

WORKING DRAFT

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MCDOWELL SONORAN PRESERVE 2024 ECOLOGICAL RESOURCE PLAN UPDATE



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Appendix A. Previous and Ongoing Scientific Studies

Executive Summary

The Ecological Resource Plan Update 2024 (ERP 2024) builds upon the 2016 Ecological Resource Plan (ERP 2016) developed for the City of Scottsdale's McDowell Sonoran Preserve (Preserve). As such, the ERP 2024 includes recommendations and guidance for continued scientific studies to evaluate ecological resources of the Preserve for the purpose of promoting the long-term health of the Preserve. The process utilized to update the ERP 2024 is built on the concepts of the 2016 ERP and incorporates past and ongoing studies of the McDowell Sonoran Conservancy. The ERP 2024 encourages continued assessment and monitoring of ecological resources of the Preserve so that changes can be measured to provide insight into adaptive management strategies tailored to the needs of the Preserve's ecological health and sustainability.

ERP 2024 provides a structure and process for the purpose of understanding and continued monitoring of baseline ecological conditions of the Preserve to sustain the health of the Preserve, identify potential areas of concern, and to provide statistically valid data analysis to observe trends. It builds on ongoing baseline diversity and monitoring surveys, broadens to include data collection for other resource indicators, and expands into the areas of abundance, composition, movement between and within habitat types, and habitat function and diversity. MORE...

I. McDowell Sonoran Preserve Description

A. Overview of the McDowell Sonoran Preserve Management Structure

The Preserve consists of over 30,580 acres of land and is home to well over 730 types of plants and animals, archaeological and historic artifacts, and unique geologic features. The Preserve is owned and operated by the City of Scottsdale (City) and managed through a partnership with the McDowell Sonoran Conservancy. Under this unique partnership the City owns, operates, and maintains the Preserve and the McDowell Sonoran Conservancy provides staff, citizen scientists, and stewards to aid the City in promoting, managing, and protecting the Preserve. The McDowell Sonoran Conservancy provides subject matter experts, research activities, and recommendations on management of natural and cultural resources within the Preserve.

A1. History and Background

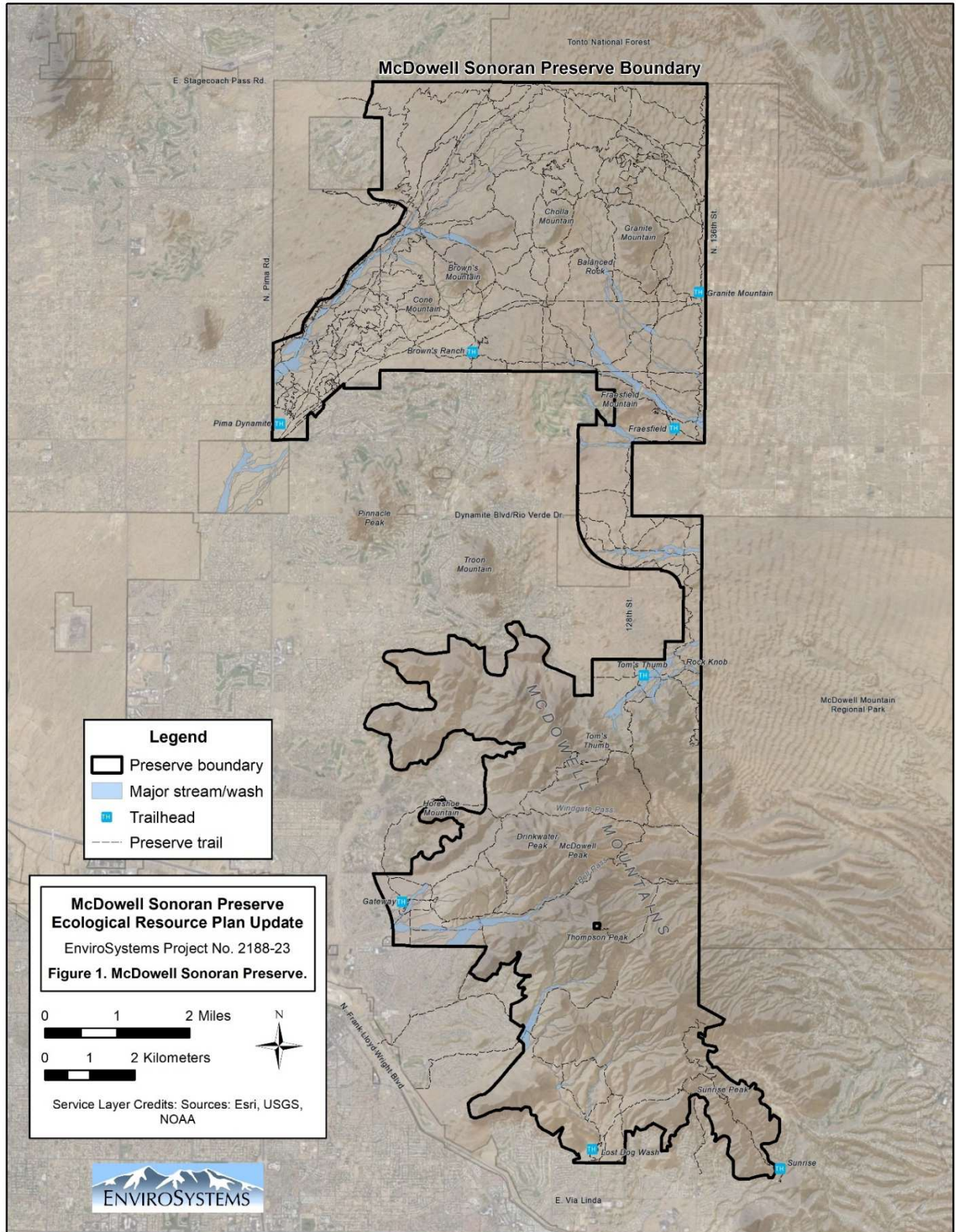
Humans have occupied the greater Phoenix Valley including Scottsdale for approximately 9,000 years. In the mid-1800's Euro-American settlements moved in bringing cattle ranching, prospecting and mining, and farming. The City of Scottsdale was incorporated in 1951, and the effort to establish the Preserve became more focused in 1991 with the formation of the McDowell Sonoran Land Trust, a 501c3 non-profit organization. The goal was to preserve the lands in and around the McDowell Mountains. In 1995 and 2004, the Citizens of Scottsdale voted to approve sales taxes devoted to providing money for the acquisition of land for the Preserve within the Recommended Study Boundary (RSB). The RSB is a 34,000-acre geographic area where the City can use the above mentioned taxes to purchase land for inclusion in the Preserve and provide appropriate recreation trails and access areas. The citizens of Scottsdale continue to value the cultural heritage, unique desert habitat for various species of wildlife, educational opportunities, and the opportunity for public recreation in a dense urban area.

