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Inventory studies at Montezuma Castle National Monument

Abstract

A broad-based inventory of the flora and fauna of Montezuma Castle National Monument in 1991 – 1994 provided comprehensive information on terrestrial vegetation, aquatic and terrestrial invertebrates, fish, amphibians, reptiles, birds and mammals, along with a series of historic photos documenting change in the area. This report summarizes and updates the inventory information to August 2005. The inventory project was motivated by perceived threats to the natural community protected by the Monument, notably drawdown of the water table supporting the riparian and aquatic communities, and water quality degradation due to development in the surrounding the area. Important results of the inventory include: 1) Historic photos showing landscape features and habitat changes since the late 1800's; 2) Evidence of decline in mesquite bosques along Beaver Creek due to decreases in ground water; 3) Discovery of new aquatic invertebrate species from the unique limestone spring pool at Montezuma Well; 4) Data on community dynamics of state-listed sensitive fish (Desert Sucker, Sonoran Sucker, and Longfin Dace); 5) Detailed overview of the bird community, including nesting Common Black Hawks and Yellow-billed Cuckoos; 6) Discovery of new mammal species for the Monument (Desert Shrew and Fringed Myotis), and documentation of the loss of several native mammal species in historic times.

Introduction

An integrated, broad-based inventory of the flora and fauna of Montezuma Castle National Monument in central Arizona was undertaken between 1991 and 1994 to provide information on current status, trends, and potential management concerns of the natural resources of the Monument. Components included in the inventory included terrestrial vegetation, aquatic and terrestrial invertebrates, fish, amphibians, reptiles, birds and mammals, as well as a series of historic photos documenting changes in the area. The work has been a collaborative effort of researchers from Northern Arizona University and the Colorado Plateau Field Station in Flagstaff, Arizona, and was supported by small park funds from the National Park Service.

Montezuma Castle National Monument is a unit of the National Park Service in central Arizona, established to protect Sinagua culture cliff dwellings, notably the five-story, 20-room structure known as Montezuma Castle, perched imposingly on a limestone cliff face overlooking lower Beaver Creek. The Monument consists of two separate sites, Montezuma Castle and Montezuma Well, located about 8 km apart in the Verde River valley between Flagstaff and Phoenix. The Montezuma Well section protects additional Sinagua and Hohokam sites, as well as the large, spring-fed limestone sink (from which the site receives its name) that has no known parallel anywhere in the world in its depth, its highly carbonated waters, and its uniquely adapted endemic invertebrate community.

Montezuma Castle is a relatively small National Monument: the Castle section comprises a little under 2.5 sq. km (2,315,376 m^2), and the Well section is just over 1 sq. km (1,030,423 m^2). The area is mid-elevation desert, ranging from 955 to 1,090 m and supporting scattered Juniper at its higher elevations, and Mesquite, Acacia and Creosotebush at its lower elevations. There is a rich Cottonwood riparian association along Beaver Creek in its course through the Monument.

The Monument was established to protect dwellings and other remnants of prehistoric culture dating back as much as 1300 years. The plant and animal communities and other natural resources of "cultural Parks" like Montezuma Castle have been relatively neglected. However, these areas protect valuable samples of biological communities. In many instances, the same features that drew early humans to the area also provided for rich biological communities - like the extensive riparian habitat at Montezuma Castle - and these biological communities are made more important by their long-term protection as Monuments and

Parks. The poor state of knowledge about biological resources at the Monument was one of the driving forces behind this inventory project.

A second motivation for the study was the rapid growth in the Verde Valley area surrounding Montezuma Castle. Like most areas with ample water in the arid Southwest, the Verde Valley region is experiencing increasing urban, suburban, and recreational development. National Park Service management at Montezuma Castle is anticipating steadily-increasing pressure from such development on the natural community protected by the Monument, both in terms of simple habitat loss and fragmentation, and also from decline of riparian and aquatic communities due to water withdrawals and water table drawdown.

The objectives of the inventory study were to:

1) Conduct a baseline floral and faunal inventory;
2) Evaluate past changes in the plant and animal community, and current threats;
3) Establish a long-term program for monitoring the natural resources of the Monument;
4) Provide information on natural resource management concerns and needs.

This executive summary provides an overview of the inventory work, and provides "pointers" to the reports, data sets, and other products of this diverse project. Each component of the project (listed below) has its own separate final report, and those reports should be consulted for detailed descriptions of methods and results.

Study Design and Methods

The Montezuma Castle project was designed at the outset to be a comprehensive, integrated inventory study, with GIS forming a foundation for the inventory, and tying its different parts together. We selected the following components for the inventory:

- Historic Photos
- Vegetation
- Aquatic Invertebrates
- Terrestrial Invertebrates
- Fish
- Amphibians and Reptiles
- Birds
- Mammals

Different Principal Investigators were responsible for the different components, and a wide variety of specific field methods were used, depending on the group being sampled. These ranged from bottom samplers and plankton tows for aquatic invertebrates and algae, to electro-shocking for fish, to automatic cameras for nocturnal mammals, to visual and call surveys for birds. The general methodology of the different components is summarized below.

Historic Photos

Initial mail and telephone inquiries were used to determine an initial list of libraries, museums, and archives that had photographs potentially pertinent to this survey. Thorough follow-up review of files and inspection of photographs located photos with biological, cultural, and historic significance. A master list of these photos was developed, noting duplicates, similar views, and quality of images. The best photos were then selected from this list, and copies made for the historic photo collection. In addition to prints and negatives, it was decided to scan all of the selected photos, so that the Park Service would also have electronic copies of the images.

Vegetation

The vegetation component of the survey included vegetation community delineation and mapping, and field surveys of floristics and community composition. Initial delineation of recognizable vegetation polygons was conducted by examination of 1:14,400 scale true color aerial photos. Each mapped polygon was sampled in the field using a relevé technique, recording species composition and dominance. These data were analyzed using TWINSPAN to group the polygons into areas with similar vegetation composition. The resulting community classification was then fitted to Brown, Lowe, and Pase types for the final vegetation maps.

Aquatic Habitats (Invertebrates and Algae)

There are three distinctly different aquatic habitats at Montezuma Castle National Monument - Beaver Creek, a Southwestern perennial desert stream; Montezuma Well, a deep, highly carbonated travertine spring pool; and the irrigation canal connecting the two. The Aquatic Habitats component looked at each of these separately, and compared and contrasted them with respect to their physical and biological make-up. A variety of methods was used for all three habitats, ranging from plankton net tows in open water, to Hess and Surber samplers for bottom-dwelling invertebrates, to artificial substrates for colonizing species. The greatest variety of methods, including ultraviolet light traps at night for adult aquatic insects, was used for the varied microhabitats of Beaver Creek. Collected specimens were sent to a variety of invertebrate specialists for species identifications.

Fish

Prior to beginning fieldwork, extensive literature and museum surveys were conducted to assemble existing information about the fish fauna of Beaver Creek at Montezuma Castle National Monument. This included computerized literature searches of library databases, searches of major museum collections throughout Arizona, and interviews with resource professionals knowledgable about the area. Field sampling of the fish fauna was conducted at three sites within the Monument: 1) Wet Beaver Creek just downstream of the Well outlet at the Well unit of the Monument; 2) Davis Hole and the portions of Beaver Creek immediately downstream of Davis Hole; and 3) Beaver Creek below (downstream of) the Castle visitor area, and just upstream of the southern boundary fence at the Castle unit. The sites were sampled during fall, winter, and spring, using a variety of methods to capture the full range of species and size/age classes present in the creek. The methods included electrofishing, stationary trammel nets (in Davis Hole), and seining. Aquatic habitats were assessed and categorized visually (as pool, riffle, and run), and measurements were taken of water quality (temperature, pH, conductivity, and dissolved oxygen) and hydrology (stream velocity and discharge).

Terrestrial Invertebrates

The objective of terrestrial invertebrate sampling was an extensive survey of insect species at the Monument. For this reason, a wide range of sampling methods were used in many different habitats and widely scattered sites at both the Castle and Well units. Sampling methods included pitfall traps for ground-dwelling insects; sweep-netting and beating for plant-dwelling insects; careful, systematic visual searches for plant-dwelling insects; aerial netting for day-flying insects such as butterflies; malaise traps for flying insects (malaise traps are fine mesh tent structures which funnel insects into a collecting jar); and ultraviolet light traps for nocturnal flying insects. Insect specimens were killed and mounted dry on pins or in alcohol (as appropriate depending on the type of insect), and labelled with location, date, and habitat of capture. Because of the diversity of insects and the difficulty of identifying many groups, most of the specimens were sent to experts across the country for identification.

Amphibians and Reptiles

Amphibians and reptiles have a wide range of life history strategies, from active, diurnal, fast-moving species, to nocturnal, slow-moving species that spend most of their lives under cover and are rarely seen. For this reason, a similarly wide range of sampling techniques was used for this group. We sampled throughout the year during the first year of the survey, but reduced this to spring, summer, and fall during

the following years, because there were almost no amphibians and reptiles active during the winter months.

Methods used included visual searches of aquatic habitats, primarily for breeding amphibians; pitfall traps and artificial cover boards for a variety of ground-dwelling species (primarily lizards and toads); funnel traps, which also trap ground-dwelling animals, particularly those living in fairly thick cover; time-constrained searches, which target animals active out in open, or those which can be found hiding under logs, boulders and other cover; and night searches, which sample snakes, lizards and frogs abroad at night. In our time-constrained searches, we walked through pre-defined habitat areas for one hour, visually searching and turning and searching through vegetation, logs, and other cover that amphibians and reptiles might as retreats. Night searches included both driving along roads in and near the Castle and Well after dark, looking for animals on the road in the headlights, and also searches on foot with flashlights along the trails at both the Castle and Well.

Birds

The majority of avian inventory data is from point counts conducted during the breeding season (April through July), and walking counts during the migration and winter periods (August through March). Additional data came from incidental observations during the course of other fieldwork, and from some special-purpose surveys (e.g. for owls at night and for nesting hawks).

Point count stations were established in six broad habitat types (three upland desert grass / shrub types and three riparian types) throughout the Castle and Well units, with at least 150 m between stations. Walking counts were conducted by moving slowly and quietly through a relatively large area, and recording the species and numbers of birds seen. These counts are more effective at covering large areas and assessing relative abundance of flocking, non-territorial birds, as are typically encountered outside of the breeding season.

Mammals

Techniques used for mammals also targeted different groups of mammals. Transects or grids of live traps were used for small mammals (rodents and shrews); standard box traps (e.g. Havahart™), and automatic camera systems were used for medium-sized, mostly nocturnal mammals; direct visual counts were used for large mammals in the early morning and evening; and mist nets to sample bats. Particular attention was given to small mammals (rodents, shrews, and bats) because they were relatively poorly known. Incidental observations (both direct visual observations and presence of sign such as tracks and scat) were also recorded.

