of open space preservation in Phoenix.

- Guidelines for structures in the preserve to include interpretive centers, public restrooms, ranger stations, ramadas, trash enclosures, and accessory buildings
 - Guidelines for site features and amenities to include walls and fences, site furniture, lighting, signage, wildlife observation areas, and preserve boundary delineation
 - Guidelines for recreation facilities to include sand volleyball courts, horseshoe pits, and playgrounds
 - Guidelines for circulation and parking to include multi-use trails, underpasses and/or overpasses, roadside barriers, parking lots, horse staging areas, transit facilities, roadways, bridges, and culvert crossings
 - Guidelines for trail planning, design, and management
- These guidelines will be used by staff, volunteers, and consultants in performing any construction or development project within the preserve.

Adjacent Development Compatibility

The PRLD will promote compatible development and design adjacent to the Sonoran Preserve. This will be accomplished by clearly communicating the preserve's plan and goals, encouraging site and development standards that are compatible with the Sonoran Preserve, and securing public access to the preserve as early in the planning process as possible. This will be accomplished by the following:

- Maintaining good communications with other city departments and county, state, and federal agencies
- Developing sensitive design guidelines for adjacent development
- Reviewing all adjacent development plans as submitted to the Development Services Department to ensure compatibility with preserve goals and plans
- Developing positive working relationships with property owners adjacent to the preserve
- Monitoring development activities on adjacent or nearby properties to identify development objectives and to seek development compatible with the preserve's goals

C. Citizen Involvement

Many boards, committees, foundations, and individuals provide guidance and support for the PRLD. These efforts have historically played a significant role in the success of open space preservation in Phoenix and they are and will continue to be key to the success of the Sonoran Preserve (Figure 5.5). The recommended governance hierarchy follows.

1. Parks and Recreation Board

The Parks and Recreation Board is appointed by the mayor and City Council and has charter authority.

2. Phoenix Sonoran Preserve Committee

The Parks and Recreation Board appointed the Phoenix Sonoran Preserve Committee to serve as an advisory group to work with staff and advise the board on issues concerning the mountain parks and Sonoran Preserve.



Figure 5.5 Citizen involvement in the preserve

3. Ad Hoc Technical Advisory Group

An ad hoc technical advisory group should be developed to provide assistance regarding natural resource issues to the Phoenix Sonoran Preserve Committee and staff responsible for implementing and managing the preserve. The ad hoc group would be composed of professionals from Arizona Game and Fish Department, Arizona State University, and federal land management agencies, as well as PRLD staff—recreation professionals, landscape architects, open space managers, archaeologists.

4. Volunteer Programs

Volunteers are crucial to the City of Phoenix in managing and operating the preserve system. Volunteers will assist staff in providing education programs, developing and maintaining trails, and acting as advocates of the Sonoran Preserve system. Programs currently in place in the Phoenix Mountain Preserve system that should be implemented in the Sonoran Preserve include the Desert Awareness Program, Preserve Watch, and Ranger Cadets. When appropriate, additional opportunities and programs should be considered.

D. Natural and Cultural Resource Protection

To effectively manage natural and cultural resources, park managers must be knowledgeable about those resources and any changes in their condition. The *Cave Creek Wash Preservation Boundary Study* identifies natural elements within the Cave Creek Wash corridor that need to be monitored through the management process (Ewan et al. 1996). Park rangers will be trained to carry out monitoring activities as

part of their patrol and maintenance activities (Figure 5.6). Trail access, facilities, and circulation components of the master plan should be designed to protect resources through control of access and visitor use. The plan recommends areas which will have access limited to designated trails. These restricted areas will enhance wildlife and revegetation efforts by limiting human impact.



Figure 5.6 Management of cultural resources

Revegetation/Restoration

A revegetation/restoration plan will be developed and implemented as time and resources permit. Indigenous Sonoran Desert plant species, as well as plants that may have been historically present, would be used in all revegetation/restoration projects.

Wildlife

A study of wildlife species using the area will complement the revegetation efforts as well as provide baseline information for ongoing monitoring of wildlife presence and diversity. Wildlife management will emphasize the protection and maintenance of vegetation communities and the diversity of animal habitats. Restricted access areas may be established to further promote the health of wildlife.

Cultural Resources

Prehistoric and historic elements in the area should be identified and categorized for restoration, preservation, or documentation and removal. Impact to prehistoric and historic features can be managed through control of access points and visitor activity. Designated trails, signs, and interpretive efforts are examples of ways to protect and enhance the heritage of a site.

Fire Prevention

Fire is a natural, although infrequent, component of the desert ecosystem. The frequency of fires in the Sonoran

Desert has increased. This is due to several factors that include the proximity to urban and developed areas and increased fuel loads due to the presence of exotic plant species. All of this creates the need to extinguish human-caused fires quickly (Bureau of Indian Affairs et al. no date).

Any fires associated with picnic use are to be restricted to cooking grates in the activity areas only. All fuels must be brought in from outside the preserve to prevent the destruction of native vegetation for firewood. Smoking will be limited to parking lots and activity areas. As in the Phoenix Mountain Preserve, the PRLD director can prohibit fires or smoking during periods of high fire danger.

E. Visitor Experience and Safety

The mission of the PRLD is to provide and maintain a diversity of safe, available, and accessible recreational opportunities (Figure 5.7).



Figure 5.7 Recreation opportunities for all residents

Visitor Experience

Through facility design and the use of signs, the first point of contact will provide visitors with information on the use and interpretation of the desert and the preserve system. Active recreational uses will be oriented toward major and secondary activity areas. They are located in areas with the greatest human disturbance, pre-existing facilities, and acceptable access to streets or other transportation corridors.

In support of the Sonoran Preserve concept, the development at these activity areas will include family and group picnic facilities, trailheads, restrooms, ranger stations, and interpretive facilities. Active recreation facilities are limited to playgrounds, horseshoes, and/or sand volleyball. The identified forms of active recreation will only occur if similar facilities are not available at neighborhood or community parks within an acceptable radius of the activity hub. Each activity may not be located in each activity area.



Figure 5.9 Mountain biking

Since 1988 the PRLD has addressed the fact that hiking and walking are two of the most popular outdoor recreational activities in Arizona (PRLD 1988) (Figure 5.8). The Sonoran Preserve will provide multi-use trails for physical fitness, communing with nature, and social interaction (Figures 5.9, 5.10, 5.11). Establishing and securing boundaries through natural and mechanical means will be the first priority for managing the desert preserve access areas and trail corridors.



Figure 5.8 Hiking in the mountain preserve

Visitor Safety

The park visitor must have a safe park where facilities are in good repair and not destroyed by vandalism. Control of unauthorized activities within the park allows nearby residents to view the park as a positive neighbor and not a threat. A combination of rules and regulations, signs, interpretive efforts, volunteer efforts (Preserve Watch, Ranger Cadets), patrols, and visitor contacts by park rangers will provide a safe, quality outdoor experience (Figure 5.12).



Figure 5.10 Hiking

horseback or mountain bike, on foot, and by marked vehicle. Visitor education will be the primary focus of any regulatory contact. Regulatory signs and ranger patrols should be obvious, but not complicate or compromise the desert preserve experience.

F. Required Resources

Areas with a high level of use will require a higher level of maintenance than passive natural areas. Maintenance standards applied to one type of area will not necessarily be applied to another.

It will be necessary to provide staff for security, maintenance, and interpretive duties at the activity hubs, on the trail system, and throughout the area for protection and promotion of the resource. Park rangers can perform all these duties, though it may be more cost effective to assign certain responsibilities, such as picnic site maintenance, to groundskeeper positions.

Adequate positions and related equipment (such as patrol and maintenance vehicles, radios, and uniforms) must be budgeted for a minimum of two shifts per day. Other equipment and supply needs can be shared with existing units in the mountain preserve system.

Adequately trained staff, with experience in open space design, planning, and landscape ecology, should be provided. Air photos of South Mountain Park taken in 1970 and 1990 illustrate the significant change that can take place in a short period of time (Figures 5.13, 5.14). Ongoing monitoring of the ecological health of the Sonoran Preserve and the existing desert parks and mountain preserves should be provided to ensure the long-term protection and management of the entire system.

As interpretive demands increase or permanent facilities are built, specialized staff to provide interpretive programming and to operate educational centers will be needed, as well as resources to support the operating component of these services.



Figure 5.12 New signage standards for preserve system adopted by PRLD in 1996

Definite hours of operation will be established and enforced for visitor safety as well as security. Other activity hubs may have hours that reflect policies in mountain preserve use areas. Park rangers will patrol the desert preserve from



Figure 5.11 Riding



Figure 5.13 Eastern edge of South Mountain Park, 1970



Figure 5.14 Eastern edge of South Mountain Park, 1990

monitoring
Ongoing monitoring of the ecological health of the Sonoran Preserve and the existing desert parks and mountain preserves should be provided to ensure the long-term protection and management of the entire system.

Chapter 6



A sense of place requires more direct contact with the natural aspects of a place, with soils, landscape, and wildlife. This sense is lost as we move down the continuum toward the totalized urban environment where nature exists in tiny, isolated fragments by permission only. Said differently, this is an argument for more urban parks, summer camps, greenbelts, wilderness areas, public seashores. If we must live in an increasingly urban world, let's make it one of well-designed compact green cities that include trees, river parks, meandering greenbelts, and urban farms where people can see, touch, and experience nature in a variety of ways.

David W. Orr
Ecological Literacy, 1992

Conclusion

The *Sonoran Preserve Master Plan* is intended to identify and guide the acquisition of significant desert areas to allow natural processes to continue and to provide safe, accessible public recreation for the citizens and visitors of Phoenix. We have the opportunity to maintain Phoenix's tradition of protecting fragile and beautiful Sonoran Desert lands by building on the history of preservation that began with South Mountain Park and continued with the Phoenix Mountain Preserves. This document can be as successful and far reaching in its impact as its predecessor, the 1971 *An Open Space Plan for the Phoenix Mountains* by Van Cleeve and Associates for the Parks, Recreation and Library Department.

The *Sonoran Preserve Master Plan* is the result of over five years of collaborative effort. The City of Phoenix Parks, Recreation and Library Department has broadened the traditional park planning process to include an understanding of ecological principles and natural processes. To accomplish this, original research was required. Field studies of wash vegetation and wildlife and the use of GIS technology contributed toward the ecological inventory of the NSA. Arizona State University has made significant contributions in the collection, management, and synthesis of this information.

The development of this plan incorporated the ongoing efforts of various city departments including Planning, Street Transportation, and Water Services. The Sonoran Preserve will enhance future settlement in the City of Phoenix and elevate the quality of life for residents. Ongoing collaboration and coordination will be required to ensure that maximum benefit and protection of the preserve is realized. The benefits of the Sonoran Preserve will reach beyond the NSA and have a positive impact on the entire city and metropolitan area. The magnitude of this impact is a reflection of the commitment and involvement of the City Council, the Planning Commission, the Parks and Recreation Board, the Sonoran Preserve Citizen Advisory Committee, and others who volunteer their time, energy, and expertise.

The Sonoran Preserve Master Plan identified the configuration of the preserve and appropriate and inappropriate uses. The plan includes 21,500 acres of desert lands that represents the diversity of the Sonoran Desert, from species-rich washes to saguaro-studded hillsides. The lands preserved will provide a broad range of recreational opportunities for diverse groups

of users. A hierarchy of access points was developed to coordinate with environmental education facilities. While trails were considered, no specific trails plan has been developed for the NSA.

Acquisition

The detailed acquisition strategies indicate a level of analysis that is uncommon in public policy documents. The acquisition model presented in chapter four allows staff to consider a number of scenarios and adjust preservation and development priorities or policies accordingly. Like the Phoenix Mountain Preserve program, this will be a long-term effort. The Sonoran Preserve study area is 130 square miles and will require several decades to completely develop. The plan and the tools discussed in this document are interactive and will allow staff and future councils to adapt to the city's constantly changing and dynamic environment.

Tasks required to continue refinement of the plan and move toward its realization and management include:

- Completion and submission of an application to the Arizona State Land Department under the Arizona Preserve Initiative for the approximately 15,000 acres of State Trust Land identified in the Sonoran Preserve Master Plan
- Continued communication with other city departments and private landowners to ensure acquisition of private lands identified in this plan as they move through the development process
- Continued coordination and communication with open space owners and managers within the NSA and outside the city—fostering long-term cooperation and coordinating integration of the preservation ethic into the overall urban form will enhance recreational opportunities and facilitate preservation of the biological diversity of the Sonoran Desert
- Continued coordination with other city departments guiding growth management plans and the planning and development of infrastructure in the NSA—coordination of the Sonoran Preserve should be balanced with the need for infrastructure to provide mutual benefit to both the developed and undeveloped areas of the NSA
- Development of design guidelines for all planned improvements that occur within the Sonoran Preserve—these guidelines should embrace the natural environment and can provide a visible example of humans living in harmony with their environment

- Development of design guidelines that address all lands adjacent to the Sonoran Preserve—careful attention is needed to balance public access and social equity with environmental sensitivity and preservation
- Development of a trails plan specifically addressing the lands identified in the Sonoran Preserve—this plan should be coordinated with existing and planned trails at both the local and regional level
- Development of trail and preserve management standards for the entire desert park and preserve system
- Continued collection, evaluation, and synthesis of cultural and ecological information to inform the refinement and management of the Sonoran Preserve
- Identification and provision of necessary resources to develop, staff, manage, and acquire the lands identified in the Sonoran Preserve Master Plan—to adequately meet the needs of preserve users and to protect this valuable resource operations funding must be linked to acquisition

History shows that the residents of Phoenix can rise to such a challenge. They have long been supporters of the mountain preserves and desert parks at the ballot box, as volunteers, and as stewards of the land. The fact that some of our prime neighborhoods are adjacent to desert parks, preserves, and natural open space attests to the value Phoenicians place on the Sonoran Desert. The tourism and development industry in the Valley recognizes this and regularly features parks and preserves when promoting the area. The *Sonoran Preserve Master Plan* is the first step in continuing this legacy and improving the quality of life in the city for future generations. The benefits of the preserve are multifaceted; in fact, approximately 15,000 acres of the proposed preserve is Arizona State Trust Land currently within the city limits, and proceeds from the sale of these lands will go to the state education trust. Preserving the desert and supporting education is a true win/win situation for the community.

The mission of the Phoenix Parks, Recreation and Library Department is to enhance the quality of life by providing and maintaining the richness and diversity of a safe, available, accessible, and affordable system of parks, recreation, and libraries. Aldo Leopold cautioned that public policies were controversial in 1949, the same year his *Sand County Almanac* was published. For many Americans, this book articulated the need for love and respect of the natural environment. Pivotal moments in history are seldom without controversy, but the opportunity to create our own legacy of preservation is within reach. The *Sonoran Preserve Master Plan* will play a prominent role in the fulfillment of this mission.

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