As of 2024, the City has acquired or protected over 30,580 acres within the RSB (Figure 1). In most cases, the City has acquired lands in fee title, but in other cases the preserved land remains privately owned although protected by conservation easements, zoning designations, or other existing land use regulations.

The Preserve lies in central Arizona, in central and northern Scottsdale. A majority of the Preserve can be described as palo verde-mixed cacti in the Arizona Upland Series of the Sonoran Desertscrub biome as described in Brown (1982). The Preserve received an annual average of 10.38 inches of precipitation between 1994 and 2022 (Flood Control District of Maricopa Official Precipitation Record, 2023). Elevations range from 1,690 feet above sea level at the southern boundary to 4,059 feet above sea level near Tom's Thumb Trailhead.

The Preserve is within the City of Scottsdale corporate limits and is situated between Maricopa County's McDowell Mountain Regional Park (approximately 20,000 acres) and the Town of Fountain Hills Preserve (approximately 1,000 acres) both to the east, Tonto National Forest (approximately 2.9 million acres) to the north, and urban Scottsdale/Phoenix to the south and

west. The Preserve protects wildlife corridors that connect the Tonto National Forest and to Maricopa County's McDowell Mountain Regional Park through areas that otherwise would be fragmented by various forms of urban development.



B. Purpose and Management Objectives of McDowell Sonoran Preserve

B1. Governing Structure

The City of Scottsdale is the landowner and manager of the Preserve. Its responsibilities include all land acquisition, trail and trailhead improvement planning, daily maintenance and operation, and public safety services. Management of the Preserve is carried out according to Chapter 21 of the Scottsdale Revised Code (S.R.C).

The stated purpose of the Preserve is described in S.R.C. Sec. 21-2:

- (a) The purpose of the McDowell Sonoran Preserve is to establish in perpetuity a preserve of Sonoran Desert and mountains to maintain scenic views, as a habitat for wildlife and desert plants; to protect archaeological and historical resources and sites, while providing appropriate public access for educational purposes; and to provide passive outdoor recreational opportunities for residents and visitors.
- (b) The preserve will be left in as pristine a state as possible to maintain for this and future generations, in perpetuity, a nearby natural desert refuge from the rigors of urban life.
- (c) The preserve will not contain traditional facilities or improvements associated with a public park but may contain facilities or improvements that the city determines are necessary or appropriate to support passive recreational activities.

The stated management objectives of the Preserve are described in S.R.C. Sec. 21-3:

- (1) Preserve the local plants, wildlife, and natural resources to maintain the biological diversity and long-term sustainability of the area's ecology.
- (2) Maintain scenic views to preserve the aesthetic values of the area for all to enjoy and for its contribution to the quality of life of the community.
- (3) Protect historical and archaeological resources, such as petroglyph sites.
- (4) Provide a superior opportunity for people to experience and enjoy the magnificent Sonoran Desert and mountains.
- (5) Provide a variety of opportunities for passive outdoor recreation, such as hiking, wildlife viewing, mountain bicycling, horseback riding, and rock climbing.
- (6) Support tourism in the community by providing public outdoor educational opportunities for visitors.
- (7) Provide opportunities for education and research on the Sonoran Desert and mountains.
- (8) Provide enough access areas of sufficient size and with adequate amenities for appropriate public access.
- (9) Develop a non-paved public trail system for hiking, mountain biking, bicycling and horseback riding and link these trails, where appropriate, with other city and regional trails.

- (10) Restore habitat in degraded areas of the preserve to its undisturbed condition, including diverse plant species and natural ecological processes.

B2. Community Conservation Values

The purpose and management objectives of the Preserve express the conservation values of the City of Scottsdale and its citizens. The conservation ethic emphasizes biological, ecological, social, cultural, and outdoor recreation values, and perpetuates preservation and sustainability of natural open space through science, education, and stewardship to assure protection of the Sonoran Desert and McDowell Mountains for this and future generations.

B3. Public Involvement

Public input and involvement are at the core of the City of Scottsdale. The Preserve was envisioned by the citizens, supported by the citizens, and exists because of the support of the citizens. The future of the Preserve will depend on involvement and support from the citizens. Citizen involvement is embodied in the McDowell Sonoran Preserve Commission, a seven member advisory body that makes recommendations to the Scottsdale City Council on matters concerning the Preserve, and in the McDowell Sonoran Conservancy, the City's non-profit partner in the care and management of the Preserve. The McDowell Sonoran Conservancy was founded by advocates for the initial vision of the Preserve, and continues to this day as a key element in the citizen support of the Preserve.

II. Status of Ecological Resources

A. Ecological Baseline

The ecological resources of the Preserve discussed in the 2016 ERP were based primarily on numerous large-scale inventories of plant and wildlife completed between 2009-2014 giving an overall snapshot of the ecological resources present in the Preserve and providing the baseline conditions. The Flora and Fauna of the McDowell Sonoran Preserve (2014) was the culmination of numerous plant and animal field studies conducted over nearly three years. Additional studies and reports were completed by the McDowell Sonoran Conservancy and partners on geological resources (Gootee et al., 2009; Gruber et al., 2010; Gootee and Gruber, 2015) and plant associations (Jones and Madera, 2014) during this time frame. These data and reports provided insight into the ecological health of the Preserve. The scientific principal investigators concluded that the flora and fauna diversity are consistent with those in surrounding natural Arizona uplands, the multiple trophic levels present indicate a robust food web, and the Preserve was in healthy condition, given the historic use and proximity to urban development (ERP, 2016).

Since 2016, scientific investigations represent more focused efforts on inventories and monitoring of groups of animals, habitat use and wildlife movement, assessing degraded lands and restoration, as well as identifying and treating invasive plant species. Formal and informal management plans for invasive plant species, wildland fire fuel load management, and cultural resources have been developed and initiated. The scientific studies that have been conducted by the McDowell Sonoran Conservancy and partners within the Preserve are located in Appendix A.

A1. Role of Preserve Stewards – Citizen Science Model

Preserve stewards assist the city of Scottsdale with the maintenance and promotion of the Preserve by patrolling trails, greeting, and providing information to visitors, providing educational hikes and programs providing support for the Preserve staff, and aiding with scientific research.

Scientific investigations in the Preserve provide a unique opportunity for interested citizen scientists and Preserve stewards to collect baseline ecological data on conditions in the Preserve and to participate in on-going scientific studies. The on-going studies provide for both desktop level analysis of data and in-field observations of on-the-ground conditions. The citizen science model connects citizens of all ages, abilities and interest levels with the operation, maintenance, and planning aspects of the Preserve. Connection to the Preserve has a multitude of benefits including better understanding of the natural and physical conditions in the Preserve, appreciation of the social and health benefits of Preserve management, and interest in maintaining the ecological and physical health of the Preserve.

The City and McDowell Sonoran Conservancy, along with numerous scientists, agency land managers, experts from research and academic institutions, and countless hours from citizen scientists and stewards have developed a strong collaborative coalition and bank of scientific information dedicated to the health and sustainability of the Preserve.

B. Preserve Management Plans

The Preserve is operated according to the purpose, goals, and objectives of Chapter 21 of the Scottsdale Revised Code, and a series of approved master plans and policies that are in accordance with Chapter 21. The following management plans have been developed for management of specific resources within the Preserve. Each of the management plans will consider the recommendations of this Ecological Resource Management Plan to provide for comprehensive, consistent, and integrated management.

B1. Wildland Fire and Fuel

The City's Community Services Department and the Scottsdale Fire Department work closely with a variety of partner agencies on the planning and implementation of wildland fire and fuel reduction projects in strategic areas throughout the City, particularly in the areas within and surrounding the Preserve. Priorities for fuel reduction projects are continually evaluated and prioritized to have the greatest impact for preventing and slowing the spread of wildfires.

B2. Invasive Plants

The City Community Services Department partners with McDowell Sonoran Conservancy to identify, plan, prioritize, and implement invasive plant management, particularly for Fountain Grass and Buffelgrass (*Pennisetum* spp.). Each year, the City and the McDowell Sonoran Conservancy work together to update the Invasive *Pennisetum* Species Strategic Plan and identify priority areas to targeted treatments.

B3. Cultural Resources

The City has a Cultural Resource Master Plan (CRMP) approved by the City Council in 2016. The CRMP provides guidance for the management of cultural resources within the Preserve and establishes an ethic of conservation archaeology. The CRMP promotes the protection and interpretation of cultural resources in the Preserve for present and future generations and encourages a sense of resource stewardship among the City's constituency.

B4. Public Trailhead Access Areas

The City has a plan for public trailhead access areas known as the Access Areas Report. This plan prescribes the location of public trailheads and the amenities included at each trailhead. This plan was created in 1999 and updated in 2010. Since that time, much of the work identified in the plan has been completed.

B5. Shared-use Non-motorized Trails

The locations of trails in the Preserve are dictated by the Preserve Trails Plan. First created in the late 1990's, the trails plan shows the locations of trails in the Preserve. In 2013, the City implemented a planning process for the trails in the northern region of the Preserve, which resulted in the creation of the Phase 2C and Phase 3 Trails Plans.

B6. Rock-Climbing

Rock-climbing in the Preserve is managed according to the Conceptual Rock-Climbing Plan which documents the locations of the rock crags in the Preserve where rock-climbing is permitted, and the climbing access routes used to connect from the main trails to the crags. The plan also includes the policy by which rock climbing is managed in the Preserve.

C. Public Education

Public education is a pillar of the City's Preserve management strategy. The Preserve Management Objectives in Chapter 21 of the Scottsdale Revised Code include providing opportunities for education and research on the Sonoran Desert and mountains. This objective is achieved through a wide variety of public education opportunities, many of which are provided by the McDowell Sonoran Conservancy. The McDowell Sonoran Conservancy delivers educational opportunities for residents and visitors including guided hikes and bike rides, public lectures, online content, youth education, and trail and trailhead ambassadors.

III. Ecological Resource Studies and Analyses

ERP 2024 provides a structure and process for the purpose of understanding and continued monitoring of baseline ecological conditions of the Preserve to sustain the health of the Preserve, identify potential areas of concern, and to provide statistically valid data analysis to observe trends. It builds on ongoing baseline diversity and monitoring surveys, broadens to include data collection for other resource indicators, and expands into the areas of abundance, composition, movement between and within habitat types, and habitat function and diversity. All investigations will be designed to collect data with replicable scientific methods to allow for statistical evaluation of results.

The following objectives of the resources studies and analyses are presented to guide the aim of continued studies to measure and maintain the ecological health and sustainability of the Preserve.

Monitor ecological health to detect change.

Identify species density, diversity, distribution, and movement.

Create consistency in method over time and across projects.

Pursue trend analyses.

Detect invasive species (plant or animal).

Recognize evidence of temperature and precipitation changes.

Apply new and emerging technologies.

Generate adaptive management strategies when indicated.

Summarize findings on a consistent basis.

Within ERP 2024, resource studies have been assigned tiers (T1 or T2) to aid in the prioritization of research projects.

Tier Definitions:

- T1 – Prioritized studies tracking changes in health, movement, and impacts.
- T2 – To be specifically studied on an as needed basis, based on trends that may be determined through T1 studies.

A. Flora

A1. Vegetation

Goals

- Baseline long-term monitoring of phenology for detection of statistically significant change.
- Establish permanent transects for vegetative baseline of species diversity, density, composition and dominance for long-term monitoring.
- Establish study plots for evaluation of vegetative biomass for long-term monitoring.

Studies

- Phenology (T1)
- Permanent line-intercept transects (density/diversity) (T1)
- Production plots (biomass) (T1)

Current Status

Since the completion of the original plant inventories and plant association work (McDowell Sonoran Conservancy, 2014), phenology of the plants of the Preserve was initiated in 2017. The

McDowell Sonoran Conservancy has been collecting phenological data at three sites in the Preserve twice a week throughout the year. Citizen scientists monitor six plant species – saguaro, buckhorn cholla, jojoba, soap tree yucca, desert senna, and velvet mesquite.

B. Fauna

B1. Game species

Goals

- Continue annual populational assessment of game species to detect statistically significant change.

Studies

- AZGFD annual game species counts (T1)

Current Status

In partnership with the City of Scottsdale, the Arizona Game and Fish Department (AZGFD) has been completing annual aerial game species counts from 2013 to present. The survey focuses on mule deer and javelina, and also records other large mammals such as coyotes, bobcats, and mountain lions.

B2. Bat monitoring

Goals

- Long-term baseline monitoring to detect statistically significant change.
- Identification of additional species and/or roosts.
- Establish baseline conditions of known maternity roosts.

Studies

- Acoustic monitoring for diversity, density, and distribution (T1)
- Maternity roost monitoring (T1)
- Monitor microclimate conditions of identified maternity roost (T1)

Current Status

Long-term monitoring performed by the McDowell Sonoran Conservancy on the Preserve has been ongoing since 2017. Twelve species of bats have been identified and a maternity roost for the Townsend's big-eared bat has been discovered.

B3. Pollinators

Goals

- Baseline long-term monitoring of butterflies to detect statistically significant change.
- Establish baseline inventory data for native bees, invasive bees, and other pollinators.

Studies

- Butterfly count (T1)
- Native bee identification (T2)
- Invasive bee (honeybee) identification (T2)
- Other pollinators (T2)

Current Status

Long-term monitoring of pollinators is completed during annual butterfly counts; 58 butterfly species have been observed in the Preserve. The McDowell Sonoran Conservancy has conducted annual fall butterfly counts at six sites since 2014. In 2017, an annual spring count was added at the same sites to better assess seasonal variances.

B4. Birds – migratory, raptor, and nocturnal species**Goals**

- Establish standard methodology for assessing bird diversity, density and habitat use and detect statistically significant change.
- Identify raptor breeding population and assess nesting success.

Studies

- Point counts – visual surveys (T1)
- Raptor nest productivity (T2)

Current Status

In 2018, annual bird monitoring was increased to a total of nine diurnal and two nocturnal survey routes. Diurnal sites are surveyed three times per year to capture seasonal fluctuation; nocturnal sites are surveyed once in late May. At least 185 species of birds have been recorded including 20 of which are considered sensitive or are experiencing global declines.

B5. Arthropods**Goals**

- Long-term baseline monitoring to detect statistically significant change.
- Assess density/diversity differences between wildland-urban interface and natural areas.

Studies

- Pitfall traps (T1)

Current Status

Since 2012, the McDowell Sonoran Conservancy has been conducting research by collecting ground-dwelling arthropods at regular intervals at sites throughout the Preserve. The sampling design pairs sites in the interior of the Preserve to sites near the urban edge. The diversity of arthropods in the Preserve is high, with almost 300 unique taxa identified.

B6. Reptiles and Amphibians

Goals

- Establish long-term baseline monitoring of reptiles and amphibians to detect statistically significant change.
- Sonoran Desert tortoise population health (Tortoise movement is identified under Section D below).
- Assess threats to amphibians.

Studies

Reptiles

- Inventory of species present (T1)
- Sonoran Desert tortoise study plots (T1)

Amphibians

- Inventory of species present (T1)
- Water quality (toxins) (T1)
- Invasive bullfrogs (T1)

Current Status

Original reptile surveys were conducted between March 2011 and November 2013 (Weber, et al., 2016). Two hundred individual amphibians and reptiles were documented including 34 species in 11 families and 29 genera (3 species of amphibians, 31 species of reptiles; 1 species of tortoise, 13 species of lizards, and 17 species of snakes).

The Desert Tortoise and Habitat Connectivity investigation was initiated in 2021. Twenty-four tortoises were weighed, measured, marked, and given a health assessment. Transmitters were attached to 17 adults and two immature tortoises which were located weekly in 2021. In spring 2022, these animals received GPS trackers, which provides location every hour for each individual and is on-going.

Amphibian surveys began in 2016 to document species presence and relative abundance during the rainy season. In 2019, these efforts increased to include weekly monitoring from July through September to assess species phenology (timing of emergence, reproduction, metamorphosis, and retreat into hibernacula) in relation to water availability. Four species of toads were documented including the Great Plains toad, red-spotted toad, Couch's spadefoot, and Sonoran Desert toad.

C. Water and Riparian Areas

Goals

- Establish vegetation baseline to detect statistically significant change.
- Establish faunal species diversity.
- Evaluate habitat functionality.

Studies

- Riparian inventory/vertical volume/cover (T1)
- Fauna inventory (T1)
- Evaluation of surface water (including tanks) and groundwater (T1)

Current Status

In The Flora and Fauna of Scottsdale's McDowell Sonoran Preserve (2014), riparian and water resources on the Preserve were characterized as scarce. Limited surface water sources include one perennial spring, several small intermittent water sources, and a series of older wildlife water catchments and old stock tanks. Little is known about these resources, particularly riparian habitat, species composition, and wildlife diversity that may exist.

D. Habitat Connectivity and Movement Corridors

Goals

- Monitor species diversity to detect statistically significant change.
- Gene flow sustainability.
- Species/habitat use between the northern, southern, and corridor regions.
- Assess impacts to wildlife at major road crossings including Rio Verde Drive and 128th Street in the Gooseneck area of the Preserve.

Studies

Radio telemetry and wildlife cameras

- Mule deer (T1)
- Desert tortoise (T1)
- Mountain lions (T2)
- Small to medium-sized mammals (T2)

Wildland Urban Interface (WUI)

- Wildlife road mortality monitoring (T1)

Current Status

In 2012, the City partnered with AZGFD to conduct a wildlife mortality study to document wildlife movements and roadway mortality in the gooseneck corridor area of the Preserve, which is the wildlife linkage between the southern and northern parts of the Preserve. This work produced a report entitled Identification of Wildlife Road Mortality Hotspots and Wildlife Activity Patterns within the Scottsdale McDowell Sonoran Preserve Wildlife Linkage (Grandmaison, 2012).

In 2016, the City, McDowell Sonoran Conservancy, and AZGFD initiated a mule deer telemetry project and produced a subsequent report entitled Mule Deer Corridor and Habitat Use in the McDowell Sonoran Preserve which tracked mule deer movements on the Preserve through the deployment of radio collars. This study investigated habitat use by mule deer in relation to trail use.

In 2018, McDowell Sonoran Conservancy, with several contributors produced Mammal Community Composition and Connectivity through an Urban Corridor in poster form summarizing data camera trapping and GPS collaring efforts.

McDowell Sonoran Preserve Corridor Viability Project (2020) monitored wildlife populations and assessed the viability of the Preserve's gooseneck corridor. Twenty-six remote wildlife cameras were placed throughout the Preserve between 2017 – 2019. Species of mountain lion, mule deer, and medium-sized carnivores were found across all regions of the Preserve. This suggests every region of the Preserve provides the needed resources for these species to survive and reproduce.

E. Soil/Geology

Goals

- Aid in restoration of impact areas.
- Identify and quantify degradation (e.g., from trail use, other).
- Preserve integrity of unique geologic features.

Studies

- Soil crust establishment and monitoring (T1)
- Degraded lands mapping (T1)
- Soil erosion and compaction (T2)
- Survey unique geologic features, especially near developed areas (T2)

Current Status

In 2018, the McDowell Sonoran Conservancy and several contributors published the Comparison of trailside degradation across a gradient of trail use in the Sonoran Desert in the Journal of Environmental Management (Rowe, et al. 2018) which was a comprehensive analysis of effects to soils on multiple levels in relation to trail use and several related variables in the Preserve.

In 2018, McDowell Sonoran Conservancy harvested biocrust from the Preserve and initiated experiments to cultivate. Several methods were researched and had various levels of success.

Geological resources have been extensively researched, inventoried, and documented throughout the Preserve (Gootee et al., 2009; Gruber et al., 2010; Gootee and Gruber, 2015).

IV. Adaptive Management Process

The adaptive management process has been defined in many ways by many natural resource scientists, institutions, educators, and managers. In general, it is a highly iterative process based on learning, sometimes from mistakes. There is usually some uncertainty about management outcomes that through continual research and learning helps refine the management efforts and goals. Adaptive management is based on involving ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself. The steps include stakeholder involvement, management objectives, management alternatives, predictive models,

monitoring plans, decision making, monitoring responses to management, assessment, and adjustment to management actions. An adaptive approach actively engages stakeholders in phases of a project, facilitating mutual learning and reinforcing the commitment to learning-based management (Williams, et al., 2009).

The Preserve has been the subject of numerous inventories and investigations, extensive monitoring of resources and restoration research since the early 2000's. Early comprehensive flora and fauna inventories and evaluation of physical attributes gave a strong indication of the presence of the necessary constituents of a healthy ecosystem. Subsequent monitoring efforts have not shown any remarkable indications of threat to the overall ecosystem health. Areas of concern have been identified such as invasive plant species, wildland fire management, restoration of areas impacted by past land use activities and recreation, trail use, wildland-urban interface, and potential obstacles to wildlife movement.

The City of Scottsdale, the McDowell Sonoran Conservancy, and other partners have been responsible for producing documentation on monitoring efforts, education briefs and materials for the public. Many of the collaborative experts have published articles in peer-reviewed scientific journals. Many of the monitoring efforts that have been carried out for several years, utilizing standard methods, have produced results that are statistically relevant.

A. Annual Report of Completed Studies

Various reports and subject briefs are prepared every year for investigations in the Preserve. In addition to the individual reports and briefs, it is recommended that a singular summarized annual report be prepared that itemizes individual investigations, baseline monitoring studies, additional studies and research undertaken, and implementation of mitigative measures. This is recommended to provide a beneficial oversight tool for all ongoing efforts completed each year.

B. Five-Year Analysis of Preserve Health

It is recommended that every five years a comprehensive analysis of information collected through monitoring and investigations be produced. Information should include any trend analyses or other statistical validation of data in such a manner to evaluate the ecosystem health of the Preserve. Any potential changes of significance detected may indicate influences or concerns and should be the subject of further study or consideration of changes in management. This may also require the development or revision of relevant management plans, including the Ecological Resource Plan.

V. Citations

Brown, D. E.

1982 Biotic communities of the American Southwest – United States and Mexico. *Desert Plants* 4(1-4):1-341.

City of Scottsdale & McDowell Sonoran Conservancy

2022 McDowell Sonoran Preserve Invasive Pennisetum Species Strategic Plan 2022-2027. Submitted to the City of Scottsdale.

Earl, Stevan R.

2013 Assessing Ground-Dwelling Arthropods in the McDowell Sonoran Preserve. Submitted to the McDowell Sonoran Conservancy. July 12, 2013.

Flood Control District of Maricopa Official Precipitation Record
2023

Gootee, Brian F., and Daniel G. Gruber

2015 Quartz Vein Investigation, McDowell Sonoran Preserve, Scottsdale, Maricopa County, Arizona. Arizona Geological Survey Open File Report, OFR-15-03, 69 p.

Gootee, Brian, Dan Gruber, Larry Levy, Joni Millavec and Bill Ruppert

2009 Limestone Discovery in the McDowell Sonoran Preserve. Arizona Geological Survey Contributed Report CR-09-B.

Grandmaison, D. D.

2012 Identification of Wildlife Road Mortality Hotspots and Wildlife Activity Patterns within the Scottsdale McDowell Sonoran Preserve Wildlife Linkage. Prepared for City of Scottsdale. Arizona Game and Fish Department, Wildlife Contracts Branch. November 2012.

Gruber, Daniel E., Larry S. Levy, Joni T. Millavec, William H. Rupert and Brian F. Gootee

2010 Preliminary Geologic Survey of the Lost Dog Overlook Vicinity, McDowell Sonoran Preserve, Scottsdale, Arizona. Arizona Geological Survey Contributed Report CR-10-E.

Jones, S., and R. Madera

2014 Plant Associations within Scottsdale's McDowell Sonoran Preserve Recommended Study Boundary. McDowell Sonoran Field Institute.

Jones, Steve

2014 McDowell Sonoran Field Institute Plant Associations of Scottsdale's McDowell Sonoran Preserve: A Report to the City of Scottsdale.

2019 Bunchgrasses of McDowell Sonoran Preserve. Submitted to the McDowell Sonoran Conservancy. February 2019.

Jones, Steve and Chelsey Hull

2014 Vegetation and Flora of the McDowell Sonoran Preserve, Maricopa County, Arizona. *Canotia* 10:1-34

McDowell Sonoran Conservancy

2014 The Flora and Fauna of Scottsdale's McDowell Sonoran Preserve. Scottsdale, AZ.

2015 Ecological Resource Plan for Scottsdale's McDowell Sonoran Preserve, version 1.0. McDowell Sonoran Conservancy, Scottsdale, Arizona

2020 McDowell Sonoran Preserve Corridor Viability Project Report.

Rowe, Helen Ivy, Melanie Tluczek, Jennifer Broatch, Dan Gruber, Steve Jones, Debbie Langenfeld, Peggy McNamara, Leona Weinstein

2018 Comparison of Trailside Degradation Across a Gradient of Trail Use in the Sonoran Desert. *Journal of Environmental Management* 207 (2018): 292-302.

Rowe, Helen I., Tiffany A. Sprague, Jennifer Broatch, Dan Gruber, Debbie Langenfeld and Lisa Rivera

2020 Lessons Learned 5+ Years After Transplanting and Seeding Restoration Sites in the Sonoran Desert. USA. *The American Midland Naturalist* 184(2):129-148.