The three-year period of the survey provided a thorough baseline for species diversity of the different groups. Because the period of the study included a heavy rainfall / major flood year as well as relatively dry years, we were able to collect important information on the range of annual variability in the populations sampled.

Results

Historic Photos

The historic photo survey drew on 23 different archives across the country, with the most productive being Montezuma Castle National Monument itself, the Western Archaeological and Conservation Center in Tucson, the Library of Congress, and the National Archives. A total of 103 images were selected and copied, giving the best selection of photos showing biological, archaeological, and historical features of the Monument, and providing a record of change over the last 100 years. The images cover the time period from 1876 to 1990 and show vegetation type and condition, historical scenes, archaeological sites, and views of Beaver Creek and Montezuma Well. Copies of the photos are housed in the Special Collections and Archives section of the Cline Library at Northern Arizona University, referenced as *Montezuma Castle / Well National Monument Historic Photograph Collection, 1876-1990.*

Flora and Fauna

The Montezuma Castle inventory study recorded 1,389 species at Montezuma Castle and Montezuma Well (Table 1). New taxa were added to the known flora and fauna of Montezuma Castle for every group except fish (where the trend is toward loss of natives and replacement by non-natives). There had been only limited study of aquatic invertebrates outside of Montezuma Well, and no formal study of terrestrial invertebrates. For all groups taken together, close to half of the species recorded are new to the species list of Montezuma Castle National Monument.

Table 1. Total number of species recorded for major taxa included in the Montezuma Castle inventory

Taxonomic Group	# of Species
Algae	108
Vascular Plants	368
Aquatic Invertebrates	204
Terrestrial Invertebrates	414++
Fish	9 (4 native, 5 non-native)
Amphibians	4
Reptiles	32
Birds	208 (69 breeding)
Mammals	42
Total:	1389

The three to six years of sampling at Montezuma Castle provide a relatively exhaustive inventory of all groups except terrestrial invertebrates (which are the most diverse group at the Monument and, in spite of two years of surveys, remain the group that we know least about). For all groups, we used a variety of methods and sampled over the range of seasons for at least three years to record abundant and rare, conspicuous and cryptic, and long-lived and ephemeral species. The thoroughness of inventory is attested to both by the number of new species added to the known flora and fauna, and the declining number of "new" species in successive years of the study.

Most areas of the United States have little good historical inventory information, making it difficult to evaluate trends in plant and animal communities. However, the U.S. Biological Survey conducted a study of terrestrial vertebrates in and around Montezuma Castle National Monument in 1910 (see Drost and Nowak 1998), and a survey of Beaver Creek in the vicinity of the Monument was conducted in 1937 (see Montgomery and Leibfried 1995). In addition, museum collectors and local birdwatchers have provided information on the avifauna of the area dating back to the late 1800's (see Sogge and Johnson 1998). Comparison with these surveys reveals striking changes in the intervening years. Table 2 notes the number of species lost since the earlier surveys, and species still present at Montezuma Castle that are of particular conservation concern.

Table 2. Changes in major taxa at Montezuma Castle National Monument, and rare or special concern species in each group.

Taxonomic Group	Species lost	Rare / Special Concern
Fish	3	Desert Sucker
		Sonora Sucker
		Roundtail Chub
Amphibians	1 or 2	Lowland Leopard Frog (now extirpated)
Reptiles	1 or 2	Gila Monster
Birds	17	Common Black Hawk
		Belted Kingfisher
		Yellow-billed Cuckoo
Mammals	8	Townsend's Big-eared Bat

In addition, the historic photo survey conducted as part of this study provides qualitative information on vegetation communities and vegetation condition at the Monument, dating back over 120 years. Taken together, the comparative information we now have on vertebrates and terrestrial vegetation provide a singular window into changes in the natural resources of Montezuma Castle National Monument and the adjacent area over the span of a century. The following sections note the main results of the different components of the flora and fauna studies.

Vegetation

Community classification and mapping of the desert riparian and upland vegetation delineates 12 vegetation communities in the Brown, Lowe and Pase system (Figure <<Vegetation map, to be added>>). Vegetation in the arid uplands includes a mixture of Chihuahuan (*Parthenium incanum* / Mariola), Sonoran (Mesquite and *Canotia holacantha*) and Mojavean (creosotebush) elements. Cottonwood gallery forest, intermixed with velvet ash and desert-willow associations, follows the course of Beaver Creek through the Monument. Areas of mesquite bosque along Beaver Creek appear to be declining because of decreases in ground water.

Aquatic Habitats (Invertebrates and Algae)

Nine additional species were added to the known aquatic invertebrate fauna inhabiting the unique limestone sink and spring at Montezuma Well, bringing the species total for the Well to 94. At least two of these, a Chironomid midge and a copepod, are probably new to science. The other endemics in the Well system are the abundant amphipod *Hyalella montezuma*, the predatory waterscorpion *Ranatra montezuma*, the predatory leech *Erpodella montezuma*, and the Montezuma Springsnail, *Pyrgulopsis montezuma*.

Water chemistry along the irrigation canal changes rapidly, with the high levels of dissolved carbon dioxide at the Well outlet being reduced by 80-90% over the 1.5 km length of the canal, and pH rising from 6.6 to 7.6. The invertebrate fauna also changes conspicuously along the length of the canal; in the upper portion (near the Well outlet), the invertebrate fauna is similar to that of the Swallet area of the Well, including the endemic Montezuma Springsnail and the bryozoan *Plumatella*; in the lower portion of

the canal, major insect groups that are conspicuously absent in the Well (such as caddisflies, dobsonflies, and dragonflies) appear in large numbers.

Sampling in Beaver Creek during this study yielded 85 invertebrate species. A study of aquatic invertebrates in the surrounding area listed 21 additional species, bringing the total for Montezuma Castle and vicinity to 106. Insects make up the majority of this total, with the most diverse group being true flies (25 species), followed by caddisflies (18 spp.), and mayflies (17 spp.). The study found one new, undescribed species of Chironomid midge in the genus *Parametriocnemus*. Invertebrate density and biomass show marked seasonal variation, and are also greatly influenced by flood events. At most times, Chironomid midges and/or caddisflies are the most abundant groups. Among non-insect invertebrates, the non-native crayfish *Orconectes* sp. can reach high numbers and is a potential threat to native species.

Fish

The inventory and monitoring surveys documented the continued presence of state-listed rare and special concern fish species in the stream habitats of the Monument (Table 3). Over the last 60 years, there has been a major shift in the fish community of Beaver Creek, from an assemblage of native Southwest endemic species to a community dominated by introduced non-native species. The native species persist in low to moderate numbers. High flood flows along Beaver Creek in the spring appear to "wash out" the introduced species, and allow the natives to at least temporarily increase in numbers.

Table 3. Changes in the Fish Fauna of Beaver Creek, Montezuma Castle N. M., 1937 to 1996.

	1937	1996
NATIVE		
	Desert Sucker	Desert Sucker
	Sonora Sucker	Sonora Sucker
	Roundtail Chub	Roundtail Chub
	Longfin Dace	Longfin Dace
	Speckled Dace	
	Spikedace	
	Loach Minnow	
NON-NATIVE		
	Carp	Carp
	Green Sunfish	Green Sunfish
	Black Bullhead	
		Yellow Bullhead
		Red Shiner
		Smallmouth Bass

Terrestrial Invertebrates

Approximately 1,600 invertebrate specimens were collected during the course of the survey. These represented 11 insect Orders, 100 Families, and 400 species or morphospecies (Table 4, following; "morphospecies" are specimens that are visually different from other species collected, but that have not been completely identified - i.e. they do not have a species name associated with them). The investigators for the Terrestrial Invertebrate component believe that their sampling is only a beginning on the invertebrate fauna of the Monument, and they estimate that the actual number of terrestrial invertebrate species is probably at least three times this initial total. Some groups of insects (such as those that form galls or scales on plants) and non-insect invertebrates (such as spiders, scorpions and centipedes) are known to be under-represented in the sampling.

Table 4. Insect species collected from Montezuma Castle National Monument in an inventory study carried out from 1993 through 1995. Categories are insect Orders, number of Families represented within each Order, and number of species distinguished within each Order. The complete species list is included as an Appendix in Price and Fondriest 1995.

Order	Families	Species
Mayflies (Ephemeroptera)	n.d.[1]	6
Dragonflies (Odonata)	3	10
Caddisflies (Trichoptera)	4	7
Grasshoppers and relatives (Orthoptera)	5	12
True Bugs (Heteroptera)	12	51
Leafhoppers and relatives (Homoptera)	4	12
Lacewings and relatives (Neuroptera)	3	9
Beetles (Coleoptera)	28	152
Butterflies and Moths (Lepidoptera)	5	17
True Flies (Diptera)	14	52
Bees and Wasps (Hymenoptera)	21	71

Amphibians and Reptiles

Amphibian diversity at Montezuma Castle is low, consisting of two toad species, one treefrog, and the introduced Bullfrog. The bullfrog is apparently a recent arrival (it was not recorded at the Monument prior to our study) and at present it is only found in low numbers. The lizard fauna at Montezuma Castle is quite diverse (15 species), equalling or exceeding the number of species at much larger Parks such as

[1] Identifications not determined as of the report date.

Grand Canyon and Organ Pipe Cactus National Parks. The population of Sonoran Mud Turtles at Montezuma Well is noteworthy for its very high density.

Although comprehensive historical survey data is not available for comparison, we do know from old museum records that Leopard Frogs (which have declined throughout the Southwest) have been lost from the vicinity of Montezuma Castle. Gila Monsters also formerly occurred at Montezuma Castle, but we did not find the species at or near the Monument in our surveys. The Southwestern Toad may also been lost from the Monument. There are no specimen records to conclusively show its former occurrence at Montezuma Castle, but it formerly occurred in the area, and appropriate habitat is present at the Monument. It is not currently found at Montezuma Castle or Montezuma Well.

Birds

Bird surveys between 1991 and 1994 documented a total of 147 species at Montezuma Castle National Monument. The total number of breeding species was 49, with 36 of these being neotropical migrants. Number of breeding species detected in a given year ranged from 42 to 48. The most common (greatest number of detections) species in each year of the survey were Black-throated Sparrow, Bewick's Wren, Lucy's Warbler, and Brown-headed Cowbird. Highest numbers of birds were recorded in the riparian habitats, but the relatively healthy desert upland habitats support an almost equally diverse range of birds.

The riparian and aquatic habitats support a number of sensitive species (Arizona State-listed Threatened or rare), including nesting Common Black Hawks, Belted Kingfishers, and Yellow-billed Cuckoos. Museum and sighting records from a variety of sources indicate the decline or loss of a number of bird species from Montezuma Castle and the surrounding area, including Peregrine Falcon, Thick-billed Parrot, Yellow-billed Cuckoo, and Willow Flycatcher.

Mammals

The inventory studies recorded a number of new mammal species, including Desert Shrew and Fringed Myotis (a bat species). Comparison with earlier survey work and museum records documents the recovery of some species that had formerly been extirpated (Mule Deer) and the recent arrival of some species that were formerly only found much further south (White-tailed Deer, Peccary). On the other hand, there have also been losses. The Hispid Pocket Mouse and Arizona Cotton Rat have disappeared from Montezuma Castle and the surrounding area, possibly due to loss or changes in grassland habitats. Some large species, including pronghorn and ocelot, are thought to have been lost because of a combination of habitat loss and direct persecution. Table 5 outlines changes in the large mammal fauna found in and and around the Monument over the past century.

Table 5. Changes in the Mammal Fauna of the Montezuma Castle Area. Each column indicates species that were present during that time period.

Carnivores

1910	1996
Gray Wolf	
Coyote	Coyote
Gray Fox	Gray Fox
Grizzly Bear	
Black Bear	Black Bear
Jaguar	
Ocelot	
Mountain Lion	Mountain Lion
Bobcat	Bobcat

Ungulates

1910	1996
	Collared Peccary
	Elk
	Mule Deer
	White-tailed Deer
Pronghorn	

Discussion

Known or probable causes for species loss from the Montezuma Castle area can be divided into three general categories:

* Habitat alteration and loss, combined with direct persecution (large carnivores, Pronghorn)

* Alteration of aquatic habitat, including introduction of non-native species (native fish, leopard frog)

* Loss or conversion of desert grassland habitat (probably Hispid Pocket Mouse, Arizona Cotton Rat, and grassland birds such as the Horned Lark)

The greatest present natural resource threats at Montezuma Castle are changes in the local water regime and concomitant effects on riparian habitats. In this regard, aquatic invertebrates, fish, and amphibians are of particular interest and concern because of their direct dependence on aquatic habitats. The link to changes in the water regime is not so obvious among reptiles, birds and mammals; however, there are riparian-dependent species in these groups as well. Most of the rare and special concern species that still persist at Montezuma Castle National Monument are associated with the aquatic and riparian habitats along Beaver Creek. In addition, the Montezuma Well aquatic system is unique in the United States and,

as far as is known, in the world. One of the main natural resource management objectives at the Monument should be protecting these aquatic and riparian communities. An important long-term concern will be ensuring an adequate water supply to the Well and to Beaver Creek in the face of continued development in the surrounding Verde Valley. The primary focus of the monitoring program initiated at the completion of the inventory study is the aquatic / riparian system.

Management Recommendations

Vegetation

* As the Verde Valley area becomes increasingly developed, wild places will become more rare and restricted to inaccessible terrain. The present, relatively undisturbed state of the southeast portion of the castle unit should be maintained by vigorous control of trespass grazing and other incompatible uses.

* Mediterranean grasses and other exotic plants should be intensely managed throughout the Beaver Creek flood plain. As described previously, these plants create seasonally high levels of fine fuels that increase to a maximum standing crop during the late summer months when lighting strikes are most likely. Incursions of off-highway vehicles, equestrians and foot-trafficking may also increase the possibility of fire through production of sparks, cigarette smoking and careless use of matches or cigarette lighters. Control should be based upon an integrated approach utilizing mechanical and cultural means and possibly herbicides and fire, if such methods can be shown to be effective and approved through appropriate compliance procedures. Failure to do so increases the risk of a catastrophic wildfire that could remove the current mesquite overstory. An integrated approach to vegetation management of the MOCA bottomlands should be sought utilizing all feasible aspects of weed control, including, where appropriate, chemical control and prescribed fire.

* A study of in-stream flow requirements for MOCA should be considered in order to ascertain the free-flowing water requirements to maintain and enhance the riparian and bottomland environments of MOCA and allow the reestablishment of natural riparian – bottomland system processes

* An up-to-date, georeferrenced soil mapping of the MOCA units has recently been done; too late to be employed in this study. The data and information gathered during the survey should be integrated into park planning and resource management decision-making at MOCA. The first and most practical reason is that a soil survey yields a body of data that could support management decisions regarding erosion control, site capabilities for development (e.g., placement of leach fields, structural slabs) etc. The second reason, and most pertinent to this report, is that intensive soil survey data from MOCA fill a data gap in terms of relating soil physical factors to vegetation structure, distribution and dynamics that is crucial to resource monitoring and vegetation management.

* Vegetation monitoring at MOCA should be interpreted in terms of vegetation recovery as no area of MOCA can be considered anthropogenically undisturbed and many areas are disturbed to severely disturbed.

* Some areas of the Well unit are so severely disturbed, for example the recently abandoned pasture at the western end of the unit and the heavily compacted old pastures in the southeastern quadrant, that proactive management prescriptions are required. These areas should be subjected to active ecological restoration. The soil chemical and physical factors have been so drastically altered that natural recovery is problematic at best. Due to the expensive and complicated procedures involved with drylands irrigation, restoration goals and objectives should concentrate on physical mitigation and preparation of the severely disturbed sites. Augmentation of natural revegetation should be based on utilizing indigenous plant species that will succeed without an extensive artificial watering system. Periodic augmentation of natural rainfall with mobile devices (such as a "water buffalo" trailer or irrigation from the existing ditch at the Well unit) should be used as needed. Control of exotics will be a cyclical task.

* The monument should review its policy of mechanical control, by machine mowing, of the annual weedy growth at the Well unit. Such actions could actually encourage the spread of weedy exotic plants by repeated disturbance of the substrate, abetting the seed dissemination of exotic weeds and retarding the natural invasion of native species, such as mesquite and acacia. Young specimens of the latter are repeatedly mowed down soon after establishment.

* Although MOCA is primarily an "historic site," the National Park Service requires that "natural areas" associated with historical sites be managed in accordance with natural resource management policies. The Monument is in the process of achieving some limited restoration goals. However, park management should also consider doing a cultural landscape evaluation of the entire MOCA environment. If an evaluation finds areas, such as the current "picnic area" and recently abandoned pasture, that are not significant in terms of a cultural landscape, monument managers should think about their removal. Upon removal, ecological restoration of the picnic area, pasture and other severely disturbed areas within MOCA, to more-or-less natural conditions and processes should proceed at an accelerated pace.

Aquatic Habitats (Invertebrates and Algae)

* The natural flow regime of Beaver Creek (i.e. spring floods, late summer / fall drought) is of singular importance to native aquatic species diversity. Include preservation of natural flows (in addition to water quality and water quantity) in management strategies and actions for protecting the aquatic habitats at Montezuma Castle.

* Encourage expanded studies of the biota of Montezuma Well, and highlight this in interpretive programs and descriptions of the Well unit. There is increasing evidence that the physical and biological system of Montezuma Well - including the deep, highly carbonated travertine spring pool and the highly unusual ecosystem it supports - is quite extraordinary, and may be globally unique. The world that lies mostly hidden beneath the quiet waters of the Well is an invaluable natural, educational, and research resource that we are still in the process of discovering and fully appreciating.

Fish

Management recommendations with respect to fish include:

* Montezuma Castle should continue to take a proactive role in water rights adjudication. In addition to water quality and water quantity, guidelines are needed that recognize and protect the natural flow regime of Beaver Creek. The seasonal pattern of flooding and drying may be important to maintaining native fish populations, especially in the face of non-native species.

* Maintain or increase communication with other agencies involved with water use and water resources in the Beaver Creek / Verde River drainage, to ensure that instream flows are maintained at Montezuma Castle.

* Continue to monitor and study the fish community in Beaver Creek. This should include: 1) continued monitoring of fish species composition and abundance, particularly in relation to flood events and periods of stream drawdown; 2) study of interactions (predation and competition) between native and non-native fish species; 3) marking of native suckers to monitor age, growth rate, and movements. Monitoring and research should be coordinated with Arizona Game and Fish Department, U.S. Forest Service, or other agencies working in this section of the Verde River drainage.

Terrestrial Invertebrates

Because our understanding of the terrestrial invertebrate fauna is so much less than that for other groups, specific management recommendations were not made for this group. General recommendations that apply to terrestrial invertebrates (and also to other groups) are:

* Protect the range of native habitats at the Monument, and work with surrounding land managers to limit further fragmentation of habitats in the rapidly developing Verde Valley. The Principal

Investigators for the Terrestrial Invertebrate component particularly noted potential threats to insect communities from alteration of riparian habitats.

* Take steps to limit the introduction of additional non-native species. Introduced plant species in general do not provide good habitat for native invertebrates, and non-native invertebrates (such as the introduced fire ant) can displace native species through competition or predation. Continuation of Park policy toward limiting public access to natural zones of the Monument is an effective means of limiting further introduction of non-natives. Revegetation of disturbed areas (e.g. around new construction) with native species also helps limit the introduction and spread of non-natives.

Amphibians and Reptiles

The following management recommendations are made for amphibians and reptiles:

* Maintain a healthy riparian community and aquatic habitats is important for the herpetofauna, particularly the amphibians. Measures to protect stream flow, water quality, the natural hydrologic regime, and native aquatic species (e.g. restoring native fish species) will all benefit amphibians.

* Reintroduce Lowland Leopard Frog, if the opportunity arises. The Arizona Game and Fish Department is carrying out intensive studies and restoration efforts for leopard frogs in the state.. The species formerly occurred at Montezuma Castle, and suitable habitat remains. Montezuma Castle would be a good candidate for a reintroduction effort for this species.

* Continue to monitor amphibian populations. Amphibian populations in much of the western United States have experienced serious declines. The cause of many of the declines is not known, and part of the reason for this is that we do not have good baseline information on amphibian populations. Given the extensive inventory work at Montezuma Castle, this area would be a valuable site for continuing to collect information on population trends.

* Encourage restoration of native grassland habitats. Some of the declines that have occurred at Montezuma Castle (including, possibly, the Gila Monster) seem to be related to decline and loss of desert grassland habitat. Unfortunately, we do not have detailed information on past habitat composition and structure at the Monument, but restoration of native species in general (and reduction of non-natives such as red brome) should be beneficial.

Birds

Management recommendations for birds are as follows.

* Continue current policies and management practices that preserve groundwater and surface water rights, in order to assure that valuable wetland and riparian habitats in Montezuma Well and along Beaver Creek are maintained.

* Maintain and strenghten other practices that prevent and minimize habitat impacts, such as excluding grazing and discouraging off-trail activities.

* Undertake surveys to document numbers and distribution of Yellow-billed Cuckoos within and adjacent to the Monument (the western subspecies of Cuckoo is being considered for Endangered Species listing).

* Monitoring of bird populations should be continued. There is a strong record of past changes in the bird community of the Montezuma Castle area, and suggested monitoring methods are sufficiently developed to detect future changes. In addition, birds are a conspicuous part of the local fauna, and information on their welfare generates considerable public interest.

Mammals

Management recommendations focusing on mammals include:

* Monitor abundance and possible impacts from overgrazing of elk at the Monument. Elk are not historically native to the Montezuma Castle area, and the number of animals that winter in and around the Monument has increased. If a large number of animals concentrate their feeding in a small area like the Monument, damage from overgrazing could become a problem

* Avoid disturbance to breeding Towndsend's Big-eared Bats at the Montezuma Well swallet cave. Townsend's Big-eared Bat is a species of special concern, and is considered sensitive to disturbance at roost caves. Any access to or disturbance of the cave at Montezuma Well should be timed to avoid the period when the bats have young (April through July).

* Work on restoration of native grassland habitats. Some of the mammal species that have been lost from Montezuma Castle (Arizona Cotton Rat, Hispid Pocket Mouse) depended on grassland habitats. Although we do not have detailed information on past habitat composition and structure at the Monument, restoration of native species in general (and reduction of non-natives such as Red Brome) should be beneficial.

Appendix 1. Listing of products from Montezuma Castle Inventory and Monitoring Design study.

Reports

Blinn, Dean, and Gaye E. Oberlin. 1996. Aquatic biota: invertebrates and algae. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station, Flagstaff, AZ.

Drost, Charles A., and Laura E. Ellison. 1996. Mammals. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station.

Drost, Charles A., and Erika Nowak. 1996. Amphibians and Reptiles. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station.

Montgomery, W. Linn, William C. Leibfried, and Gloria C. Hardwick. 1995. Beaver Creek Aquatic Study: Fish and Herpetofauna. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station.

Price, Peter W., and Steven M. Fondriest. 1995. Terrestrial invertebrate survey of Montezuma Castle National Monument, Arizona. Final Report. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station, Flagstaff, AZ.

Price, Peter W., and Steven M. Fondriest. 1995. Terrestrial invertebrate survey of Montezuma Castle National Monument, Arizona. Monitoring Handbook. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station, Flagstaff, AZ.

Richmond, Albert J. 1995. Historic Photograph Survey: Montezuma Castle / Well National Monument, 1876-1990. Technical Report NPS/NAUMOCA/NRTR-95/08. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station.

Rowlands, Peter. 1999. Vegetation survey of Montezuma Castle National Monument. Montezuma Castle National Monument Integrated Inventory and Monitoring Studies. U.S. Department of Interior, National Park Service, Colorado Plateau Research Station.

Sogge, M.K. and M.J. Johnson. 1998. Bird Community Ecology at Montezuma Castle National Park : Avian Inventory 1991-1994. Unpublished report. USGS Colorado Plateau Field, P.O. Box 5614, Flagstaff, AZ 86011.

Checklists

Sogge, Mark K., Matthew J. Johnson, and Charles van Riper III. in press. The birds Of Montezuma Castle National Monument, AZ. Western Birds.

Appendix 2. Species lists from the 1992-1997 inventory and monitoring studies at Montezuma Castle National Monument. Included are vascular plants (i.e. ferns and flowering plants) and vertebrates (fish, amphibians, reptiles, birds, and mammals). The lists of algae and aquatic and terrestrial invertebrates are longer; see the respective final reports (Blinn and Oberlin 1996, Price and Fondriest 1998) for those lists.

ACERACEAE—Maple Family

Acer negundo L. ssp. californicum (T. & G.) Wesm. (=Acer negundo L. var. interius Britt.) Sarg.). Box-elder. Rare, perennial tree to 15 m. tall, flowers in April and May, fruit a samara.

AGAVACEAE—Agave Family

Agave parryi Engelm. var. parryi Engelm. Parry Agave, Century Plant. Rare, perennial succulent, "cat claw" like thorns along leaf margin, flowers in June, flowers white, fruit a capsule.

Nolina microcarpa Wats. Beargrass. Uncommon perennial with razor-sharp, serrate leaf margins, the tips of which split intro brush-like tips, base stemless above the ground, flowers small and white, blooms May and June.

Yucca baccata Torr. var. baccata Torr. Blue Yucca, Banana Yucca, Fleshy-fruited Yucca. Rare, perennial succulent, leaves broad, flowers April to July.

Yucca elata Engelm. var. verdiensis (McKelvey) Reveal. Soap Tree Yucca, Palmilla. Infrequent, perennial, succulent, leaves narrow, flowers May to July.

AMARANTHACEAE—Amaranth Family

Amaranthus powellii Wats. Powell's Amaranth, Pigweed. Annual herb.

ANACARDIACEAE—Sumac Family

Rhus trilobata Nutt. Squawbush, Skunkbush, Sumac. Infrequent, peremial shrub to 2 meters tall, flowers yellow, flowers March to June, fruit a red, viscid, 1-seeded drupe.

Toxicodendron rydbergii (Small ex Rydb.) Greene (= Rhus radicans L. var. rydbergii (Small ex Rydb.) Rheder). Poison Ivy. Rare, perennial shrub, causes painful skin irritation in many people, flowers April to September, petals greenish white, fruit yellowish white when mature.

APIACEAE (=UMBELLIFERAE)—Parsley Family

Berula erecta (Hutds.) Coville. Water Parsnip. Rare, perennial, aquatic plant, flowers white from June to September.

Cymopterus multinervatus (Coult. & Rose) Tidestrom. Purple Cymopterus. Rare, perennial herb, flowers purplish, blooms March to May, fruits often purplish.

Cymopterus purpurascens (Gray) Jones. Rare, perennial herb, flower purple, blooms March to May.

Daucus pusillus Michx. American Carrot, Wild Carrot, Rattlesnake Weed. Rare, biennial herb, petals white, flowers March to June.

Hydrocotyle verticillata Thunb. Water Pennywort. Rare, perennial herb, found in wet places or in sluggish water, flowers white.

APOCYNACEAE—Dogbane Family

Amsonia peeblesii Woodson. Rare, perennial herb, flowers blue.

Vinca major [Authority unknown] Periwinkle. Rare, ornamental trailing plant with white or pink flowers. This introduced plant has escaped from cultivation and flowers in the spring and summer months.

ASCLEPIADACEAE—Milkweed Family

Asclepias asperula (Decne.) Woodson ssp. capricornu (Woodson) Woodson. (= A. capricornu Woodson). Antelope Horns. Rare, perennial herb, flowers greenish white, blooms April to August.

Asclepias engelmanniana Woodson. Rare, perennial herb, flowers greenish yellow, sometimes tinged with purple, blooms June to September.

Asclepias subverticillata (Gray) Vail. Poison Milkweed, Western Whorled Milkweed, Poison Milkweed. Rare, perennial herb, flowers greenish white, sometimes tinged with purple, blooms May to September.

Sarcostemma cynanchoides Decne. (=Funastrum cynanchoides (Decne.) Schlechter). Climbing Milkweed. Uncommon, perennial herbaceous vine, often climbing over bushes along streams and washes, flowers white or purple.

ASTERACEAE (=COMPOSITAE)—Sunflower Family

Acourtia wrightii (Gray) Reveal & King. (=Perezia wrightii Gray). Brownfoot. Infrequent, perennial herb, flowers lavender-pink, January to July and sometimes later, common name refers to "wooly", brown root.

Agoseris glauca (Pursh) D. Dietr. var. laciniata (D.C. Eaton) Smiley. Mountain Dandelion. Rare, perennial herb, flowers yellow when fresh, blooms May to October.

Ambrosia confertiflora DC. (=Franseria confertiflora (DC.) Rydb.). Ragweed, Altamisa. Annual herb, flowers April to October.

Ambrosia psilostachya DC. Western Ragweed. Annual herb, flowers July to October. MW

Artemisia ludoviciana Nutt. Uncommon, perennial herb, herbage fragrant (sage scent), flowers August to November.

Aster coerulescens DC. Annual herb, found in marshy places and along streams, flowers August to October.

Aster subulatus Michx. var. ligulatus Shinners. (= A. exilis Ell.). Annual herb, found in moist soil along streams and ditches, flowers June to October.

Baccharis emoryi Gray. Emory Baccharis. Rare, perennial shrub to 5 meters tall, but usually 2-3 meters tall, found along streams, flowers September to November.

Baccharis salicifolia (R. & P.) Pers. (=B. glutinosa Pers.). Seep Willow, Batamote, Jara. Uncommon, perennial shrub to 5 meters tall, flowers March to December.

Baccharis sarothroides Gray. Broom Baccharis, Desert Broom. Rare, perennial shrub, 1-4 meters tall, flowers throughout the year but more commonly in winter.

Baccharis viminea DC. Mule Fat. Uncommon, perennial shrub, 2-4 meters tall, similar in appearance to B. salicifolia, but more definitely woody and often larger, flowers March to July.

Baccharis wrightii Gray. Wright's Baccharis. Uncommon, perennial herb, woody only at the base, 1-nerved leaves, blooms May to July.

Baileya multiradiata Harv. & Gray. Wild Marigold, Desert Baileya. Uncommon, biennial or perennial herb, common on sandy plains and mesas, flowers are yellow and blooms March to November.

Brickellia atractyloides Gray. Uncommon, small, perennial shrub 20-30 centimeters tall, flowers white and blooms March to September.

Brickellia californica (T. & G.) Gray. Pachaba. Uncommon, perennial shrub, 25-100 centimeters tall, flowers greenish-white, blooms July to October.

Brickellia chlorolepis (Woot. & Standl.) Shinners. (=Kuhnia rosmarinifolia Vent.). Rare, perennial herb, flowers white, blooms May to October, found on mesas, slopes, and in forest openings.

Centaurea melitensis L. Malta Star Thistle, Tocolote. Annual "weed" on waste land and open, rocky slopes, flowers yellow, blooms May to July, naturalized from Europe.

Cichorium intybus L. Blue Sailors, Chicory. Rare, perennial herb with deep-seated taproot, flowers blue (rarely pink or white), blooms June to October, naturalized from Europe.

Cirsium arizonicum (Gray) Petrak. Arizona Thistle. Rare, biennial or short-lived perennial, flowers crimson to carmine, blooms May to October.

Cirsium wheeleri (Gray) Petrak. Rare, perennial herb, flowers usually purple or lavender, but sometimes white, blooms June to October.

Conyza canadensis (L.) Cronq. var. pusilla (Nutt.) Cronq. (=Erigeron pusillus Nutt.). Horseweed. Annual herb, flowers white but inconspicuous, common weed, flowers July to October.

Dyssodia acerosa DC. Dogweed. Frequent, low, woody perennial sub-shrub of dry rocky places, flowers April to October.

Dyssodia pentachaeta (DC.) Robins. var. belenidium (DC.) Strother. (=D. thurber (Gray) A. Nels.). Thurber Dyssodia. Rare, low, perennial herb with yellow flowers, blooms March to October.

Encelia frutescens Gray. Rayless Encelia. Uncommon, perennial shrub, disk flowers yellow (ray flowers normally none), blooms nearly throughout the year.

Encelia virginensis A. Nels. Uncommon, perennial shrub, similar to the species above, but with ray flowers, blooms nearly throughout the year.

Erigeron concinnus (H. & A.) T. & G. Tidy Fleabane. Uncommon, perennial herb with taproot, flowers blue, pink or white, flowers April to October.

Erigeron divergens T. & G. Spreading Fleabane. Uncommon, biennial herb with slender taproot, rays lightblue, lavender-pink or white, flowers February to October on dry, rocky slopes and mesas.

Erigeron flagellaris Gray. Running Fleabane. Rare, biennial herb or short-lived perennial, flowers usually white, but sometimes blue or pink, flowers April to September.

Gaillardia pinnatifida Torr. Blanket Flower. Rare, perennial herb, flowers yellow with lobes veined with purple, blooms April to November.

Grindelia aphanactis Rydb. Gumweed. Uncommon, perennial herb, phyllaries gummy resinous, flowers yellow, blooms June to October.

Gutierrezia microcephala (DC.) Gray. (includes G. lucida Greene.). Three Leaf Snakeweed. Rare, perennial sub-shrub, flowers yellow, flowers June to October.

Gutierrezia sarothrae (Pursh) Britt. & Rusby. Broom Snakeweed. Common, perennial sub-shrub, flowers yellow, blooms July to November. [Broom Snakeweed is the first most common species, found in 84 vegetation units.]

Helianthus annuus L. Common Sunflower, Mirasol. Annual herb, stems 30 to 200 centimeters tall, disk flowers purple-brown, ray flowers yellow, flowers March to October.

Heterotheca villosa (Pursh) Shinners var. foliosa (Nutt.) Harms. (=Chrysopsis foliosa Nutt.). Hairy Goldenaster. Uncommon, perennial herb, flowers yellow, blooms July to October.

Hymenoclea monogyra T. & G. Burro Brush. Uncommon, perennial shrub, with prominently striate-ridged, slender branches, found usually in sandy soils, blooms September and October.

Hymenothrix loomisii Blake. Rare, annual or perennial herb, found on mesas, plains and along streams, flowers June to October.

Lactuca pulchella (Pursh) Riddell. (=L. tatarica (L.) C. A. Mey. ssp. pulchella (Pursh) Steb.). Large Blue Lettuce. Rare, perennial herb with spreading rhizomes, flowers blue, blooms July to August

Layia glandulosa (Hool.) H. & A. Tidy-tips. Annual herb, found on dry slopes and mesas, flowers March to June.

Leucelene ericoides (Torr.) Greene. (=Aster hirtifolius, Blake, A. arenosus (Heller) Blake). White Aster, Rose Heath. Infrequent, perennial herb, ray flowers white, sometimes pink when very young, disk flowers yellow, but drying whitish, blooms March to October, found on mesas and slopes, often on limestone, blooms April to October.

Machaeranthera gracilis (Nutt.) Shinners. (=Haplopappus gracilis (Nutt.) Gray. Annual herb with taproot, blooms April to October.

Machaeranthera tephrodes (Gray) Greene. (=Aster tephrodes (Gray) Blake). Infrequent, biennial herb, flowers lavender to violet, blooms May to October.

Malacothrix fendleri Gray. Annual herb, flowers yellow, but usually purplish on the underside, blooms April to June.

Melampodium leucanthum T. & G. Black Foot. Common, annual or perennial herb, found on dry rocky slopes and mesas, often on limestone, ray flowers white with purple veins, blooms March to November.

Microseris linearifolia (DC.) Schultz Bip. Silver Puffs. Rare, perennial herb, ephemeral flowers, pale yellow but drying reddish or purplish, found on plains, mesas, and foothills, blooms March to June.

Parthenium incanum H.B.K. Mariola. Common, perennial shrub found on dry plains and mesas, flowers white, blooms June to October. [Mariola is the ninth most common species, found in 37 vegetation units.]

Senecio douglasii DC. var. longilobus (Benth.) L. Benson. (=S. longilobus Benth.)

Thread Leaf Groundsel. Uncommon, perennial shrub, found on slopes, mesas and along washes, flowers yellow, blooms nearly throughout the year.

Senecio neomexicanus Gray. Rare, perennial sub-shrub, flowers yellow, blooms April to August.

Senecio quercetorum Greene. Rare, perennial herb, flowers yellow, blooms March to May.

Solidago sparsiflora Gray. Rare, perennial herb, ray and disk flowers yellow, blooms June to October.

Solidago wrightii Gray. Uncommon, perennial herb, ray and disk flowers yellow, blooms July to October.

Sonchus asper (L.) Hill. Spiny Sow Thistle, Achicoria Dulce. Annual herb, found mostly on roadsides and waste lands, flowers yellow, blooms February to August, naturalized from Europe.

Stephanomeria exigua Nutt. Wirelettuce. Annual herb, involucre with 3-9 flowers, flowers light purple, found on plains, mesas, and hillsides, often among shrubs, blooms April to September.

Stephanomeria pauciflora (Torr.) A. Nels. Desert Straw. Rare, perennial herb with woody base, flowers rose or flesh colored, blooms almost throughout the year.

Stephanomeria tenuifolia (Torr.) H.M. Hall. Rare, perennial herb, flowers rose or flesh colored, blooms May to September.

Taraxacum laevigatum (Willd.) DC. Red-seeded Dandelion. Rare, perennial herb, flowers yellow, blooms March to August, naturalized from Europe.

Townsendia annua Beaman. Rare, annual, biennial, or perennial herb, flowers white to lilac, blooms March to September.

Townsendia strigosa Nutt. Rare, annual, biennial, or perennial herb, flowers white to lilac, blooms March to September.

Tragopogon dubius Scop. Goats Beard. Rare, biennial or perennial herb with fleshy taproot, corollas lemon-yellow, common weed naturalized from Europe, blooms Mayto September.

Verbesina encelioides (Cav.) Benth. & Hook. Yellowtop, Cowpen Daisy. Rare, annual herb with taproot, common weed of roadsides and waste ground, flowers yellow, blooms April to September.

Verbesina encelioides (Cav.) Benth. & Hook var. exauriculata Robins. & Greenm. Crownbeard. Annual with taproot, flowers yellow, blooms April to September.

Viguiera multiflora (Nutt.) Blake. Golden Eye. Rare, perennial herb, flowers yellow, blooms May to October.

Xanthium strumarium L. (=X. Saccharatum Wallr.). Common Cocklebur, Abrojo. Annual herb, common weed of disturbed sites, blooms February to October.

BERBERIDACEAE—Barberry Family

Berberis haematocarpa Woot. Red Barberry, Red Mahonia, Algerita. Common, perennial shrub to 4 meters tall, flowers fragrant and yellow, berries red, juicy, and edible. Flowers February to May. [Red Barberry is the fourth most common species, found in 44 vegetation units.]

BETULACEAE—Birch Family

Alnus oblongifolia Torr. Arizona Alder. Rare, perennial tree to 18 meters tall, found mostly along streams, flowers are yellowish green catkins, fruit a nutlet, scarcely winged.

BIGNONIACEAE—Bignonia Family

Chilopsis linearis (Cav.) Sweet var. arcuata Fosberg. Desert Willow, Desert Catalpa, Mimbre. Infrequent, perennial shrub or small tree to 9 meters tall, found mostly along washes in deserts and foothills, flowers lavender or white, often marked with purple lines or spots, seeds borne in a capsulewith each seed tipped at end by silky, hairlike process, blooms April to August.

BORAGINACEAE—Borage Family

Amsinckia intermedia F. & M. Coast Fiddleneck. Bristly, annual herb, flowers orange-yellow, blooms February to May.

Cryptantha confertiflora (Green) Payson. Golden Crypthantha. Uncommon, perennial herb with woody crown and stout root, flowers pale yellow to cream-colored, blooms May and June.

Crypthantha crassisepala (T. & G.) Greene. Thick-sepaled Cryptantha. Annual herb, flowers inconspicuous, white or whitish, blooms April to July.

Cryptantha nevadensis Nels. & Kenn. Nevada Cryptantha. Annual herb, flowers white, blooms March to June or sometimes to August.

Lappula redowskii (Hornem.) Greene. Stickseed. Annual herb, flowers white to light blue or ochroleucous, found in sunny places in disturbed soil, blooms March to September.

Lappula redowskii (Hornem.) Greene. var. cupulatum (Gray) Jones. (=Lappula texana (Scheele) Britt.). Stickseed. Annual herb, flowers white to light blue or ochroleucous, found in sunny places in disturbed soil, blooms March to September.

Lithospermum incisum Lehm. Gromwell, Puccoon. Uncommon, perennial herb with thick, woody root, flowers yellow, blooms March to June.

Tiquilia canescens (DC.) A. Richardson (=Coldenia canescens DC.). Shrubby Coldenia. Common, low, spreading perennial, flowers white, found mostly in rocky, calcareous soil on dry mesas and slopes, blooms March to September. [Shrubby Coldenia is the tenth most common species, found in 29 vegetation units.]

BRASSICACEAE (= CRUCIFERAE)—Mustard Family

Arabis perennans Wats. Rare, perennial herb, flowers purple to pink, blooms February to October.

Capsella bursa-pastoris (L.) Medic. Paniquesillo, Shepherds Purse. Annual or winter annual, flowers white, blooms March to September, introduced from Europe.

Chorispora tenella (Pall.) DC. Annual herb, introduced from Asia, flowers purple, blooms March to June.

Descurainia pinnata (Walt) Britt. Yellow Tansy Mustard. Annual herb, petals whitish to yellow, blooms April to August.

Descurainia sophia (L.) Webb. Flixweed. Annual herb, flowers greenish-yellow, naturalized from Europe, blooms April to June.

Draba cuneifolia Nutt. ex T. & G. Whitlow Grass. Rare, annual herb, flowers white, foundmostly in sandy soil, blooms February to May.

Erysimum aspermum (Nutt.) DC. var. purshii Durand. (=E. capitatum (Dougl.) Greene. Wallflower, Western Wallflower. Rare, perennial or biennial, flowers yellow, blooms March to September.

Lepidium lasiocarpum Nutt. Sand Peppergrass. Annual herb, flowers small and whitish, found in sandy soil, blooms April to July.

Lepidium montanum Nutt. Pepper Grass. Uncommon, biennial or perennial, petals white, blooms April to September.

Lepidium montanum Nutt. var. glabrum C.L. Hitchc. Pepper Grass. Uncommon, biennial or perennial, plants entirely without hairs, see above.

Lesquerella gordoni (Gray) Wats. Gordon Bladderpod. Annual herb, flowers bright yellow, found on dry plains and mesas, blooms February to June.

Lesquerella intermedia (Wats.) Heller. Rare, perennial herb, flowers yellow, blooms April to August.

Lesquerella tenella Nelson. (=L. gordoni (Gray) Wats. var. sessilis Wats.). Rare, annual herb, flowers bright yellow, plants with pubescent siliques, blooms February to June.

Nasturtium officinale R. Br. (=Rorippa nasturtium-aquaticum (L.) Schinz & Thell.). Watercress. Rare, aquatic or semiaquatic perennial herb, flowers white, naturalized from Europe, blooms April to August.

Sisymbrium irio L. London Rocket. Annual herb, flowers yellow, common weed naturalized from Europe, blooms January to April.

Streptanthus arizonicus Wats. Twist Flower. Annual or biennial herb, flowers whitish to yellow with conspicuous brown-purple veins, blooms January to April.

Thelypodium wrightii Gray. Rare, biennial herb, flowers white or pinkish, blooms March to November.

CACTACEAE—Cactus Family

Coryphantha vivipara (Nutt.) B. & R. var. arizonica (Engelm.) W.T. Marshall. (=Mammillaria arizonica Engelm.). Uncommon, perennial cactus, often solitary or caespitose, flowers pink, blooms May to July.

Echinocereus fasciculatus (Engelm.) L. Benson var. boyce-thompsonii (Orcutt) L. Benson. (=E. boyce-thompsonii Orcutt). Infreqent, perennial cactus, stems 5-20 in rather loose clumps, large flowered, flowers purple or lavender, blooms May to June.

Opuntia leptocaulis DC. Desert Christmas Cactus. Common, perennial cactus or cholla, petals greenish-yellow, fruit fleshy, obovoid and red, blooms April to June.

Opuntia phaeacantha Engelm. var. discata (Griffiths) Benson & Walkington. (=O. engelmannii Salm-Dyck). Engelmann Prickly Pear. Infrequent, large, perennial prickly-pear cactus with prostrate or spreading stems, spines usually not present on lower quarter or third of each pad, flowers usually yellow but occasionally red or pink, fruit ovoid and red, juicy and edible, blooms April to June.

Opuntia violacea Engelm. var. macrocentra (Engelm) L. Benson. (=O. macrocentra Engelm.). Black-spined Prickly Pear. Rare, large, perennial, shrubby prickly-pear, flowers yellow, often suffused with red toward the base, fruit fleshy, red to purple, blooms April and May.

CAMPANULACEAE—Bellflower Family

Lobelia cardinalis L. ssp. graminea (Lam.) McVaugh. Cardinal Flower. Rare, perennial herb, often vegetatively reproduces by means of slender offsets, flowers red, found in moist soil especially along streams, blooms June to October.

Nemacladus glanduliferus Jeps. var. orientalis McVaugh. Thread Plant. Annual herb, flowers white with purplish lobes, found in dry, sandy places, blooms March to May.

CARYOPHYLLACEAE—Pink Family

Silene antirrhina L. Sleepy Catchfly. Annual herb, flowers white, often rose-tipped, blooms March to July.

CELASTRACEAE—Staff Tree Family

Canotia holacantha Torr. Crucifixion Thorn. Common, perennial shrub or small tree, leaves reduced to small, deciduous scales, flowers white, blooms May to August.

CHENOPODIACEAE—Goosefoot Family

Atriplex canescens (Pursh) Nutt. Wingscale, Cenizo, Chamiso, Four-wing Saltbush. Infrequent, perennial shrub, dioecious, fruits conspicuously four-winged, found on dry slopes, flats and washes, often in sandy or subalkaline places.

Atriplex canescens (Pursh) Nutt. ssp. canescens (Pursh) Nutt. See above.

Ceratoides lanata (Pursh) J.T. Howell ~~var. lanata~~ (Pursh) J.T. Howell. (=Eurotia lanata (Pursh) Moq.). Winter Fat. Infrequent, perennial sub-shrub, found on dry plains and mesas usually among grasses, blooms May to October.

Chenopodium fremontii Wats. (includes C. incanum (S. Wats.) Heller). Fremont Goose Foot. Annual herb, blooms June to September.

Salsola iberica Sennen & Pau (=S. kali L. var. tenuifolia (Tausch.) Aellen and includes S. pestifer A. Nels.). Russian Thistle. Annual weed or "tumble weed", naturalized from Eurasia.

CLEOMACEAE—Cleome Family

Cleome lutea Hook. var. jonesii Macbr. (=C. jonesii (Macbr.) Tidestrom). Yellow Bee Plant, Yellow Spiderwort. Annual herb, flowers pale yellow, blooms May to August.

Polanisia dodecandra (L.) DC. ssp. trachysperma (T. & G.) Iltis (=P. trachysperma T. & G.). Western Clammyweed. Annual herb, strong scented, flowers whitish with conspicuous purple stamens, blooms May to October.

CONVOLVULACEAE—Morning Glory Family

Convolvulus arvensis L. Field Bindweed. Rare, perennial herb with prostrate stems, flowers white to pink, usually with darker bands on the outside, naturalized from Europe, blooms May to September.

Convolvulus equitans Benth. (=C. incanus Vahl). Hoary Bindweed. Rare, perennial herb with a deep-seated, weedy, perennial root, found mostly on dry slopes and mesas, blooms May to October.

Evolvulus nuttallianus R. & S. (=E. pilosus Nutt.). Rare, perennial herb with woody base, flowers lavender, drying purple, blooms March to July.

CUCURBITACEAE—Gourd or Melon Family

Cucurbita foetidissima H.B.K. Buffalo Gourd, Calabazilla. Rare, perennial, strong-smelling herb, flowers yellow, fruit light green with creamy-white stripes, blooms May to August.

Marah gilensis Greene. Big Root, Wild Cucumber. Rare, perennial vine, found often in thickets along streams, blooms February to April.

CUPRESSACEAE—Cypress Family

Cupressus arizonica Greene. Arizona Cypress, Cedro Blanco. Rare, perennial tree to 27 meters or less, fruit a woody cone with many seeds.

Juniperus monosperma (Engelm.) Sarg. One-seed Juniper. Frequent, perennial shrub to small tree up to 8 meters tall, usually without a definite trunk, seeds solitary or rarely two, unisexual flowers with the two sexes on different plants.

Juniperus osteosperma (Torr.) Little. Utah Juniper. Infrequent, perennial small tree, 3-5 meters tall with a definite trunk, similar to the species above in appearance, stamens and pistils in separate flowers on the same plant.

CYPERACEAE—Sedge Family

Carex aquatilis Wahl. Rare, perennial, grass-like herb with three sided stem, found in wet places.

Eleocharis parishii Britt. Rare, perennial herb with slender, creeping rhizomes, found in wet places.

Scirpus validus Vahl. (=Scirpus acutus Muhl.) Softstem Bulrush. Rare, perennial herb with stout rhizomes.

EPHEDRACEAE—Joint-Fir Family

Ephedra viridis Cov. Mountain Joint-fir. Frequent, perennial, dioecious shrub, young twigs bright green to yellowish-green, leaf bases brown and persistent.

EUPHORBIACEAE—Spurge Family

Croton texensis (Klotzsch) Muell. Arg. Dove Weed, Skunk Weed. Annual herb, strong-scented, stellate-pubescent herbage, blooms May to November.

Euphorbia albomarginata T. & G. Rattlesnake Weed. Rare, prostrate, perennial herb, appendages to flower glands conspicuous and white.

Euphorbia capitellata Engelm. Rare, perennial herb with woody taproot, gland appendages white or pinkish, blooms March to October.

Euphorbia fendleri T. & G. Fendler Spurge. Rare, perennial herb with deep-seated taproot, glands reddish, flowers May to September.

Euphorbia fendleri T. & G. var. chaetocalyx Boiss. See above, variety has narrower leaves and petaloid appendages.

Euphorbia lurida Engelm. Rare, perennial herb, glands without petaloid appendages, blooms April to August.

Euphorbia strictospora Engelm. (=Chamaesyce strictospora Small). Narrow-seeded Spurge. Rare herb, blooms August to October.

Tragia ramosa Torr. (=T. stylaris Muell. Arg.) Noseburn. Rare, perennial herb with woody base, has stinging hairs, blooms March to November.

FABACEAE (=LEGUMINOSAE)—Pea Family

Acacia greggii Gray. var. arizonica Isely (=A. greggii Gray). Catclaw. Common, perennial, large shrub or small tree to 5 meters tall, flowers yellow in spikes, found forming thickets along streams and washes, blooms April to October. [Catclaw is the fifth most common species, found in 44 vegetation units.]

Amorpha fruticosa L. var. occidentalis (Abrams) K. & P. Bastard Indigo. Uncommon, perennial shrub, gland-dotted, heavily-scented, deciduous leaves, glabrous pods, found in canyons and along streams, blooms May to July.

Astragalus amphioxys Gray. Uncommon, winter annual or short-lived perennial herb, flowers pink-purple, herbage densely silvery-white.

Astragalus calycosus Torr. var. scapiosus (Gray) Jones. Frequent, perennial herb, herbage silvery with dolabriform hairs, flowers whitish, often purple- or pink-tipped, fading bluish, found on rocky slopes and mesas, blooms April to July.

Astragalus lentiginosus Dougl. ex Hook. var. albiflorus (Gray) Schoener (=A. lentiginosus Dougl. ex Hook. var. diphysus (Gray) Jones). Rare, perennial or biennial herb, flowers white.

Astragalus lentiginosus Dougl. ex Hook. var. palans (Jones) Jones. Rare, perennial or biennial herb, petals purple.

Astragalus newberryi Gray. Uncommon, perennial herb with appressed-silky herbage, flowers pink-purple, sometimes pale, found on dry, stony mesas, blooms March and April.

Astragalus nuttallianus Nutt. Nuttall Locoweed. Slender annual, flowers whitish or purplish, keep tipped with dark purple, found on plains and mesas, blooms February to May.

Astragalus nuttallianus Nutt. var. trichocarpus[1] Rare herb, similar to species above, found on dry plains, mesas and slopes, has pubescent pods.

Astragalus subcinereus Gray. Annual herb, found mostly on dry hillsides and openings in pine forests or in oak thickets, blooms May to September.

Astragalus tephrodes Gray var. brachylobus (Gray) Barneby. Rare, perennial herb, flowers pink-purple to dull lilac, blooms April to July.

Astragalus wootonii Sheldon. ~~var. wootonii~~ Sheldon. Wooton Loco. Uncommon, winter annual or biennial, flowers whitish, often tinged with pink, lavender or lilac, blooms March to July.

Dalea formosa Torr. Feather Plume, Indigo-bush. Frequent, perennial shrub, flowers rose-purple, the banner sometimes yellowish, pods hairy and glandular-dotted, blooms April to June.

Dalea searlsiae (Gray) Barneby (=Petalostemon searlsiae Gray). Rare, perennial herb from a woody base, flowers rose-purple, blooms April to June.

Desmanthus cooleyi (Eaton) Trel. Bundleflower. Rare, perennial herb or shrub, flowers white, found on dry slopes, mesas and plains, blooms May to September.

Hoffmanseggia drepanocarpa Gray. Sicklepod Rush Pea. Uncommon, perennial herb with thick, woody, taproot, flowers yellow, blooms May to September.

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[1]Variety not listed in Lehr (1978) and Lehr and Pinkava (1980, 1982).

Lotus corniculatus L. Birdsfoot Trefoil. Rare, perennial herb with green and leaf-like stipules, corolla yellow to reddish-orange, introduced from Europe and an adventive.

Lotus humistratus Greene. Hill Locust. Annual herb with decumbent to ascending stems, flowers yellow tinged with purple, found mostly in sandy deserts, flowers March to June.

Lotus mearnsii Britt. Rare, perennial herb, with decumbent or nearly prostrate stems, flowers yellow, often drying purple, found mostly in grasslands on dry mesas and slopes, blooms March to August.

Lupinus brevicaulus Wats. Short-stemmed Lupine. Annual herb, densely hairy, flowers blue or purple, found on dry slopes and mesas, blooming April to July.

Medicago lupulina L. Black Medick. Annual or sometimes perennial herb, flowers yellow, naturalized from Europe, found in waste places, blooms March to September.

Medicago minima (L.) Grufberg. Small Bur Clover. Annual or perennial herb, naturalized from Europe, not common, soft-pubescent herbage.

Medicago polymorpha L. var. vulgaris (Benth.) Shinners (=M. hispida Gaertn.). Bur Clover. Annual herb with procumbent stems, flowers yellow, naturalized from Europe, found on waste land, blooms March to May.

Medicago sativa L. Alfalfa. Rare, perennial herb, flowers violet, introduced from Eurasia, often cultivated, becomes established in waste places, blooms April to October.

Melilotus albus Desr. ex Lam. White Sweet Clover. Uncommon, annual or biennial herb, naturalized from Eurasia, found mostly in waste places, flowers white, blooms July to September.

Melilotus indicus (L.) All. Alfalfilla, Annual Yellow Sweet Clover, Sour-clover. Uncommon, annual or biennial herb, naturalized from Eurasia, found in waste places a low altitudes, blooms April to October.

Melilotus officinalis (L.) Lam. Yellow Sweet Clover. Rare, annual or biennial herb, naturalized from Eurasia, found in disturbed areas, flowers yellow, blooms June to October.

Mimosa biuncifera (Benth.) B. & R. Wait-a-Minute, Cat's Claw Mimosa. Rare, perennial shrub, well armed with stout, flat spines, flowers whitish or pink, found in dry soil on mesas and rockyslopes often in chaparral, blooms May to August.

Phaseolus angustissimus Gray var. latus Jones. Rare, annual or perennial herb, flowers purple with a yellow keel, found often on mesas among trees or shrubs, blooms May to October.

Prosopis velutina Woot. (=P. juliflora (Swartz) DC. var. velutina (Woot.) Sarg.). Velvet Mesquite. Common, perennial tree, with pubescent foliage, common along streams and washes where the water table is relatively high, flowers yellow, blooms March to August. [Velvet Mesquite is the eighth most common species, found in 39 vegetation units.]

Rhynchosia sena Gill. var. angustifolia (Gray) Grear (=R. texana T. & G.). Rosary Bean. Rare, perennial herb with weakly twining stems, flowers yellow, found mostly on dry plains and mesas, blooms May to September.

Senna bauhinioides (Gray) Irwin & Barneby (=Cassia bauhinioides Gray). Rare, annual or perennial herb, flowers yellow, found on dry rocky slopes and mesas, blooms April to August.

Trifolium repens L. White Clover. Rare, perennial herb, with creeping stems which root at the nodes, flowers white, often tinged with pink, naturalized from Europe, blooms June to September.

Vicia ludoviciana Nutt. (=V. exigua Nutt.). Annual herb, flowers white to purple, found often among bushes on slopes and in canyons, blooms March to May.

FAGACEAE—Beech Family

Quercus dunnii Kell. Palmer Oak. Rare, perennial, evergreen shrub or tree to 5 meters tall, often forming thickets, leaf blades gray-green above and mostly glabrous and yellowish to whitish underneath.

Quercus turbinella Greene ~~ssp. turbinella~~ Greene. Shrub Live Oak, Turbinella Oak. Uncommon, perennial small or large shrub to about 4 meters tall, leaf blades with upper surface dull gray-green and the lower densely stellate-tomentose.

FUMARIACEAE—Fumitory Family

Corydalis aurea Willd. ssp. aurea Willd. Golden Corydalis. Rare, biennial or short-lived perennial herb with watery juice, flowers yellow, blooms February to June and sometimes later.

Corydalis aurea Willd. ssp. occidentalis (Engelm.) Ownbey. Rare, biennial or short-lived perennial herb, flowers yellow, surpassing the leaves and conspicuously spurred, blooms February to June.

GERANIACEAE—Geranium Family

Erodium cicutarium (L.) L'Her. Filaree, Afilerillo, Alfilaria. Annual herb, leaves pinnate, flowers pink or rose-lavender, naturalized from Europe, blooms February to July.

Erodium texanum Gray. Large-flowered Stork's Bill. Annual herb, leaves palmately lobed, flowers purple, found mostly on plains and mesas, blooms February to August.

HYDROPHYLLACEAE—Waterleaf Family

Eucrypta chrysanthemifolia (Benth.) Greene var. bipinnatifida (Torr.) Constance. Torrey Eucrypta. Annual herb, strong-scented, sticky foliage, leaves bipinnatifid, flowers white or bluish, blooms February to April.

Eucrypta micrantha (Torr.) Heller. Small-flowered Eucrypta. Annual herb, strong- scented, sticky foliage, leaves once pinnate, flowers purplish or blue or sometimes white with a yellowish tube, blooms February to May.

Phacelia crenulata Torr. Annual herb, flowers deep violet or bluish-purple with exerted stamens, found on plains, mesas and foothills, blooms January to June.

Phacelia crypthantha Greene. Small-flowered Phacelia. Annual herb, flowers borne in a scorpioid cyme, flowers lavender, stamens included, found on dry slopes under shrubs, blooms April to June.

Phacelia distans Benth. var. australis Brand. Wild Heliotrope. Annual herb, flowers blue, stamens included or slightly exerted, blooms February to May.

Phacelia ivesiana Torr. Ives Phacelia. Annual herb with taproot, flowers in relatively small, scorpioid cyme, flowers white with yellowish tube, found in sandy soil, blooms March to June.

Phacelia rotundifolia Torr. Round-leaved Phacelia. Annual herb, flowers white to pink or pale violet with the lower part of the tube pale yellow, found often on rocky talus, blooms March to May.

JUGLANDACEAE—Walnut Family

Juglans major (Torr.) Heller. Arizona Walnut, Nogal Silvestre. Uncommon, perennial tree up to 15 meters tall, found mostly along streams.

JUNCACEAE—Rush Family

Juncus ensifolius Wakstr. var. montanus (Engelm) C.L. Hitchc. (=Juncus saximontanus A. Nels.). Rare, perennial herb with stout, creeping rhizomes, flat stems.

Juncus torreyi Coville. Rare, perennial herb with slender, creeping rhizomes with tuberlike thickenings from which other stems arise, found in wet places, flowers July to September.

Juncus xiphioides E. Mey. Rare, perennial herb with stout, creeping rhizomes, flat stems, flowers June to August.

KRAMERIACEAE—Ratany Family

Krameria parvifolia Benth. Range Ratany. Common, perennial shrub, flowers purplish, blooms April to October. [Range Ratany is the seventh most common species, found in 39 vegetation units.]

LAMIACEAE (=LABIATAE)—Mint Family

Hedeoma drummondii Benth. Drummond's Mock-pennyroyal. Uncommon, perennial herb, often from a woody base, flower rose-purple or blue-purple, blooms April to September.

Hedeoma nanum (Torr.) Briq. Uncommon, annual or perennial herb, flowers blue to purple, blooms March to October.

Hedeoma oblongifolium (Gray) Heller. Rare, annual or perennial herb, flowers purple, blooms April to September.

Marrubium vulgare L. Common Horehound, Marrubio. Uncommon, perennial herb with white-woolly stems, flowers white or pale lavender, naturalized from Europe, blooms April to September.

Mentha spicata L. Spearmint. Rare, perennial, aromatic herb, flowers pale lavender, naturalized from Europe, blooms July to September.

Salvia reflexa Hornem. Rocky Mountain Sage. Annual herb, flowers blue, blooms July to October.

LILIACEAE—Lily Family

Calochortus flexuosus Wats. Straggling Mariposa. Infrequent, perennial herb, with bent and twisted branched stems, root a corm, flowers white to lilac or purple with a yellow gland and purple spot near the base (and a few short hairs near the gland), blooms April to June.

Calochortus nuttallii T. & G. Sego Lily. Rare, perennial herb, root a corm, stems erect and usually simple, flowers white to lilac or purple or lemon yellow, blooms May to July.

Dichelostemma pulchellum (Salisb.) Heller. (=Brodiaea capitata Benth.) Bluedicks. Infrequent, perennial herb, flowers blue-violet, blooms February to May and occasionally July or later.

Dichelostemma pulchellum (Salisb.) Heller var. pauciflorum (Torr.) Hoover. Rare, perennial herb, similar to species above, but the bracts are narrower, pale-colored and shorter than the pedicels.

LINACEAE—Flax Family

Linum lewisii Pursh. Blue Flax. Rare, perennial herb, flower blue, rarely white, blooms March to September.

Linum puberulum (Engelm) Heller. Plains Flax. Annual herb, flowers yellow, blooms April to October.

LOASACEAE—Stick-leaf Family

Mentzelia albicaulis Dougl. Small-flowered Blazing Star. Annual herb, flowers yellow, found often in sandy soil of plains and along washes, blooms February to August.

Mentzelia pumila (Nutt.) T. & G. var. multiflora[2]. Uncommon, biennial herb, flowers yellow, found in dry stream beds and along roads, common, blooms February to October.

LYTHRACEAE—Loosestrife Family

Lythrum californicum T. & G. Hierba del Cancer, Loosestrife. Rare, perennial herb, stems with exfoliating bark, flowers purple, found often in wet soil along streams, blooms June to August.

MALVACEAE—Mallow Family

Abutilon parvulum Gray. Small-leaved Abutilon, Indian-mallow. Rare, herbaceous perennial, often with a woody base, flowers pink to red, found often on dry plains and slopes, sometimes with scrub oak, blooms April to October.

Malva neglecta Wallr. Common Mallow. Rare, annual or biennial herb, naturalized from Eurasia, common weed of waste places, flowers pink or white, blooms May to October.

Sphaeralcea ambigua Gray. Desert Mallow, Apricot-mallow. Common, perennial herb with thick, woody stem, flowers red, pink or orange, blooms March to June. [Desert Mallow is the sixth most common species, found in 42 vegetation units.]

Sphaeralcea grossulariaefolia (H. & A.) Rydb. Rare, perennial herb, flowers grenadine, found often on mesas and slopes, often in -juniper woodlands, blooms April to October.

Sphaeralcea parvifolia A. Nels. Littleleaf Globe Mallow. Rare, perennial herb with large root and woody crown, flowers grenadine, found mostly in the open on dry slopes and mesas, the most common species of the genus in Arizona, blooms April to November.

Sphaeralcea rusbyi Gray. Rare, perennial herb with thick crown, flowers grenadine, found on well-drained slopes often in openings in pine forests, blooms April to September.

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[2]Variety not in Lehr (1978) and Lehr and Pinkava (1980, 1982).

MARTYNIACEAE—Unicorn Plant Family

Proboscidea parviflora (Woot.) Woot. & Standl. var. parviflora Woot. & Standl. Devil's Claw, Cinco Llagas, Unicorn Plant. Annual herb with slender taproot, flowers purple to nearly white, often with purple spots or blotches, blooms April to October.

NYCTAGINACEAE—Four-O'Clock Family

Allionia incarnata L. Trailing Four-O'Clock, Windmills. Rare, perennial herb, flowers, purplish-red or rarely white, blooms April to October.

Boerhaavia coccinea Mill. Red Spiderling. Rare, perennial herb with declining or prostrate stems, flowers purplish-red, blooms April to November.

Boerhaavia coulteri (Hook. f.) Wats. Coulter Spiderling. Annual herb, flowers pink or white.

Boerhaavia torreyana (Wats.) Standl. Annual herb, similar in appearance to B. coulteri.

Mirabilis multiflora (Torr.) Gray. var. multiflora (Torr.) Gray. Colorado Four O'Clock. Uncommon, perennial herb, flowers red-purple, blooms April to September.

Mirabilis pumila (Standl.) Standl. (=Oxybaphus pumilus Standl.). Rare, perennial herb from a woody root, flowers pale pink, flowers June to September.

OLEACEAE—Olive Family

Forestiera pubescens Nutt. Tanglebrush, Desert Olive. Rare, perennial shrub, leaves opposite, flowers in small fascicles, fruit a blue-black drupe, blooms March to June.

Fraxinus pennsylvanica Marsh. ssp. velutina (Torr.) G.N. Miller (=Fraxinus velutina Torr. ssp. velutina Torr.) Velvet Ash. Unc

Menodora scabra Gray ~~var. scabra~~ Gray.[3] Uncommon, perennial herb, flowers bright yellow, found on dry mesas and slopes, blooms March to September.

ONAGRACEAE—Evening Primrose Family

Gaura coccinea Pursh. Scarlet Gaura. Uncommon, perennial herb, flowers whitish, pink or red, found usually on dry plains and slopes, blooms April to September.

Gaura hexandra Ort. ssp. gracilis (Woot. & Standl.) Raven & Gregory. (=G. gracilis Woot. & Standl. and forma glandulosa (Woot. & Standl.) Munz. Annual or perennial herb, found commonly in canyons and along roadsides, flowers red, blooms May to October.

Gaura parviflora Dougl. Lizard Tail, Velvet Leaf Gaura. Rare, biennial or winter-annual herb, flowers usually pink, found often in waste places, blooms June to October.

Oenothera albicaulis Pursh. Prairie Evening Primrose. Annual or winter-annual herb, flowers white, becoming pink in age, blooms March to September.

Oenothera caespitosa Nutt. Rare, perennial herb, flowers white, aging pink, blooms April to September.

Oenothera caespitosa Nutt. var. marginata (Nutt.) Munz. Large White Desert Primrose. Rare, perennial herb, similar to species above.

Oenothera flava (A. Nels.) Garrett. Rare, perennial herb, without a stem, flowers pale yellow, drying reddish, blooms April to September.

ORCHIDACEAE—Orchid Family

Epipactis gigantea Douglas ex Hook. Giant Helleborine. Rare, perennial herb with creeping rhizomes, flowers purple, strong veined with darker purple, found in moist soil, blooms April to July.

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[3]Variety not in Lehr (1978) and Lehr and Pinkava (1980, 1982).

PAPAVERACEAE—Poppy Family

Argemone pleiacantha Greene. ssp. ambigua G. B. Ownbey. Rare, annual or perennial herb, moderately prickly herbage, flowers yellow, blooms all summer.

PINACEAE—Pine Family

Pinus edulis Engelm. Pinyon, Pinyon Pine. Rare, perennial tree to 15 meters tall, leaves mostly in two's, but sometimes in three's or solitary, fruit edible.

Pinus monophylla Torr. & Frem. Single-leaved Pinyon. Rare, perennial tree, similar to P. edulis except that the leaves are mostly single.

PLANTAGINACEAE—Plantain Family

Plantago major L. Common Plantain. Rare, perennial herb, naturalized from Europe, found often in moist soil along streams, blooms March to October.

Plantago patagonica Jacq. var. gnaphalioides (nutt.) Gray (=P. purshii R. & S.). Annual herb, found on dry slopes and mesas, blooms February to August.

Plantago patagonica Jacq. var. oblonga (Morris) Shinners (=P. purshii R. & S. var. picta (Morris) Pilger). Annual herb, see species above.

Plantago rhodosperma Decne. Red-seeded Plantain. Annual or winter biennial with slender taproot, flowers white or whitish, seeds red, found often along streams, blooms March to May.

Plantago virginica L. Pale-seeded Plantain. Annual herb with slender taproot, flowers white or whitish, seeds golden yellow or pale orange, blooms February to April.

PLATANACEAE—Plane Tree Family

Platanus wrightii Wats. Arizona Sycamore. Uncommon, perennial tree to 25 meters tall, older branches white-barked after the thin, outer bark exfoliates, leaves deeply 5-lobed, found along streams, blooms April and May.

POACEAE (= GRAMINEAE)—Grass Family

Agropyron subsecundum (Link) Hitchc. Uncommon, perennial grass.

Agropyron trachycaulum (Link) var. unilaterale (Cassidy) Malte. Wheatgrass. Rare, perennial grass, blooms May to October.

Agrostis semiverticillata (Forsk.) C. Chr. Water Bent. Perennial grass, stolons root at nodes, found in wet places, blooms May to October.

Aristida hamulosa Henr. Uncommon perennial grass, blooms June to September.

Aristida purpurea Nutt. Purple Three-awn. Common, perennial grass with a trifid awn, blooms May to September. [Purple Three-awn is the third most common species, found in 59 vegetation units.]

Avena fatua L. Wild Oat. Annual grass, spikelets mostly three-flowered, awns bent or geniculate and twisted, introduced from Europe, blooms March to August.

Avena sativa L. Cultivated Oat. Rare, annual or perennial grass which is found as an escape from cultivation, introduced from Europe, found often in disturbed areas or along roads, spikelets mostly two-flowered, awns straight and not twisted.

Bothriochloa barbinodis (Lag.) Herter (=Andropogon barbinodis Lag.) Bluestem. Rare, perennial grass, culms densely bearded at the nodes, awns twisted below and geniculate or bent, blooms April to October.

Bothriochloa saccharoides (Swartz) Rydb. (=Andropogon saccharoides Swartz). Silver Beardgrass. Rare, perennial grass, culms tufted, awns twisted below and geniculate or bent, blooms June to October.

Bouteloua aristidoides (H.B.K.) Griseb. Six-weeks Needle Grama, Needle Grama, Six Weeks Grama. Annual grass, blooms June to October.

Bouteloua barbata Lag. Six-weeks Grama. Annual grass, found on dry mesas and rocky hills, blooms July to October.

— Bouteloua curtipendula (Michx.) Torr. Side Oats Grama. Infrequent, perennial grass, blooms April to October.

— Bouteloua eriopoda (Torr.) Torr. Black Grama. Infrequent, perennial grass, blooms July to October.

— Bouteloua gracilis (H.B.K.) Lag. Blue Grama. Uncommon, perennial grass, often with rhizomes, spikelets arranged in a semi-circle, blooms, July to October.

— Bromus carinatus H. & A. California Brome. Rare, annual or biennial grass, blooms in late summer, found in open ground and waste places. Bromus mollis L. Soft Chess. Annual grass, softly pubescent throughout, naturalized from Europe.

— Bromus rigidus Roth. Ripgut Grass. Annual grass, naturalized from Europe, a weed of waste places.

— Bromus rubens L. Red Brome, Foxtail Chess. Annual grass, naturalized from Europe, a weed of waste places.

— Bromus tectorum L. Downy Chess, Cheat Grass. Annual grass, naturalized from Europe, a weed of waste places.

— Cenchrus insertus M.A. Curtis (=C. pauciflorus Benth.). Field Sandbur. Annual grass, the spikelets falling entire at maturity as a spiny bur, found in waste places, blooms June to October.

— Cynodon dactylon (L.) Pers. Pata de Gallo, Bermuda Grass. Rare, perennial grass, with creeping stolons or rhizomes, spikes digitate at the top of the culm, introduced in America, found on lawns and in waste places.

— Echinochloa crusgalli (L.) Beauv. Barnyard Grass. Annual grass, coarse, found in waste places, blooms July to September.

— Elymus glaucus Buckl. Blue Wild Rye. Uncommon, perennial grass, found in open woods, thickets, and along streams, blooms April to September.

— Eragrostis cilianensis (All.) Mosher. Stink Grass. Annual grass, weedy, naturalized from Europe, found in cultivated ground and waste places, blooms May to October.

— Eragrostis lehmanniana Nees Lehmann Lovegrass Perennial, weedy, naturalized.

— Erioneuron pilosum (Buckl.) Nash (=Tridens pilosus (Buckl.) Hitchc.) Hairy Tridens. Rare, perennial grass, densely tufted, blooms summer and fall.

— Erioneuron pulchellum (H.B.K.) Tateoka (=Tridens pulchellus (H.B.K.) Hitchc.). Fluff Grass. Frequent, perennial grass, densely tufted, consisting of a single, long internode bearing at its summit a fascicle of leaves and spikelets, the fascicle finally bending over to the ground, taking root and producing more culms, found on mesas and rocky hills, blooms March to October.

— Hilaria belangeri (Steud.) Nash. Curly Mesquite Grass. Rare, perennial grass, tufted, found on mesas and foothills, blooms March to October.

— Hilaria mutica (Buckl.) Benth. Tobosa Grass, Tobosa. Uncommon, perennial grass, nodes usually glabrous or merely puberulent, blooms May to October.

— Hordeum geniculatum All. (=H. hystrix Roth). Mediterranean Barley. Annual grass, naturalized from Europe, found as a weed along ditches, but not common.

— Hordeum glaucum All. (=H. stebbinsii Covas) Annual grass, introduced from the Old World, a weed of cultivated land and waste places.

— Hordeum jubatum L. Fox-tail Barley. Rare, perennial grass, found mostly as a weed in moist open ground along ditches and in waste places, blooms June to September, introduced from southern Europe.

— Hordeum leporinum Link. Wild Barley. Annual grass, blooms April to June.

— Leptochloa filiformis (Lam.) Beauv. