Scottsdale's McDowell Sonoran Preserve

# Ecological Resource Plan

Developed by the
McDowell Sonoran Conservancy Field Institute
in partnership with the City of Scottsdale
and EPG (Environmental Planning Group)





CITY OF SCOTTSDALE

McDowell Sonoran Conservancy

epg

2016

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Top row, from left
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Bottom row, from left
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### The McDowell Sonoran Conservancy

The McDowell Sonoran Conservancy (MSC) champions the sustainability of the Scottsdale McDowell Sonoran Preserve (MSP) for the benefit of this and future generations. As stewards, we connect the community to the MSP through education, research, advocacy, partnerships and safe, respectful access.

### McDowell Sonoran Conservancy Field Institute

Our mission is to conduct ecological research through partnerships and citizen science for the long-term natural resource management of Scottsdale's McDowell Sonoran Preserve, to educate, and to contribute to broader scientific knowledge.

### City of Scottsdale

The City of Scottsdale owns, operates, and maintains Scottsdale's McDowell Sonoran Preserve.

### EPG (Environmental Planning Group, LLC)

EPG is an environmental planning and design firm with over 25 years' experience serving the western and midwestern United States.

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# Executive Summary

Scottsdale's McDowell Sonoran Preserve (MSP) consists of over 30,165 acres of land and is home to over 730 types of plants and animals. The MSP has been substantially secured through taxes supported by the citizens of Scottsdale and the state of Arizona. The MSP is managed by the City of Scottsdale through a unique partnership with the McDowell Sonoran Conservancy (MSC), where the City owns, operates, and maintains the MSP while the MSC provides staff and volunteers to aid the City in promoting, managing and protecting the MSP. The McDowell Sonoran Conservancy Field Institute (MSCFI), research center for the MSC, provides research, expertise and recommendations on management of natural and ecological resources.

The MSCFI developed the Ecological Resource Plan (ERP) in partnership with the City of Scottsdale and with the guidance of EPG (Environmental Planning Group, LLC). The vision for the ERP is that it will be a component of the City of Scottsdale's Resource Management Plan (RMP) to provide a scientific reference for other volumes of the RMP such as the Trails Master Plan and Cultural Resource Master Plan. Its purpose is to ensure the understanding and protection of the plants, animals, and biodiversity of the MSP in a manner that promotes long-term sustainability of those resources and restoration of degraded lands to its undisturbed condition.

The ERP uses a known baseline state to begin monitoring key resources and ecological indicators in order to detect changes that may signal concern. The ERP is based on current knowledge of the MSP gathered from previous MSCFI studies as well as other studies conducted in or around MSP lands, and publically available Geographic Information System (GIS) layers. This information was combined with expert consultation to develop a preliminary understanding of the current state, or ecological health of the MSP, and to identify information needed to develop a more complete understanding.

Based on this understanding, the primary conservation objectives of the ERP are to:

> Maintain the MSP ecosystem diversity at levels typical of species composition within Sonoran Desert upland.
>
> Maintain ecosystem functioning as indicated by robust and diverse food webs, connectivity and wildlife corridors, viable plant and animal populations, and other components necessary to long-term ecosystem health.

To develop the ERP, the MSCFI worked closely with the City of Scottsdale Preserve staff and

MSCFI Science Advisory Committee to select priority issues, define specific objectives, select indicators of environmental change, and develop evaluation thresholds for determining when changes should be further investigated or management actions should be recommended. EPG consulted on plan structure, data analysis, and public involvement. The plan was reviewed by a committee of MSC steward volunteers who provided in-depth early feedback on objectives, recommendations, and on-the-ground implications. The MSCFI held two public meetings to inform and update members of the general public about the plan and provide opportunities for feedback.

The topics addressed in this plan are:

- Flora and fauna diversity
- Sensitive species
- Species listed as "invasive"
- The wildland-urban interface
- Riparian areas
- Surface water and ground water resources
- Geology
- Soils
- Wildlife corridors

Each topic has an objective, primary indicators, and an evaluation threshold, which provides a measure of when a change in an indicator becomes a matter of concern. This is followed by a section entitled next steps, which provides guidance on determining what course of actions to recommend. Current MSCFI studies contributing to the knowledge of these resources are referenced and information needs are identified.

The current plan provides a first framework which the MSCFI and the City of Scottsdale can use to guide data collection and management activities. The ERP will be evaluated, revised, and updated as needed and sections can be added, expanded upon, or moved to other volumes of the RMP as necessary. It is our hope that the ERP will be continuously and actively used to enhance, evaluate, and improve the knowledge for management of the MSP in a way that serves as a model for public participation in science-based management.

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# CHAPTER 1: INTRODUCTION

## Overview

In 1991, the McDowell Sonoran Conservancy incorporated as a 501c3 non-profit organization, then called the McDowell Sonoran Land Trust, to rally support for preserving the lands in and around the McDowell Mountains. In 1995 and again in 2004, the citizens of Scottsdale voted to approve several taxes to provide money for the establishment and completion of the McDowell Sonoran Preserve within a 34,000-acre area, referred to as the "Recommended Study Boundary (RSB) (figure 1). The RSB is the geographic area in Scottsdale where the City can use proceeds from taxes approved by voters in 1995 and 2004 to purchase land for inclusion in the MSP to meet the purpose of the MSP as defined in Chapter 21 of the Scottsdale Revised Code, which 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.*"

Today, the roughly 30,000-acre preserve contains over 730 types of plants and animals, numerous archaeological and historical artifacts, and unique geologic features. It protects wildlife corridors that connect the Tonto National Forest with Maricopa County's McDowell Mountain Regional Park through areas that otherwise would be fragmented by various forms of urban development. As such, the City of Scottsdale's MSP is one of the largest urban preserves in the United States.

### Location and setting

#### *Physical Setting*

Scottsdale's McDowell Sonoran Preserve lies in central and northern Scottsdale, Arizona, between the Tonto National Forest to the north and the McDowell Mountain Regional Park and Fountain Hills Preserve to the east. Approximately 45 miles of the MSP's 86 mile boundary is lined with housing developments of varying density and design. The current and planned MSP lands fall entirely within the rectangular area between 33.59N to 33.82N and 111.76W to 111.93W. The MSP is at the northeastern limit of the Basin and Range Province of southern and western Arizona, near its boundary with the Central Mountain Province (Nations and Stump 1981). Elevations range from 1,690 feet southwest of the Lost Dog Wash access area to 4,059 feet at East End peak. The southern half of the MSP is composed of the McDowell Mountain range and associated pediments. The northern MSP is made up of an extensive pediment surrounding Pinnacle Peak. The pediment consists of several small hills and peaks of granite bedrock and gently-sloping washes.

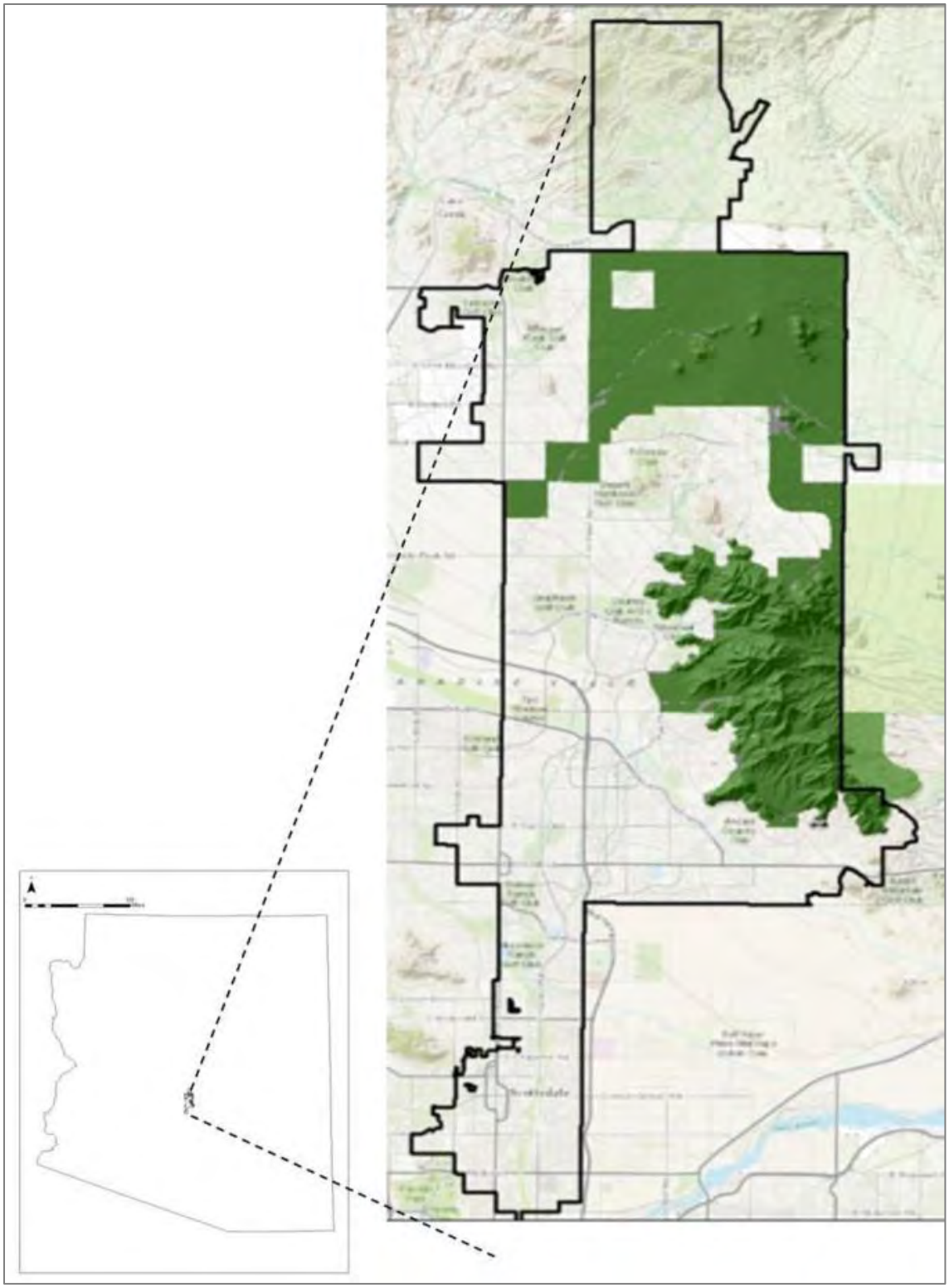

Figure 1. Location of Scottsdale's McDowell Sonoran Preserve Recommended Study Boundary in Arizona and Scottsdale.

The average precipitation between 2001 and 2012 was 8.7 inches across MSP (Jones and Hull 2014). The average yearly temperature is 71 °F, with a range between 17 °F and 118 °F, typical of the Sonoran Desert (Flood Control District of Maricopa County 2013).

***Geology***

The northern and southern MSP have related but different geology. In the southern MSP, the majority of the McDowell Mountains are composed of metamorphic rocks formed about 1.7 billion years ago, forming steep slopes with thin soils. In contrast, the northern MSP is largely composed of 1.4 billion year old coarse-grained granite that weathers readily into spheroidal blocks and coarse sand-size particles called grus. The transition between granite and metamorphic bedrock occurs along the northern flank of the McDowell Mountains. Associated soils and landscape morphology are visibly distinct.

***Water Resources***

Natural water sources are scarce in the MSP. Only one perennial stream flows from a pipe across a section of trail on the west side of the McDowell Mountains. There are two intermittent streams near Tom's Thumb and Brown's Mountain. Both support small communities of aquatic vegetation. Another small intermittent stream has been reported on the west side of Granite Mountain. This report needs to be verified. There are a total of nine wildlife water catchments in the MSP, three of which are known to be functional. In addition, several water holes left over from the cattle ranching days retain water for portions of the year, providing temporary aquatic habitat. Numerous ephemeral water sources dot the MSP and often hold water after rain.

***Biology***

Scottsdale's McDowell Sonoran Preserve falls entirely within palo verde - mixed cacti "Arizona Upland" Series of the 154.1 Sonoran desertscrub biome as described in Brown (1982). Within this, the MSCFI has classified 14 distinct plant associations. Associations are identified by their plant species composition, specifically the dominant trees, shrubs, and succulents (figure 2).

Two small areas contain relict elements of interior chaparral and/or semi-desert grassland vegetation. Interior chaparral and semi-desert grassland communities are found at higher elevations north and east of the MSP. In the southern MSP, a community present on north facing slopes of an exposure of diorite between Lookout Point and Tom's Thumb contains species commonly found in interior chaparral and semi-desert grassland communities. A small area with semi-desert grassland affinities is found near Brown's Ranch.

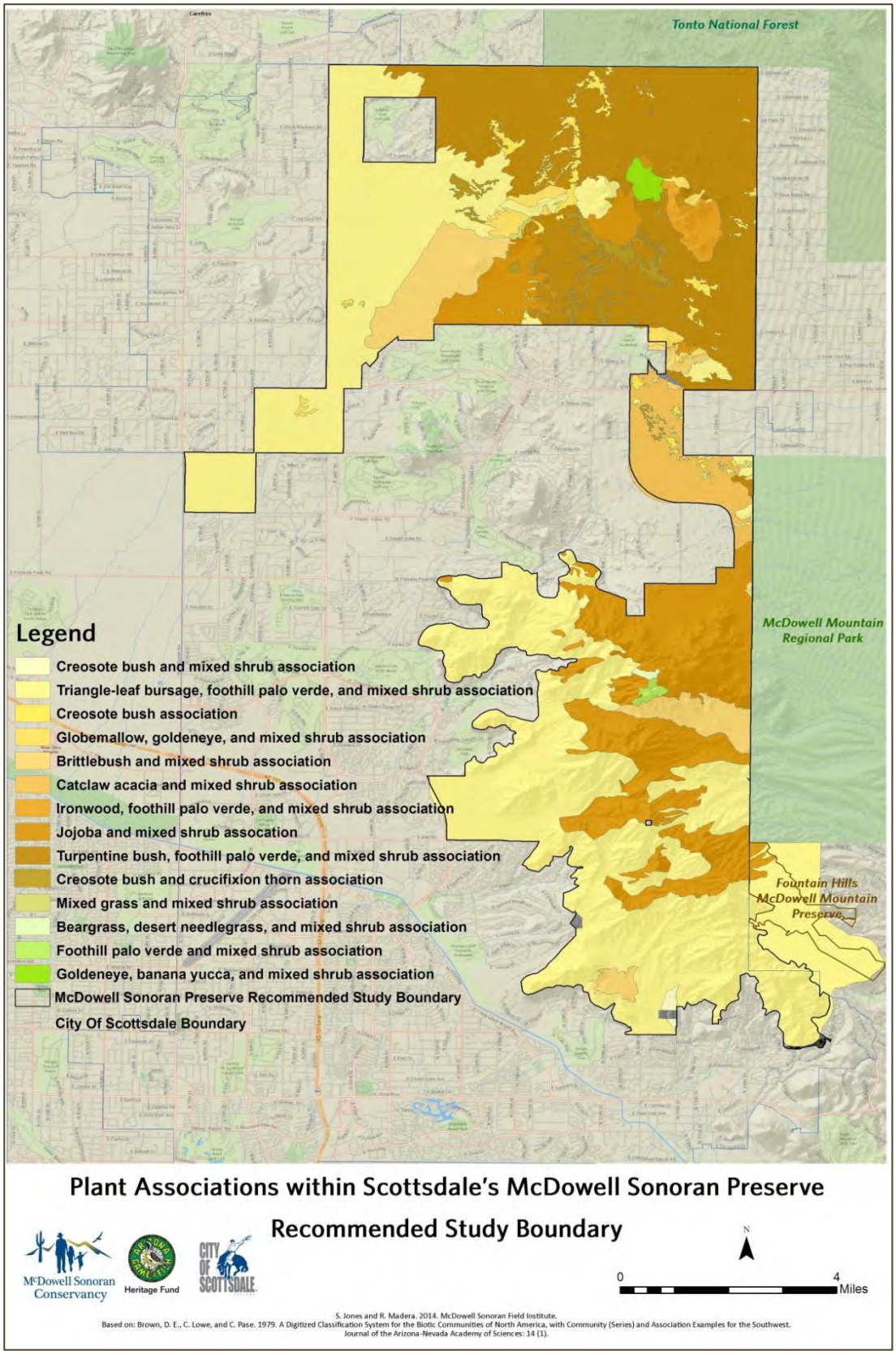


Figure 2. Plant associations in the Recommended Study Boundary of Scottsdale's McDowell Sonoran Preserve. Developed by Steve Jones and Robert Madera, 2013.

### Historical Land Use

Humans have inhabited and utilized the area within the MSP for approximately 7,000 years. The earliest humans, referred to as the Archaic people, moved in and out of the MSP area between 5,000 BCE and 500 CE. Between 600 CE and 1250-1300 CE, Hohokam culture made use of resources in the McDowell Mountains and surrounding area. While there are no known permanent habitations in the MSP, both the Archaic people and the Hohokam established many seasonal and temporary sites.

After the collapse of the Hohokam culture, Yavapai people occupied the area as hunter-gatherers (Wright 2002). They established rock shelters and temporary resource procurement and food processing sites, some of them on former Hohokam sites.

Euro-American settlement began in the 1860's. Mining and ranching were the primary draws to the area. A US Army site, Camp McDowell, was established in 1865 along the Verde River to the east of the modern MSP. After the Fort McDowell Mohave-Apache Reservation (now the Fort McDowell Yavapai Nation) was established in 1903, mining and ranching began in earnest. Dixie Mine in the eastern section of the MSP was operated as a gold and silver mine for a few years around the turn of the 20th Century as was Paradise Mine and several small exploratory mining sites.

Several ranches operated in and near what is now the MSP (Jones 2012). Edwin (E. O.) Brown operated Brown's Ranch in the northern MSP beginning as early as 1916. The Brown Ranch, known today as Brown's Ranch, continued operating primarily in the northern portion of the MSP until the 1970s. Miguel Ochoa established a ranch site in a canyon southwest of the current Tom's Thumb trailhead in 1919.

As the metropolitan area has developed, the area now known as the MSP was increasingly utilized for recreational activities. These activities have historically included hiking, rock climbing, mountain biking, horseback riding, and off-road vehicle use including jeeps, ATVs, and motorbikes. Much of the current MSP lands were previously state trust lands, where motorized vehicle use and off-trail use was permitted. As the City of Scottsdale purchased parcels of land, motorized vehicles were restricted and official trails were established. Over time, illegal motorized vehicle and off-trail use has decreased.

Human-caused fires in 1992, 1993 and 1995 are responsible for altering large areas of vegetation, if not always the species composition, of some communities. Some burned areas are in successional phases of recovery from the disturbance.

### Current Land Use

Under the MSP Ordinance, only passive recreation is permitted within MSP, which includes hiking, biking, wildlife watching, horseback riding, and rock-climbing. Hiking, biking, wildlife

watching and horseback riding are permitted on designated and posted trails, and rock-climbing is permitted within designated areas. Hunting is governed by the Arizona Game and Fish Department. Usage of the MSP is from sunrise to sunset. Any night-time activity, off-trail activity, or vehicle use must be permitted through the City of Scottsdale. Research activity requires a permit according to the MSP Ordinance and the City of Scottsdale Research Permit process (Appendix III).

The MSP Ordinance (Chapter 21) states that animals cannot be brought into the MSP and released. However, domestic dogs are permitted on the trail system as long as they are on a leash and their waste is removed from the MSP. Livestock grazing is not permitted. On a few occasions hawks have been released as part of trailhead-opening ceremonies, and bobcats, owls, and badgers have been released by city and state personnel.

Human use of the MSP has increased dramatically over the last decade. Between 2005 and 2010 alone, use of the MSP lands increased by 93% (City of Scottsdale, unpublished data). Currently the MSP receives over 600,000 visits per year (City of Scottsdale, unpublished data). Heavy use is generally concentrated on highly accessible trails near trailheads, with use decreasing with distance away from the trailheads.

The majority of users adhere to trails and designated areas. Newly acquired areas in the north portion of the MSP are still occasionally used illegally by off-highway vehicles, and the City of Scottsdale and the MSC are taking measures to discourage this.

## Purpose of Scottsdale's McDowell Sonoran Preserve

The purpose, management objectives, rules, and regulations for use and administration of the MSP are outlined in Chapter 21 of the City of Scottsdale Revised Code. The ordinance states the purpose of the MSP as follows:

a) 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 MSP 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 MSP 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.

Management Objectives (as defined in MSP Ordinance, Section 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 for its contribution to the quality of life of the community.

3) Protect historical and archeological 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 degraded lands in MSP to its undisturbed condition, including diverse plant species and natural ecological processes

### Governing structure

Scottsdale's McDowell Sonoran Preserve has been substantially secured through taxes supported by the citizens of Scottsdale and the state of Arizona. The MSP is managed by the City of Scottsdale through a unique partnership with the McDowell Sonoran Conservancy, where the City owns, operates, and maintains the MSP and the MSC provides staff and volunteers to aid the City in promoting, managing and protecting the MSP.

### Land ownership and management

The McDowell Sonoran Preserve (figure 3) is owned by the City of Scottsdale. As of 2015, the City of Scottsdale has acquired or otherwise protected over 30,000 acres for the MSP within the RSB. In most cases, the City has acquired parcels in fee simple ownership. In other cases, land within the RSB remains privately owned but is protected through a variety of means, the most common of which are conservation easements or existing land use regulations. The exact implications of some City regulations for land use are still being examined, so this category of land ownership (privately owned but protected) is approximate and subject to small future adjustments.

The MSP contains a number of easements from private landowners and the State of Arizona which protects land within the RSB but are subject to separate use regulations, according to those outlined in the individual agreements. For more information on a specific easement within the RSB, please contact the City of Scottsdale Preserve staff.

The City plans to acquire additional land within the RSB, guided by acquisition priorities recommended by the McDowell Sonoran Preserve Commission and approved by the Scottsdale city council. The next planned acquisition is approximately 415 acres in several parcels northeast of the intersection of Pima Road and Dynamite Boulevard. The 2004 tax also funds the construction of physical improvements such as trails and trailheads. The Scottsdale City Council approves initiatives related to the MSP. The McDowell Sonoran Preserve Commission is an appointed citizen advisory body that makes recommendations to the Scottsdale City Council on matters concerning the MSP.

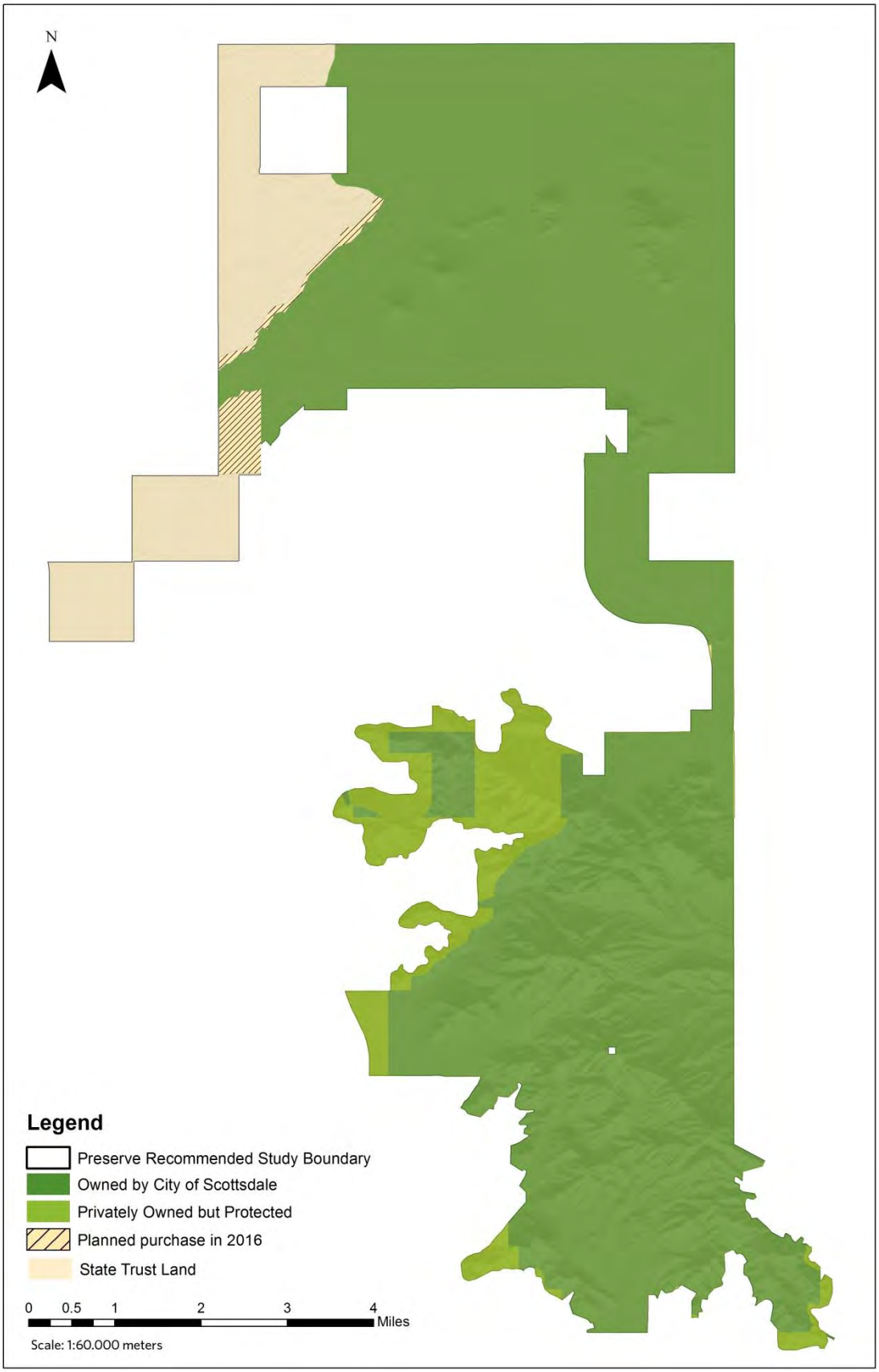


Figure 3. Ownership of land within Scottsdale's McDowell Sonoran Preserve Recommended Study Boundary, April 2015.

**Management**

The role of the City of Scottsdale is that of land owner and manager. Responsibilities include all acquisition and improvement planning and development within the MSP. Management of the MSP is carried out according to Chapter 21 of the Scottsdale Revised Code. The City is also responsible for providing all public safety services.

The McDowell Sonoran Conservancy is a non-profit organization that works in partnership with the City of Scottsdale to ensure the sustainability of the MSP for the benefit of this and future generations. The MSC has more than 600 trained volunteers supported by a small paid staff. Volunteers, called stewards, help maintain and promote the MSP by patrolling trails, repairing damaged areas, greeting and providing information to visitors, providing educational hikes and programs for all ages, building relationships with the surrounding community, providing office and technical support for the MSC staff, and aiding with scientific research.

The McDowell Sonoran Conservancy Field Institute is the research center of the McDowell Sonoran Conservancy. Its mission is to study the environment, human history, and human impacts in the MSP using trained volunteer citizen scientists who work with scientists and subject-matter experts. MSCFI uses research results for long-term resource management, for education, and to make contributions to the scientific knowledge about the natural areas comprising the MSP.

# CHAPTER 2: ORGANIZATION AND SCOPE OF ERP

The ERP organization and structure drew on numerous sources, including the Bureau of Reclamation Resource Management Plan Guidebook (2003), Pima County Monitoring Plan (RECON Environmental Inc. 2007), and a series of example plans supplied by EPG. The ERP will be a volume in the City of Scottsdale RMP, which will be composed of a Cultural Resource Master Plan, a Recreation Plan, Policies and Guidelines, Land Preservation Plan, and Public Safety Plan (figure 4). The ERP contains information and recommendations specifically relating to the natural and ecological resources of the MSP, which include flora, fauna, water, geology, and soils. In addition, questions of impact of human activity, removal of introduced plants, and restoration of damaged areas are addressed. Specific plan interactions are outlined in chapter 7, "Integration with Other Plan Volumes".


Figure 4. Resource Management Plan volumes and interactions. From Ecological Resource Plan Public Meeting, May 23, 2014.