Rowe, Helen I., Daniel Gruber and Mary Fastiggi

2021 Where to start? A New Citizen Science, Remote Sensing Approach to Map Recreational Disturbance and Other Degraded Areas for Restoration Planning. *Restoration Ecology* Vol 29, No. 6, e13454. Society for Ecological Restoration

Rowe, Helen I., Tiffany A. Sprague and Paul Staker

2022 Comparing Common Fountain Grass Removal Techniques: Cost Efficacy and Response of Native Plant Community. *Biological Invasions*. Published online: 14 August 2022.

Rowe, Helen I., Tiffany A. Sprague, Mary Fastiggi and Paul Staker

2023 Comparing common Buffelgrass (*Pennisetum ciliare*) removal techniques: cost efficacy and response of native plant communities. *Biological Invasions*. Published online: 09 May 2023.

Rutowski, Ron, Doug Jensen, Tiffany Sprague, Helen Rowe, Jennifer Broatch

2022 Butterfly Survey Status Report, May 2022. Submitted to Parson Field Institute, McDowell Sonoran Conservancy.

Skotnicki, Steven J. and Dan Gruber

2019 Mesoproterozoic Rocks of the McDowell Mountains, Arizona- Journey into the Magmatic Gap. *The Geologic Society of America Field Guide 55*. Sprague, Scott C. Susan R. Boe, Tiffany A. Sprague,

Colin Beach, Emily E. Herring and Jeffrey W. Gagnon

2019 Mule Deer Corridor and Habitat Use in the McDowell Sonoran Preserve. Prepared for the City of Scottsdale. Arizona Game and Fish Department, Wildlife Contracts Branch. May 2019.

Weber, David J., and Gordon W. Schuett

2016 A Citizen Science Survey of the Herpetofauna of Scottsdale's McDowell Sonoran Preserve, Arizona, USA. *Herpetological Review*, 2016, 47(1). 5-10.

Williams, B. K., R. C. Szaro, and C. D. Shapiro

2009. Adaptive Management: The U.S. Department of the Interior Technical Guide. Adaptive Management Working Group, U.S. Department of the Interior, Washington, DC

APPENDIX A

Previous and Ongoing Scientific Studies

Previous and Ongoing Scientific Studies

Report Name	Study Dates	Frequency	Location	References
McDowell Mtn Limestone	2009	1×	Entire Preserve	Gootee et al., 2009
Lost Dog Geologic Survey	2010	1×	Lost Dog Wash	Gruber et al., 2010
Flora and Fauna of the Preserve	2010-2013	1×	Entire Preserve	McDowell Sonoran Conservancy, 2014
Past Restoration	2010-2018	1×	Eight Study Sites	Rowe et al., 2020
Herpetofauna of the Preserve	2011-2013 March-Nov	Monthly for 10 Mo/Yr	Nine Survey Areas	Weber et al., 2016
Biotic Communities of the MSP	2011-2014	1×	Entire Preserve	Jones, 2014
Wildlife Road Mortality Hotspots	2012-2013	1×	Wildlife Linkage Area	Grandmaison, 2012
Ground Dwelling Arthropods	2012-2013	Quarterly	Ten Transects	Earl, 2013
Vegetation of the Preserve	2014	1×	Entire Preserve	Jones and Hull, 2014
Plant Associations with Scottsdale's Preserve (Map)	2014	1×	Entire Preserve	Jones and Madera, 2014
Butterfly Survey Status	2014-2022	Biannual Spring and Fall	Six Locations	Rutowski et al., 2022
Milky Quartz Vein	2015	1×	Two Study Areas	Gootee and Gruber, 2015
Ecological Resource Plan	2016	1×	Entire Preserve	McDowell Sonoran Conservancy, 2015
Mule Deer Corridor and Habitat Use in the Preserve	2016-2018	Annually	Entire Preserve	Sprague et al., 2019
Preserve Corridor Viability Project	2017-2019	1×	Wildlife Linkage Area	McDowell Sonoran Conservancy, 2020
Trail Impact Study	2018	1×	Nine Trail Segments	Rowe 2018
Degraded Lands Mapping	2018	1×	10 Sections	Rowe et al. 2021
Biological Invasions – Fountain Grass Removal	2018-2021	1×	Entire Preserve	Rowe et al. 2022
Geology Field Guide	2019	1×	Entire Preserve	Stotnicki and Gruber 2019
Bunchgrasses of the Preserve	2019	1×	Entire Preserve	Jones 2019
Biological Invasions – Buffelgrass Removal	2019-2022	1×	36 Sites	Rowe et al. 2023
Invasive Pennisetum Species Strategic Plan 2022-2027	2022	1×	Entire Preserve	City of Scottsdale and McDowell Sonoran Conservancy 2022

Other studies with no reports yet?				
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