

SKY ISLANDS AND DESERT SEAS

Summary of Theme

Southwestern New Mexico, southeastern Arizona, northwestern Chihuahua, and northeastern Sonora are a landscape of wonder, beauty, wildness, and astounding biological diversity. This is the Sky Island region, and the proposed National Heritage Area is its heart. The *Sky Islands and Desert Seas* theme highlights the globally unique landscape and extraordinary biological diversity of the proposed National Heritage Area. This landscape has provided the resources and opportunities for exceptional natural and cultural diversity in the region. The southwestern Sky Island archipelago is unique on the planet, and is the only Sky Island complex extending from subtropical-to-temperate latitudes, with a globally unprecedented array of plant and animal species of northern and southern origins. These mountain islands are among the most diverse ecosystems in North America due to their great topographic relief and location at the meeting point of major desert and forest biomes. These unique qualities result from several factors, including the wide range of elevations in the region, the convergence of the Sonoran and Chihuahuan deserts, the north-south trending mountain ranges that contain a mingling of species (many endemic) from the Rocky Mountains to the north and the Sierra Madre Occidental to the south, and two, distinct rainy seasons.

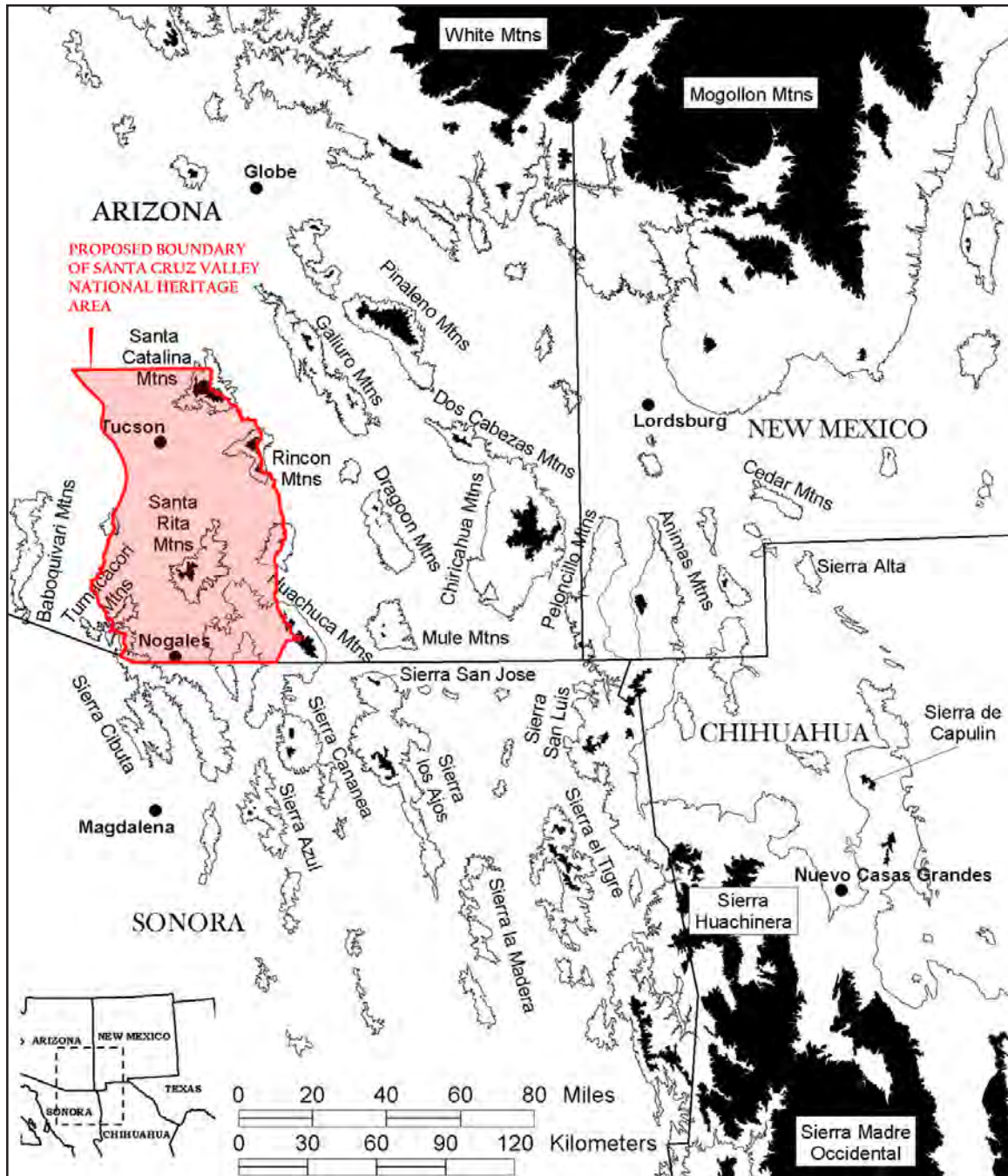
Description of Theme

Sky Islands are mountain ranges isolated from each other by intervening basins and valleys of desert and grassland, usually below 4,000 ft in elevation. The basins and valleys in this Basin and Range topographic province act as barriers to the movement of woodland and forest species at higher elevations, somewhat like the way saltwater seas isolate plants and animals on oceanic islands. The 40 ranges of the Sky Island system may be thought of as an archipelago connecting the continents of the Sierra Madre Mountain Range of northern Mexico to the south with the Rocky Mountains of the United States to the north.

Sky Islands are forested ranges that rise thousands of feet above seas of desert and grassland, like islands in the sky. They are typically over 5,000 ft in elevation and have oak forests at lower elevations, oak-pine forests at middle and higher elevations, and spruce-fir forests on the highest peaks. About 40 such mountain ranges occur in the Sky Island region, of which eight (Santa Catalina, 9,157 ft; Rincon, 8,666 ft; Santa Rita, 9,453 ft; Patagonia, 7,221 ft; Whetstone, 7,684 ft; Huachuca, 9,466 ft; Tumacácori, 5,634 ft; and Atascosa/Pajarito, 6,440 ft) occur in the proposed National Heritage Area.

At lower elevations, the western portion of the proposed National Heritage Area is in the Arizona Upland Subdivision of the Sonoran Desert Biome, while the eastern part is in the Desert Grassland Community. Higher elevations comprise the Madrean Evergreen Woodland Community: warm-temperate oak-pine communities with connections to the Sierra Madre Range in northern Mexico. These comprise the Sky Island, or Apache Highland communities.

The Santa Cruz Valley has two rainy seasons. From December to February, winter storms originating in the North Pacific bring gentle rain. From July to mid-September, the summer monsoon brings surges of wet tropical air and localized deluges in the form of violent



Map of the Sky Island region and location of the proposed National Heritage Area (copyright 2004 Cory Jones, Sky Island Alliance).

thunderstorms. Rain falls about equally in the two seasons and provides the region with an average of 12 inches annually, although this varies widely with elevation, as do temperatures.

To my mind these live oak-dotted hills fat with side oats grama, these pine-clad mesas spangled with flowers, these lazy trout streams burbling along under great sycamores and cottonwoods, come near to being the cream of creation. — Aldo Leopold, 1937

This mosaic of deserts, grasslands, and mountains is used for outdoor recreation (hiking, camping, rock climbing, skiing, summer homes, car-based tourism), extraction of natural resources (hunting, grazing, fuel-wood, mining), habitat use and scientific research (critical habitat for threatened and endangered species, scenic views, birdwatching, film making), preservation of prehistoric archaeological sites, and practice of traditional Native American ceremonies.

High Natural Diversity

High levels of natural diversity are expressed in several forms on the Sky Island landscape and represent some of the most important resources relevant to this theme. Biodiversity is the natural variety and variability among living organisms, the ecological complexes in which they naturally occur, and the ways in which they interact with each other and the natural environment. It includes three elements: ecosystem diversity, biotic community diversity, and species diversity.

Ecosystem diversity includes the variety of landscapes found together within any region, and the ways in which their biotic communities interact with a shared physical environment, in this case the Santa Cruz Valley watershed. Here, the high diversity is attributed to the variable landscape, interspersed with native desert and grassland vegetation, oasis-like cienegas and lakes, and riparian woodlands.

Biotic community diversity refers to the richness of plants and animals found together within any single landscape mosaic, such as the watershed. The numerous Sky Islands in the watershed demonstrate a gradient of communities as they rise from desert and grassland to xeric woodlands and coniferous forests.

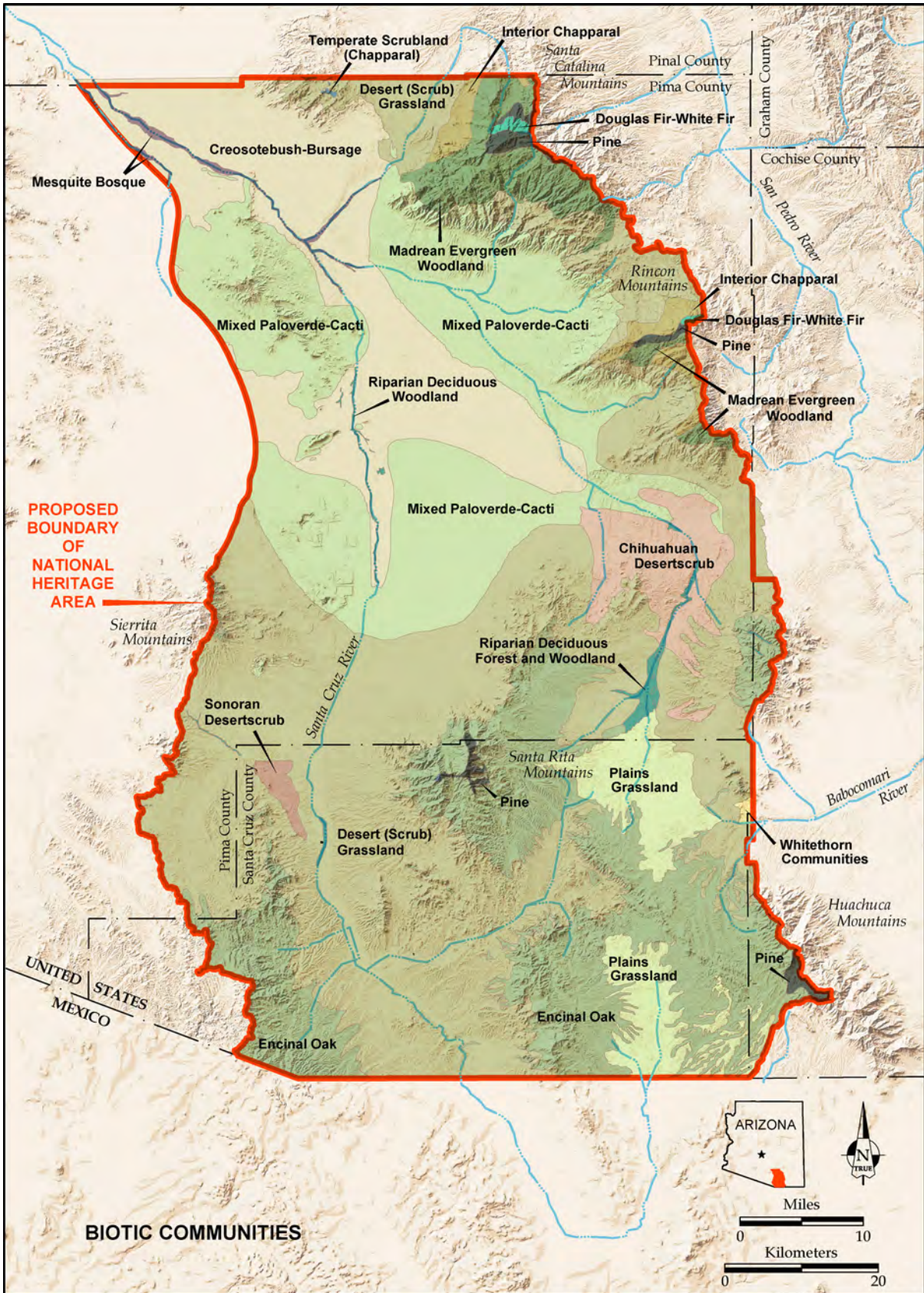
Species diversity encompasses the richness of living species in the area, made possible by the merging of four biomes (Neotropical Sierra Madre, temperate Rocky Mountain, and Sonoran and Chihuahuan deserts), an extreme three-dimensional landscape, and two rainy seasons. Species diversity is constantly changing and must be tracked by continued monitoring programs. Although each species plays a vital role in its community, some have attained special status. For example, the flower of the protected saguaro cactus is the state flower, while the ironwood tree—now protected in Ironwood National Monument—is regarded as the tree of life for the Sonoran Desert.

These and other components of biodiversity ensure some form of ecosystem stability to inhabitants of the watershed. When a mosaic of biotic communities occurs together and are environmentally healthy in a large landscape—as occurs in the proposed National Heritage Area—fewer species will succumb to endangerment or extinction.

Sensitive and Unique Species in the Sky Islands of the Proposed National Heritage Area

Plants (common name)

- ◆ Agave
- ◆ Wild onion
- ◆ Aster
- ◆ Milk-vetch
- ◆ Zorillo



The diverse biotic communities located in the proposed National Heritage Area.

- ◆ Climbing milkweed
- ◆ Fleabane
- ◆ Lemon lily
- ◆ Huachuca water umbel
- ◆ Dock sorrel
- ◆ Groundsel
- ◆ Sophora
- ◆ Kearney's blue star
- ◆ Canelo Hills ladies tresses

Animals (common name)

- ◆ Fish
 - ❖ Sonora chub
 - ❖ Gila chub
 - ❖ Gila topminnow
 - ❖ Desert pupfish

- ◆ Amphibians
 - ❖ Barking frog
 - ❖ Tarahumara frog
 - ❖ Chirichua leopard frog
 - ❖ Mountain tree frog
 - ❖ Narrow-mouthed toad
 - ❖ Sonoran green toad
 - ❖ Sonoran tiger salamander

- ◆ Reptiles
 - ❖ Mexican garter snake
 - ❖ Ridge-nosed snake
 - ❖ Tucson shovel-nosed snake
 - ❖ Mexican vine snake
 - ❖ Green rat snake
 - ❖ All montane rattlesnakes

- ◆ Birds
 - ❖ Buff-breasted flycatcher
 - ❖ Southwest willow flycatcher
 - ❖ Gray hawk
 - ❖ Black hawk
 - ❖ Yellow-billed cuckoo
 - ❖ Mexican spotted owl
 - ❖ Northern goshawk
 - ❖ Peregrine falcon

- ◆ Mammals
 - ❖ Lesser long-nosed bat
 - ❖ Mexican long-tongued bat
 - ❖ Arizona shrew
 - ❖ Mesquite mouse

- ❖ Jaguar
- ❖ Mexican gray wolf
- ❖ Desert bighorn sheep

Recent biological inventories of vascular plants and vertebrates at Tumacácori National Historical Park (Table 4.1.) and Saguaro National Park (Table 4.2) give an idea of the extraordinary biological diversity at these sites. Note that there was no survey for bats at Tumacácori National Historical Park or fish at Saguaro National Park, and that results from Saguaro National Park are preliminary. These inventories were conducted by the Sonoran Desert Network, a joint research collaboration of the University of Arizona (School of Natural Resources) and the United States Geological Survey (Sonoran Desert Research Station), and were funded by the National Park Service between 2000 and 2003.

Table 4.1. Observed biodiversity in Tumacácori National Historical Park (2000 to 2003).

Taxon	Tumacácori (132 ha)	Calabazas (9 ha)	Guevavi (3 ha)
Plants	302	179	152
Fish	8	-	-
Amphibians	7	2	2
Reptiles	15	11	7
Birds	129	80	74
Mammals	26	15	10
Totals	487	287	245

Table 4.2. Observed biodiversity in Saguaro National Park (2001 and 2002).

Taxon	Rincon Mountains (27,186 ha)	Tucson Mountains (9,710 ha)
Plants	539	177
Amphibians	8	4
Reptiles	38	31
Birds	175	71
Mammals	35	20
Totals	795	303

The high natural diversity in the Santa Cruz watershed is most visible to residents and visitors as a spectrum of distinct life zones at different elevations. The elevational extremes in the region extend from about 2,000 ft above sea level at Marana, to 9,453 ft at the top of Mount Wrightson in the Santa Rita Mountains. Depending on the elevation of the Sky Islands, each will have two to five life zones, with distinct plant communities providing different foods for animals and lower temperatures at higher elevations. Thus, each Sky Island has a unique ecosystem with a stack of life zones, ranging from arid at the bottom to potentially boreal at the top. Many species migrate vertically to feed and breed at different elevations. Further, life zones occur at lower elevations on the northern faces of Sky Islands and higher elevations on their southern faces. As an example, in the Huachuca Mountains, the grassland zone occurs up to approximately 4,500 ft, the encinal (oak woodlands) zone to about 6,000 ft, the pine-oak

woodland zone to about 7,500 ft, the pine forest to roughly 9,500 ft, and the fir forest from 8,000 to 9,500 ft (only on the northern face).

Natural Core Areas

Large expanses of land in the proposed National Heritage Area are managed for the conservation of natural conditions by public agencies such as the National Park Service, the National Forest Service, and the Bureau of Land Management, or by conservation organizations such as The Nature Conservancy. In a number of parks and preserves located in core natural areas, extractive uses of natural resources are prohibited, and ecological and evolutionary processes are maintained. These areas are important for focal species such as Mexican gray wolves, jaguars, mountain lions, black bears, and northern goshawks, while providing an umbrella effect for protecting many other species in the same habitats.

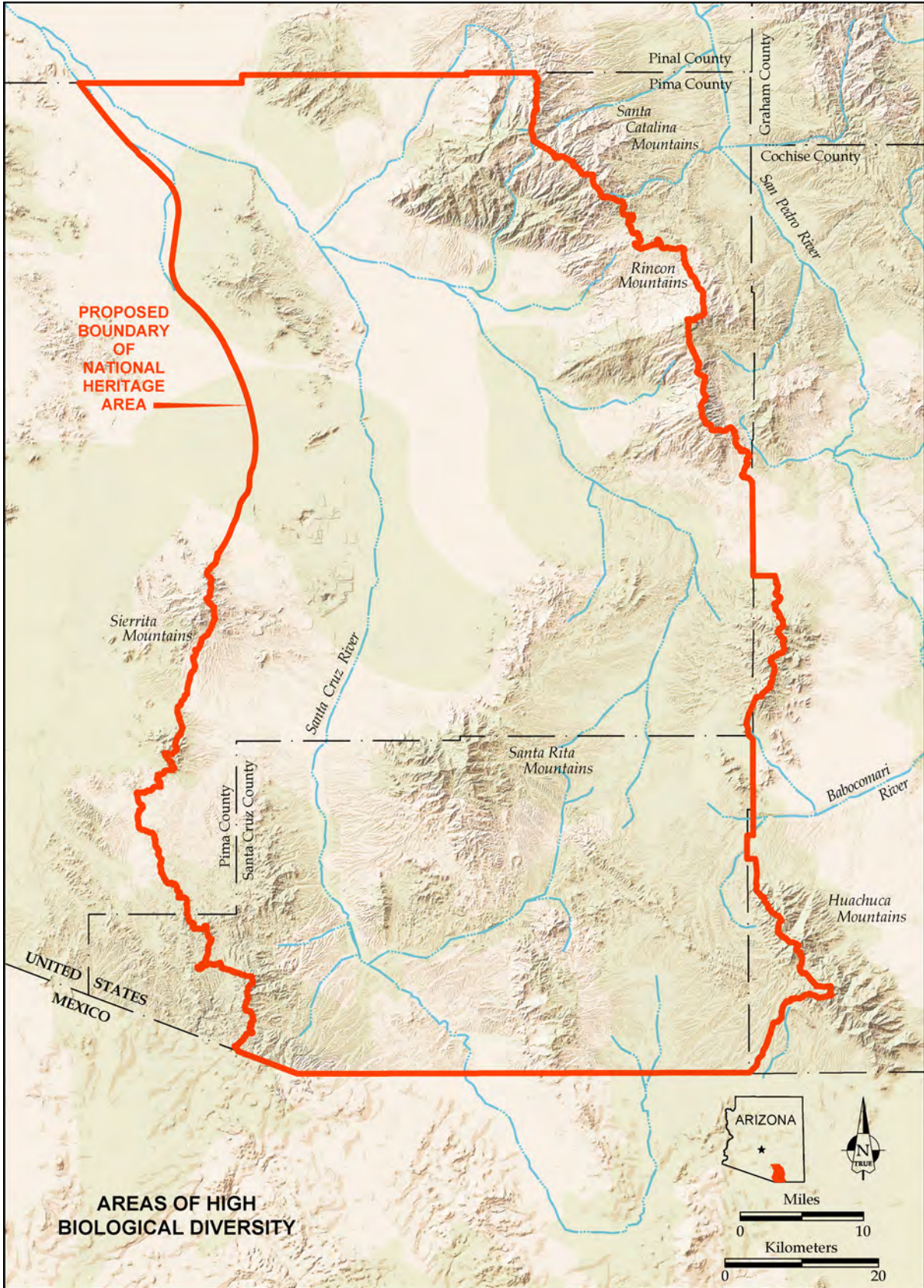
The Arizona Nature Conservancy has developed a plan of Portfolio Conservation Sites identified in terms of eco-regions and biological diversity. Of the 147 regions with high biological diversity identified in the State of Arizona, nine occur within the proposed National Heritage Area, including number one on their list – the Huachuca Mountains Grassland Valley Complex, which covers about 35 percent of the proposed National Heritage Area and extends into Sonora, Mexico (Table 4.3). This area has the highest biological diversity in Arizona.

Table 4.3. Endemic and threatened species in Arizona Nature Conservancy Natural Core Areas in the proposed National Heritage Area.

Portfolio Conservation Area	Endemic Species	Endangered/ Threatened Species	State Rank (147 Total)
Huachuca Mountains Grassland Valley Complex	36	14	1
Atascosa/Pajarito Mountains	12	8	12
Tanque Verde Ridge	2	2	48
Tucson Mountains	2	1	50
Sabino Canyon	1	1	51
Patagonia Mountains	3	1	55
Santa Rita Mountains	2	1	59
Tortolita Mountains	1	1	119
East Tucson Riparian	0	0	128

Courtesy of The Arizona Nature Conservancy

The natural core areas in the Santa Cruz watershed have 15 endangered species, including five plants (Kearney's blue star, Nichol Turk's head cactus, Pima pineapple cactus, Huachuca water umbel, and Madrean ladies'-trusses), two fish (Gila topminnow and desert pupfish), two amphibians (Sonoran tiger salamander and Chiricahua leopard frog), four birds (southwestern willow flycatcher, masked bobwhite, cactus ferruginous pygmy-owl, and Mexican spotted owl), and two mammals (lesser long-nosed bat and jaguar). In Pima County, 9 mammals, 8 birds, 7 reptiles, 7 plants, 6 fish, 2 amphibians, and numerous invertebrates have been identified as being in need of protection.



Map showing natural core areas with high biological diversity within the proposed National Heritage Area.

Biological Corridors

Landscape features that connect large tracts of isolated habitat (natural core areas) across a fragmented terrain are present within the proposed National Heritage Area. Movement of wildlife through these linkages ensures that a species can persist in an isolated habitat patch and in the overall region. Wildlife activities within these corridors include foraging movements, seasonal migrations, and dispersal of juveniles. Additionally, the resultant connectivity between natural core areas fosters genetic exchange among wide-ranging plants and animals, helping to maintain viable populations, while maintaining migratory pathways in times of environmental change.

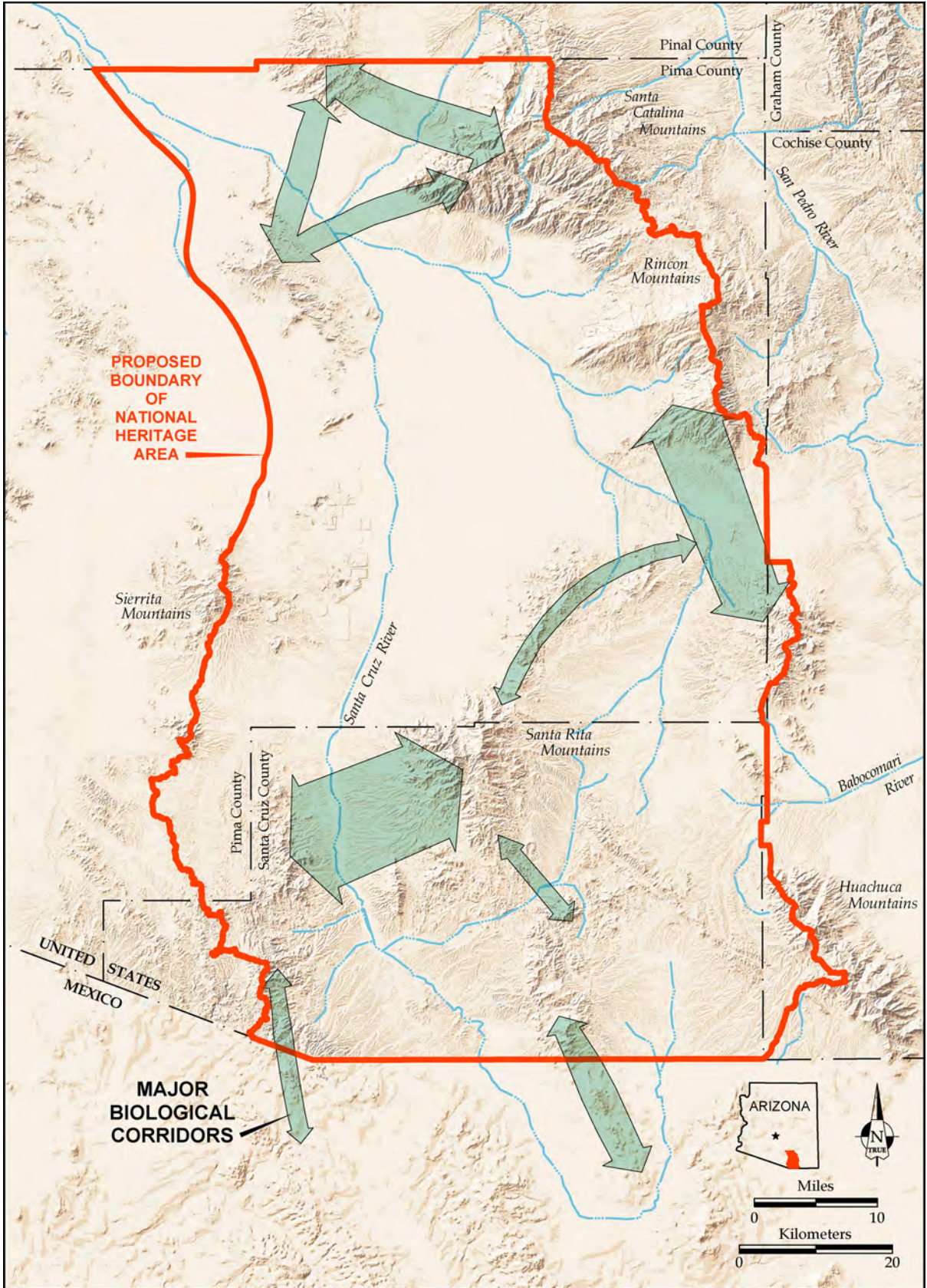
The Sky Island Alliance's Wildlife Monitoring Program has identified three critical wildlife corridors that fall within the proposed National Heritage Area: (1) the Tumacácori/Santa Rita Corridor links the Tumacácori/Atascosa mountain complex to the Santa Rita Mountains; (2) the Cienega Creek Corridor connects the Rincon Mountains east of Tucson to the Empire, Whetstone, and Santa Rita mountains to the south; and (3) the stretch of landscape south of the Santa Ritas, continuing to the connection to the Patagonia Mountains. Since 2001, the Sky Island Alliance's Wildlife Monitoring Program has mobilized volunteers to collect data on wildlife movement within the first two linkages.

In the spring of 2004, the Arizona's Missing Linkages Workshop, sponsored by the Arizona Game and Fish Department and the Arizona Department of Transportation, produced a statewide habitat linkage map identifying natural core areas and linkages. The Sky Island Regional Working Group listed 18 critical landscape linkages within southeastern Arizona, and placed both the Cienega Creek Linkage and the Tumacácori/Santa Rita Linkage at the top of the list with high biological value and facing high threat from urban development. These two critical linkages are also recognized as high priorities for protection in the Pima County Sonoran Desert Conservation Plan. There are several other linkages along spines of mountains that cross the border into Sonora, Mexico.

For many land animals, corridors that facilitate movement between Sky Islands are through riparian habitats. Eleven selected priority habitats and corridors were identified in the Sonoran Desert Conservation Plan for Pima County, and seven of these occur in the proposed National Heritage Area: Cienega Creek, Eastern Tucson Riparian Complex, Sabino Canyon, Santa Rita Mountains, Silverbell Mountains, Tortolita Mountains, and Tucson Mountains.

Scenic Landscapes

The proposed National Heritage Area includes some of the most breathtaking scenic landscapes in North America, highlighted by over 300 days of annual blue skies and majestic mountains. With numerous world-renowned observatories in the area (Mount Bigelow, Mount Hopkins, Kitt Peak, Mount Graham), the standards for outdoor lighting are more strict than in other parts of the nation, providing spectacular night skies for wonderment and stargazing. Daytime marvels include the saguaro-studded slopes of Saguaro National Park, the lush riparian forests along Sonoita Creek, and the splendor of the San Rafael Valley. Visitors during the rainy seasons will forever remember the seas of purple, orange, and red wildflowers. There are also mountain heights and the cool elevations of the Sky Islands. These can be reached by road (Mount Lemmon), hiking trails (Rincon Mountains), or a combination of the two (Santa Rita and Patagonia mountains).



Map showing critical landscape linkages in the proposed National Heritage Area.

Distinctiveness of Theme

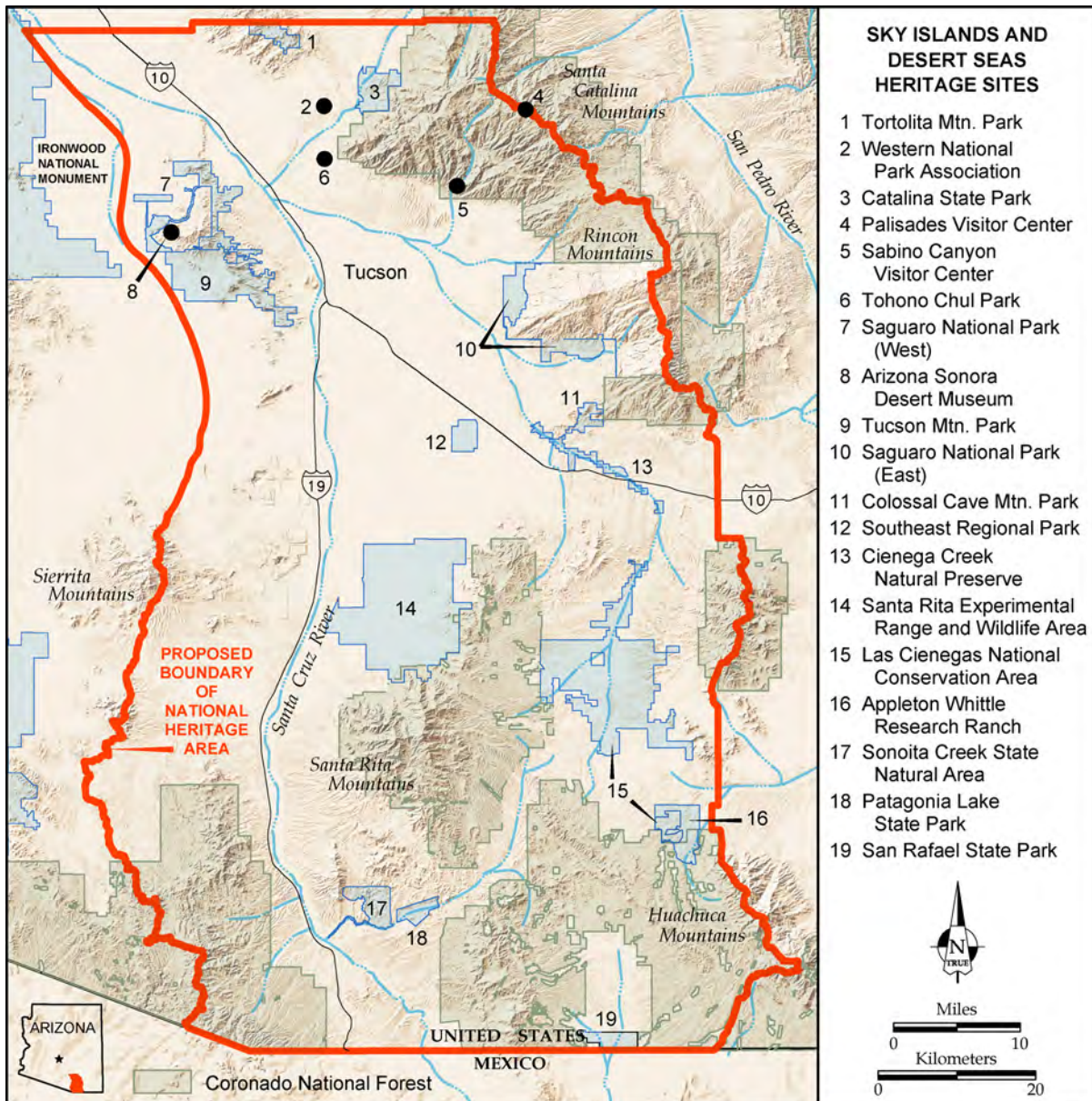
Sky Islands and Desert Seas is a distinctive theme among National Heritage Areas. The unique landscape of the proposed National Heritage Area is an environment that hosts the richest biological diversity in the State of Arizona and has supplied the natural resources that have enabled a diverse and rich cultural history. With about 1.5 million acres of public lands, parks, and preserves, the future conservation of this landscape and preservation of its rich cultural history is ensured. Further conservation and preservation efforts are primary goals of Pima County's Sonoran Desert Conservation Plan and Santa Cruz County's newly approved Comprehensive Plan.

Most urban and rural communities depend on nature and heritage tourism, and there is strong public awareness that if the natural and cultural resources are preserved, this will lead to increased tourism and economic development. Creation of a National Heritage Area will enhance the pride of people living in the area. To foster the understanding and knowledge of the area, place-based educational programs will be a primary objective in the mission of this proposed National Heritage Area. The unique qualities of the area are well known nationally, as reflected by the fact that this is a desirable place to live and one of the three most rapidly growing regions in the nation. With the establishment of a National Heritage Area, nature tourism can become a sustainable strategy of economic development that will balance promotion and preservation of the nature resources that make this region unique and that attract visitors from around the world.

The Sky Island region of southeastern Arizona, southwestern New Mexico, and northwestern Mexico is significant due to its rich diversity of species and habitats, and as the last North American stronghold for such magnificent predators as the Mexican gray wolf and jaguar. This is the only place in the United States where tourists can visit this Sky Island landscape and enjoy the exceptional scenic views and biological complexity in a designated National Heritage Area.

Astronomy Capital of the World

The numerous sky islands in the proposed National Heritage Area provide unparalleled opportunities for viewing and studying the night skies. Tucson is considered to be the astronomy capital of the world. Local ordinances require that streetlights and other outdoor lighting minimize light pollution, and there are more observatories and telescopes within a 50 mile radius of Tucson than anywhere else on our planet. Within the proposed Santa Cruz Valley National Heritage Area are the Smithsonian's Fred Lawrence Whittle Observatory (on Mount Hopkins), the University of Arizona's Steward Observatory (with facilities on Mount Lemmon, Mount Bigelow, and Tumamoc Hill) and Flandreau Observatory (with a 16-inch telescope for use by the public), and numerous private observatories. Local organizations include the Tucson Amateur Astronomy Association and the Southern Arizona Section of the International Dark Sky Association. Nearby is Mount Graham International Observatory and Kitt Peak National Observatory, the world's largest astronomical observatory and home of the world's largest solar telescope. These observatories include optical, radio and infra-red scopes. Kitt Peak and the Flandreau have educational programs for the public, and the Steward Observatory has been providing astronomy field camps on Mount Lemmon for the past 20 years.



Heritage sites located in the “Sky Islands and Desert Seas” of the proposed National Heritage Area.

Related Resources

Numerous places in the Santa Cruz Valley are available to the public, where they can experience and learn about Sky Islands and their surrounding deserts. Coronado National Forest includes all of the major mountain ranges, the Sky Island Scenic Byway (Mount Lemmon Highway), and the Madera Canyon and Sabino Canyon recreational areas. In the Santa Catalina Ranger District, the Palisades Visitor Center and Sabino Canyon Visitor Center have exhibits about Sky Island geology and natural history. Sky Island landscapes and wildlife can also be explored in Saguaro National Park (East and West Units), Catalina State Park, Colossal Cave Mountain Park, Tortolita Mountain Park, and Tucson Mountain Park. The natural histories and ecologies of Sky Islands and the Sonoran Desert are interpreted at Saguaro National Park, the Arizona-

Sonora Desert Museum, Tohono Chul Park, and the Tucson Botanical Garden. Relevant maps and publications can be found at the Western National Parks Association in Oro Valley, and at many local bookstores and businesses that sell outdoor gear. Each year, the Ironwood Festival is held at the Mason Audubon Center, and Tohono Chul Park hosts the Wildflower Festival.

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