# Purpose of the Ecological Resource Plan

The Ecological Resource Plan (ERP) builds upon current ecological, geological, and historical information collected during the baseline study period (see page x) to refine the Management Objectives from the MSP Ordinance into a plan that provides the basis for a long-term understanding of the health of the MSP and urban impact on the ecological integrity of the MSP. The ERP establishes a systematic methodology by which the MSCFI, in partnership with the City of Scottsdale, is able to monitor the ecological health of the MSP and recommend science-based management actions.

# Expert and public involvement

The ERP was developed by the MSCFI in partnership with the City of Scottsdale, and with the support of EPG (Environmental Planning Group, LLC). The McDowell Sonoran Conservancy Field Institute Science Advisory Committee (table 1), McDowell Sonoran Conservancy stewards, the McDowell Sonoran Preserve Commission, the McDowell Sonoran Conservancy Board of Directors, and members of the general public each played a role in providing valuable input at various stages in the process.

### Science Advisory Committee

The McDowell Sonoran Conservancy Field Institute Science Advisory Committee provided scientific expertise and resources to develop the topic-level plans. David Kahrs, biologist for EPG, also contributed biological expertise.

Table 1. McDowell Sonoran Conservancy Field Institute Science Advisory Committee members and affiliated organizations, 2014.

| Committee member | Organization |
|---|---|
| Curtis Herbert | Arizona Game and Fish Department |
| David E. Brown | Arizona State University School of Life Sciences |
| Helen Rowe* | Arizona State University School of Life Sciences |
| John Griffin | Environmental Planning Group |
| Julie Stromberg | Arizona State University School of Life Sciences |
| Randy Babb | Arizona Game and Fish Department |
| Ron Rutowski | Arizona State University School of Life Sciences |
| Stevan Earl | Arizona State University CAP-LTER program |
| Marc Schwartz | Environmental Planning Group |
| Walter Thurber | Arizona Field Ornithologists |
| Brian Gootee | Arizona Geological Survey |

*Hired as MSCFI Director in July 2015.

### McDowell Sonoran Conservancy Stewards

MSC stewards support MSCFI projects and were involved in the development of the ERP in the following ways:

- Drafting sections of the ERP document
- Reviewing, editing, and formatting the ERP document
- Planning and advertising public informational meetings
- Acting as small-group facilitators at the October 2014 public meeting
- Providing input for improvement of the ERP document via a steward committee

The ERP Steward Review Committee consisted of seven MSC stewards who volunteered to review the ERP document in stages and provide early input on clarity, organization, and implications of management recommendations from the perspective of individuals who use the MSP frequently and are deeply invested in its long-term sustainability. The steward committee provided in-depth reviews of four iterations of sections of the ERP document and the complete document.

### McDowell Sonoran Preserve Commission

The McDowell Sonoran Preserve Commission was updated periodically on the Ecological Resource Plan and provided with opportunities to comment and ask questions. The MSPC meetings are open to the public and provide another venue for input from the general public as well as MSPC members.

### McDowell Sonoran Conservancy Board of Directors

The McDowell Sonoran Conservancy Board of Directors was updated through the ERP development process at board meetings. The board was invited to attend public open houses and provide input. Several board members participated in the public meetings. Additionally, the board chairman was an active participant in the Ecological Resource Plan Steward Review Committee.

### Stakeholder involvement

Stakeholders include jurisdictions and organizations that manage open space adjacent to or near the MSP. Table 2 shows the participating stakeholders. This group was selected for participation due to their proximity to the MSP and shared natural resources. The group met once in August 2014 to discuss common goals, concerns, and objectives.

Table 2. Representatives from agencies, organizations, and jurisdictions adjacent to or close to Scottsdale's McDowell Sonoran Preserve.

| Jurisdiction/organization | Representative |
|---|---|
| McDowell Mountain Regional Park | Rand Hubbell, Park Supervisor *** |
| Tonto National Forest | Neil Bosworth, Forest Supervisor<br>Ed Northam, biologist |
| Fountain Hills McDowell Mountain Preserve | Steve Fleming, board co-chair |
| Desert Foothills Land Trust | Vicki Preston, Conservation Director |
| Pinnacle Peak Park | Yvonne Massman*, Park Coordinator, John Loleit, Park Coordinator** |
| Arizona Mountaineering Club | Erik Filsinger, Liaison to COS |

*Park Coordinator assistant until August 2014, Pinnacle Peak Park and MSP Natural Resource Coordinator thereafter.

**Pinnacle Peak Park Coordinator until August 2014, MSP Natural Resource Coordinator thereafter.

***Retired. Contact main office at (480) 471-0173 for current personnel.

**Public input**

Input from the public was gathered at two public meetings. The meetings consisted of an informational session on the ERP process, followed by an open house with opportunities to submit comments. The objectives of the meetings were to (1) ensure that the broader community had the opportunity to be informed about the development of the ERP and the science involved in the planning process, and (2) gather feedback from the community regarding the ERP and how resource management of the MSP is perceived. Public input was systematically collected for consideration by the developers of the ERP.

Feedback was gathered through comment cards made available at the public meetings, through an internet survey on the MSC website, and through facilitated discussion groups at the second public meeting. The surveys, along with video recordings of the first meeting and presentation materials, were made available through the website for members of the public to view and provide input for 60 days following the public meetings. The second meeting was conducted as a workshop, where feedback was collected through small-group discussion. In both cases, feedback gathered was analyzed for common themes, as well as reviewed for specific issues and ideas that would need to be addressed within the ERP. Raw data is available in Appendix IV.

The comments gathered from the steward committee, the public, and the Science Advisory Committee were carefully reviewed at multiple stages while developing the ERP. Much of the introductory material was included as a result of requests for additional background information to help readers understand the analysis. Topic-level objectives reflect many of

the concerns raised by reviewers and the general public. For example, one member of the public raised the point that restoration areas should be prioritized based on biological needs, in addition to visibility to hikers. As another example, a reviewer from the steward committee suggested that the name of the units shown in figure 8 be changed from "management units" to "preservation units" to better reflect the relationship of the MSCFI to MSP management.

## Development Process

The ERP development and revision process is illustrated in figures 5 and 6. Figure 6 shows the development, implementation, and review/revision process. The development begins with an analysis of the current information. For this version of the ERP, the current information consisted of data collected on flora and fauna surveys, locations of water resources, a map of plant associations, a map of the geology of the MSP, and a soil map from the National Resource Conservation Service (2014). Guiding principles consist of defining the purpose of the ERP, the primary conservation objectives, topic-level objectives, and baseline state to which future information will be compared. An important component of the analysis was to identify information gaps where it will be necessary to develop a better understanding of whether the MSP is in a "healthy" state.

The final part of the analysis consists of assessing whether a topic: a) is in a state that meets the objectives, b) is not in a state that meets the objectives or c) requires more information to make the determination. In the first case, monitoring the resource or an indicator of the state of the resource would be the preferable action. This would provide information on whether the goals are continuing to be met. In the second case, the next step would be to assess the cause of the disjunction between the state of the resource object and the objective, after which various actions would be weighed. In the third case, more information is sought, whether it is through monitoring, literature search, or expert consultation, in order to develop a better understanding of the resource condition.

The review/revision section shows the iterative process that the ERP will go through periodically in order to update the information and re-assess conditions, goals, and actions as more information becomes available.

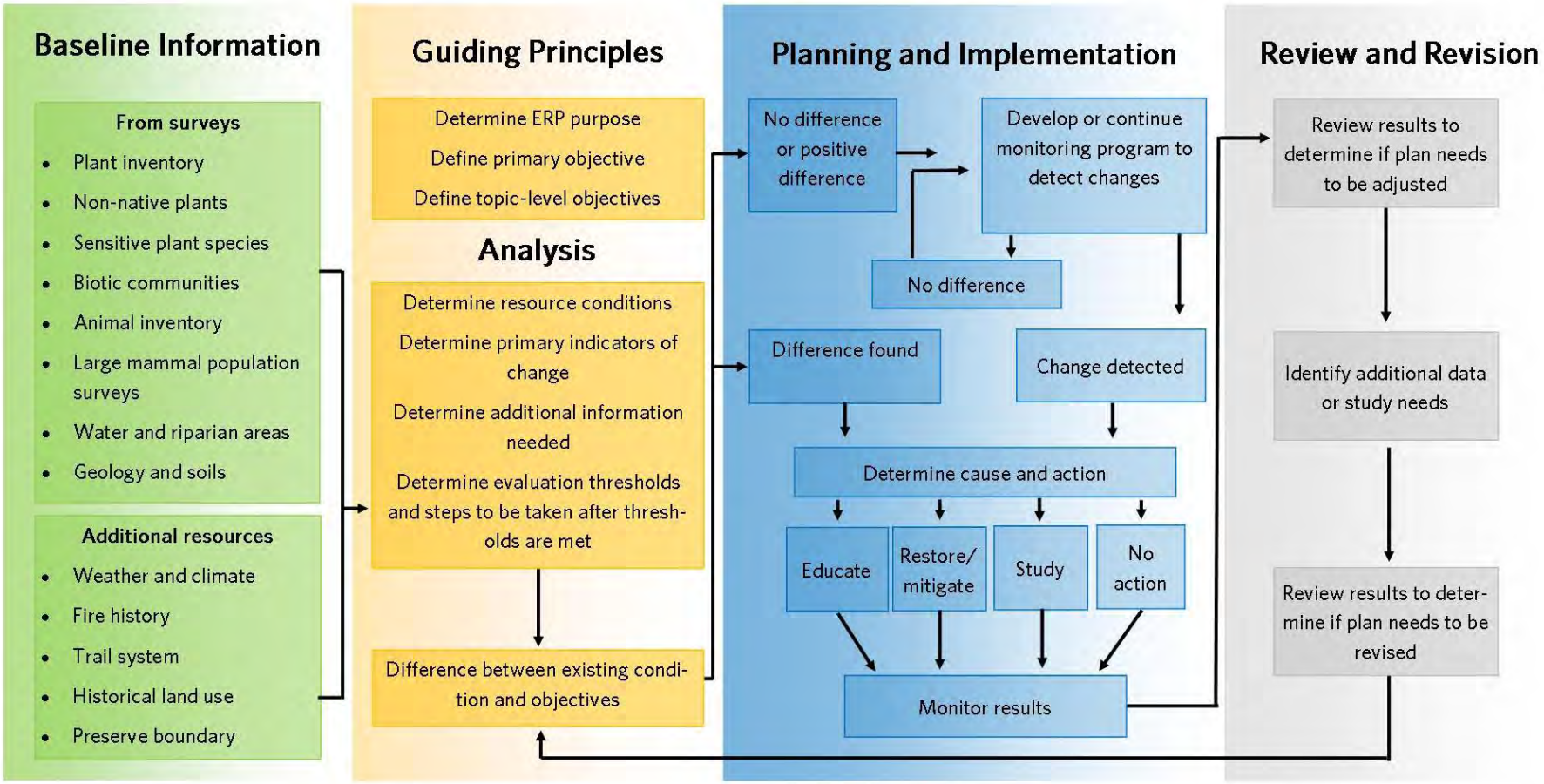


Figure 5. Ecological Resource Plan development process, revised from ERP work plan, February, 2015.

The City of Scottsdale initiated the development of a comprehensive Resource Management Plan (RMP) for the MSP. The Ecological Resource Plan comprises a major component, or volume, of the RMP. The MSC developed the ERP in a manner that is consistent with the overall RMP. Ultimately the RMP will be reviewed by the McDowell Sonoran Preserve Commission, who will recommend its acceptance or revisions to the Scottsdale City Council as part of the RMP review.

The MSCFI was responsible for developing the ERP, analyzing the baseline data, coordinating with COS, stakeholders, planning and conducting public meetings, working with the Science Advisory Committee, and drafting the ERP document itself, with guidance from EPG (Environmental Planning Group).

The Science Advisory Committee's role was to review sections of the draft ERP and provide expert input, as well as to make recommendations for management actions. In the future, members may help design monitoring or mitigation projects for areas within their specific expertise. The Science Advisory Committee has a sub-committee devoted to the development and future review of the ERP. Stakeholders, Conservancy stewards, and MSC Board of Directors also reviewed this plan and provided input before submission to the City of Scottsdale.

The plan will be reviewed and approved by the MSC Executive Director, MSCFI Science Advisory Committee, and Preserve Director. After this it will be presented to the McDowell Sonoran Preserve Commission for review, input, and recommendation for inclusion in the City of Scottsdale Resource Management Plan. As volumes of the RMP are completed, they will be presented to the City Council for consideration of approval.

The City of Scottsdale will then work to administer and implement management recommendations, such as temporary closures, building or removing structures, or enforcement activities utilizing ongoing input and recommendations from the MSCFI, supported by research and data. The MSCFI will administer and implement research projects and data collection as permitted through the City of Scottsdale scientific research permitting process (Appendix II).

For the first two years after the plan has been approved, the MSCFI will conduct an annual review and incorporate any additional data from MSCFI monitoring projects and other scientific studies in the MSP. Revisions that come through the MSC will be submitted for review by the Science Advisory Committee and MSP Director, with input from the MSP Commission. Changes may be incorporated directly into the document or the MSCFI may be requested to submit the changes for review and comment by the public. After two years the necessity for a yearly review will be re-evaluated.

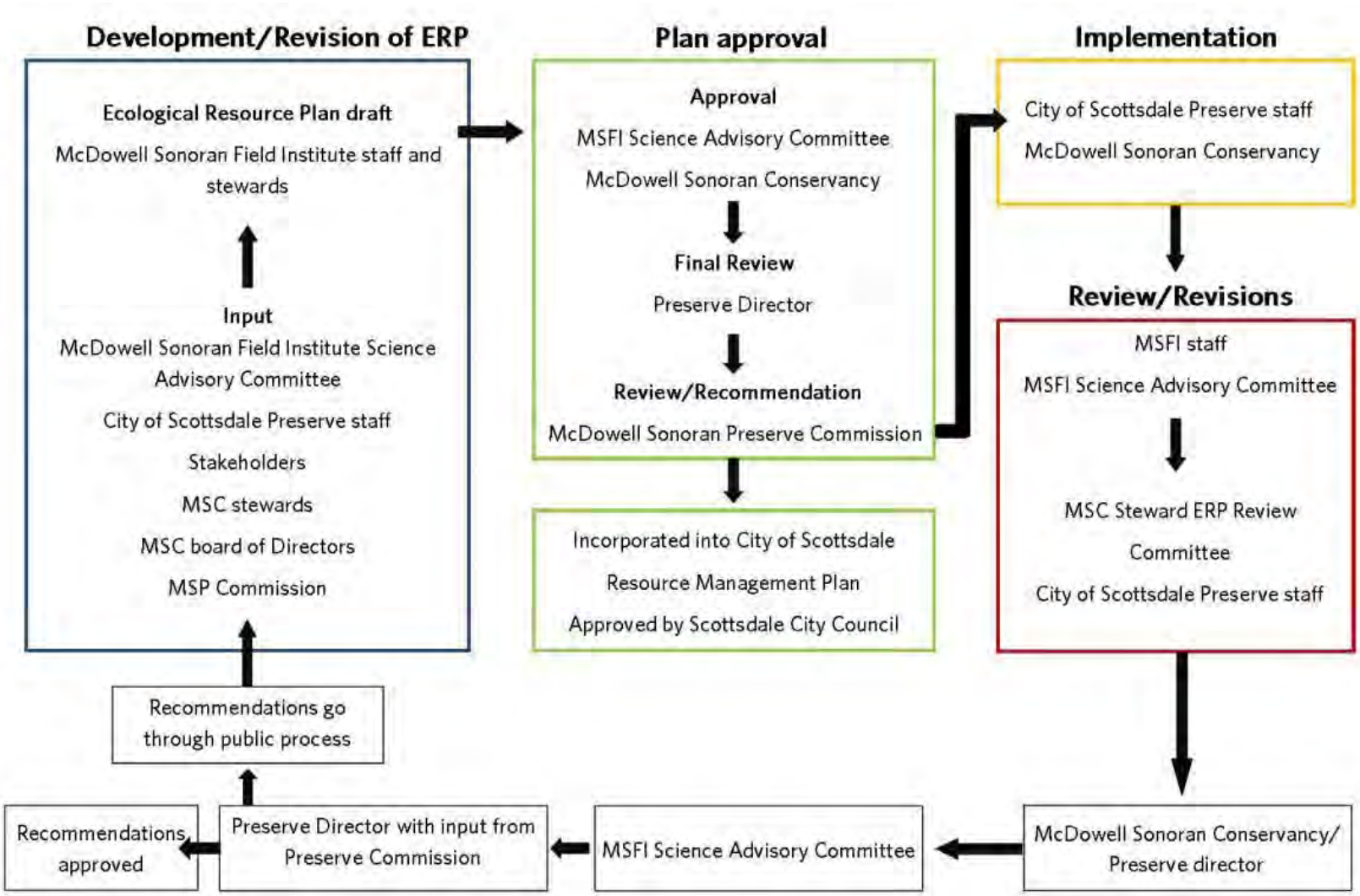


Figure 6. Management framework chart showing workflow, approval, implementation and review process for the

# CHAPTER 3: GUIDING PRINCIPLES

The Ecological Resource Plan is based on the principles of science-based inquiry and adaptive management. Science-based management means using the best available scientific information, monitoring, and documentation as the basis for decision-making. Adaptive management is a process by which data from monitoring, research, and documented, credible observations are added to the knowledge and used to re-evaluate management recommendations and actions.

The McDowell Sonoran Preserve Ordinance No. 3321 (Scottsdale's Revised Code Chapter 21) provides overall guiding principles for MSP management and the foundation for determining the broad scope and focus of the Ecological Resource Plan. The MSP Ordinance is a general document that provides direction on such items as recreation, facilities, and broad ecological goals. The current City of Scottsdale plans, such as the Access Areas Report and the Trail Plan, address portions of the MSP Ordinance. The Ecological Resource Plan addresses those portions relating to the natural resources of the MSP. Those portions are underlined in the following excerpt from the MSP Ordinance.

## Purpose and Priorities of the MSP

The purpose and priorities are as defined in Scottsdale's McDowell Sonoran Preserve ("Preserve") Ordinance No. 3321, (Scottsdale's Revised Code Chapter 21).

**Purpose of MSP**

a) 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.

**Management Objectives (as defined in MSP Ordinance)**

1) Preserve the local plants, wildlife and natural resources to maintain the biological diversity and long-term sustainability of the area's ecology.

2) Restore degraded habitat of the MSP to its undisturbed condition, including diverse plant species and natural ecological processes.

The underlined portions of the MSP Ordinance provide the general guidelines and focus for the Ecological Resource Plan, as stated in the Purpose of the ERP. The primary conservation objectives and all topic-level objectives provide increasing levels of specification and definition, which lead to measurable indicators, evaluation thresholds, and additional steps leading to studies, monitoring, or recommended management decisions. The process is designed to go from general to specific with clear links back to the guiding principles. The next step is to define the purpose of the ERP to clarify its role in relation to other volumes of the RMP.

### Baseline and reference state

In order to begin setting objectives and measuring the condition of the MSP, there must be a state to which the current data is compared in order to determine whether objectives are being met. Words and terms in bold are either defined or referred to in the Glossary section (p. 137).

A ***reference state*** is defined for ERP purposes as the state to which MSP resources will be compared for the purposes of future management. A baseline state can be used as a reference state for managing natural resources. Using a baseline state as a reference state allows managers to measure how resources may be changing and to determine specific resources or locations that may require focused monitoring or rehabilitation. In the case of the MSP, the baseline state, as defined by the flora and fauna survey as well as geologic and plant association mapping, will be used this way. For example, 379 types of plants were documented in the MSP during the surveys. This level of plant diversity was slightly greater than that of comparable areas of upper Sonoran Desert habitat in the vicinity and can be considered adequate to maintain a functioning ecosystem. Therefore it makes a good reference for management.

The ***baseline state*** is the state at which a resource is inventoried or described. In the case of the MSP, the baseline state includes the flora, fauna, geology, plant associations, and habitat features which were documented as part of the MSCFI surveys between 2011 and 2013. The baseline state is documented in *The Flora and Fauna of Scottsdale's McDowell Sonoran Preserve* (McDowell Sonoran Conservancy 2014), the geologic compilation map of Scottsdale's McDowell Sonoran Preserve and Vicinity (Gootee and Day 2013), and the plant association map (Jones and Medara 2014). Although there is an extensive history of human impact on the Preserve lands through grazing, vehicular impacts, mining and other uses, choosing the inventoried state as the baseline will allow researchers to measure change against a known state.

Although the baseline serves as the reference state for management, this is not to imply that

the MSP be managed to conform to a permanent, static state. Ecosystems are constantly in flux due to year-by-year weather conditions, population cycles of ***keystone species***, long-term climate change, ***plant community succession***, and other factors. By monitoring changes in the baseline state and ***ecological indicators***, managers can pinpoint changes that are within reasonable limits versus changes that could be detrimental to the sustainability of the MSP. Additionally, the MSP Ordinance management objectives state that ***degraded*** lands should be rehabilitated to their ***undisturbed condition***.

***Degraded lands*** *in the MSP* are largely due to vehicular impact and unauthorized use, and exhibit a combination of at least three of the following characteristics:

1. Largely absent of plant material
2. Compacted soil as compared to control for undisturbed condition
3. Erosion that is greater than surrounding areas
4. Absence of topsoil

Using the baseline state as a reference state, the definition of ***undisturbed condition*** is "plant and animal composition and diversity comparable to surrounding area within the same plant association".

# CHAPTER 4: METHODS AND ANALYSIS

# Baseline information

The baseline data collected during the flora and fauna surveys was used to analyze the current condition of the ecological resources and identify additional information needed to assess the health and functioning of the MSP ecosystem. In addition, data collected from the City of Scottsdale, publicly available sources, and additional MSCFI projects were incorporated into the data set.

**Flora and fauna surveys**

Between January 2011 and November 2013, the MSCFI completed an inventory of the biological resources of the MSP. This inventory resulted in lists of plants and animals documented during that three-year period (McDowell Sonoran Conservancy 2014). In addition, the MSCFI produced a digitized map of the MSP's major plant associations (Jones and Madera 2014) and a compilation map of the known geological features of the MSP (Gootee et al. 2013). This information provides a baseline data set for the ERP and for subsequent monitoring and study.

McDowell Sonoran Conservancy Field Institute staff coordinated with scientific partners at Arizona State University, Scottsdale Community College, the Desert Botanical Garden, the Arizona Game and Fish Department, the Arizona Field Ornithologists, North American Field Herping Association, and the Arizona Geological Survey to complete the baseline inventory. Scientists and subject-matter experts from these organizations acted as principal investigators for specific aspects of the surveys. They oversaw volunteer training, developed protocol, and created material for education and publication. The effort was coordinated by an MSCFI staff person hired specifically to oversee these activities, and the field data collection was carried out largely by volunteers.

The baseline data set includes the following resource categories:

1. Flora
    a. Flora inventory
    b. Invasive plant species and locations
    c. Rare and endangered plant species and locations

    d. Map of plant associations

2. Fauna
    a. Large-mammal population estimates (from aerial surveys)
    b. Small-mammal  inventory
    c. Reptile and amphibian (herp) inventory
    d. Bird inventory
    e. Preliminary invertebrate inventory
    f. Sensitive animal species
    g. Non-native animal species
3. Bedrock geology and soils
4. Water sources
5. Fire history and locations
6. Wildland-urban interface areas
7. Trails, official and unofficial

**Analysis**

A preliminary analysis was conducted using the baseline information, flora and fauna lists for nearby areas (when available), and expert observation from the MSCFI principal investigators to determine whether the flora and fauna present in the MSP were comparable in diversity and composition to those of surrounding natural Sonoran Desert upland areas. A preliminary list of sensitive species was developed first using global – state (G-S) sensitivity rankings obtained from the Arizona Game and Fish Department Heritage Database. All species considered sensitive in the United States and/or State of Arizona were included on this list. In addition, the MSCFI Science Advisory Committee was asked to provide additional species for consideration.

Current state of the resource (health)

a. Diversity and species composition as compared to surrounding Sonoran Desert Upland areas

    i. Using expert observation and comparison of MSP and other species lists as available

b. Population estimates for large mammal species

    i. Using Arizona Game and Fish Department helicopter surveys

c. Sensitive species

    i. Using MSP species list and G-S species sensitivity rankings

    ii. Expert recommendations for additional species.

2. Additional data needed to determine the state of the resource

The following were developed to aid in filling information gaps, developing research, and determining appropriate courses of action.

3. Primary indicators – indicators of ecological change that can be monitored over time

4. Evaluation thresholds – thresholds at which change in an indicator becomes a cause for concern

5. Next steps – course of action once evaluation thresholds are reached. This may be a call for investigation into the cause of change, the initiation of a more focused study, or a management recommendation.

Figure 7 on the following page provides an illustration of the process.

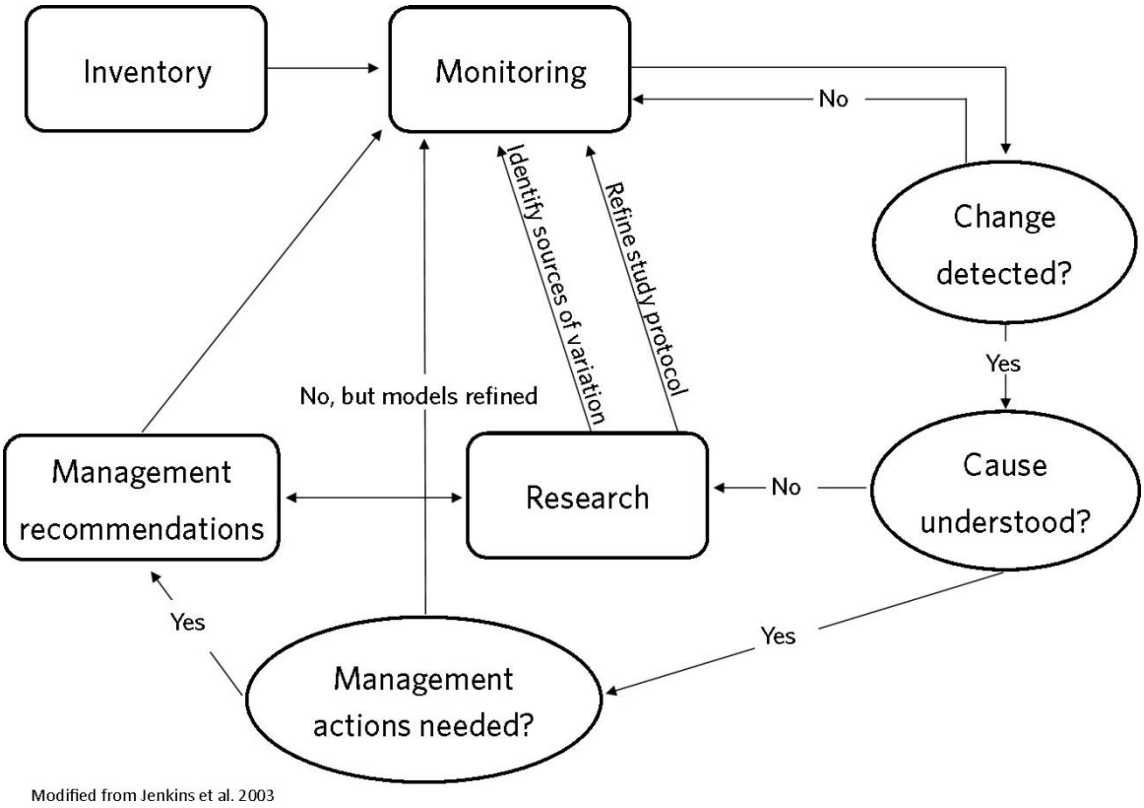


Figure 7. Illustration of research and decision making process for Ecological Resource Plan for Scottsdale's McDowell Sonoran Preserve, 2015. Adapted and modified from Jenkins et al. 2003 and RECON Environmental Inc. 2007.

# ECOSYSTEM CHANGE AND MANAGEMENT CHALLENGES

All natural systems are inherently dynamic. They change constantly at all scales from microscopic to continental and over all time periods from hours to geologic epoch. The Sonoran Desert is no exception. Although vegetation changes may occur more slowly in arid environments, they continue to be in a state of flux.

Human-induced changes can have an unusual combination of scale and speed. For example, human activities appear to be causing global climate changes over decades that previously took centuries or millennia to occur. The extent to which human-induced changes will alter the environment is unknown.

In Scottsdale's McDowell Sonoran Preserve, changes are likely to occur due to a number of

human and non-human factors. Some of these changes will result in challenges to managing the MSP. Regardless, it is important to understand the sources of these changes and consider various implications when making specific management recommendations.

Some of the changes in types of use will likely bring about vegetation and animal community changes in the decades and centuries to come. For example, vegetation understory in the northern portion of the MSP near Brown's Ranch is dominated by subshrubs such as turpentine bush (*Ericameria laricifolia*) and broom snake-weed (*Gutierrezia sarothrae*) due to heavy grazing in the 1930s and 1940s. With the release of grazing pressure and the soil disturbance associated with it, there may be a shift back to a more grass-dominated ecosystem.

The increase in use of MSP trails, the proximity of the MSP to the greater Phoenix urban core, and the potential for continued development around MSP boundaries present a number of ecological challenges.

**Habitat Fragmentation**

Although the MSP is over 30,000 contiguous acres and shares common borders with both the McDowell Mountain Regional Park and the Tonto National Forest, it is exposed to several fragmentation risks.

The north and south areas of the MSP are connected through a segment only 0.75 miles (about 3,937 feet) wide. The land on either side of this connector is beginning to be developed as large-lot residential. Development is expected to accelerate in coming years and the area is subject to possible up-zoning to denser residential or other uses. Note that the narrowest portion of the MSP itself is 0.25 miles (1,312 feet) wide, but in this area MSP land is contiguous with the McDowell Mountain Regional Park so the actual open space corridor is much wider.

Dynamite Boulevard, which becomes Rio Verde Drive east of Alma School Road, separates the large, continuous block of the northern area of the MSP from what is referred to as "the gooseneck", or the narrow, connecting segment of the MSP. Dynamite currently is a two-lane undivided highway with a speed limit of 50 mph. In 2012, the traffic count on Dynamite Boulevard averaged 8500 cars per day (Grandmaison 2012). This is expected to increase as the area is developed. The impact of this road across and alongside the MSP on habitat continuity is a matter of concern. In 2012, the City of Scottsdale contracted with the Arizona Game and Fish Department Contracts Branch to conduct a study on wildlife mortality hotspots along Dynamite Boulevard in order to assess the severity of wildlife risk that Dynamite Boulevard presents (Grandmaison 2012). The MSP is bordered by frontage roads

such as 136th Street and Thompson Peak Parkway; however, Dynamite Boulevard is the only major street that separates segments of the MSP.

There is additional land within the MSP Recommended Study Boundary that currently is owned by the Arizona State Land Department. Two parcels of approximately 640 acres (about 260 hectares) each within this area could be acquired for the MSP in the future (figure 3). The two parcels are connected only at a corner through a 50 meter easement, and the two parcels are connected to the main MSP area through a 0.25 mile (400 meter) connector. The surrounding areas are developed.

Finally, the entire MSP perimeter except for the common borders with the Regional Park and the National Forest is adjoining predominantly single family residential or retail development. The impact of increasing development along the MSP perimeter on habitat fragmentation is unknown at this time.

### Use of Scottsdale's McDowell Sonoran Preserve

By the end of 2016, about 180 miles of trails will be open for public non-motorized use in the MSP. Eleven major and minor trailheads directly access the MSP, and several additional ones provide indirect access. Total visits to the MSP for 2014 were estimated at roughly 600,000 and this is expected to increase (City of Scottsdale 2014).

The City of Scottsdale has followed a plan to disperse use by regularly opening new trails and new trailheads. By the end of 2017-2018, almost all planned trails will be open. Master planning is in progress to review phase 2 improvements for two access areas that currently provide parking only, and if land northeast of the Pima Road and Dynamite Road intersection is acquired, a major trailhead will be completed.

Current usage levels and patterns may strain existing trailhead, and should be monitored and evaluated for potential impacts on habitat. The ultimate carrying capacity of MSP trails – the limit, if any, of usage on existing facilities beyond which habitat impact becomes detectable and accelerates or the visitor experiences are degraded – also is unknown. The potential impacts on MSP habitat is a matter of question. Activities conducted under the auspices of the ERP will measure the impact of MSP use and determine what, if any, actions may be required to manage possible impact.

### Groundwater Drawdown

More information is needed on groundwater and water use in the area, and potential effects on vegetation and habitat of the MSP. Any available information on this topic will be gathered in discussions with the City of Scottsdale Water Resources Department and will be included

in a subsequent version of the ERP.

### Pollution

Prevailing winds in the general MSP area come from the west to southwest for much of the year (Western Regional Climate Center 2015). This means that airflow over the MSP comes from developed and industrialized areas of the Phoenix metropolitan area. Also, as areas near the MSP (especially in the north area) continue to develop, there will likely be more pollution. Currently there is no pollution monitoring equipment in the MSP, so the historical and current effects of pollution on the habitat are not known.

### Introduced species

Plant and animal species introduced from one ecosystem to another have widely varying effects, ranging from minor alterations in species composition to large-scale changes in species composition, abundance, and density. Depending upon the species and the ecological conditions, these changes may impact other resources such as fire-prone areas or sensitive species. In other cases, removal of introduced species can have unintended consequences. The types of changes and duration of changes to the ecosystem created by species introductions and removals need to be carefully considered before developing management plans.

As an urban preserve, the MSP is susceptible to species introductions from surrounding neighborhoods and roadways. The proximity to urban landscaping and ease of public access provides opportunity for species introductions through human dispersal on clothing and gear, or direct introductions through release of animals.

### Climate Change

Although current models do not accurately forecast the impact of large-scale climate change on small areas, the local climate is widely expected to become generally hotter and drier (CLIMAS 2015). In addition to possible effects on groundwater and surface water, other significant habitat impacts are possible.

The MSP provides a "vertical" environment, with elevation ranges in the southern area from about 1700 to 4100 feet and in the northern area from about 2500 to 3500 feet. Since temperature decreases with elevation and rainfall may increase as a result of orographic lift, this vertical relief provides some opportunity for vertical migration as species seek to mitigate the effects of a hotter, drier prevailing climate.

However, the available land area decreases as elevation increases, and the mountains and

hills in the MSP are isolated in small ranges or singular features. As a result, the opportunities for migration are severely limited, especially for species with limited mobility or inability to spread seeds widely. Furthermore, some species that already are at the edge of their range like relict chaparral species (e.g., juniper) or those currently found only at higher elevations in the MSP may have no natural refuge from changing conditions.

## Current state

The flora and fauna studies were led by principal investigators who were experienced scientists or established subject-matter experts in their fields (table 3). Based on personal observations made during the study, review of the MSP species lists, and knowledge of species composition in comparable areas, the MSCFI flora and fauna principal investigators determined that the flora and fauna diversity (as defined by the number of taxa) and composition of the MSP are consistent with those of surrounding natural areas. Additionally, the multiple trophic levels present indicate a robust food web. Using the mammal group as an example, the MSP is home to a large carnivore (mountain lion), a meso-carnivore (bobcat), medium-sized omnivores (coyote, fox), and large and small herbivores (deer, javelina, desert cottontail, black-tailed jackrabbit, seven species of small rodent). The consensus of the principal investigators was that the MSP was in a generally healthy condition, given the historical use and proximity to an urban area.

Table 3. Principal Investigators for the flora and fauna surveys of Scottsdale's McDowell Sonoran Preserve.

| Survey | Principal Investigator | Partner Organization |
|---|---|---|
| Flora | Steve Jones | Independent botanist |
| Ground-dwelling arthropods | Stevan Earl | Arizona State University, Central Arizona-Phoenix Long-Term Ecological Research (CAP-LTER) |
| Large, day-flying insects | Ron Rutowski | Arizona State University School of Life Sciences (SOLS) |
| Reptiles and amphibians | Dave Weber | North American Field Herping Association |
| Birds | Walter Thurber | Arizona Field Ornithologists |
| Small mammals | Russ Haughey | Scottsdale Community College Center for Native and Urban Wildlife (CNUW) |
| Large mammals | Curtis Herbert | Arizona Game and Fish Department |
| Fauna oversight | Randy Babb | Arizona Game and Fish Department |

As described in Chapter 3, however, historical use of the lands now within MSP has left visible changes in the plant community, and the location and use of the MSP presents a number of ecosystem challenges. The map below (figure 8) shows the MSP divided into what

are termed ***Preservation Units.*** Preservation units are areas of land with similarities in plant associations, bedrock geology, slope, aspect, and drainage patterns. Dividing the MSP into preservation units helps to pinpoint different resources and challenges so that management can be tailored to the unique aspects of that location.

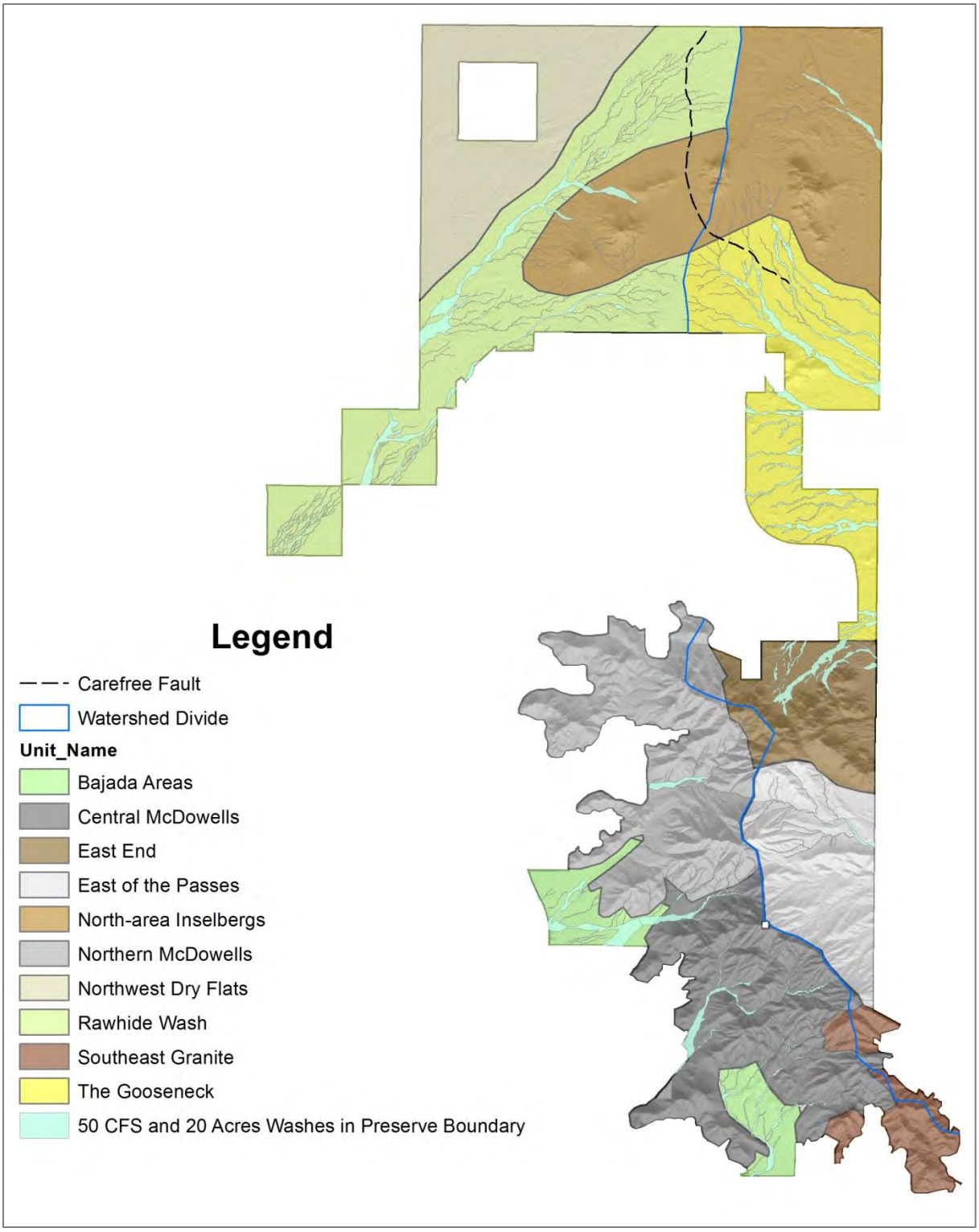


Figure 8. Preservation units (noted in the legend above) for Scottsdale's McDowell Sonoran Preserve Recommended Study Boundary.

Ten preservation units were identified in the MSP Recommended Study Boundary based on the following criteria:

- Average slope
- Drainages and drainage patterns
- Dominant plant associations
- Bedrock geology

Table 4 summarizes the major characteristics of each preservation unit.

Table 4. Physical characteristics of Scottsdale's McDowell Sonoran Preserve Preservation Units within the Recommended Study Boundary.

| Preservation Unit | Description |
|---|---|
| 1. Northwest Dry Flats | Characterized by level alluvium and granite pediment without major drainages; tree-dominated plant associations. |
| 2. Rawhide Wash | Characterized by a major, extended wash draining to the southwest, running through alluvium and granite pediment; mostly tree-dominated plant associations. |
| 3. North-area Inselbergs | Characterized by isolated granitic and volcanic foothills and small mountains rising from pediment; tree- and shrub-dominated with some creosote-dominated areas. |
| 4. The Gooseneck | Characterized by moderate washes draining east/southeast through alluvium and pediment; tree- and shrub-dominated. Includes the narrow connector between the northern and southern MSP areas. |
| 5. East End | Characterized by steep, boulder-strewn granite slopes, including the highest elevations in the MSP; mostly shrub-dominated plant associations with some relict grassland. |
| 6. East of the Passes | Characterized by rugged metamorphic mountains with exposed rock faces; shrub- and tree-dominated. Lies east of the major passes over the McDowell Mountains. |
| 7. Northern McDowells | Characterized by rugged metamorphic mountains with exposed rock faces; tree-dominated. Lies west of the major passes over the McDowell Mountains. |

| | |
|---|---|
| 8. Central McDowells | Characterized by rugged metamorphic mountains with exposed rock faces; generally tree-dominated. Lies south and west of the crestline of the mountains, with a large amphitheater opening to the south. |
| 9. Bajada Areas | Characterized by large alluvium-filled bajada areas traversed by major drainages from metamorphic mountains; mostly tree-dominated plant associations. |
| 10. Southeast Granite | Characterized by steep, boulder-strewn granitic foothills; tree-dominated without major drainages. |

These units already have been useful in delineating areas that have generally consistent characteristics for research projects. For example, each of the research transect groups for the Trail Impact Study lies almost entirely within a single preservation unit. Each unit also presents challenges and opportunities that are summarized below. Each of these preservation units has unique characteristics, challenges, and opportunities for possible future research or for continuing previous or current work.

1. Northwest Dry Flats

   Challenges

- This unit surrounds a residential development and two of three exterior sides are adjacent to developed areas, one across a major arterial road.
- Two access roads to the interior development cross the unit.
- The southeastern boundary is close to high voltage power lines.

  Opportunities

- The interior and exterior developments consider proximity to open space a major benefit. Homeowners and HOAs in these areas may be supportive of study, protect, and enhance the interface areas.

2. Rawhide Wash

   Challenges

- Development of a major access area in the southwest portion, which could increase recreational use of this area.

- High voltage power lines, with associated access roads and equipment sheds, run the entire length of the unit.

   Opportunities

- This unit is the major riparian corridor in the northern MSP.

- It is a unique location to study the effects of environmental stressors like narrow corridors, vehicular traffic inside the MSP, and even the possible effects of high voltage lines on biota.

- If a new public access area opens, the impact of increased recreational use could be studied.

3. North-area Inselbergs

   Challenges

- The northeastern portion of this unit is adjacent to a main Tonto National Forest access area. The Forest allows motorized use.

- The eastern boundary is adjacent to residential development with many neighborhood access points.

- Historically, this area was the center of large-scale ranching operations. The effects of grazing can be seen throughout the area.

   Opportunities

- The northern boundary presents an opportunity to study the interface between two open-space areas, one with motorized use and one without.

- There is relict vegetation, such as chaparral and grassland associations, on some of the higher peaks.

- There are unique vegetative associations on the northern slopes.
- The eastern boundary offers the opportunity to study neighborhood access issues.
- Elevation changes within the unit of up to 300 meters could be used to explore phenology, or species range changes over time.
- Ranching ended almost 50 years ago, making portions of the area useful to study long-term unmanaged remediation.
- The Center for Native and Urban Wildlife at Scottsdale Community College did some research in restoring vegetation in the ranch headquarters area and along the nearby major wash area. This research could be continued or extended.

4. The Gooseneck

   Challenges

- This unit contains the narrow connector between the northern and southern MSP. The connector is bisected by a major arterial road.
- Much of the eastern and western boundary of this unit either is or will be developed as residential subdivisions.
- The area is crossed by several abandoned dirt roads that serve as multi-use trails.
- Fire in this area has significantly changed the vegetative communities.

Opportunities

- The future development of currently undeveloped areas around this unit provides an opportunity to study the cumulative effects of nearby urbanization over time.

- Some work on wildlife mobility across the arterial street was already done by the Arizona Game and Fish Department. This research could be continued or extended.

- Restoration work was already done in this area. The results of previous or alternative restoration approaches could be studied here.

- A portion of this unit is contiguous with McDowell Mountain Regional Park, which also allows only non-motorized multi-use of its trails. Research across or along the border is possible, as well as work comparing this boundary with that adjacent to the Tonto National Forest in the northern MSP.

5. East End

   Challenges

- This unit contains some abandoned or blocked jeep roads.

- There are many active climbing areas in this unit, some near known or suspected raptor nesting sites.

- This unit includes the second largest landslide known in Arizona, and there is evidence of other, smaller rock falls.

   Opportunities

- Previous and alternative restoration approaches could be studied here.

- The impact of climbing use and seasonal closures on raptor nesting behavior could be studied.

- The 400 meter elevation differences within the unit provide

opportunities for studying phenology and species range movement.

- The landslide area offers opportunities for further study of a unique phenomenon.
- There are existing research transects for the continuing Trail Impact Study in this unit. These transects can be used for other purposes.
- The eastern boundary of this unit is contiguous with McDowell Mountain Regional Park, which also allows only non-motorized multi-use of its trails. Research across or along the border is possible, as well as work comparing this boundary with that adjacent to the Tonto National Forest in the northern MSP.

6. East of the Passes

Challenges

- The area housed historic ranching operations. Remnants are accessible via obvious off-trail routes.
- The area has one significant historic mine and several abandoned mining prospects.
- Future opening of a new access area in the adjacent Fountain Hills McDowell Mountain Preserve could increase recreational usage.

Opportunities

- The ranching area and the mining sites provide opportunities to study unmanaged remediation.
- This seldom-visited area provides an opportunity to study the impact of human use as access increases.
- There is a very large constructed water catchment in this area, the only one in the southern MSP that is used actively by wildlife.
- The eastern border contains the only cottonwood-willow forest area in the MSP, one of the most ecologically rich washes surveyed so far.
- The entire eastern boundary of this unit is contiguous with McDowell

Mountain Regional Park, which also allows only non-motorized multi-use of its trails. Research across or along the border is possible, as well as work comparing this boundary with that adjacent to the Tonto National Forest in the northern MSP.

7. Northern McDowells

Challenges

- The western boundary area is developed, and the northern boundary will develop over time.
- This unit houses the only permanent spring in the McDowell Mountains. The spring crosses a trail and the spring source is easily accessible off-trail.
- The central and southern portions of this unit are among the most heavily used areas in the MSP.

Opportunities

- The spring and its source contain vegetation unique in the MSP and are used extensively by wildlife, some of which are found in only a few places in the MSP.
- Elevation changes of more than 500 meters provide opportunities for phenology or species range movement studies.
- There are existing research transects for the continuing Trail Impact Study in this unit. These transects can be used for other purposes.
- Urban interface studies could be conducted along the western boundary. One of the largest neighboring developments has been very supportive of past conservation and research efforts.

8. Central McDowells

Challenges

- The western boundary of this unit is developed.

- Much of this rugged area was purchased recently from the Arizona State Land Department. Trails are planned that will open more of the interior area for recreational use.

Opportunities

- Urban interface studies could be conducted along the western boundary.
- This area presents an opportunity to view the impact of human use in an area that previously had no trails.
- Elevation changes of more than 500 meters provide opportunities for phenology or species range movement studies.

9. Bajada Areas

Challenges

- These are currently among the most heavily used areas of the MSP.
- Part of the boundary of the northern bajada area is developed for office and commercial use as well as residential use.
- The areas are defined by major drainages from the mountains.
- There are some known archeological sites in these units.

Opportunities

- Bajada areas contain a unique mix of vegetation.
- Washes in the southern bajada area contain a high level of reptile and amphibian activity, including prime habitat for Sonoran desert tortoise and potential rattlesnake birthing dens.
- The southern bajada unit was the first area in the MSP opened for recreational use. It provides an opportunity to study the overall long-term impact of human use.
- The mixture of development types along part of the northern bajada

area boundary would allow study of possible differential effects of commercial and residential development.

10. Southeast Granite

Challenges

- The southern boundary of this unit is developed.
- Part of the eastern boundary is contiguous with the Fountain Hills McDowell Mountain Preserve. Use of this portion of the Fountain Hills preserve will increase as access to it is improved over time.

Opportunities

- Almost 400 meters of elevation change provides an opportunity for phenology research.
- The shared boundary with the Fountain Hills preserve allows for along or cross-border research.
- As access to and therefore use of the adjacent Fountain Hills preserve increases, possible effects in the MSP could be studied.

# CHAPTER 5: TOPIC-LEVEL PLANS

The ecological resources are divided into topics which are addressed separately. The purpose is to move from the more general primary conservation objectives to specific courses of action for each resource based on the available information in a way that is transparent and can be replicated. For a summary of current studies, studies needed, and current management recommendations based on topic-level plans, see Table 9 in Chapter 7, "Implementation".

### Primary conservation objectives

Using the baseline state as a reference, the primary conservation objectives were developed. These are as follows:

Maintain MSP ecosystem diversity at current levels or above and species composition typical of Sonoran Desert upland. Maintain ecosystem functioning as indicated by robust and diverse food webs, connectivity and wildlife corridors, viable plant and animal populations, and other components necessary to long-term ecosystem health.

### Definitions and structure

In cases where multiple indicators exist for the same objective, lower-case letters are used to link corresponding indicators, thresholds, and next steps.

**Objectives – Long-term objectives for specific topic areas.**

| | |
|---|---|
| Current state of resource | Evaluation of health of the resource according to an assessment of flora and fauna survey results. This evaluation may change as more information is gathered. |
| Primary indicators | The most important indicator(s) of change of the resource. More specific indicators may be selected within specific studies. |
| Evaluation thresholds | The amount of change in a measured indicator that will trigger further investigation or action. Evaluation thresholds in this portion of the plan are general, as each study will have its own statistical tests or methods of evaluating change. More specific evaluation thresholds will be developed per study. |

| | |
|---|---|
| Next steps | Determine the cause for a change in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

What information does the MSCFI currently have on the state of this resource, either through literature searches or through MSCFI studies?

*Additional information needs*

What additional information does the MSCFI require in order to evaluate the current state of the resource and to monitor the primary indicators?

*Monitoring*

What monitoring or studies are currently in place to address these questions?

# FLORA

**Objective 1: Flora diversity is at baseline or higher levels.**

| | |
|---|---|
| Current state of resource | Species diversity is at levels comparable to similar Sonoran Upland areas. Functional type diversity unknown. |
| Primary indicators | Change in biodiversity, functional type diversity |
| Evaluation thresholds | Decrease in species or functional type diversity below what would be expected due to uncontrollable variables such as temperature and precipitation changes. |
| Next steps | Determine the cause for a decrease in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

The flora portions of the MSCFI flora and fauna survey provided baseline information about flora species richness, as determined by number of species present (McDowell Sonoran Conservancy 2014, Jones and Hull, 2014).

*Additional information needs*

Species diversity, as determined by the number of species, abundance of species, and dominance of species, is needed. Additionally, an evaluation of the functional groups and their diversity is needed.

*Monitoring*

As of 2015 there are no monitoring programs or studies to specifically address these questions.

**Objective 2: Populations of sensitive species remain viable.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | Population size, growth, and recruitment, population viability |
| Evaluation thresholds | Sensitive species populations fall below minimum viability, or their range or numbers are directly and measurably impacted by human activity. |
| Next steps | Determine the cause for a decrease in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

Sensitive species were documented as part of the MSCFI flora and fauna survey. Species at risk of collection, including night blooming cereus (*Peniocereus greggii* var. *transmontanus*) were mapped.

*Additional information needs*

The "sensitive species" section of the ERP lists plants that may be considered sensitive for various reasons. The MSCFI Science Advisory Committee needs to determine which of these should be the focus of monitoring or conservation efforts.

More specific information is needed to determine viability and measure human impact on selected sensitive plant species, once they are established.

More information is needed about the range and extent of sensitive plant species, along with information about population recruitment, growth, and viability.

*Monitoring*

Monitoring of sensitive species has been done on an ad-hoc basis over the past 15 years. This information can be gathered by interviewing individuals involved in monitoring and used as the basis for a formal monitoring program for priority species.

**Objective 3: Species listed by state or city government as invasive or noxious do not have a negative impact on MSP biodiversity, sensitive species, or ecosystem functioning.**

| | |
|---|---|
| Current state of resource | About 35 species present. |
| Primary indicators | a) Change in population size, species composition, and/or density of plant species.<br>b) Presence of new listed species. |
| Evaluation thresholds | a) Plant species are empirically shown to have a negative impact on MSP diversity, ecosystem functioning, or sensitive species.<br>b) New listed species is detected in the MSP. |
| Next steps | a) Determine the cause of the measured negative impacts by listed species. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken.<br>b) Determine the source of any new problematic species detected. Assess the impacts and ramifications of newly introduced listed species and decide on eradication versus monitoring based on potential impacts. |

*Existing information*

The City of Scottsdale has identified eight priority plants due to perceived fire risk and concerns regarding their effect on native flora and fauna. These are:

1. Desert Broom (*Baccharis sarothroides*)
2. Red Bromegrass (*Bromus rubens*)
3. Buffelgrass (*Pennisetum ciliare*)
4. Tamarisk/Salt Cedar *(Tamarix spp.)*
5. Fountain Grass (*Pennisetum setaceum*)
6. Malta Starthistle (*Centaurea melitensis*)
7. Saharan Mustard (*Brassica tournefortii*)
8. Bermuda Grass (*Cynodon dactylon*)

Large populations of buffelgrass (*Pennisetum ciliare*), fountain grass (*Pennisetum setaceum*), and salt cedar (*Tamarix chinensis*) were delineated in 2011 (Scott and Haussler 2011). These populations were re-surveyed in 2014 (Scott 2014). Based on these comparisons the populations have increased.

*Additional information needs*

Ongoing monitoring of populations is needed to determine if they are growing, declining, or remaining the same.

Information is needed about the negative and/or positive impacts and ecosystem roles of listed species found in the MSP. Negative impact is often assumed but rarely tested or quantified (Stromberg et al. 2009). A combination of literature review and additional studies are needed to guide management recommendations for current populations.

*Monitoring*

Monitoring of the populations included in Scott and Haussler (2011) and Scott (2014) will continue on an annual basis. Monitoring of these populations needs to be coordinated with the City of Scottsdale staff and the MSC Construction and Maintenance Program. Specific questions about fire susceptibility should be addressed and coordinated with the Scottsdale Fire Department.

**Objective 4: Plant communities and biomass along the wildland – urban interface is consistent with the ecological health of the MSP and the safety of the surrounding community.**

| | |
|---|---|
| Current state of resource | Largely unknown, although some potential fire hazards exist. |
| Primary indicators | a) Plant community change<br><br>b) Density, height, and proximity of vegetation to urban structures. |
| Evaluation thresholds | a) Plant communities at the wildland – urban interface differ significantly from those in the interior.<br><br>b) Plants within 30 feet of structures or roads reach a combination of height and density that is considered a fire hazard. |
| Next steps | a) Determine the cause or source for differences in vegetative communities. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken.<br><br>b) Plants within 30 feet of a structure or road should be treated according to Scottsdale Fire Department Defensible Space guidelines (City of Scottsdale Fire Department, date unknown). Fuel loads within washes adjacent to housing developments should be evaluated on a case-by-case basis to determine if a) the vegetation biomass is significantly greater than adjacent areas and b) if this presents a fire danger. |

*Existing information*

Limited observations and monitoring have been done at selected sites.

*Additional information needs*

A survey of the boundary area is needed to identify: 1) areas where plant community composition may differ from surrounding area as a result of urbanization, and 2) areas where plant biomass may present a fire concern as the result of urbanization.

Information is needed about the density, height, and proximity to urban structures of vegetation that is considered a fire hazard. Landforms and other environmental conditions that can promote the spread of fire need to be mapped. The boundary of the MSP should be surveyed to identify differences in vegetation that may lead to fire hazards.

The MSCFI will work with the Scottsdale Fire Department, the Science Advisory Committee, and other experts to develop a plan to assess fire hazards and spread potential along the wildland – urban interface, and to identify areas of special concern.

*Monitoring*

Ongoing monitoring should be established once areas of concern are identified.

# FAUNA

**Objective 1. Animal diversity is at baseline or higher levels.**

| | |
|---|---|
| Current state of resource | Species diversity for vertebrate species is at levels comparable to similar Sonoran Upland areas. |
| Primary indicators | Species diversity, functional type diversity, food web functioning |
| Evaluation thresholds | Decrease in one or more indicators below what would be expected due to uncontrollable causes such as temperature and precipitation changes. |
| Next steps | Determine the cause for a decrease in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

The MSCFI fauna surveys documented 188 vertebrate species and 175 invertebrate species (McDowell Sonoran Conservancy 2014). Subsequent documentation has added eight bird species and 10 invertebrate species to the lists, and numbers are expected to grow as more species are documented through monitoring programs and crowdsourcing efforts.

*Additional information needs*

Baseline species diversity has been documented and expert review indicates it is comparable to that of similar areas, but there has not been a comprehensive synthesis of background literature. There currently is no information about functional group diversity or food webs, which is needed in order to understand how various ecosystem components interact.

The list of invertebrate species is preliminary and does not represent the actual diversity of the invertebrate species in the Sonoran Desert. The MSCFI will continue to add to this list through additional studies and monitoring, and collection. Diversity will be re-evaluated after more information is collected.

*Monitoring*

Arthropods are a diverse animal group that provides excellent indicators of overall ecosystem diversity and environmental change. Since 2012, CAP LTER (Central Arizona-Phoenix Long-Term Ecological Research) has collected and identified arthropods at five MSP areas to develop an inventory of these animals, understand ground-dwelling arthropod diversity as an indicator of ecosystem health, and see if there is a difference between the arthropod communities near the wildland–urban interface versus the MSP interior. The MSCFI will continue the project long-term to both add to the invertebrate list and contribute to the understanding of the wildland-urban interface.

A bird survey will be conducted once every five years in order to track changes in bird diversity and abundance. This will be done according to protocol used for the flora and fauna baseline survey (McDowell Sonoran Conservancy 2014). The MSCFI conducted monthly bird surveys in Tom's Thumb Canyon during 2015 in order to develop a year-round picture of bird activity. The MSCFI will also take part in the annual North American Migration Count and the Carefree Christmas Bird Count, in order to add species to the bird list and contribute to the understanding of national migration patterns and winter populations.

In 2014, the MSCFI registered a butterfly count circle with the North American Butterfly Association (NABA). The circle encompasses the MSP. A count will be conducted annually to both contribute information to the NABA and to track butterfly diversity and abundance.

Additional fauna diversity monitoring will be established as needed.

**Objective 2. Populations of sensitive species remain viable.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | Population size and trends, recruitment, and population viability. |
| Evaluation thresholds | a) Sensitive species populations fall below minimum viability, or their range or numbers are directly and measurably impacted by human activity.<br><br>b) Change in habitat of sensitive species occurs. |
| Next steps | a) Determine the cause for a decrease in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken.<br><br>b) Determine if change in habitat will affect sensitive species. Recommend actions or monitor as appropriate. |

*Existing information*

Chapter 6 contains a list of all sensitive fauna species in the MSP. There is no existing information on population size, trends, recruitment, or population viability of sensitive species.

Specific sensitive species have been located within the MSP, such as the prairie falcon aerie on the north face of Tom's Thumb. The nest may be used by other falcon species as well, such as peregrine falcons. Monitoring during 2015 yielded baseline information on timing of mating, nesting, and fledging. A preliminary survey of the climbing areas in the Tom's Thumb area did not uncover any other raptor nests.

*Additional information needs*

This list should be examined and monitoring, study, or recommendations developed for each species. Information is needed about habitat requirements for sensitive fauna species, where such habitats are located in the MSP, and whether these habitats are sustainable.

In 2015, a preliminary survey of the climbing areas around Tom's Thumb was conducted to determine whether other sensitive raptor nests were present. None was documented. However, a second more thorough survey should be considered, as well as a survey of other climbing areas in the MSP, such as Granite Mountain.

Information is also needed on population size, trends, recruitment, and viability of selected sensitive species.

*Monitoring*

Monitoring of a prairie falcon aerie on the north face of Tom's Thumb was conducted for the first time in 2015 and will continue annually. Other sensitive bird species nests will be monitored as they are discovered.

Additional monitoring will be developed as needed.

**Objective 3. Species listed by federal, state, or city government as exotic or domestic* do not have a negative impact on MSP biodiversity, sensitive species, or ecosystem functioning.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | a) Change in population size, species composition, spatial distribution and/or density of exotic species.<br><br>b) Presence of new species. |
| Evaluation thresholds | a) Species are empirically shown to have a negative impact on MSP diversity, ecosystem functioning, or sensitive species or visitor experience.<br><br>b) New species is detected in the MSP. |
| Next steps | a) Determine the cause of the measured negative impacts by species. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken.<br><br>b) Determine the source of any new species detected. Assess the impacts and ramifications of newly introduced listed species and decide on eradication or removal versus monitoring based on potential impacts. |

**At-large movement of domestic species is prohibited by the Preserve Ordinance (section 21) and are controlled by the City of Scottsdale Preserve staff in coordination of the Scottsdale City Police Department.*

*Existing information*

Species present in the MSP are documented in *The Flora and Fauna of Scottsdale's McDowell Sonoran Preserve* (McDowell Sonoran Conservancy 2014). Personal communications with the Arizona Game and Fish Department have identified feral pigs residing on or near MSP lands near the Tom's Thumb area.

*Additional information needs*

Information is needed about the negative and/or positive impacts and ecosystem roles of exotic, feral and domestic species found in the MSP.

*Monitoring*

Monitoring of some species will be done through aerial large mammal surveys and bird, butterfly, and arthropod monitoring. Additional monitoring targeting specific fauna species will be developed as necessary.

**Objective 4. Maintain habitat value and conditions at the wildland–urban interface and in high use areas in a way that supports the health of MSP animal populations.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | a) Animal abundance and density near wildland–urban interface and high use areas versus MSP interior.<br><br>b) Animal health near the wildland–urban interface compared with MSP interior and urban areas. |
| Evaluation thresholds | a) Animal abundance and/or density is greater or less than what would be expected.<br><br>b) Animal health is highly affected by proximity to urban areas. |
| Next steps | a) Determine whether movement restrictions will have long-term negative impacts on the animal species in question. If negative impact is likely, evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken.<br><br>b) Determine source of negative impact and evaluate various actions. Monitor results of any actions taken. |

*Existing information*

The ground-dwelling arthropod study has three years of data comparing diversity of arthropods between interface and interior of the MSP.

No other information is available.

*Additional information needs*

Need to identify hot spots for animal travel and/or animal activity concentration at the wildland–urban interface. Information also is needed about the health of selected animals at the interface, urban area and in the MSP interior.

Information is needed about how selected animals move in trail-less areas and the impact of trail density and patterns on animal movement.

*Monitoring*

Information about the impact of the wildland–urban interface and MSP infrastructure on the movement of mule deer will be provided by the Mule Deer Corridor and Habitat Use Study, which is a joint effort among the COS, the MSCFI and the Arizona Game and Fish Department. Thirty-two mule deer were collared in February, 2015, and will be monitored through 2017 with a final report developed in 2018. Individual home ranges, major corridors, and areas of intense use by the mule deer will be identified, as well as seasonal habitat preferences.

The City of Scottsdale currently funds an annual big game survey through the Arizona Game and Fish Department. This survey provides annual population estimates for mule deer and javelina and will show population trends over time.

Additional monitoring and/or studies will be developed as needed.

**Objective 5. The MSP functions as a wildlife corridor between adjacent open spaces, and sections of the MSP are biologically connected.**

| | |
|---|---|
| Current state of resource | The northern and southern portions of the MSP are separated by Dynamite Boulevard and constricted on both sides by current and planned development. The northern portion connects with the Tonto National Forest along a three-mile section of contiguous boundary. The eastern boundary of the MSP connects with the McDowell Mountain Regional Park and the Fountain Hills McDowell Mountain Preserve. |
| Primary indicators | a) Gene flow among select species<br><br>b) Direct and indirect observation of indicator species at boundaries, corridors and interior portions in MSP (road kills, scat, tracks, skeletal remains, observation) |
| Evaluation thresholds | a) Movements of large animal species are restricted or constricted by human-caused barriers such as human use of trails and roads.<br><br>b) Gene flow and genetic diversity are restricted or constricted for indicator species. |
| Next steps | a) Determine the nature of the human-caused barriers to animal movement and recommend appropriate actions. Monitor and assess the results of any action taken.<br><br>b) Determine the nature of the barriers to gene flow and recommend appropriate mitigation actions. Monitor and assess the results of any mitigation action taken. |

*Existing information*

From mid-2011 through late 2012, the Arizona Game and Fish Department was contracted by the COS to conduct road mortality surveys along several roads in or adjacent to the wildlife linkage area that connects the northern and southern portions of the MSP, and wildlife track surveys along washes in the linkage area. These surveys identified animal species mortality associated with the roads and species activity along the washes. The results were summarized in a report to the City of Scottsdale (Grandmaison 2012).

Arizona Game and Fish Department maintains a database of vehicle-wildlife collisions. Data can be requested to show where large mammals are crossing urban areas and roads adjacent to MSP.

Arizona Game and Fish Department maintains a database of human-wildlife interactions. Data can be requested to show where indicator species are present adjacent to MSP. For example, the Department receives frequent reports of mountain lion sightings adjacent to MSP.

*Additional information needs*

- Currently there is limited information regarding large mammal movement by large animal species throughout the MSP and between the MSP and adjacent areas. This movement is a key indicator of whether large animal species are restricted by human-caused barriers on and immediately adjacent to the MSP.

- Information about gene flow and genetic diversity for selected indicator species is needed to determine whether sections of the MSP are connected biologically as well as physically.

*Monitoring*

Starting in 2016, mule deer movement will be monitored through GPS telemetry by the Arizona Game and Fish Department through an agreement with the MSCFI and COS. The collars will record locations for approximately two years. Individual home ranges, major corridors, and areas of intense use by the mule deer will be identified, as well as seasonal habitat preferences. The MSCFI will survey current literature and work with the Science Advisory Committee and other experts to determine approaches to monitoring gene flow and genetic diversity among selected species.

# RIPARIAN AREAS

**Objective 1. Plant and animal species diversity and functional group diversity remain at current or higher levels.**

| | |
|---|---|
| Current state of resource | Some riparian areas near the wildland–urban interface have been impacted by motorized vehicle use. Others have been impacted by historical ranching or mining activities. |
| Primary indicators | Species diversity, functional group diversity, riparian obligate plant and animal indicator species |
| Evaluation thresholds | Decrease in species or functional group diversity or selected indicators to below what would be expected due to uncontrollable causes such as temperature and precipitation changes. |
| Next steps | Determine the cause for a decrease in species or functional group diversity and/or selected indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

Portions of the MSCFI flora and fauna baseline survey – namely the flora survey, bird survey, the herp (reptiles and amphibians) survey, and the butterfly count – were conducted in some of the major MSP washes (McDowell Sonoran Conservancy 2014).

The Center for Native and Urban Wildlife at Scottsdale Community College conducted a restoration and monitoring study of the Brown's Ranch area in Rawhide Wash, one of the major riparian areas in the northern MSP (CNUW, unpublished data).

The City of Scottsdale has a GIS layer showing all 50+ cubic feet per second (CFS) washes in the MSP.

*Additional information needs*

- Inventory of washes and selection of riparian areas that are of interest to study and monitor
- Baseline information on selected riparian areas, including species

diversity, functional group diversity, and riparian obligate species.

- Select riparian obligate plant and animal indicator species.

*Monitoring*

Monitoring of species diversity, functional group diversity, and selected indicator species once baseline is established.

**Objective 2. Riparian areas function as wildlife corridors.**

| | |
|---|---|
| Current state of resource | Some riparian areas have been impacted by motorized vehicle use. Others have been impacted by historical ranching or mining activities. A small number of current trails follow riparian corridors or washes. |
| Primary indicators | Use of riparian corridors by key species |
| Evaluation thresholds | Studies indicate that key species do not use a viable corridor. Corridor use by key species stops or decreases markedly over time. |
| Next steps | Determine the cause of non-use, decreases, or cessation of riparian corridor use by key species. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. Educate those within the interface on practices that will reduce or eliminate attractants within residential areas. |

*Existing information*

Portions of the MSCFI flora and fauna baseline survey – namely the flora survey, bird survey, the herp (reptiles and amphibians) survey, and the butterfly count – were conducted in some of the major MSP washes (McDowell Sonoran Conservancy 2014).

From mid-2011 through late 2012, the Arizona Game and Fish Department conducted road mortality surveys along several roads in or adjacent to the wildlife linkage area, and wildlife track surveys along washes in the linkage area. These surveys identified animal species mortality associated with the roads and species activity along the washes. The results were summarized in a report (Grandmaison 2012).

The Center for Native and Urban Wildlife at Scottsdale Community College conducted a restoration and monitoring study of the Brown's Ranch area in Rawhide Wash, one of the major riparian areas in the northern MSP (CNUW, unpublished data).

*Additional information needs*

- Baseline information on use of selected riparian corridors by other key species. This information can be gained either through additional radio/GPS telemetry studies or by track and scat transects.
- Determine key species.
- Movement and corridor use by mule deer from GPS telemetry study, which will provide preliminary information to help pinpoint riparian areas for that key species.
- Miles of trails in and adjacent to riparian corridors
- MSCFI intends to track the movements of bobcats and mountain lions, which are key predator species. If undertaken, these projects would add information about the movement of animal species within the MSP and possible use of riparian corridors.

*Monitoring*

Monitoring the use of selected riparian corridors by key species may continue through telemetry studies, track and scat transects, or other methods as determined.

**Objective 3. Vegetative structure and productivity is conducive to riparian area functioning.**

| | |
|---|---|
| Current state of resource | Some riparian areas have been impacted by motorized vehicle use. Others have been impacted by historical ranching or mining activities. |
| Primary indicators | Canopy layer diversity, vegetation biomass, vegetative cover versus bare ground, exotic, invasive and non-native species |
| Evaluation thresholds | Decrease in vegetative structure, diversity, and/or biomass to below what would be expected due to uncontrollable variables like temperature and precipitation changes. |
| Next steps | Determine the cause(s) of decrease in indicators. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

Portions of the MSCFI flora and fauna baseline survey – namely the flora survey, the bird survey, the herp (reptiles and amphibians) survey, and the butterfly count – were conducted in some of the major MSP washes (McDowell Sonoran Conservancy 2014).

The Center for Native and Urban Wildlife at Scottsdale Community College conducted a restoration and monitoring study of the Brown's Ranch area in Rawhide Wash, one of the major riparian areas in the northern MSP (CNUW, unpublished data).

*Additional information needs*

- Riparian areas have not been surveyed or classified. Specific riparian areas should be selected for survey, classification, and monitoring.
- See above comment regarding tracking bobcats and mountain lions.
- Continuation of periodic flora and bird surveys may provide additional information about species biodiversity in selected riparian areas.

# GEOLOGY

**Objective 1. Unique geologic features are not negatively impacted by human activity.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | Photographic documentation of changes in unique geologic features. |
| Evaluation thresholds | Significant changes in appearance, including changes in size, structure or color, are demonstrably linked to human use or activity. |
| Next steps | Evaluate the potential and implications of various alternatives for deterring inappropriate or damaging human use or activity and recommend mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

The MSCFI worked with the Arizona Geological Survey (AZGS) to create a compilation geologic map of the MSP and immediate vicinity from existing maps covering portions of the area (Gootee and Day 2014). The MSCFI also funded the completion of a new, comprehensive geologic map of the McDowell Mountains by geologist Steve Skotnicki (2014), which is currently being digitized by MSCFI stewards. The MSCFI previously sponsored geologic field work in the MSP, resulting in the publication of three papers by AZGS describing a detailed geologic survey of the Lost Dog Overlook area (Gruber et al. 2010), the discovery of a previously-unknown travertine deposit (Gootee et al. 2009), and a study of the large milky quartz outcrops and veins found in the MSP (Gootee and Gruber 2015).

*Additional information needs*

The MSCFI will work with the Science Advisory Committee, AZGS and Steve Skotnicki to define "unique geologic features" and develop a list of known unique geological features within the MSP. Baseline photo-documentation must be created or located for features where this information is currently missing, or is insufficient to serve as a baseline for determining whether significant damage has occurred.

Application of new geologic mapping to identify source areas and associations for flora and

springs can be applied. Any future water quality and isotope analysis of springs and water catchments is typically associated with geology substrate and can be applied for future data collection and analysis related to water resources.

Additional geologic mapping of slope-sensitive areas prone to landslides (soil creep, rock falls, landslides and debris flows) needs further research and addition to a geologic map database, not included in recent mapping by Skotnicki (2015).

*Monitoring*

The MSCFI will monitor unique geologic features through periodic examination of aerial or satellite imagery and/or photo-documentation to determine whether any significant changes are evident.

# SOILS

**Objective 1. Anthropogenic impacts on soil from trail use, off-trail use, and fire are minimal.**

| | |
|---|---|
| Current state of resource | Soils along trails and roads show varying levels of compaction and possible decrease in plant cover and soil crust compared with analogous areas that have not been used as heavily. |
| Primary indicators | a) Compaction of soil near use areas<br>b) Existence and extent of biological soil crust |
| Evaluation thresholds | a) Increased soil compaction near trails, vehicle-impacted areas, and fire-impacted areas.<br>b) Decreases in biological soil crust extent near trails, vehicle-impacted areas, and fire-impacted areas. |
| Next steps | Determine the cause for the changes in indicators. Evaluate the potential and implications of various actions and take the most appropriate action. Monitor and assess results. |

*Existing information*

The MSCFI has collected information over two spring blooming seasons on the existence and extent of biological soil crust in quadrats within the Trail Impact Study transects.

*Additional information needs*

- Much of the MSP has been impacted historically by ranching, mining, motorized use, and other human activity. Maps and information on the intensity of these activities are needed to understand the current soil compaction and vegetation patterns.
- Additional information also is needed about the productivity of soils in disturbed and undisturbed areas.

*Monitoring*

The MSCFI will review available literature and consult with the Science Advisory Committee to determine an approach for measuring soil compaction near use areas. Based on this determination, the MSCFI will assess the degree of soil compaction and the existence and extent of biological soil crust near trails, areas impacted by motorized use, and fire-impacted areas.

**Objective 2. Transport and use of non-native soils in the MSP are minimal.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | None |
| Evaluation thresholds | None |
| Next steps | Determine best practices, or clarify current practices, for using soils and rock materials transported from elsewhere in trail construction and maintenance. |

*Existing information*

The City of Scottsdale Access Area Design and Site Standards provides best practices for use for site grading during trailhead construction, but does not address use of soils from outside the Preserve. Construction documents from various trailheads may provide some insight into past practices in using non-native soils.

*Additional information needs*

- There is currently no city policy for transporting soils into the MSP, although construction documents from various trailheads have addressed this issue. Best practices should be identified and compared to current practices.

*Monitoring*

No monitoring needed. Locations of non-native soils would be used as background information for studies.

# WATER RESOURCES

**Objective 1. Surface water availability in the MSP is adequate to maintain sustainable populations of long-term resident surface water-dependent wildlife within sustainable levels.**

| | |
|---|---|
| Current state of resource | A number of wildlife catchments, earthen cattle tanks, and tinajas have been mapped throughout the MSP. |
| Primary indicators | a) Population trends of key surface-water dependent wildlife<br>b) Spatiotemporal water availability on and adjacent to MSP<br>c) Wildlife indicator species seasonal habitat use in relation to monitored water sites |
| Evaluation thresholds | a) Decreases in wildlife populations demonstrably linked to drought or the loss of surface water sources.<br>b) No permanent surface water available per identified habitat blocks<br>c) Major observed change in wildlife indicator species habitat use in relation to water. |
| Next steps | a) Determine which supplemental water sites under an emergency water-provisioning plan are likely to stabilize wildlife populations. Recommend appropriate actions and monitor and assess results.<br>b) Evaluate whether permanent surface water is present in habitat blocks.<br>c) Determine whether observed change is not sustainable to wildlife population. If so, see "a" in "next steps" above. |

*Existing information*

The MSCFI has collected partial information on permanent (perennial) and temporary (ephemeral) sources of surface water in the MSP. This includes wildlife water catchments installed by the Arizona Game and Fish Department, springs, livestock water holes, and ephemeral pools known to persist for more than a few weeks.

During January of 2013, 2014, and 2015, and 2016 the Arizona Game and Fish Department conducted aerial large mammal surveys in Game Management Unit 25 M, which includes the MSP, the adjacent McDowell Mountain Regional Park, and some unincorporated, low-density housing areas north of the park. These surveys provide population estimates for deer and javelina, and constitute baseline information that can be used to track population trends (AZGFD 2013, AZGFD 2014).

Table 5. Mule deer survey results for Scottsdale's McDowell Sonoran Preserve, Game Management Unit 25M, 2013 – 2016.

| Year | Survey hours | Bucks | Doe | Fawns | Total | Population estimate |
|---|---|---|---|---|---|---|
| 2013 | 3.9 | 12 | 41 | 17 | 70 | |
| 2014 | 4.2 | 23 | 62 | 21 | 106 | 257 |
| 2015 | 3.9 | 34 | 84 | 54 | 172 | 271 |
| 2016 | 4.2 | 36 | 75 | 27 | 138 | 288 |

Table 6. Javelina survey results for Scottsdale's McDowell Sonoran Preserve, Game Management Unit 25M, 2013 – 2016.

| Year | Survey hours | Juveniles | Adults | Total | Population estimate |
|---|---|---|---|---|---|
| 2013 | 3.9 | 55 | 15 | 70 | |
| 2014 | 4.2 | 13 | 49 | 62 | 130 |
| 2015 | 3.9 | 12 | 78 | 90 | 113 |
| 2016 | 4.2 | 18 | 57 | 75 | 101 |

*Additional information needs*

- Seasonality of surface water availability in the MSP.
- Currently documented ephemeral waters in the MSP.
- Water sources immediately outside the MSP that may influence wildlife

behavior and habitat use.

- Information on seasonal use of water resources by deer and possibly mountain lion is needed.

- Develop a plan for emergency water provisioning and maintenance in consultation with Arizona Game and Fish Department and Arizona Department of Water Resources.

*Monitoring*

The MSCFI will assess the working condition of water catchments and report on whether they are holding water. The MSCFI will also assess the water retention of the ephemeral sources in the driest time of the year (June/July), after monsoon rains (September), in early winter (November), and after winter rains (March/April).

Animals such as mule deer and javelina range over large areas of open space and likely utilize the Tonto National Forest, the McDowell Mountain Regional Park, and available waters in the surrounding unprotected area. The MSCFI will work with the Tonto National Forest and the McDowell Mountain Regional Park to identify waters in the area surrounding the MSP. In addition, MSCFI will survey available aerial photography and satellite imagery to identify sources in the surrounding neighborhoods that may be accessible to wildlife.

The water requirements of many game animals in Arizona have been studied and management recommendations as to water provisioning are available. The MSCFI will conduct a review of available literature related to key water requirements and management recommendations for providing water for these species. Based on this review and the plans described above, the MSCFI will determine whether it is necessary to develop an emergency plan for water provisioning.

The mule deer radio-telemetry project will yield information over time that will suggest patterns in water use when combined with the surface seasonal water monitoring observations. A final report for the radio collar data will be available in 2018, at which time an assessment will be made.

**Objective 2. Groundwater resources are adequate to support hydrologic connectivity, riparian vegetation, and spring flow.**

| | |
|---|---|
| Current state of resource | Unknown |
| Primary indicators | Stream flow rate and direction, vegetative structure in riparian areas, depth to groundwater in selected areas |
| Evaluation thresholds | Changes in vegetative structure in riparian areas, vegetation die-off of groundwater-dependent species, or stream flow amount and direction demonstrably linked to drought, changes in the depth to groundwater, or other causes. |
| Next steps | Evaluate whether there has been a change in the water table large enough to produce the observed effects. If so, rule out any additional causes for the vegetation changes. If it is determined that water drawdown is the cause of the observed changes, examine the cause for the drawdown. Evaluate the potential and implications of alternatives and recommend appropriate mitigation actions. Monitor and assess the results of any action taken. |

*Existing information*

Currently there is a map of wells within and around the MSP. Registered well information is available through the Arizona Department of Water Resources.

- Depth to groundwater readings need to be obtained and the data examined for adequacy in answering questions about groundwater resources.

- Vegetative structure should be examined in specific locations to establish a baseline for monitoring.

*Monitoring*

To assess the adequacy of groundwater resources, the MSCFI will work with the Science Advisory Committee and water resources experts at the Arizona Game and Fish Department, the Maricopa County Flood Control District, the City of Scottsdale Water Resources Department and the Arizona Department of Water Resources. Based on input from these sources and a synthesis of available literature, the MSCFI will develop plans to determine groundwater resources and monitor indicators such as stream flow, stream direction, and depth to groundwater.

# DEGRADED LANDS

Restoration of degraded habitat is referred to directly in the MSP Ordinance (Chapter 21, revised code). For the purposes of the ERP, this provision refers to areas in the MSP that have been impacted by human activity that results in at least three of the following changes*:

1. Largely absent plant material
2. Compacted soil as compared to control for undisturbed condition
3. Erosion that is greater than surrounding areas
4. Absence of topsoil

*Degraded wildlife populations are covered in Fauna section above.

**Objective 1. Degraded lands in the MSP are restored to its undisturbed condition, including diverse plant species and natural ecological processes.**

| | |
|---|---|
| Current state of resource | There are approximately 60 acres of combined area in the MSP that have been visibly impacted by vehicular use (which now is prohibited). |
| Primary indicators | a) Plant survival and recruitment in restoration plots.<br><br>b) Plant structure and function in restoration areas similar to reference plots. |
| Evaluation thresholds | a) Plant survival and/or recruitment is different over time between sites using different restoration approaches, or sites using the same restoration approach under different circumstances.<br><br>b) Plant structure and function in restoration sites does not follow expected trajectory toward structure of reference sites. |

| | |
|---|---|
| Next steps | a) Determine the cause for difference between survival and recruitment in study plots versus reference plots. If the difference is the result of restoration technique or timing, adjust accordingly and monitor results.<br><br>b) Determine the cause for difference between structure and function in study plots versus reference plots. If the difference is the result of restoration technique or timing, adjust accordingly and monitor results. |

*Existing information*

The MSC Construction and Maintenance Program, working with City of Scottsdale preserve staff, has done extensive restoration of damaged areas. In 2012, the MSCFI worked with City of Scottsdale staff to develop a partial database of restoration projects that can be used as the basis for a monitoring program.

The MSCFI has developed a draft map that shows areas of vehicular impact visible from aerial photography.

The MSCFI has mapped 14 separate plant associations in the MSP according to the methods of Brown et al. (1979). This can be used as the basis for restoration work.

The EPG has provided a view shed analysis, a GIS layer that defines areas that are most likely to be seen, that can be overlaid to show visibility of each area to the public. An analysis of the contribution of degradation to habitat fragmentation should be conducted. The combined result would be priority areas for restoration.

*Additional information needs*

We recommend working with the Science Advisory Committee and City of Scottsdale field staff to develop a set of restoration guidelines based in the MSP plant association map (Jones and Madera 2013), principles of ecological succession in the Sonoran Desert, and principles of minimizing visual impact of restoration sites. Areas targeted for restoration will be prioritized based on 1) promoting ecological connectivity, and 2) visibility to the public.

*Monitoring*

Known sites where restoration has occurred will be mapped and catalogued with the assistance of City of Scottsdale personnel and MSC stewards. All available background information will be collected for each site. Paired undisturbed reference sites for each existing restoration site will be established within the same biotic community and sharing as many site characteristics as possible.

The MSCFI needs to monitor the indicators: survival of transplanted plants at restoration sites, regeneration of volunteer plants at restoration sites, and recovery of natural ecological processes within restored areas. Doing this will require development of reference sites in the surrounding plant communities as benchmarks to measure the recovery trajectory.

In addition, new restoration sites in high-priority degraded areas may be established to test alternative restoration techniques suggested by the literature or by subject-matter experts.

Vegetative survival, recruitment, structure and function sampling for high priority established and new restoration sites and their reference plots will be conducted annually.

# CHAPTER 6: SENSITIVE SPECIES

This chapter lists designated sensitive species in the MSP. The tables and species summaries indicate species ranking by relevant federal or state government agencies and non-profit organizations. Sensitivity rankings were assigned as relevant to the species from the following sources: The Nature Conservancy's Global Priority Ranking Definitions (Natureserve, 2014), the Endangered Species Act list (1988), and the Nature Conservancy Ecoregional Plan (Marshall et al. 2000), Arizona Department of Agriculture (2015) and the North American Bird Conservation Initiative (2014). Any species that received a sensitivity ranking from any one of these sources was included. Organisms that either support another sensitive species (i.e. butterfly host plants) or organisms that are locally threatened are also included. Sensitive species monitoring will be given priority in the MSCFI research plan for monitoring and as ecological indicators.

During the next annual review, this section will be afforded special attention to assure that it is up to date with current listing status. The species summaries following the tables provide useful reference information for certain sensitive species listed in the tables, and a template for future additions. Species currently with summaries are marked with an asterisk in tables.

### Sensitivity ranking system definitions

Table 7. State and Government Agency Ranking Definitions from Natureserve (2014).

| Rank | Global Priority Ranking Definitions |
|---|---|
| G1-S1 | Very Rare: 1 to 5 occurrences or very few individuals or acres. |
| G2-S2 | Rare: 6 to 20 occurrences or few individuals or acres |
| G3-S3 | Uncommon or Restricted: 21 to 100 occurrences, rather rare throughout a fairly wide range, or fairly common in a rather restricted range. |
| G4-S4 | Fairly Common: 51 to 100 occurrences and found over a rather wide range within the State. |
| G5-S5 | Demonstrably Secure: more than 100 occurrences. |
| GU | Unranked |

G = Global rank, S = State rank.

Table 8. Endangered Species Status Definitions from the Federal U.S. Status under Endangered Species Act of 1973 (1988).

| Status | Status definitions |
|---|---|
| LE | Listed Endangered: imminent jeopardy of extinction. |
| LT | Listed Threatened: imminent jeopardy of becoming Endangered. |
| XN | Experimental Nonessential population |
| PE | Proposed Endangered |
| PT | Proposed Threatened |
| C | Candidate Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity. |
| SC | Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the US Fish and Wildlife |

Table 9. Global Distribution Characteristics for Conservation Targets in the Sonoran Desert Ecoregion (Marshall et al 2000).

| Distribution | Characteristics |
|---|---|
| Restricted/ Endemic | Species or vegetation community occurs primarily in one Ecoregion: it is either entirely endemic to the Ecoregion or has more than 80% of its range within Ecoregion. |
| Limited | Species or vegetation community occurs in the Ecoregion, but also within a few other adjacent Ecoregions (*i.e.,* its core range is in one or two Ecoregions, yet it may be found in several other Ecoregions). |
| Widespread | Species or vegetation community is distributed widely in several to many Ecoregions, and is distributed relatively equally among Ecoregions. Widespread does not necessarily mean "common." For example, some wetland types are distributed widely, although total acreage is small and the occurrences are widely separated. |
| Disjunct | Species or vegetation community occurs in the Ecoregion as a disjunct from the core of its distribution (less than 10% of its total distribution is in Ecoregion), and is more commonly found in other Ecoregions. Disjunct occurrences of communities reflect similarly disjunct occurrences of key environmental factors or ecological processes, and these occurrences may represent variation in composition, structure, and potential for evolutionary divergence. |
| Peripheral | Species or vegetation community is more commonly found in other adjacent Ecoregions(less than 10% of its total distribution is in the ecoregion of interest). Peripheral occurrences may or may not represent significant variation relative to occurrences in adjacent ecoregions. Goals for peripheral communities should account for the fact that most of their conservation will take place in other ecoregions. Opportunistic capture of these types often may be sufficient. Selection of examples for conservation should be informed by consideration of how they compare in size, quality, and variation with those in the adjacent or other ecoregions. |

Table 10. Salvage restricted plants classified by the Arizona Department of Agriculture (2015).

| Code | Definition |
|---|---|
| HS | Highly Safeguarded |
| SR | Salvage Restricted |
| HR | Harvest Restricted |
| SA | Salvage Assessed |

Table 11. North American Bird Conservation Initiative Watch list.

| Code | Description |
|---|---|
| Red | Species with extremely high vulnerability due to small population, small range, high threats, and range-wide declines. |
| Yellow | Species that are either range restricted (small range and population), or are more widespread but with troubling declines and high threats. |
| Rapid decline | Do not meet Watch List criteria, yet are rapidly declining throughout their range |

**Sensitive species within MSP**

Plant and animal species listed in tables 12 – 14 below are designated as sensitive according to one or more of the criteria listed in tables 7 – 11.

Table 12. Ranking of sensitive plants found in Scottsdale's McDowell Sonoran Preserve.

| Scientific name | Common name | global rank | distribution | ESA status | AZDA 2015 | MSP status | Threats |
|---|---|---|---|---|---|---|---|
| *Acourtia nana* | Dwarf Desert Peony | G5 | W | n/a | | Three clonal colonies in the northern MSP | |
| *Agave americana* | American Century Plant | GNR | D | n/a | | Single plant of unknown origin near the cistern in Ochoa Canyon | |
| *Agave deserti* | Desert Agave | G4 | E | n/a | SR | | |
| *Agave murpheyi* | Hohokam Agave | G2 | E | SC | HS | *Agave murpheyi* – Single population, three living plants; declining from 13 living plants seen in 1994 | Declining due to long-term drought. It and most of the others are at risk if drought conditions persist. |
| *Agave toumeyana* ssp. *toumeyana* | Toumey's Century Plant | G3 | L | n/a | SR | Two populations: Brown's Mountain plus Lookout Trail and points north | |
| *Ambrosia ambrosioides* x *A. salsola* | Ambrosia Leaf Bursage | G5 | N/A | n/a | | Single hybrid individual below Powerline Road #2 and near Troon North | |

Table 12. Ranking of sensitive plants found in Scottsdale's McDowell Sonoran Preserve.

| Scientific name | Common name | global rank | distribution | ESA status | AZDA 2015 | MSP status | Threats |
|---|---|---|---|---|---|---|---|
| *Astrolepis windhamii* | Windham's Scaly Cloakfern | G3 | W | n/a | | Single colony, Maricopa County record, out of known range | |
| *Brickellia californica* | California Brickell Bush | G5 | W | n/a | | Fewer than a dozen plants below the large boulder near Lookout Trail junction with Tom's Thumb Trail (TL1) | |
| *Calochortus kennedyi* var. *kennedyi* | Red Mariposa Lily | G4 | W | n/a | SR | Known populations along Windgate Pass Trail east of Windgate Pass and Lookout Trail near Tom's Thumb Trail | The small populations are at risk due to habitat destruction. Steve Jones noted several instances along trails where blossoms were picked and discarded. |
| *Carnegiea gigantea* | Saguaro Cactus | G5 | E | n/a | HS, SR | Abundant | |
| *Celtis reticulata* | Netleaf Hackberry | G5T5 | W | n/a | | Single population of a few dozen trees in Tom's Thumb Canyon | |

Table 12. Ranking of sensitive plants found in Scottsdale's McDowell Sonoran Preserve.

| Scientific name | Common name | global rank | distribution | ESA status | AZDA 2015 | MSP status | Threats |
|---|---|---|---|---|---|---|---|
| *Cheilanthes wrightii* | Wright's Lipfern | G4G5 | L | n/a | | Single small colony | |
| *Cylindropuntia arbuscula* | Pencil Cholla | G4 | L | n/a | SR | Two plants, one large, one small, same location | |
| *Cylindropuntia* x *tetracantha* | Tucson Prickly Pear | GNA | E | n/a | SR | Single hybrid individual north of Fraesfield Mountain | |
| *Dudleya saxosa* ssp. *collomiae* | Gilia County Live-forever | G4Q | L | n/a | SR | Few plants, scattered in the Lookout Trail and upper Tom's Thumb Trail areas. | |
| *Metastelma arizonica (Cynanchum arizonicum)* | Arizona Swallow-wort | G3G4 | L | n/a | | Two small vines near The Lookout. | |
| *Nolina microcarpa* | Sacahuista Bear-grass | G4 | W | n/a | SR, HR | Single large population along Tom's Thumb Trail east of Lookout Trail junction (TL1); small population on north slope nearby | |

Table 12. Ranking of sensitive plants found in Scottsdale's McDowell Sonoran Preserve.

| Scientific name | Common name | global rank | distribution | ESA status | AZDA 2015 | MSP status | Threats |
|---|---|---|---|---|---|---|---|
| *Olneya tesota* | Ironwood Tree | G4G5 | E | n/a | SR, HR | Occasional, throughout MSP | |
| *Opuntia engelmannii* var. *linguiformis* | Cow-tongue Prickly Pear | G5TUQ | D | n/a | | Established from landscape debris, north of Legend Trail community | |
| *Parkinsonia florida* | Blue Paloverde | G5 | L | n/a | SA | Occasional, throughout MSP | |
| *Parkinsonia microphylla* | Littleleaf Paloverde | G5 | L | n/a | SA | Common, throughout MSP | |
| *Peniocereus greggi* var. *transmontanus* | Desert Night-blooming Cereus | G3G4T3T4 | L | n/a | SR | Thirty-eight known individuals in MSP scattered across Tom's Thumb and northern MSP areas | At risk due to illegal collection. |
| *Portulaca pilosa* | Pink Purslane | G5 | W | n/a | | Single population of annuals near Lookout and Tom's Thumb Trails junction, along trail, likely accidentally introduced by hikers; otherwise unknown from Maricopa County | |

Table 12. Ranking of sensitive plants found in Scottsdale's McDowell Sonoran Preserve.

| Scientific name | Common name | global rank | distribution | ESA status | AZDA 2015 | MSP status | Threats |
|---|---|---|---|---|---|---|---|
| *Portulaca umbraticola* | Wingpod Purslane | G5 | L | n/a | | Two plants photographed along Tom's Thumb Trail east of TT7, annual plant, likely accidentally introduced by hikers; rare in Maricopa County | |
| *Prosopis juliflora* var. *velutina (P. velutina)* | Velvet Mesquite | G5 | L | n/a | SR, HR | Occasional, throughout MSP | |
| *Sairocarpus nuttallianus* | Nuttall's Snapdragon | G4G5 | W | n/a | | Few annual plants at the junction of Tom's Thumb Trail and Glass Dome climbing trail | |
| *Sapindus saponaria* | Wingleaf Soapberry | G5 | W | n/a | | Single population of about two dozen shrubs in the northeastern MSP along a major wash | |
| *Yucca baccata* var. *baccata* | Fleshy-fruit Yucca | G5TNR | W | n/a | SR, HR | Common in the northern MSP, occasional elsewhere | |
| *Yucca elata* | Soaptree Yucca | G5 | W | n/a | SR, HR | Occasional in the northern MSP | |

Table 13. Ranking of non-avian fauna found Scottsdale's McDowell Sonoran Preserve.

| Scientific Name | Common Name | Protection Status* | | | | | | State Rank** | Global Rank** | Critical Habitat |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ESA | USFS | USFW | BLM | AZGFD | IUCN | | | |
| *Sauromalus ater* | Chuckwalla* | | | SC | | | | S4 | G5 | |
| *Heloderma suspectum* | Banded gila monster* | | | SC | | | NT | S4 | G4 | |
| *Gopherus agassizii* | Desert tortoise* | LT | | | | WSC | VU | S4 | G4 | Y |
| *Corynorhinus townsendii* | Townsend's big-eared bat* | | S | SC | S | | | S3, S4 | G4 | |
| *Taxidea taxus* | American badger* | | | | | | | | | |
| *Sonorella allynsmithi* | Phoenix talussnail* | SC | S | | | | NT | S1 | G1 | |
| *Danaus plexippus* | Monarch butterfly** | | | | | | | | | |

Table 14. Ranking of sensitive birds found in Scottsdale's McDowell Sonoran Preserve

| Scientific Name | Common Name | Protection Status* | | | | | | State Rank** | Global Rank** | NABCI Watchlist |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ESA | USFS | USFW | BLM | AZGFD | IUCN | | | |
| *Falco peregrinus* | American peregrine falcon* | SC | | | | WSC | | S4 | G4 | |
| *Melozone aberti* | Abert's towhee* | | S | | | | | | G3, G4 | |
| *Lanius ludovicianus* | Loggerhead shrike [B*] | | | SC | | | | S4 | G4 | Rapid decline |
| *Buteo albonotatus* | Zone-tailed hawk* | | S | | | | | S4 | G4 | |
| *Aquila chrysaetos* | Golden eagle* | | | | S | | | S4 | G5 | |
| *Colaptes chrysoides* | Gilded flicker* | | | | S | | | S5 | G5 | Yellow |
| *Contopus cooperi* | Olive-sided flycatcher | SC | | | | | | S4 | G4 | Yellow |
| *Phalacrocorax brasilianus* | Neotropic cormorant | | S | | | | | | G5 | |
| *Toxostoma bendirei* | Bendire's Thrasher | | | | | | | S4 | G4G5 | Red |
| *Colaptes chrysoides* | Gilded Flicker | | | S | | | | S5 | G5 | |
| *Vireo vicinior* | Gray Vireo | | | S | | | | S4 | G4 | Yellow |

[B] Breeding confirmed in MSP

Table 14. Ranking of sensitive birds found in Scottsdale's McDowell Sonoran Preserve

| Scientific Name | Common Name | Protection Status* | | | | | | State Rank** | Global Rank** | NABCI Watchlist |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ESA | USFS | USFW | BLM | AZGFD | IUCN | | | |
| *Oreothlypis virginiae* | Virginia's Warbler | | | | | | | S5 | G5 | Yellow |
| *Spizella atrogularis* | Black-chinned Sparrow | | | | | | | S5 | G5 | Yellow |
| *Spinus lawrencei* | Lawrence's Goldfinch | | | | | | | S5 | G5 | Yellow |
| *Anas americana* | American Wigeon | | | | | | | S1B, S5N | G5 | Rapid decline |
| *Anas cyanoptera* | Cinnamon Teal | | | | | | | S5 | G5 | Rapid decline |
| *Eremophila alpestris* | Horned Lark | | | | | | | S5 | G5 | Rapid decline |
| *Auriparus flaviceps* | Verdin[B] | | | | | | | S5 | G5 | Rapid decline |
| *Cardellina pusilla* | Wilson's Warbler | | | | | | | S5M | G5 | Rapid decline |
| *Calamospiza melanocorys* | Lark Bunting | | | | | | | S1B, S5N | G5 | Rapid decline |

### Sensitive habitats and ecological indicators

The following tables outline areas or animal groups considered sensitive for reasons other than state or national listing. Table 15 shows the Dixie Mine area which contains sensitive plant and animal species and is considered a conservation site by The Nature Conservancy (2000). Table 16 shows groups of animals found on the Preserve which are known to be sensitive to human disturbance such as pollution and climate change. Although not all members of these groups are listed by state or federal sources as sensitive, as a whole they are excellent ecological indicators and should be part of a long-term monitoring program.

Table 15. Conservation Site in Scottsdale's McDowell Sonoran Preserve and McDowell Mountain Regional Park as listed in the TNC Ecoregional Plan* #: 84 Dixie Mine Total Conservation Targets 4 *(Excluding Biophysical Units)* Site Size acres: 4,330 Hectares: 1,752 Ecoregional Subdivision: Arizona Uplands Conservation Targets.

| Taxon | Scientific Name | Common Name | Global rank | Distribution | ESA status |
|---|---|---|---|---|---|
| Mammal | **Leptonycteris curasoae yerbabuenae* | Long-nosed Bat | G4 | LE | |
| | *Macrotus californicus* | California Leaf-nosed Bat | G4 | | SC |
| | *Myotis velifer* | Cave Myotis | G5 | | SC |
| Plant | *Agave murpheyi* | Hohokam Agave | G2 | | SC |
| Biophysical Unit | Parkinsonia-Carnegia-Opuntia | (group) | | | |
| | Paloverde-mxed cacti | (group) | GU | | |

*Misidentification. Name retained in the table for reference purposes. Field Institute, unpublished data 2016.

Table 16. Animal groups sensitive to human disturbance that may serve as ecological indicators.

| Animal group | Threats | Recommended action |
|---|---|---|
| Raptors* | Raptors, specifically species of falcons such as Peregrine and Prairie falcons, are sensitive to human disturbance during their breeding season. | Continue and possibly expand raptor monitoring. |
| Amphibians | Amphibians are especially sensitive to pollutants and decreases in precipitation. | Amphibian surveys should be given priority in the research plan. |
| Butterflies | Butterflies are sensitive to changes in habitat and climate. | Butterflies continue to be monitored as an indicator of change. |

# SENSITIVE SPECIES SUMMARIES

## Hohokam Agave

### Common and scientific name

Hohokam agave

*Agave murpheyi*

### Morphology

This agave produces a dense rosette of leaves 20 to 31 inches long by 2 to 8 inches wide in shades of green to blue-green with pale banding. The leaves are edged with small, straight teeth and tipped with a spine up to 0.8 inches long. The plant produces a flowering stalk 10 to 13 feet tall with many flowers along the branches. The flowers are greenish with purple or brown tips and are up to three inches long (Arizona Game and Fish Department 2003). Like all agaves, *A. murpheyi* is a leaf succulent with shallow radial roots, a radial rosette of spoon-shaped leaves, and a thick waxy cuticle to conserve moisture (Arizona Game and Fish Department 2003).

### Conservation status and basis

Global status – G2 Imperiled

State status – S2 Highly Safeguarded

Endangered Species Act – Species of Concern

USFS - Sensitive

BLM – Sensitive

This species occurs in a limited area of southern Arizona and northern Sonora, in isolated populations with few genetically-distinct individuals. This leaves the species subject to risk due to chance events and human encroachment (NatureServe 2014).

### Range in Arizona and in MSP

Found in southern Arizona and northern Sonora locations associated with historic human habitation. Occasionally found wild in south-central Arizona (Arizona Game and Fish Department 2003).

In the MSP, it has been noted in only one location near the Prospector trail south of the junction with the Bell Pass trail (Jones 2014).

### Habitat

The agave is found near drainage systems on mountain slopes between 1,640 – 3,280 feet in desertscrub. It often is found around prehistoric settlement areas, although the plant and its propagules are easily transported and transplanted (NatureServe 2014).

### Physical habitat, light, water, soil, temperature

These agaves grow best in full sun and tolerate poor soil and extended drought, but they require good drainage. Loose rock environments help increase moisture and reduce rodent predation (Arizona Game and Fish Department 2003). This plant requires only infrequent water. It tolerates full sun and high temperatures and is hardy to about 10 degrees Fahrenheit (Arizona Game and Fish Department 2003).

### Reproduction and Phenology

The agave flowers once in as little as nine years under favorable conditions, and then the main plant dies (Adams and Adams 1998). The flower stalks begin to form in winter. Although the plant has many potential pollinators including birds and insects, flowers rarely produce viable fruit. Instead, pups or bulbils are produced on the branches of the flowering stalk in mid-summer and may persist successfully on the stalk for several years. When the stalk collapses, the bulbils can root if the ground has been disturbed. The plants also reproduce via rhizomatous pups. As a result, most isolated groups of plants are genetically identical (Adams 1998).

### Pollinators and seed dispersers

The plant has many potential pollinators including birds and insects.

### Seed germination and seedling establishment

Information needed.

### Herbivores

These agaves are eaten by rodents (Arizona Game and Fish Department 2003). They also may be severely damaged or killed by the agave snout weevil (*Scyphophorus acupunctatus*) (Desert Botanical Garden 2010).

### Next Steps

The *A. murpheyi* population is in decline. Discuss with the MSCFI Science Advisory Committee the costs and benefits of collecting and propagating *A. murpheyi* for *ex situ* conservation and potentially for restoration. The discussion points would then be provided to the City of Scottsdale preserve staff for a decision.

# Phoenix Talussnail

### Common and scientific name

Phoenix talussnail or Squaw Peak talussnail (AZGFD 2003)

*Sonorella allynsmithi* synonym *Maricopella allynsmithi*

### Brief description

The Phoenix talussnail is a land snail with a rounded, shiny, grayish to brownish-white shell up to 0.5 inches in diameter. The shell has a tan to light-brown spiral band on a rounded shoulder. The shell itself has 4 – 4½ whorls in mature adults. Its body is dark gray to black with a bumpy texture and small tan flecks (Arizona Game and Fish Department 2003).

### Conservation status and basis

Global status – G1 Critically Imperiled

State status – S1 Critically Imperiled

Endangered Species Act – Species of Concern

IUCN – Near Threatened

Conservation status is based on very limited distribution with associated risk due to chance events and human encroachment on habitat (Gregg 1969). A small population in a restricted habitat makes this species sensitive in the MSP.

### Range in Arizona and in MSP

This species is known only in the mountains of northeastern Maricopa County including Piestewa Peak, Mummy Mountain, and the McDowell Mountains (Gregg 1969).

It has been observed twice in or near the MSP, once in the steep wash embankment along the Quartz Trail outside the MSP boundary and once inside the MSP in the vicinity of Tom's Thumb.

### General habitat requirements

The snail lives in steep talus slopes, rockslides, and rocky wash banks above the flood zone where it can seal its shell aperture to solid rock to avoid desiccation while being protected from heat by rocks and plants above (Arizona Game and Fish Department 2003).

### Critical habitat requirements: den sites, nest sites, breeding sites

The snail requires environmental calcium carbonate (limestone, caliche) in loose chunks to build its shell and to buffer carbonic acid (water and carbon dioxide) created by respiration while the shell is sealed. The eggs sometimes have calcite (calcium carbonate) crystals or even shells (Arizona Game and Fish Department 2003).

### Food habits and water requirements

The talussnail eats decaying plants, fungal material and lichen in the soil. The snail lays its eggs in moist conditions and may retain its eggs until sufficient soil moisture is present (Gregg 1969).

### Overall biology

Talussnails are hermaphroditic. Eggs and immature snails have reduced ability to withstand dry periods. Sexual maturity takes four years or more, and the snails may reproduce only once before dying (Arizona Game & Fish Department 2003).

### Activity patterns: daily, hibernation or similar, migration

Most of the snail's life is spent in estivation underground. During the hotter, drier summer months the snail retreats deep under loose rock, retracts its body into the shell, and seals the shell aperture to rock to avoid desiccation (Gregg 1969).

### Predators

Snails have many predators, including many species of birds, reptiles, and mammals. They also are prey for some invertebrates, including the non-native predatory decollate snail (Waters 2011).

### Next steps

Identify potential talussnail habitat within the MSP and survey for talussnails as well as predatory snails. Identify necessary measures to protect talussnail habitat.

# Gila Monster

*Heloderma suspectum*

## Brief description

The banded Gila monster is a large, heavy-body lizard with a short, swollen tail and a pattern of black and pink, salmon, orange, or yellow bands. The dorsal surface is covered with bead-like scales. The ventral surface is covered with square scales. The neck has loose folds of skin. The gular (throat) fold is well developed. Unlike most lizards, the fourth toe is as long as the third. The dark tongue flicks out like that of a snake (Stebbins 2003). Its maximum length is about 22 inches (Ernst 1992) and the tail is about 20 percent of its body size.

## Conservation status and basis

International Union for Conservation of Nature - Near Threatened
Global status – G4 apparently secure (Arizona Game and Fish Department 2015)
State status – S4 apparently secure (Arizona Game and Fish Department 2015)

An active pet trade by humans and road kills are the main dangers to the Gila monster. Degradation of habitat, especially den sites, is also a concern (Arizona Game and Fish Department 2015).

The Gila monster was the first venomous animal in North America to get legal protection. This means it is illegal to collect, kill, or sell them in Arizona (Arizona-Sonora Desert Museum 2015).

## Range in Arizona and in MSP

This lizard is found in the southwestern United States and Mexico, including Arizona, parts of California, Nevada, Utah, and New Mexico, and Sonora, but not Baja California. (Stebbins, 2003)

The banded Gila monster has been observed in the MSP (McDowell Sonoran Conservancy 2014).

## General habitat requirements

The Gila monster lives in shrubby, grassy, and succulent desert habitat and lower mountains, canyons, and arroyos with permanent or intermittent streams (Ernst 1992). It seeks shelter in self-made or mammal burrows, woodrat nests, dense thickets, under rocks and in natural cavities. It prefers rocky areas to scattered bushy areas. It is chiefly ground dwelling but occasionally climbs in search of eggs and nestlings (Stebbins 2003).

### Critical habitat requirements: den sites, nest sites, breeding sites

The Gila monster seeks places out of the sun, usually underground or hidden within rocky areas. Subsurface shelter is an important element of necessary habitat (Beck 2003).

### Food habits and water requirements

The Gila monster eats small mammals, the nestlings and eggs of ground-nesting birds, such as quail and mourning doves, eggs of reptiles (including the Desert tortoise), lizards, insects, and carrion. It kills its prey by crushing it with its powerful jaws (Stebbins 2003). It inhabits areas where it can find ready access to moisture. It has been observed immersing itself in puddles of water after a summer rain (Cavendish 2001).

### Overall biology

The Gila monster is a slow-moving, large lizard. It is the only venomous lizard native to the United States and one of only two known species of venomous lizards in North America. The venom is thought to be largely defensive, since the lizard's normal prey is largely defenseless and would not require venom to subdue or kill (Phillips 2000).

Mating usually occurs in May (Ernst, 1992). The eggs are buried five inches below the surface in sand. The clutch varies from two to 12 eggs. Five is the average (Stebbins 2003). Incubation lasts nine months. After mating, adult Gila monsters gradually spend less time on the surface to avoid the hottest part of the summer (Mattison 1998).

In captivity, some have lived to over 35 years (Arizona-Sonora Desert Museum 2015).

### Activity patterns: daily, hibernation or similar, migration

The Gila monster spends 90 percent of its time underground in burrows or rocky shelters. It is active in the morning during the dry season (spring and early summer) and later in the day during the summer. It may be active on a warm night or after a thunderstorm (Mattison 1998). The Gila monster hibernates in subsurface shelters from late November through February (Phillips 2000).

### Predators

Humans are the main predators of Gila monsters. They have few other predators (Arizona-Sonora Desert Museum 2015).

### Next steps

A monitoring program will be developed to assess the population parameters and viability of the Gila monster in the MSP.

# Common Chuckwalla

*Sauromalus ater*

## Brief description

The common chuckwalla is a large, bulky lizard with sandpapery skin. The color varies with sex and age. The adult males have black heads and forelimbs and their trunks may be black, red, orange, grey or yellow. The females and juveniles have grey or yellow banding. The tail is long and a buff color. On the inside of a male's thighs are large pores that produce secretions believed to be used in marking territories. Excess skin folds allow it to take in air and expand to protect itself by wedging itself in a rock crevice. This lizard is between 0.5 and 0.7 pounds, though males are usually heavier than females. Average head length is 1.4 inches, with the greatest head width being 1.3 inches. Average snout-vent length is 6.4 inches with a range from 3.1 and 7.8 inches, and the length of tail averages 7.2 inches. Almost half the length of the common chuckwalla is comprised of tail (Animal Diversity Web 2014). It is the second largest lizard in the U.S., slightly smaller than the Gila monster (Stebbins 2003).

## Conservation status and basis

International Union for Conservation of Nature – Least concern (International Union for Conservation of Nature 2015)
Global status – G5 secure (Arizona Game and Fish Department 2015)
State status— S4 apparently secure (Arizona Game and Fish Department 2015)

The common chuckwalla is fairly common in a restricted range and apparently secure. Threats to the wild population are the result of collecting. There is habitat loss in the desert areas where development has occurred (International Union for Conservation of Nature 2015).

## Range in Arizona and in MSP

The common chuckwalla ranges in the western United States and northwestern Mexico, including southern Nevada and southern Utah, southeastern California, Arizona, Baja California and west-central Sonora. In Baja California, most of the distribution is away from the Pacific coast (International Union for Conservation of Nature 2015).

The common chuckwalla has been observed in the MSP (McDowell Sonoran Conservancy 2014).

### General habitat requirements

Normal habitat for this lizard is rocky outcrops, lava flows, and rocky hillsides in arid regions. It seeks shelter in burrows usually from late October until mid-February or early March (International Union for Conservation of Nature 2015).

### Critical habitat requirements: den sites, nest sites, breeding sites

The common chuckwalla is strictly a rock dweller. Females prepare nests in dry soil in undisturbed areas (International Union for Conservation of Nature 2015).

### Food habits and water requirements

This lizard is primarily herbivorous, especially eating creosote bush, but also perennials, annual wildflowers, and some insects. Its water intake comes from the plants it consumes (Stebbins 2003).

### Overall biology

The common chuckwalla is diurnal and active up to temperatures of 102 degrees Fahrenheit. When threatened, it will seek shelter in a rock crevice, gulp air to expand, and wedge itself tightly there, making it difficult for predators to dislodge it (Stebbins 2003).

Females lay between five and 16 eggs but only every other year. Mating occurs between April and July, and eggs are laid between June and August in moist ground. Hatching occurs in September (Stebbins 2003). Males reach sexual maturity when they reach a 4.9 inch snout-vent length, or at about two years old. Females reach sexual maturity at the same length, but may take two to three years to reach that length. The annual reproductive frequency of each female varies greatly from year to year, depending on food availability and rainfall. Females incubate eggs until they hatch. The incubation period lasts 33 to 50 days. The birth mass range of the eggs is 0.21 to 0.34 ounces. Larger females produce clutches more frequently than smaller females. Females prepare an underground nest in dry soil where the area is unlikely to be disturbed. After hatching the young are independent (Animal Diversity Web 2015).

### Activity patterns: daily, hibernation or similar, migration

The common chuckwalla is often found basking on boulders. They hibernate in cooler temperatures and decreased daylight, and emerge in February (Naturalist.org 2015). Average territory size is 11,483 square feet. Male home ranges are typically larger than female home ranges and generally overlap with those of several females. Female home ranges also may overlap (Merlot 2015). According to a seven-year study in the Colorado Desert of southwestern California, densities ranged from 15 to 30 individuals per hectare. Home range sizes do not change from spring to summer (Animal Diversity Web 2015).

### Predators

Predators include snakes, carnivorous lizards, coyotes, hawks, rattlesnakes, American kestrels, and humans (Animal Diversity Web 2015).

### Next steps

A monitoring program will be developed to assess the population parameters and viability of chuckwalla in the MSP.

# Desert Tortoise

*Gopherus morafkai*

## Brief description

The desert tortoise has a high, oblong domed shell with a length of up to 15 inches. Distinct growth rings mark the carapace. The coloration of the carapace can be brown, orange-brown, gray-brown, dark-brown, dark-gray, or near black. The underside is usually tan or yellow. The tail is short and the hind limbs are short, rounded, thick, and elephant like. The forelimbs are flattened for digging and longer than the hind limbs. All four limbs are armored with large, thick scales. This tortoise has a shorter gular (throat) shield and a more narrow shell width than the similar looking Agassiz (Mojave) desert tortoise (Stebbins 2003).

## Conservation status and basis

Global status: G4 apparently secure (Arizona Game and Fish Department 2015)
State status: S4 apparently secure (Arizona Game and Fish Department 2015)

Except for being vulnerable to the mountain lion, the desert tortoise is protected from other predators by its thick shell. A more serious threat to the tortoise is the loss and degradation of habitat from development and other human activities (Arizona Game and Fish Department 2015).

## Range in Arizona and MSP

The species ranges east and south of the Colorado River from Arizona into Mexico, at elevations ranging from near sea level along the Colorado River to just over 3500 feet (U.S. Department of the Interior, Bureau of Land Management 2015).

This tortoise has been observed in the MSP (McDowell Sonoran Conservancy 2014).

## General habitat requirements

The desert tortoise generally lives on rocky slopes and bajadas in the Arizona Uplands (Phillips 2000).

## Critical habitat requirements: den sites, nest sites, breeding sites

The Sonoran desert tortoise constructs a burrow under shrubs and rocks or in caliche rocks or caves. The tortoise may expand existing crevices under rocks if the soil permits. Desert washes provide exposed banks with variable aspects, exposed caliche caves for burrows, and vegetation for thermal cover (Nevada Fish & Wildlife Office 2015).

### Food habits and water requirements

The desert tortoise is herbaceous. The plants eaten vary by season and region. Generally, annuals dominate its spring diet while dry grasses dominate during the summer (NatureServe 2014). During the rainy season, a tortoise will drink large amounts of water from temporary pools (Arizona-Sonora Desert Museum 2003).

### Overall biology

The desert tortoise breeds from spring to fall. The female stores sperm in her reproductive tract for up to 18 months. Females often mate in late summer and hibernate before laying eggs in the spring. A female desert tortoise normally lays three to five eggs, but that can vary from one to 14. She buries the eggs in a deep nest that is scooped out of the desert floor. Usually the incubation period is 90 to 135 days, and the eggs hatch in September or October. The length of the incubation period and the sex of the offspring are determined by temperature (Arizona-Sonora Desert Museum 2003). After the mother leaves the nest, the hatchlings must survive on their own (Nevada Fish & Wildlife Office 2015).

The shell of a newly hatched tortoise is extremely soft and remains soft during the first five years of life. It eventually hardens as the tortoise matures (Arizona-Sonora Desert Museum 2003).

Sexual maturity is reached in about 14 to 21 years (Arizona-Sonora Desert Museum 2003).

Mortality for young tortoises is very high. Once a tortoise reaches 20 years of age, it is likely to live to approximately 50 to 80 years of age. The tortoise grows slowly and generally has low reproductive rates (Nevada Fish & Wildlife Office 2015).

### Activity patterns: daily, hibernation or similar, migration

The desert tortoise is active during the summer monsoon season when fresh forage is available (U.S. Department of the Interior, Bureau of Land Management 2015).

The desert tortoise is very sensitive to heat. Exposure to extreme temperatures can kill it in less than one hour. It stays in a burrow or rock shelter about 90 percent of the time. When it is young, it seldom ventures more than 150 feet from its burrow. When it is older, it may go over 1 km in a day and use a network of burrows. In the most densely populated areas, there may be one tortoise per hectare. Typically, tortoise densities are closer to one tortoise per 40 hectares (Nevada Fish & Wildlife Office 2015).

### Predators

The mature animal's thick skin and hard shell protect it from most predators, but the young are vulnerable. Ravens, Gila monsters, kit foxes, badgers, roadrunners, golden eagles and coyotes take a toll on the young. Mountain lions occasionally kill an adult tortoise (Arizona-Sonora Desert Museum 2015).

### Next steps

This species is not only a priority sensitive species, but is also an excellent indicator of environmental change due to habitat fragmentation, introduction of non-native fauna, and other urban impacts. A monitoring program will be developed in the next year that will be consistent with monitoring being conducted elsewhere in the Phoenix metropolitan area and vicinity.

# Townsend's Big-eared Bat

*Corynorhinus townsendii*

**Brief description**

This is a medium-sized bat, with a body about four inches long and a wingspan of 12 to 13 inches. It has very long, flexible ears and lumps on each side of the snout. It is medium to dark brown on the back and sides, and lighter brown on the ventral surfaces (Arizona Game and Fish Department 2003).

**Conservation status and basis**

Global status – G4

State status – S3, S4

U.S. Fish & Wildlife Service – Species of Concern

U.S. Department of the Interior, Bureau of Land Management – Sensitive

U.S. Forest Service – Sensitive

Concerns include human disturbance of maternity and hibernating sites, loss of roosting habitat (mines and caves), and loss of foraging habitat due to deforestation (Arizona Game and Fish Department 2003).

**Range in Arizona and in MSP**

This bat is widespread in Arizona. They are found in every county except Apache and Greenlee counties along the eastern border of the state (Arizona Game and Fish Department 2003).

This bat has been observed in the MSP in the Dixie Mine area (McDowell Sonoran Conservancy 2014).

**General habitat requirements**

The bat is found where caves or abandoned mine tunnels are available for roosting and hibernating. They also may use abandoned buildings (Arizona Game and Fish Department 2003). Bats require free water to survive.

### Critical habitat requirements: den sites, nest sites, breeding sites

These bats prefer hanging from open ceilings. They hibernate in winter. Their roosts require stable temperatures between about 32 and 54 degrees Fahrenheit, mostly in upland areas. The bats feed primarily on moths and roost within about 3-5 miles of suitable foraging sites (Arizona Game and Fish Department 2003).

### Food habits and water requirements

The bat's diet includes small moths, flies, and other small insects taken from leaves and while in flight (Arizona Game and Fish Department 2003).

### Overall biology

The reported lifespan of the Townsend's big-eared bat is a little over 16 years (Pierson 1998).

During summer, males and females roost separately and forage nightly. Mating takes place in late fall although ovulation and fertilization are delayed until spring. Gestation is 50 – 100 days and the pups, born in late spring to early summer, require care for three to eight weeks in maternity colonies of females (Arizona Game and Fish Department 2003).

### Activity patterns: daily, hibernation or similar, migration

The bats forage nightly, often in several forays with night roosting in between. During summer, males and females roost and forage separately, with females grouped into maternity colonies. During winter, the bats hibernate in upland areas with stable temperatures not far above freezing. Hibernation is frequently disturbed as bats move within the roosts or even relocate to a new roost. They do not migrate (Arizona Game and Fish Department 2003).

The bats hibernate during winter in tightly-packed clusters. However, they tend to wake up and move around frequently during this period (Arizona Game and Fish Department 2003).

### Predators

Bat predators are either aerial, like raptors, or arboreal like some snakes. Bats are especially subject to predation during their torpid daytime state and during winter hibernation (Animal Diversity Web 2015).

### Next steps

Periodic monitoring of bat populations in and near the MSP.

# American Badger

*Taxidea taxus*

### Brief description

The badger has a flattened body with short, stocky legs and long foreclaws. The body is covered with grayish to reddish fur. The face is distinctive with a white throat and chin, black cheek patches, and a white stripe extending from the nose back over the head. The species is sexually dimorphic, with males larger than females. Badgers measure 20 to 35 inches including a relatively short tail, and weigh eight to 26 pounds (Long 1999).

### Conservation status and basis

IUCN: Least concern (International Union for Conservation of Nature 2015)

Global Rank: G5 – secure (Arizona Game and Fish Department 2015)

State Rank: S3, S4 vulnerable to apparently secure (Arizona Game and Fish Department 2015)

A small population in a restricted habitat in proximity to heavily used hiking trails makes this species sensitive in the MSP.

### Range in Arizona and in MSP

Badgers are found throughout the state (Swain, date unknown) and one has been seen in the MSP (McDowell Sonoran Conservancy 2014).

### General habitat requirements

The badger prefers open areas with enough soil to dig in. In Arizona, badgers are found in desertscrub and semi-desert grasslands (Davis 1992). It inhabits underground burrows when inactive (International Union for Conservation of Nature 2015).

### Critical habitat requirements: den sites, nest sites, breeding sites

Badgers have a home range that can vary in size from two to 725 hectares depending on the season and prey availability (International Union for Conservation of Nature 2015). Soil in the range must be sufficiently friable to facilitate den construction (Long 1972). Male home ranges are larger than female ranges, and male ranges are likely to overlap with those of several females to facilitate finding mates (Long 1999). Males occupy 2.4 square kilometers versus 1.6 for the female (Animal Diversity Web 2015). Natal dens are built within the

female's home range.  Badgers require free water to survive.

### Food habits and water requirements

Badgers are fossorial carnivores, feeding primarily on small rodents captured by digging out the prey's burrow or invading its den (International Union for Conservation of Nature 2015). Badgers also eat scorpions, lizards, snakes, (Messick 1981) and the eggs and nestlings of ground-nesting birds (Sullivan 1996).

### Overall biology

Badgers mate in late summer but embryo implantation is delayed. Gestation lasts about six weeks and pups are born in the spring of the year following mating. Litters contain one to five pups that are born blind and helpless. Juveniles leave the den and are independent by late summer or early fall, five or six months after birth (Swain). Although badgers generally are solitary, males occasionally stay with females while the young are still in the burrow (Messick 1981).

Estimates of the average lifespan of wild badgers range from four to 10 years (Long 1999).

### Activity patterns: daily, hibernation or similar, migration

Badgers are primarily nocturnal but are occasionally seen during the day. They become less active in cold weather but do not hibernate (Long 1972).

### Predators

The primary predator of badgers is humans. The animals are hunted for their fur and because of the perceived risk of their burrows to livestock, etc. Natural predators include golden eagles, bobcats, mountain lions, and coyotes. Young animals are most vulnerable to predation (Long 1999).

### Next Steps

A population study of badgers would provide information about whether there is a viable population in the MSP and whether we can expect it to persist.

# Gilded Flicker

*Colaptes chrysoides*

**Brief description**

The gilded flicker is approximately 12 inches long with a gray face and brown cap. The male has a red slash on each side of its face. Its body is grayish brown with a conspicuous black crescent on its chest. It has black bars on its back and black spots below. Its white rump and yellow wing linings are conspicuous in flight (National Audubon Society 2015).

**Conservation status and basis** (Arizona Game and Fish Department 2015)

BLM Sensitive

S5 Secure

G5 Secure

The gilded flicker is vulnerable due to possible loss of its habitat from development (National Audubon Society 2015).

**Range in Arizona and in MSP**

This bird lives in the Sonoran Desert where there are saguaro cacti and in areas where there are cottonwood trees (National Audubon Society 2015).

The gilded flicker has been sighted in the MSP (McDowell Sonoran Conservancy 2014).

**General habitat requirements**

The gilded flicker prefers deserts, where it nests in holes in the giant saguaro cactus. It also lives in tree groves, especially cottonwoods, which line streams and rivers in areas of low elevation (National Audubon Society 2015).

**Critical habitat requirements: nest sites, breeding sites**

The gilded flicker nests in unlined holes that the male and female dig seven to 20 feet above ground in the giant saguaro cactus (Cornell Lab of Ornithology 2015).

**Food habits and water requirements**

This bird forages by hopping on the ground, and will climb tree and cactus trunks looking for food. It will occasionally fly into the air to catch an insect. Its food is mainly insects, especially

ants, and fruits, seeds and nuts (National Audubon Society 2015), (Cornell Lab of Ornithology 2015).

### Overall biology

The female lays four to five eggs in the unlined nesting cavity. Both parents incubate the eggs for about 11 days. Both parents feed the young by regurgitation for about four weeks. When the young can fly, they follow their parents to forage. The pair generally has one brood per year (National Audubon Society 2015).

### Activity patterns: daily, hibernation or similar, migration

The gilded flicker stays in the same area for its entire life (Cornell Lab of Ornithology 2015).

### Predators

Records exist of Harris's hawk, sharp-shinned hawk, Cooper's hawk, and broad-winged hawk preying upon flickers. Various species of rodents, lizards, snakes, crows, ravens, and raccoons are common predators of flicker nestlings (U.S. Department of the Interior 2008).

### Next steps

Monitor the gilded flicker populations through the MSCFI bird monitoring program. This program follows the methods of the bird surveys conducted by the MSCFI in 2012-2013, and is repeated every five years.

# Abert's Towhee

*Melozone aberti*

**Brief description**

The Abert's towhee is a large New World sparrow. Its length is eight to nine inches. It is mostly gray-brown but has dark rust undertail coverts and black lores (the area between the eye and bill). Its bill is pale. Males and females have identical plumage (National Audubon Society 2015).

**Conservation status and basis** (Arizona Game and Fish Department 2015)

Global status – G3 Rare, G4 Apparently Secure

USFS - Sensitive

This species inhabits Arizona from Nogales to Sedona, and contiguous small areas in neighboring states (National Audubon Society 2015). It rarely leaves its favored habitat. This could make it vulnerable due to loss of habitat to development. Widespread change in its favored habitat has led to a reduction in Abert's towhee populations in its historical range (Cornell Lab of Ornithology 2015).

**Range in Arizona and in MSP**

The Abert's towhee occurs in Arizona from Nogales to Sedona (National Audubon Society 2015).

It has been sighted multiple times in the MSP (McDowell Sonoran Conservancy 2014).

**General habitat requirements**

The Abert's towhee lives near desert streams and rivers, cottonwoods, mesquite trees, dense brush, and dense shrubs (Cornell Lab of Ornithology 2015). It has adapted to urban backyards in the Phoenix area (National Audubon Society 2015).

**Critical habitat requirements: nest sites, breeding sites**

The Abert's towhee is a permanent resident of a small territory. A mated pair comes from the same territory and forms a monogamous pair (National Audubon Society 2015). Mating season is generally from March through July. The female Abert's towhee prefers to build a nest from five to eight feet above the ground in a tree with leaves, but will build one in a shrub if a tree is unavailable.

### Food habits and water requirements

This bird eats insects and seeds. It forages on the ground and around the base of trees and bushes, scratching at the ground with both feet (Cornell Lab of Ornithology 2015).

### Overall biology

The female builds the nest about one week before mating. After mating, there are generally one to four eggs that the female incubates for two weeks. Both parents feed the young for up to one month. There may be two broods per year (Cornell Lab of Ornithology 2015).

### Activity patterns: daily, hibernation or similar, migration

The Abert's towhee lives in its habitat year-round. It does not migrate. It spends only 5 percent of its time flying, and that is for the purpose of moving to a nearby shrub (National Audubon Society 2015).

### Predators

Hawks and mammals prey upon Abert's towhees (Center for Native and Urban Wildlife Studies 2015). Coachwhip snakes and roadrunners prey upon nestling Abert's towhees (Finch 1981).

### Next steps

Monitor the Abert's towhee populations through the MSCFI bird monitoring program. This program follows the methods of the bird surveys conducted by the MSCFI in 2012-2013, and is repeated every five years.

# Loggerhead Shrike

*Lanius ludovicianus*

### Brief description

This is a robin-sized (eight to 10 inches in length) gray bird with black wings, white wing patches, a black mask, and black tail (National Audubon Society 2015). Compared to most birds, its head is large in proportion to its body size – which is the source of its name (Yousef 1996).

### Conservation status and basis

State Rank: S4 Apparently secure (NatureServe 2014)

Global Rank: G4 Apparently secure (NatureServe 2014)

U.S. Fish and Wildlife Service: Species of concern (Pruitt 2000)

IUCN conservation status: Least concern (International Union for Conservation of Nature 2015)

This species is widespread across the continent. However, its population has declined in recent decades possibly due to loss of open habitat, biocide usage, and increased competition (NatureServe 2014).

### Range in Arizona and in MSP

The loggerhead shrike is resident in at least five counties in Arizona (NatureServe 2014). It has been observed in the MSP (McDowell Sonoran Conservancy 2014). During a bird survey, observers identified recently fledged young incapable of sustained flight or with limited mobility (McDowell Sonoran Conservancy 2014 – unpublished data).

### General habitat requirements

The shrike is found in a variety of habitats but prefers open areas with scattered trees and shrubs, very open grassy woodlands, and desert habitats with short vegetation and a few trees (Yousef 1996).

### Critical habitat requirements: nest sites, breeding sites

This bird typically nests in thorny shrubs or trees (National Audubon Society 2015).

### Food habits and water requirements

Shrikes eat large insects, rodents, lizards, and other birds. A unique characteristic of the species is impaling larger prey on sharp natural or manmade objects, such as a barbed wire fence, where the prey can be torn up for eating or stored for later consumption. It captures prey via a short flight from a perch (NatureServe 2014).

### Overall biology

The species usually lives in pairs on permanent territories defended by the males (Yousef 1996). Both sexes gather nesting material, but the female builds the nest which is an open cup of twigs lined with softer material and usually located in thorny vegetation (Yousef 1996).

Mating occurs in late spring and produces clutches of four to six eggs. During incubation of 16 to 18 days, the male feeds the female. The juveniles become independent in about 36 days and disperse (NatureServe 2014).

### Activity patterns: daily, hibernation or similar, migration

In Arizona, the loggerhead shrike is a permanent resident that does not hibernate or migrate (Yousef 1996).

### Predators

Predators may include feral cats, coyotes, badgers, various raptors, gopher snakes and rattlesnakes (NatureServe 2014).

### Next steps

Monitor the loggerhead shrike population through the MSCFI bird monitoring program. This program follows the methods of the bird surveys conducted by the MSCFI in 2012-2013, and is repeated every five years.

# Raptors

Raptors, as a group, are protected under the Migratory Bird Treaty Act. Many raptor species have been threatened by pesticides, electrocution on powerlines, and other human activity. The diversity and abundance of this group can be indicative of negative human impact. Diversity and abundance of all raptor species in the MSP will be tracked through the MSCFI bird monitoring program. Below are the raptor species considered to be sensitive, and specific steps over and above the surveys that are recommended to track and protect them.

## Peregrine Falcon

*Falco peregrinus*

### Brief description

The peregrine falcon is a raptor with a blue-gray back. Its underside is buff colored, barred and spotted. Its head is dark and there is a dark moustache marking above the yellow bill. Its large feet are yellow (Peterson 2012).

The peregrine falcon is a large, crow-sized bird. Its body length is between 14 to 23 inches. The female can measure up to 20 percent larger and 50 percent heavier than the male. Its average weight is about 2 pounds (White 2002). It is known for its pointed wings, narrow tail, and quick, powerful wing beats. The wingspan is from 36 to 44 inches (Peterson 2012).

### Conservation status and basis

International Union for Conservation of Nature Status – Least concern
Global rank – G4 apparently secure (Arizona Game and Fish Department 2015)
State rank – S4 apparently secure (Arizona Game and Fish Department 2015)

The peregrine falcon is federally protected under the Migratory Bird Treaty Act and was monitored until 2015. The U.S. Fish and Wildlife Service removed peregrine falcon from the U.S. Endangered Species List in 1999 (U.S. Fish and Wildlife Service 2015). Its survival has marked the most dramatic success of the Act (The Nature Conservancy 2015). However, in the Sonoran Desert, its distribution is unstable due to variable rainfall in the spring and summer (Luensmann 2010).

### Range in Arizona and in MSP

The peregrine falcon is one of the most widely distributed species in the world. It is found on every continent except Antarctica. It can survive in a wide variety of

habitats, including cities, the tropics, deserts, and the tundra (Defenders of Wildlife 2015).

The peregrine falcon has been sighted in the MSP (McDowell Sonoran Conservancy 2014).

**General habitat requirements**

This raptor prefers open habitats with cliff faces and crevices for nesting. It also colonizes urban areas, where tall buildings or bridges provide suitable nesting sites and pigeons are available as prey (White 2002).

**Critical habitat requirements: nest sites, breeding sites**

The peregrine falcon nests in a scrape, normally on cliff edges. The female chooses the nest site. She scrapes a shallow hollow in the loose soil, sand, gravel, or other substrate for her eggs. Little or no nest materials are added. In urban areas, peregrines nest on tall buildings or bridges (Cornell Lab of Ornithology 2015).

**Food habits and water requirements**

The peregrine falcon eats other birds such as songbirds, pigeons, doves and ducks, as well as bats. It catches its prey in mid-air (Defenders of Wildlife 2015).

**Overall biology**

The peregrine falcon can reach cruising speeds of more than 30 mph. When in the chase, its speed can reach 65 mph. When hunting, it can dive toward its prey at speeds over 200 mph. It often is cited as the fastest bird in the world (Cornell Lab of Ornithology 2015).

When not breeding, the peregrine falcon is solitary and territorial. Territory size depends on food availability. In northern populations the distance between nests varied from 3.3 to 5.6 km. (White 2002).

The male peregrine falcon reaches sexual maturity between one and five years, and the female somewhat later. Falcons form monogamous pair bonds that last through many breeding seasons and the pair returns to the same nesting spot annually (White 2002).

Egg-laying is generally from February to March in the mid-latitudes. The normal clutch size is three to four eggs but can range from one to five. The female incubates the eggs for 29 to 33 days, mainly at night. The male helps with incubation during the day. The average number of young that hatch and fledge is about 1.5, due to some

infertile eggs and various natural nestling losses. The male and female both leave the nest to gather prey for the young. Chicks fledge 42 to 46 days after hatching. They remain dependent on their parents for as long as two months (Nevada Fish & Wildlife Office 2015).

The wild falcon has an average life span of up to 15.5 years if it survives its first year, when the mortality rate is 59-70 percent (U.S. Fish & Wildlife Service 2015).

### Activity patterns: daily, hibernation or similar, migration

The peregrine falcon is active during the day within its hunting territory, which ranges from about 200 to 1500 square kilometers depending on food availability (White 2002). Populations in warmer climates including Arizona do not migrate (Ridgely 2003).

### Predators

Young peregrines are preyed upon by other birds of prey, including golden eagles and great horned owls. Eggs and nestlings at vulnerable nest sites are sometimes taken by mammalian predators (White 2002). Adult peregrine falcons have few threats other than man. One of the greatest human disturbances to the bird was the use of DDT that began during World War II. The U.S. Environmental Protection Agency banned DDT in 1972.

### Next steps

Work with the City of Scottsdale, Arizona Game and Fish Department, the rock climbing community and other MSP users to 1) survey raptor nesting habitat for potential nest sites, and 2) develop a management plan that addresses seasonal trail closures.

Monitor potential peregrine falcon nest sites for evidence of conflict with human activity, using Arizona Game and Fish Department peregrine falcon nest monitoring protocol. If evidence is found of a) nesting activity and b) agitated behavior of falcons in response to human activity (nearby hiking, rock climbing), work with experts at the Arizona Game and Fish Department to recommend a seasonal closure of the immediate area. Continue monitoring and adjust recommended actions according to falcon response.

# Zone-tailed Hawk

*Buteo albonotatus*

**Brief description**

The zone-tailed hawk is a medium to large-sized slate black hawk. Its tail has two or three light bands and its under-wings are dark with paler flight feathers. Its legs and face are yellow (National Audubon Society 2015). Its wingspan is 47 to 55 inches (Cornell Lab of Ornithology 2015). It closely resembles a turkey vulture.

**Conservation status and basis** (Arizona Game and Fish Department 2015)

U.S. Forest Service - Sensitive

State Rank 4 - Apparently Secure

Global Rank 4 - Apparently Secure

Loss of cottonwoods growing beside streams affects the availability of nesting sites for this bird and may cause a population decline (National Audubon Society 2015).

**Range in Arizona and in MSP**

This bird lives throughout Arizona during the warmer months (National Audubon Society 2015), (Cornell Lab of Ornithology 2015) and has been sighted in the MSP (McDowell Sonoran Conservancy 2014).

**General habitat requirements**

The zone-tailed hawk favors habitats by rivers and in desert mountains, canyons and tree groves. It soars over open countryside, chaparral, and areas with scattered trees (National Audubon Society 2015).

**Critical habitat requirements: nest sites, breeding sites**

A zone-tailed hawk pair performs spectacular aerial displays during courtship and mating. They call to each other while performing rolls and aerial loops at up to 1,640 feet above ground and make dives from that height (National Audubon Society 2015), (Cornell Lab of Ornithology 2015).

The nest, which may be reused for many years, is a bulky platform of sticks lined with green leafy twigs. The nest site is in a very large tree, often in an isolated grove of cottonwood or pine by a river or stream. The nest is at least 30 feet above the ground,

sometimes up to 100 feet or more (National Audubon Society 2015), (Cornell Lab of Ornithology 2015). This bird is aggressive in defending its nesting territory (Cornell Lab of Ornithology 2015).

### Food habits and water requirements

The zone-tailed hawk hunts lizards, small animals and birds while soaring like a vulture. After spotting its prey, the hawk will circle away or screen itself behind trees or rocks, then make a sudden dive to surprise and capture its prey (National Audubon Society 2015), (Cornell Lab of Ornithology 2015).

### Overall biology

The female lays up to three eggs and incubates them for about 35 days. After the eggs hatch, she gives the young food that the male brings to her. The young fly after about six to seven weeks (Cornell Lab of Ornithology 2015). Both sexes hunt by soaring.

### Activity patterns: daily, hibernation or similar, migration

The zone-tailed hawk migrates to warmer areas in the colder months. A pair often returns to their previous nesting site the next year (National Audubon Society 2015).

### Predators

No information about predators of zone-tailed hawks was found.

### Next steps

Monitoring as part of the overall bird monitoring protocols.

## Golden Eagle

*Aquila chrysaetos*

### Brief description

The golden eagle is one of the best-known large raptors in North America. It is a uniform dark brown, with a golden head and neck. Both the male and female have yellow feet and yellow at the base of the bill. The juvenile has white wrist patches and white at the base of the tail (Tekiela 2003). The legs are feathered all the way down to the toes (Animal Diversity Web 2015).

The golden eagle is one of the largest raptors in its class, measuring 26 to 40 inches in length and weighing nine to 14 pounds, with a wingspan of six to eight feet. The

head is smaller and the tail appears longer than the bald eagle (Carolina Raptor Center 2015).

### Conservation status and basis

International Union for Conservation of Nature – Least concern (International Union for Conservation of Nature 2015)
Global status – G5 secure (Arizona Game and Fish Department 2015)
State status – S4 apparently secure (Arizona Game and Fish Department 2015)

The golden eagle has been protected in the United States since 1963. During the 1950's an estimated 20,000 eagles were destroyed by ranchers, particularly sheep farmers who perceived them as a livestock threat. In the northeastern states, remnant populations declined drastically. The reasons for the decline of the eastern species are unclear. One of the many possible contributors is believed to be pesticide contamination (New York State Department of Environmental Conservation 2015).

The golden eagle is not on the Federal Endangered Species List (New York State Department of Environmental Conservation 2015).

### Range in Arizona and in MSP

The golden eagle ranges from western North America and the Alaskan tundra south to Arizona and into Mexico, but is less abundant in the eastern United States (New York State Department of Environmental Conservation 2015).

The eagle has been sighted in the MSP (McDowell Sonoran Conservancy 2014).

### General habitat requirements

The golden eagle inhabits mountainous terrain where there are rocky cliffs for nesting and observing. It requires an extensive territory with a large food supply of smaller mammals and birds near grasslands, sagebrush flats, deserts or open lands (National Geographic Society 2015).

### Critical habitat requirements: nest sites, breeding sites

The golden eagle range spans as much as 60 square miles. It relies on undisturbed nesting areas, since monogamous mates return to the same nest year after year and renew their pair bond in late winter.

### Food habits and water requirements

The golden eagle is a powerful raptor and has no difficulty taking jackrabbits and

somewhat larger ground animals, and smaller birds. This raptor hunts by perching or soaring and watching for movement. It preys on the desert tortoise by carrying it high, dropping it, and breaking the shell. It also takes advantage of carrion (Tekiela 2003).

### Overall biology

Breeding is most successful where prey is abundant. If food is scarce, a pair may forego reproduction until a more prosperous year. Deforestation and urban sprawl have eliminated some of its nesting and breeding sites. Under natural conditions, the golden eagle is a long-lived bird, especially when its body size is large. In the wild, golden eagles are known to live up to 32 years (Kochert 2002).

### Activity patterns: daily, hibernation or similar, migration

Some golden eagles migrate while others do not, depending on conditions in their geographic location. Alaskan and Canadian eagles typically fly south in the fall, while golden eagles living in the western continental United States tend to remain in their ranges year-round (National Geographic Society 2015).

### Predators

The adult golden eagle has few natural predators except humans. The nesting and young eagles are susceptible to other birds of prey, bears, wolves, and cougars. Fearing eagles will harm their livestock, farmers have shot golden eagles, causing a population decline. In modern times, construction of windmills creates a serious problem for all birds. The U.S. Environmental Protection Agency has strict compliance regulations in place for companies constructing windmills.

### Next steps

Work with the City of Scottsdale, Arizona Game and Fish Department, the rock climbing community and other MSP users to 1) survey raptor nesting habitat for potential nest sites, and 2) develop a management plan that addresses seasonal trail closures.

Monitor potential golden eagle nest sites for evidence of conflict with human activity, using the Arizona Game and Fish Department peregrine falcon nest monitoring protocol. If evidence is found of a) nesting activity and b) agitated behavior of falcons in response to human activity (nearby hiking, rock climbing), work with experts at the Arizona Game and Fish Department to recommend a seasonal closure of the immediate area. Continue monitoring and adjust recommended actions according to eagle response.

# CHAPTER 7: IMPLEMENTATION

The Ecological Resource Plan is a living, collaborative document developed by the MSCFI and City of Scottsdale MSP staff in consultation with EPG. The 2015 version of the ERP represents a first step toward an adaptive management model, where research and monitoring is used to evaluate the success of management actions and adjust as necessary. The 2015 ERP brings together currently available information for the natural resources of the MSP in order to identify information and research gaps, in addition to putting forth specific recommendations (See Summary Table 8).

Based on this 2015 version of the ERP, the MSCFI will develop a research plan with the MSCFI Science Advisory Committee to prioritize research and monitoring that will best inform long term management of the MSP. The prioritized research will be conducted by MSCFI and its partners in close communication with and permits issued by the City of Scottsdale. Research results will be interpreted by MSCFI and communicated to the City of Scottsdale as status updates and/or management recommendations, using the framework of the ERP. The City of Scottsdale is responsible for deciding if and how to directly implement the recommendations, or approving the implementation of the recommendations by MSCFI or another qualified entity. The role of partners, agencies, Scottsdale city government, and other stakeholders is illustrated in figure 6, "Management Framework Chart".

Table 17. Current studies, studies needed, and management recommendations to the City of Scottsdale from the Ecological Resource Plan, October 2015.

| | Current studies | Studies needed | Recommendations |
|---|---|---|---|
| **Flora** | | | |
| *Diversity* | Flora survey | Monitoring | |
| *Sensitive species* | Preliminary list from survey | Prioritization, monitoring | |
| *Introduced species* | Non-native species monitoring & mapping | Continued monitoring. Research. Assess fire hazard. | Continue removal efforts of listed species within small populations, no removal at this time of five large populations in proposed study areas. |
| *Wildland-urban interface* | None | Survey of boundary to assess species composition and fire hazard. | |

| | Current studies | Studies needed | Recommendations |
|---|---|---|---|
| **Fauna** | | | |
| *Diversity* | Fauna survey | Monitoring and research | |
| *Sensitive species* | Preliminary list from survey, raptor monitoring | Prioritize. Monitor and study population viability of priority species. | Temporary closure of north face of Tom's Thumb during raptor breeding. |
| *Introduced species* | Preliminary list from survey | Prioritization, monitoring, and research. | |
| *Wildland-urban interface* | Ground-dwelling arthropods, Mule deer radio telemetry study. | Study effects of neighborhoods on select wildlife species. | |
| *Wildlife corridors* | Mule deer radio telemetry | Radio telemetry studies for additional species. Investigate wildlife movement patterns and range. | |
| **Riparian areas** | | | |
| *Diversity* | None | Prioritization and monitoring of indicators. | |
| *Wildlife corridors* | Limited wildlife camera data, Mule deer radio telemetry, some survey information on birds and herps. | Track and scat surveys along priority riparian areas and/or camera studies. | |
| *Structure and productivity* | None | Survey, classify, and monitor priority riparian areas. | |

| | Current studies | Studies needed | Recommendations |
|---|---|---|---|
| **Geology** | | | |
| *Unique features* | Several unique features identified | Identify unique features and educational outreach opportunities. | |
| *Baseline geologic map* | Digitization of new mapping | Merging with surrounding geologic maps | |
| *Associations* | None | Identify relationships between geology and biology, water resources (springs, aquifer recharge zones, etc.) | |
| *Landslides* | None | Identify landslides (soil- and slope-sensitive areas for soil creep, rock falls, landslides, and debris flows) | |
| **Soils** | | | |
| *Human impact* | Trail Impact Study | Continue monitoring | |
| *Transport* | Defer to City of Scottsdale Access Areas Report | N/A | |
| **Water Resources** | | | |
| *Surface water* | Limited identification and seasonal monitoring | Continue seasonal monitoring,, identify surface water sources within three miles of the RSB. Review literature for water requirements of water-dependent wildlife species. | |
| *Groundwater* | Some groundwater information exists | Gather existing information to evaluate groundwater resources. Monitor streamflow in perennial and intermittent streams. | |

| | Current studies | Studies needed | Recommendations |
|---|---|---|---|
| **Degraded lands** | | | |
| *Restoration* | Restoration has been conducted in some areas. | Work with City of Scottsdale staff and MSCFI Science Advisory Committee to develop restoration guidelines. Monitor past and future restoration efforts. | |

Monitoring = Long-term repeated sampling to detect change over time.

Research = A study to test a hypothesis or answer a specific question.

Prioritization = In the case of the ERP, this refers to selecting specific important or sensitive species upon which to focus further study and monitoring.

The following table illustrates the integration of the ERP with the other volumes of the City of Scottsdale's Resource Management Plan for the MSP. These volumes include the Cultural Resource Master Plan, Recreation Resource Plan, Land Preservation Plan, Public Safety Plan, and Policies and Guidelines. The column on the right provides a course of action for further investigating or refining the connections between the ERP and other RMP volumes. In addition, a variety of City of Scottsdale ordinances, policies, and guidelines are in place that require a wide range of environmental and cultural reviews.

Table 18. Intersections of Ecological Resource Plan and other volumes of Scottsdale's McDowell Sonoran Preserve

| Component | Item | Status | Intersection with ERP | Action needed |
|---|---|---|---|---|
| Cultural Resource Plan | Cultural Resource Master Plan | Completed fall of 2016 | Avoidance of sensitive species at sites that may be open to cultural interpretation | City of Scottsdale and MSCFI coordinate to ensure new projects do not impact cultural resources or sensitive species. |
| Recreation Resource Plan | Access Areas Report | Exists | Avoidance of sensitive species | City of Scottsdale and MSCFI coordinate to ensure new projects do not impact sensitive species. |
| | Access Area Design and Site Standards | Exists | Avoidance of sensitive species | City of Scottsdale and MSCFI coordinate to ensure new projects do not impact sensitive species. |
| | Trails Plan | Exists | Avoidance of sensitive species, evaluation of impact of trails on plants and animal movement | City of Scottsdale and MSCFI coordinate to ensure new projects do not impact sensitive species. |
| | Rock Climbing Policy and | In Progress | Avoidance of sensitive species, especially raptor nests | Monitoring and plan to decide when to limit trail use. |
| Policies and Guidelines | Commercial Permit Policy | Exists | None | None |
| | Special use guidelines | Exists | None | None |

Table 18. Intersections of Ecological Resource Plan and other volumes of Scottsdale's McDowell Sonoran Preserve

| Component | Item | Status | Intersection with ERP | Action needed |
|---|---|---|---|---|
| Policies and Guidelines | Naming of Manmade Features | Exists | None | None |
| | Trail Naming | Exists | None | None |
| | Research Permit Guidelines | Exists | Research permits required for any work conducted on Preserve outside of daylight hours, off trail, involving collection of specimens, use of UAVs (Unmanned Aerial Vehicles), or use of amplified sound. | Periodic evaluation of efficiency and effectiveness of research permit process |
| Public Safety Plan | Fire and Emergency Response Plan (Fire) | Exists | "Invasive" plants near urban development | Addressed in non-native plant section of ERP |
| | Police Department Plan | City of Scottsdale to Determine Status | None | None |

Table 18. Intersections of Ecological Resource Plan and other volumes of Scottsdale's McDowell Sonoran Preserve

| Component | Item | Status | Intersection with ERP | Action Needed |
|---|---|---|---|---|
| Land Preservation Plan | Land Acquisition Plan | Exists | Evaluation for ecologically valuable land acquisitions | As needed, continue to coordinate analysis of environmentally sensitive lands. |
| | Preserve Land Inventory | Exists | None | None |
| | Access Control Plan | Planned | Take into account access control in sensitive areas | City of Scottsdale and MSCFI coordinate to ensure new projects do not impact sensitive species. |

# GLOSSARY

***Adaptive management*** – Adaptive management involves experimenting with different management approaches, monitoring the results over time, and then adopting or altering the approach based on the results (Williams and Brown 2012).

***Baseline state*** – The state to which information gathered about a resource is compared. In the case of the MSP, this is the diversity and composition of plant and animal species between 2011 and 2013, as documented in *The Flora and Fauna of Scottsdale's McDowell Sonoran Preserve.*

***Biological diversity*** – The abundance, variety, and genetic constitution of animals and plants in nature (Dodson et al. 1998). Species richness is sometimes referred to as biological diversity (see species richness).

***Degraded lands*** – Referenced in the MSP ordinance. For the purposes of the ERP, this refers to areas in the MSP that have been impacted by human activity that results in at least three of the following changes. Priority will be given to larger, more visible sites:

1. Compacted soil as compared to control for undisturbed condition
2. Largely absent of plant material
3. Erosion that is greater than surrounding areas
4. Absence of topsoil

***Catchments, wildlife*** – A ___ designed to capture rain water for use by wildlife. Catchments vary in design but all consist of an apron, designed to capture and funnel water toward a cistern, a large holding tank for water, and a trough, which contains water that flows from the cistern and is exposed for wildlife to drink.

***Ecological indicators*** – "A species which is a good indicator of the living conditions in a particular habitat." (Biology Online). For example, butterfly assemblages and in particular the Western Viceroy butterfly can be used as an indicator of riparian quality in this region (Nelson 2003, 2006).

***Ecological integrity*** – When an ecosystem has biodiversity, productivity, and resilience characteristic of its natural or historic range of variation. The natural range of variation is the variability in these indicators before or without significant human intervention. If an ecosystem looks like and functions over extended time periods as it did under similar climatic and other environmental conditions in the past, it is said to have integrity. Ecological integrity is conceptually similar to ecosystem health (see definition) and, like the latter, there

is no current consensus about how to objectively assess ecosystem integrity. Note that ecosystem functioning is sometimes used as a synonym for ecological integrity or ecosystem health (De Leo Levin 1997).

***Ecological succession*** – "The progressive replacement of one dominant type of species or community by another in an ecosystem…" (Biology Online)

***Ecosystem health*** – This is a metaphor used to describe the condition of an ecosystem. Because there is no widely accepted objective measure for the health of an ecosystem, there is a judgmental element in this determination. Common measures of ecosystem health include combinations of productivity (defined elsewhere), biological diversity (defined elsewhere), and resilience (the ability of an ecosystem to recover previous levels of productivity and diversity after disturbances like fire or freezing). Ecosystem sustainability is sometimes used as a synonym (*Ecosystem Health: Definitions, Assessment, and Case Studies*. David J. Rapport et al. Encyclopedia of Life Support Systems, Volume II. Also *What is a healthy ecosystem?* by Robert Costanza and Michael Mageau. Aquatic Ecology. 1999, Volume 33, Issue 1, pp. 105 – 115).

***Environmental stress*** – Impact on the environment caused by human activities like pollution or by natural events like drought. Impact often is measured in terms of changes in productivity (see definition) in the affected area. Stressors always are present and most species and ecosystems can tolerate some change in stressor intensity and composition, but when the limit of tolerance is reached ecological integrity (see definition) may be challenged (*Towards a definition of ecological disturbance* by Edward J. Rykiel, Jr. Australian Journal of Ecology, 10, 361-365, 1985).

***Evaluation threshold*** – The amount of change in a measured indicator that will trigger further investigation, especially into the potential causes and consequences of the change.

***Food web*** – A network of relationships focused on who eats what; also a flow chart of how energy flows through an ecosystem (Dodson et al. 1998).

***Habitat*** – "The Place where an organism or a biological population normally lives or occurs." (Biology Online). In wildlife management, habitat often refers to the physical components (e.g., plants, terrain, water sources) supporting an animal population.

***Habitat fragmentation*** – The process by which large, continuous habitats are divided into smaller ones that are partially or completely separated by dissimilar habitats (Didham 2010).

***Invasive species*** – A term applied to a species that has a tendency to spread more rapidly than most other species and/or are not native to the ecosystem under consideration.

Although the term often is applied to introduced species, some common Sonoran Desert species may be considered invasive under certain conditions. For example, brittlebush (*Encelia farinosa*) often appears early and spreads rapidly in fire-disturbed areas. Desert broom (*Baccharis sarothroides*) also is well-adapted to disturbed areas.

***Keystone species*** – "A *keystone species* is one whose impact on its community or ecosystem is disproportionately large relative to its abundance." (Biology Online 2015). A change in the abundance of a keystone species can elicit drastic shifts in the habitat through changes in the food web.

***Long-term sustainability*** – The ability of an ecosystem to perpetuate itself through maintaining biodiversity and ecosystem functions.

***Plant association*** – Distinctive groupings of dominant species of shrubs and succulent plants according to the Brown, Lowe and Pase classification system (1979).

***Population recruitment*** – The addition of new individuals to a population through birth and subsequent survival. In practice, this often means when juvenile organisms survive to a stage where they can be detected by an observer or contribute to ecosystem functioning (Allen et al. 2006).

***Productivity*** – The increase in biomass per unit area per unit time, usually expressed as grams per square meter per day, produced by autotrophs. This biomass production is the basis for the local food web, since all other organisms in the ecosystem consume it directly (e.g., herbivores eating plant biomass) or indirectly (e.g., carnivores eating herbivores or other carnivores) (Allaby 2010).

***Species composition*** – The identities of all the plant or animal species within a specified area.

***Species richness*** – The number of species in an area (Dodson et al. 1998).

***Tank, cattle*** – An earthen basin created to capture and retain rain water and run-off. Tanks were constructed by ranchers in order to provide water for cattle.

***Tinaja*** – A naturally occurring area where rainwater and run-off collects and persists for weeks to months at a time.

***Trophic level*** – "A position in a food chain or Ecological Pyramid occupied by a group of organisms with similar feeding mode." (Biology Online)

***Undisturbed condition*** – Plant and animal composition and diversity comparable to the surrounding area within the same plant association.

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# APPENDICES

## APPENDIX I: RESEARCH PERMITS

| Permittee | General Description | Permit Period(s) | Status |
|---|---|---|---|
| McDowell Sonoran Conservancy – McDowell Sonoran Field Institute | Survey of ground-dwelling insects within MSP | 10/1/11 – 9/30/12<br>11/19/12 – 11/30/13<br>8/1/14 – 7/31/15 | Active |
| | Survey of flying insects within MSP | 10/1/11 – 9/30/12<br>11/19/12 – 11/30/13 | Expired |
| | Survey of plants within MSP | 2/1/11 – 1/31/12<br>2/1/12 – 1/31/13<br>4/1/13 – 3/31/14 | Expired |
| | Survey of birds within MSP | 10/1/11 – 9/30/12<br>11/19/12 – 11/30/13<br>1/21/15 – 12/31/15 | Active |
| | Survey of reptiles and amphibians in MSP | 2/1/11 – 1/31/12<br>2/1/12 – 1/31/13<br>3/1/13 – 2/28/14 | Expired |
| | Study of how trail use and human impacts affect the natural environment of MSP | 10/1/11 – 9/30/12<br>11/19/12 – 11/30/13<br>2/1/14 – 3/31/14<br>2/1/14 – 1/31/15 | Active |
| | Survey of small mammals within MSP | 11/1/11 – 10/31/12<br>11/19/12 – 11/30/13 | Expired |

| | | | |
|---|---|---|---|
| | Measuring impacts across the wildland urban interface | 7/9/12 – 9/30/12<br>11/19/12 – 11/30/13 | Expired |
| | Survey of the historic Stoneman Road within the northern region of the McDowell Sonoran Preserve | 1/1/12 – 12/31/12 | Expired |

## APPENDIX II: RESEARCH PERMIT GUIDELINES

*Approved by MSPC on September 29, 2010*

**Research Guidelines**
**City of Scottsdale – McDowell Sonoran Preserve**
**September 2010**

**Background**

Per Chapter 21 of the Scottsdale Revised Code, 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 archeological and historical resources and sites, while providing appropriate public access for educational purposes; and to provide passive outdoor recreational opportunities for residents and visitors. 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.

**Purpose**

This policy is aimed at promoting useful research while preventing damage to the Preserve. It will serve as a guideline for evaluating and permitting research projects, monitoring projects in the Preserve, and assuring proper reporting and credits to the City of Scottsdale. Research activities in the McDowell Sonoran Preserve shall include all organized attempts to gather data from the Preserve for purposes of scientific evaluation. Research conducted by the City of Scottsdale does not require a Research Permit.

The nature and location of the Preserve makes it a prime setting for a wide range of research projects aimed at understanding the upper Sonoran Desert. Typical appropriate projects include, but are not limited to, those of the broad fields of geology, botany, anthropology, archeology, and zoology, as well as the applied science applications of each discipline.

**Process**

Authorization to proceed with research activities in the Preserve will be considered and allowed through a two-stage process. First, any proposed research must be supported by a proposal that provides basic information about the project, and meets the goals and objectives of the Preserve. Once the proposal has been reviewed and accepted by the Preserve Director, or designee, a permitting process will begin to specify the terms, conditions, location, duration and other pertinent information related to a specific research project. If appropriate, a permit of limited scope and duration may be considered, allowing the researcher to determine the feasibility of a more expansive project. Research projects will be allowed to start after acceptance of permit terms and conditions by the project Principal Investigator and approval by the Preserve Director, or designee.

*Research Guidelines September, 2010* *Page 1 of 5*

**A favorable determination may result if the research project:**

- Is relevant and applicable to the Preserve.
- Minimizes disruption to the Preserve's natural and cultural resources, to Preserve operations, and to Preserve visitors.
- involves a principal investigator with a record of accomplishments in the proposed field of investigation and with a demonstrated ability to work cooperatively and safely, and to accomplish the desired tasks within a reasonable timeframe.
- Has specific scientific objectives and/or planned results.
- Contributes information useful to an increased understanding of the Preserve resources, and thereby contributes to effective management and/or interpretation of preserve resources.
- Provides for scheduled sharing of information with Preserve staff, including any manuscripts, publications, maps, databases, etc. which the researcher is willing to share.
- Provides opportunities for local students and/or volunteers to participate in the project.
- Addresses problems or questions useful to science or society and shows promise of making an important contribution to knowledge of the subject matter.
- Provides for the investigator to prepare occasional summaries of findings for public use, such as seminars, brochures, newsletter articles, etc.
- Includes plans for the cataloging and care of collected specimens.
- Clearly anticipates logistical needs and provides detail about provisions for meeting those needs.

those resources (i.e. drawing the public to sensitive sites). Disclaimers must be used which clearly explain that the research work was completed under a permit from the City of Scottsdale, and that without a research permit issued by the City of Scottsdale off-trail travel and removal of items from the Preserve is strictly prohibited, and punishable by law. The City of Scottsdale reserves the right to review printed materials for compliance.

- All off-trail travel, physical disturbance, or removal of items from the Preserve must be within the parameters of the research permit issued by the City of Scottsdale.
- Any physical disturbance to the Preserve resulting from the research activities must be repaired or otherwise returned to original condition, to the greatest extent possible.
- Research projects must have a designated project leader who shall be responsible for conformance to all permit requirements. The Principal Investigator or other key team member may serve as the project leader. The project leader must have appropriate qualifications and understand the permit terms and conditions under which the project will operate.
- The permittee must make periodic reports to the Preserve Director or their designee.
- The permit will be limited to a one year term, renewable at the option of the Preserve Director, and apply to a specified project and investigation area. Permits are not transferable between groups, projects, or areas.
- Evidence of comprehensive general liability coverage will be required and must show the City of Scottsdale as the Certificate Holder, and as Additional Insured. Worker's Compensation coverage may also be required. In addition, a signed hold harmless and indemnity agreement must be on file with the City.
- Such other terms and conditions may be included as the Preserve Director, in their sole discretion, deems appropriate and/or necessary.
- Upon completion of research activities in the Preserve, the permittee shall report to the Preserve Director that field work has been completed.
- Within 3 months after cessation of research activities, submit to the Preserve Director a brief summary of findings and interpretations of data gathered in the Preserve, unless an extension is granted by the Preserve Director.
- Any published documents shall formally acknowledge the City of Scottsdale's McDowell Sonoran Preserve as a source of the data.

END

# APPENDIX III: PUBLIC INPUT

*Public input from May 23, 2014 meeting*

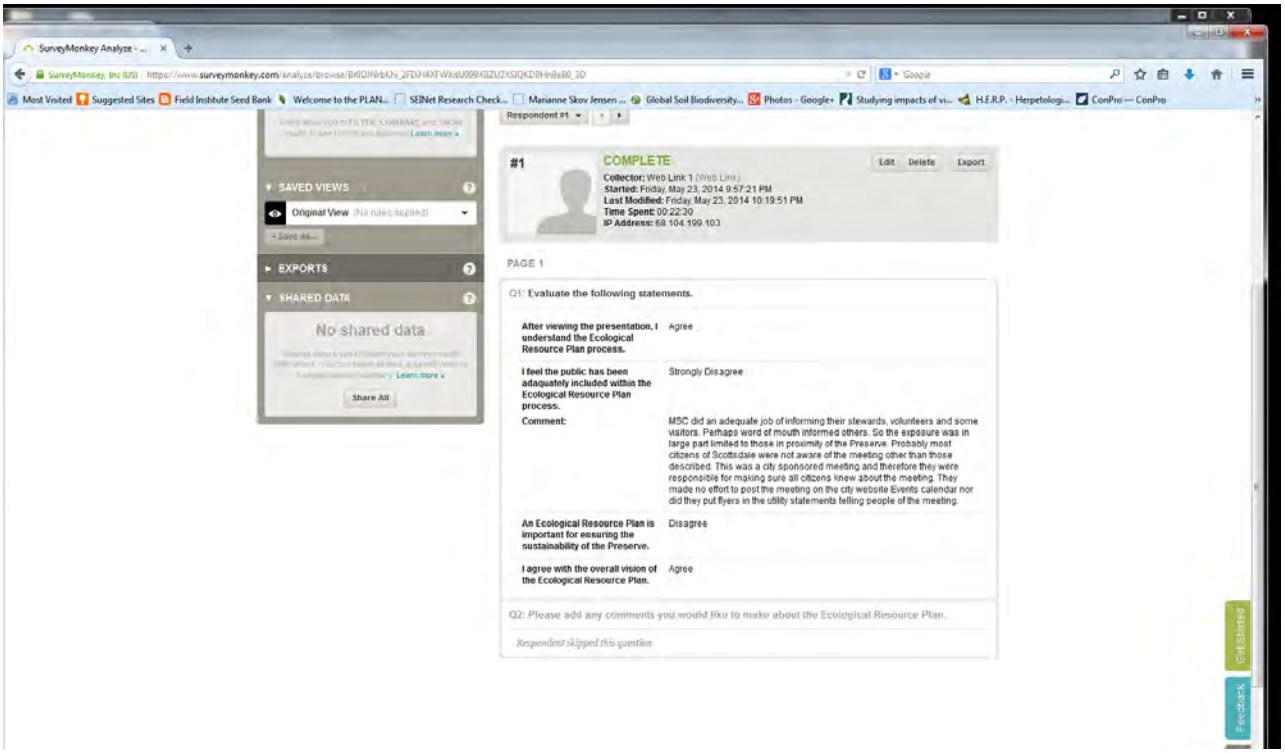
## Survey questions and responses:

| | Strongly Disagree | Disagree | Undecided | Agree | Strongly Agree |
|---|---|---|---|---|---|
| After viewing the presentation, I understand the ERP process | 1 | | | 3 | 8 |
| I feel the public has adequate representation within the ERP process | 1 | | 2 | 1 | 8 |
| An ERP is important for ensuring the sustainability of the Preserve | 1 | | | 1 | 10 |
| I agree with the focus and direction of the ERP | 1 | | | 2 | 9 |

## Additional comments:

| | |
|---|---|
| 1 | Stakeholders - who are considered stakeholders? How was the meeting communicated to the public - stakeholders? Interest groups, bike, hike, equestrian clubs. Of those in attendance how many were MSC Stewards, City Scottsdale, public? |
| 2 | Conservancy and Scottsdale are doing incredible job managing our Preserve. |
| 3 | Amazing work!! Bernie is really cool! |
| 4 | Presentation was quite basic about the planning process - a bit too academic. Most interesting and useful part was about specific baseline data and findings in the preserve. More examples and discussion specific to the preserve would improved the presentation - What are examples of possible recommendations? What are options or directions MSC can go in? MSP? What changes are needed? What facilitates achievement of plan? Potential barriers? |
| 5 | Important Effort - well organized and presented! |
| 6 | No advertisement in newspaper of this meeting. No meeting info in "AZ Republic" or "Scottsdale Republic" about this meeting. I wouldn't have known had I not contacted Melanie on another matter. A lot of us don't have time to view your website frequently. Have you thought of connecting with KAET to spread the word? A lot of press about City Council and its sudden change in unplanned preserve acquisition. I realize this requires a lot of $$., but I am suspicious of the council's interest. Politics defeat a lot of good works because of personal agendas. It is useless and impedes progress. How about comment cards at trailheads and hand them out and collect them before / after guided hikes? |
| 7 | This approach will be the base for the preservation of the Preserve, create are better understand of the value of the Preserve and offer valuable information to the public and the administration to more appropriate decisions for its future. Thank You |
| 8 | I look forward to the next steps in the process. There are many aspects that make the MSP a model for other preserves and this attention to detail, scientific base and public involvement is important to the process. Thank you |

## Comments from web survey: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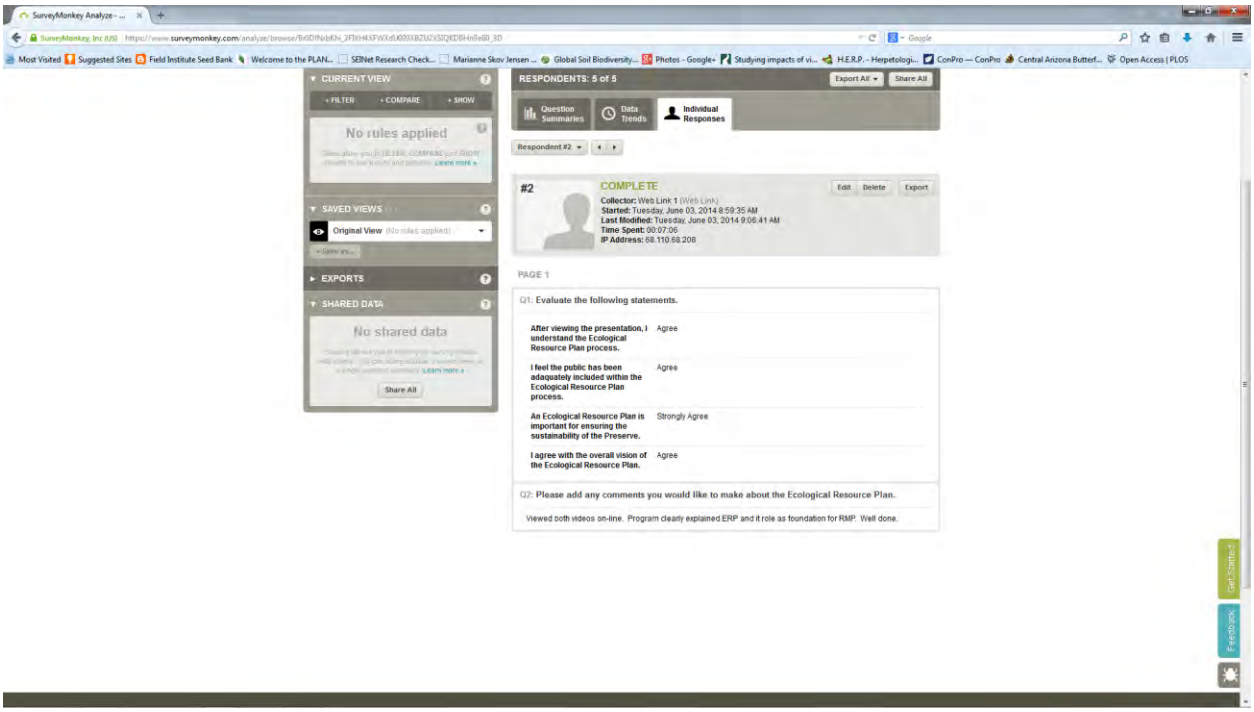
PAGE 1
Q1: Evaluate the following statements.
After viewing the presentation, I understand the Ecological Resource Plan process.
Agree
I feel the public has been adequately included within the Ecological Resource Plan process.
Strongly Disagree
Comment:
MSC did an adequate job of informing their stewards, volunteers and some visitors. Perhaps word of mouth informed others. So the exposure was in large part limited to those in proximity of the Preserve. Probably most citizens of Scottsdale were not aware of the meeting other than those described. This was a city sponsored meeting and therefore they were responsible for making sure all citizens knew about the meeting. They made no effort to post the meeting on the city website Events calendar nor did they put flyers in the utility statements telling people of the meeting.
An Ecological Resource Plan is important for ensuring the sustainability of the Preserve.
Disagree
I agree with the overall vision of the Ecological Resource Plan.
Agree
Q2: Please add any comments you would like to make about the Ecological Resource Plan.
Respondent skipped this question
Get Started
Feedback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SAVED VIEWS
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EXPORTS
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Share All
RESPONDENTS: 5 of 5
Export All
Share All
Question Summaries
Data Trends
Individual Responses
Respondent #2
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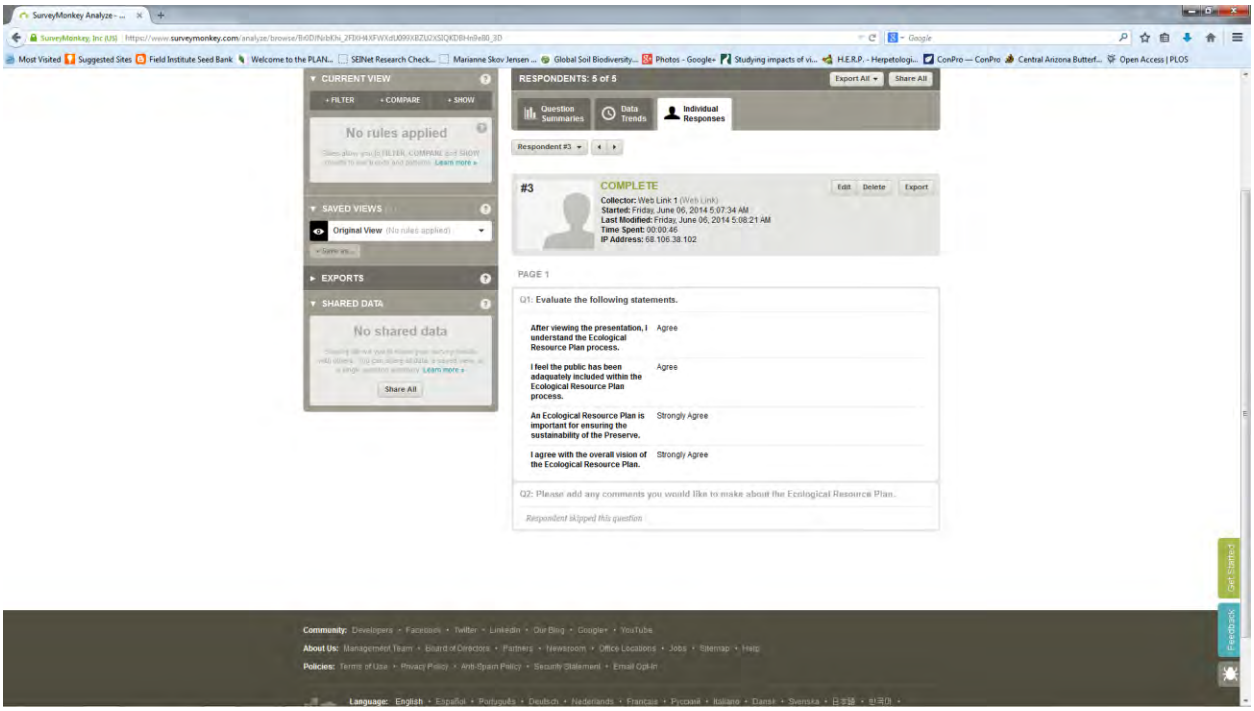
PAGE 1
Q1: Evaluate the following statements.
After viewing the presentation, I understand the Ecological Resource Plan process.
Agree
I feel the public has been adequately included within the Ecological Resource Plan process.
Agree
An Ecological Resource Plan is important for ensuring the sustainability of the Preserve.
Strongly Agree
I agree with the overall vision of the Ecological Resource Plan.
Agree
Q2: Please add any comments you would like to make about the Ecological Resource Plan.
Viewed both videos on-line. Program clearly explained ERP and it role as foundation for RMP. Well done.
Get Started
Feedback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Share All
RESPONDENTS: 5 of 5
Export All
Share All
Question Summaries
Data Trends
Individual Responses
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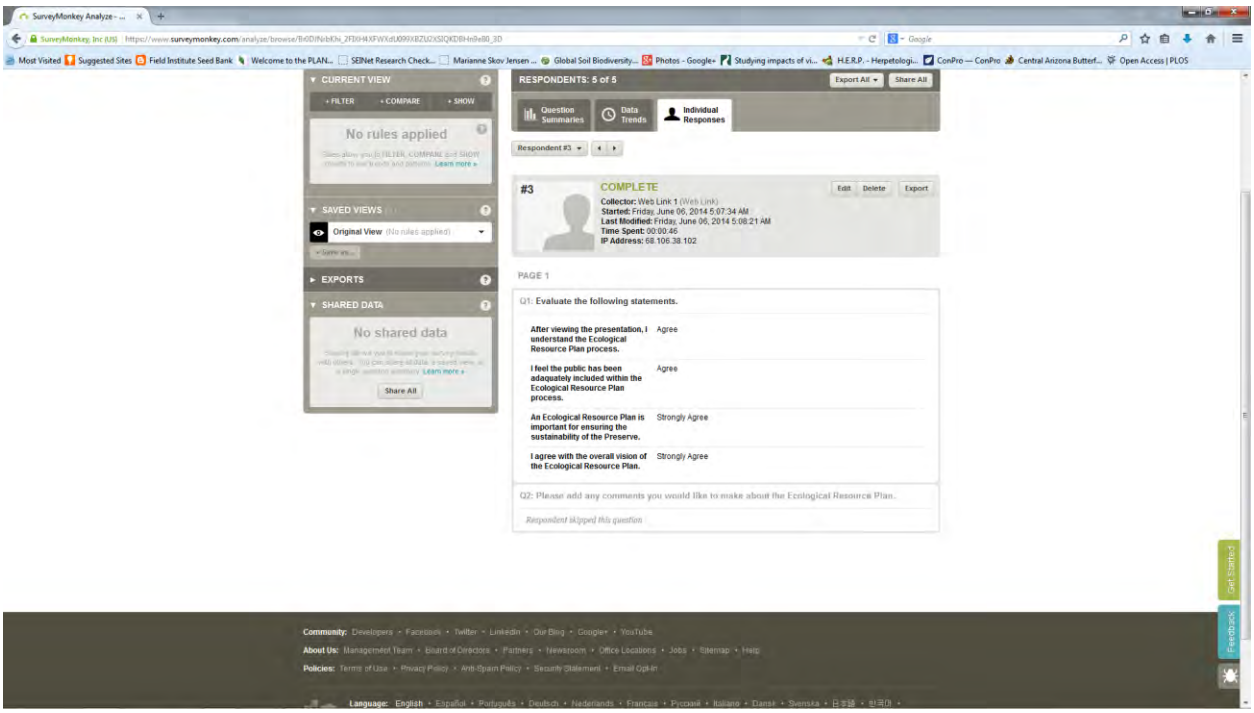
PAGE 1
Q1: Evaluate the following statements.
After viewing the presentation, I understand the Ecological Resource Plan process.
Agree
I feel the public has been adaquately included within the Ecological Resource Plan process.
Agree
An Ecological Resource Plan is important for ensuring the sustainability of the Preserve.
Strongly Agree
I agree with the overall vision of the Ecological Resource Plan.
Strongly Agree
Q2: Please add any comments you would like to make about the Ecological Resource Plan.
Respondent skipped this question
Get Started
Feedback
Community: Developers • Facebook • Twitter • LinkedIn • Our Blog • Google+ • YouTube
About Us: Management Team • Board of Directors • Partners • Newsroom • Office Locations • Jobs • Sitemap • Help
Policies: Terms of Use • Privacy Policy • Anti-Spam Policy • Security Statement • Email Opt-In
Language: English • Español • Português • Deutsch • Nederlands • Français • Русский • Italiano • Dansk • Svenska • 日本語 • 한국어 •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RESPONDENTS: 5 of 5
Export All
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Question Summaries
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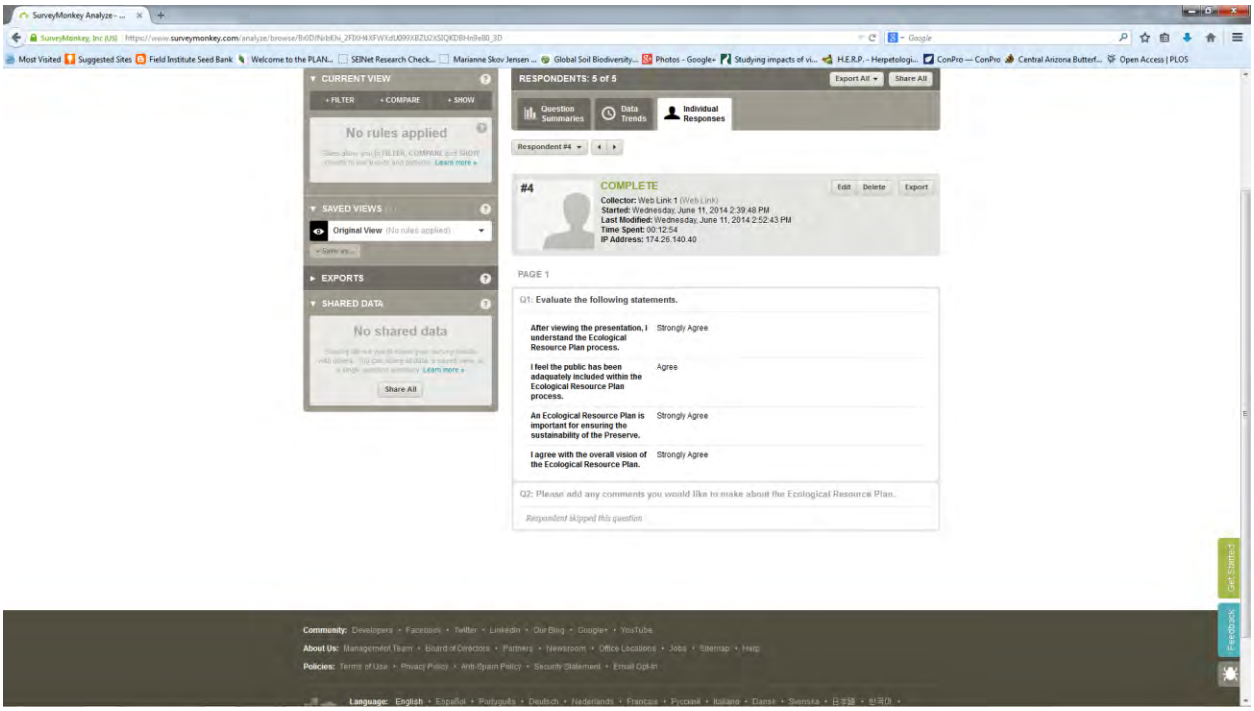
IP Address: 68.106.38.102
PAGE 1
Q1: Evaluate the following statements.
After viewing the presentation, I understand the Ecological Resource Plan process.
Agree
I feel the public has been adaquately included within the Ecological Resource Plan process.
Agree
An Ecological Resource Plan is important for ensuring the sustainability of the Preserve.
Strongly Agree
I agree with the overall vision of the Ecological Resource Plan.
Strongly Agree
Q2: Please add any comments you would like to make about the Ecological Resource Plan.
Respondent skipped this question
Get Started
Feedback
Community: Developers • Facebook • Twitter • LinkedIn • Our Blog • Google+ • YouTube
About Us: Management Team • Board of Directors • Partners • Newsroom • Office Locations • Jobs • Sitemap • Help
Policies: Terms of Use • Privacy Policy • Anti-Spam Policy • Security Statement • Email Opt-In
Language: English • Español • Português • Deutsch • Nederlands • Français • Русский • Italiano • Dansk • Svenska • 日本語 • 한국어 •




*Public input from October 23, 2014 meeting*

Flora was the most mentioned topic in an interactive public meeting on planning for the future of the MSP. The meeting was hosted on October 23 at the Mustang Library by the MSCFI, the research arm of Scottsdale's McDowell Sonoran Conservancy.

The public meeting included a presentation on the development progress of the Ecological Resource Plan for the MSP, followed by the audience breaking down into five small discussion groups, so attendees could provide comments and feedback on their thoughts about the MSP. Each group included an MSCFI Citizen Scientist volunteer as a facilitator.

During the discussions, there were 156 comments addressing Flora, Fauna, Water and MSP Disturbance. Each of these topics included comments relating to a value or a concern in these areas. Values were defined as any area that is a positive characteristic and should be maintained in the plan. Concerns were defined as areas where there is a matter that negatively affects the Flora, Fauna, Water or MSP Disturbance. These concerns indicate areas where the plans should address additional conservations or remediation measures.

The Flora topic received the most comments. Flora values had 23% of the total comments

(36/156) and Flora Concerns had 17% (27/156). The high number of Flora comments was most frequently on the scenic views and variety of plants. Flora concerns mentioned were most frequently about the invasion of non-native plants.

Disturbance concerns were also high. Many of the comments in this area were about trail damage.

The most frequent comment was on the subject of "natural" followed by cactus/saguaro/cholla. Natural, cactus, trails, education and native are all frequently mentioned in the comments. The number of times each subject was mentioned in the comments indicates a high value or concern regarding these topics.

Below are the total comments and the top five topics mentioned:

**Total Comments**

| Category | Number of Comments | Percent of Total Comments |
|---|---|---|
| Flora concern | 27 | 17% |
| Flora value | 36 | 23% |
| Fauna concern | 23 | 15% |
| Fauna value | 10 | 6% |
| Disturbance concerns | 26 | 17% |
| Disturbance values | 15 | 10% |
| Water concerns | 14 | 9% |
| Water values | 5 | 3% |
| Grand Total | 156 | 38% |

**Top 5 Topics Mentioned**

| Most Frequenty mentioned Topic | # Times Mentioned |
|---|---|
| natural | 14 |
| cactus / saguaro / cholla | 9 |
| trails | 8 |
| education | 8 |
| native | 7 |

| CATEGORY | COMMENT |
|---|---|
| Disturbance concerns | Safety |
| Disturbance concerns | effects the enjoyment of the land |
| Disturbance concerns | consideration of the animals in high priority areas |
| Disturbance concerns | disturbance vs. historical site |
| Disturbance concerns | mines - keep safe vs. historical viewing |
| Disturbance concerns | fencing is a balance between historical vs. free flowing corridors |
| Disturbance concerns | what plants needs are needed for restoration |
| Disturbance concerns | provide photo examples of invasive and non-native plants found in MSP |
| Disturbance concerns | education for the stewards and the public |
| Disturbance concerns | should fence be removed as disturbances |
| Disturbance concerns | disturbance of trails by horses after rain |
| Disturbance concerns | mines vs. historical sites |
| Disturbance concerns | conflicting jurisdiction between Game & Fish and McDowell Conservancy |
| Disturbance concerns | consider animals when we define priority to damaged area |
| Disturbance concerns | power lines road badly eroded - APS should maintain |
| Disturbance concerns | power lines disturbing large areas |
| Disturbance concerns | number of trails vs. open areas |
| Disturbance concerns | too many trails |
| Disturbance concerns | wear on the trails |
| Disturbance concerns | trails are getting wider |
| Disturbance concerns | dog do |
| Disturbance concerns | plan for wild fires |
| Disturbance concerns | restorative after a fire |
| Disturbance concerns | motorized / rutted trails and roads |
| Disturbance concerns | need to be properly mitigated especially where visible |
| Disturbance concerns | disturbed areas - appearance when restored |
| Disturbance values | trails are well maintained |
| Disturbance values | easy access to locations |
| Disturbance values | open natural space available to public |
| Disturbance values | recreational opportunities |
| Disturbance values | free access to pristine desert |
| Disturbance values | safe habitat for wildlife during night-time for the animals |
| Disturbance values | north vs. south very different |
| Disturbance values | remote from population |
| Disturbance values | unique opportunity to be involved in activities depending on interest |

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| Disturbance values | variety of different areas |
| Disturbance values | can be reasonable isolated / remote from populations |
| Disturbance values | recreational opportunities |
| Disturbance values | scenic view of undisturbed land in natural state |
| Disturbance values | ability to enjoy the land via hiking |
| Disturbance values | natural disturbance by water or animals is OK |
| Fauna concern | expect to see more |
| Fauna concern | narrow wildlife corridor |
| Fauna concern | the corridor is too small and limits the number of wildlife |
| Fauna concern | the north end of MSP is very different than the south end |
| Fauna concern | animals I would like to see: deer, fox, badger, deer and desert tortoise |
| Fauna concern | lack of control of dogs by owners |
| Fauna concern | too many trails for animals |
| Fauna concern | do we need wildlife corridors across Dynamite Road |
| Fauna concern | wildlife corridor is considered to be too narrow |
| Fauna concern | urban boundary and wildlife |
| Fauna concern | keep large animal population |
| Fauna concern | maintaining critter population |
| Fauna concern | most fauna is not visible |
| Fauna concern | rattlesnakes are fairly common hikers like to stop and photograph |
| Fauna concern | education on where to find |
| Fauna concern | dwindling water source |
| Fauna concern | don't see as many animals as expected |
| Fauna concern | conflict with animals going outside preserve |
| Fauna concern | bow hunting |
| Fauna concern | expect to see more animals |
| Fauna concern | narrow wildlife corridor |
| Fauna concern | are catchments as good idea |
| Fauna concern | purpose food for what |
| Fauna value | excited to see |
| Fauna value | more animals than what may expect to see |
| Fauna value | education for when, where (location), and time of day can see animal life |
| Fauna value | deer |
| Fauna value | big cats |
| Fauna value | preserve has excellent opportunities to observe large felines: mountain lions and bobcats |
| Fauna value | exhibits i.e.. Brown's Ranch |

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| Fauna value | animals look healthy and are visible |
| Fauna value | living near preserve a positive experience seeing wildlife |
| Fauna value | positive experience seeing animals |
| Flora concern | are we directing native vs. non-native |
| Flora concern | enjoy land but encroachment of population |
| Flora concern | mistletoe destroys paloverde: should it be removed or let grow to the detriment of the tree |
| Flora concern | water - rain changes to plants. Will this rain amount always be available. What is the impact during drought |
| Flora concern | disease and parasite impacts on ecosystem |
| Flora concern | the north end of MSP is very different than the south end |
| Flora concern | would like to know more about what is seen in MSP. Need more education |
| Flora concern | more education on non-native plants that are evasive vs. not evasive |
| Flora concern | non-native concerns |
| Flora concern | food chain information |
| Flora concern | what is evasive |
| Flora concern | too much planting of cholla where there is more nature |
| Flora concern | telegraph plants |
| Flora concern | damage by visitors by removing flora |
| Flora concern | fire |
| Flora concern | can there be overgrowth or one species |
| Flora concern | parasitic plants impact on quality |
| Flora concern | education awareness of those using the land to preserve the purpose of the land |
| Flora concern | overuse and encroachment of the urban area adjoining MSP |
| Flora concern | non-native species - but is there advantage to reduce erosion |
| Flora concern | visitors destroying by off trail use |
| Flora concern | human impact don't realize fragility |
| Flora concern | don't understand impact of non-native |
| Flora concern | want to see mid-size saguaro |
| Flora concern | health of older and larger saguaro |
| Flora concern | health of total flora population |
| Flora concern | I want to see more juniper |
| Flora value | away from crown and quiet |
| Flora value | unique environment even in the rain and mud |
| Flora value | scenic views in natural state and can view the city and country |
| Flora value | enjoy land hiking yet close to civilization |

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| Flora value | natural environment |
| Flora value | everyone can enjoy |
| Flora value | resource plan but different than 5 miles maintain vs. natural |
| Flora value | uniqueness and can adapt |
| Flora value | very green |
| Flora value | peoples reaction to the greenness |
| Flora value | food chain biological impact allows to see how a plant may also allow opportunity to see an animal / or its predator |
| Flora value | wildflower better ID and locations |
| Flora value | good diversity of flora |
| Flora value | observe change in growth, seasonal flowers |
| Flora value | diversity of plants |
| Flora value | wildflowers |
| Flora value | cactus |
| Flora value | greener than anybody from outside expects |
| Flora value | variety enough - plenty |
| Flora value | space to include full variety of Sonoran desert plans |
| Flora value | those natural to the land are critical component to having the land in its natural state |
| Flora value | the scenic beauty |
| Flora value | observe the natural history life and death |
| Flora value | adaption / survival cactus living and dead |
| Flora value | watching the seasonal changes |
| Flora value | wide variety wildflowers and cactus |
| Flora value | adaptability of plants to live in this ecosystem (cholla cactus asexual reproduction) |
| Flora value | scenic view, quiet, solitude |
| Flora value | a desert is not sand dunes |
| Flora value | pristine desert |
| Flora value | education opportunities |
| Flora value | experience nature |
| Flora value | expectation from MSP: a wildlife experience the Sonoran desert in a natural state |
| Flora value | exercises in unique natural setting |
| Flora value | see plants in their natural habitat |
| Flora value | crested saguaro |
| Water concerns | more education on water use |
| Water concerns | water impact what does it do to ecological |

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| Water concerns | natural catchments vs. manmade catchments |
| Water concerns | charging water sources can effect animal and plant population |
| Water concerns | beware of unintended consequences |
| Water concerns | current catchments should be maintains since animals have historically used them |
| Water concerns | providing 'artificial' water resources - wisdom? |
| Water concerns | swimming pools and golf courses may cause immature ecological environments |
| Water concerns | water dwindling impact from human |
| Water concerns | water table dwindling |
| Water concerns | human impact by providing source of water |
| Water concerns | ecological impact of adding water |
| Water concerns | humans are no longer a fair balance |
| Water concerns | water provides help but may impact other animals |
| Water values | study of water |
| Water values | need more study of water |
| Water values | natural catchments |
| Water values | water helps some animals but with impact on others |
| Water values | maintenance of water catchments |

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McDowell Sonoran Conservancy

The McDowell  Sonoran Conservancy champions the sustainability of Scottsdale's McDowell Sonoran Preserve for the benefit of this and future generations. As stewards, we connect the community to the Preserve through education, research, advocacy, partnerships and safe, respectful access.

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All McDowell Sonoran Conservancy Field Institute studies conducted in Scottsdale's McDowell Sonoran Preserve were completed in compliance with the permit requirements of the City of Scottsdale. These requirements promote best practices in field research and minimal impact on the resources  of the Preserve.  Agencies and organizations representing the surrounding open spaces were included in the Ecological Resource Plan development process as stakeholders so that their insights and concerns were taken into account.

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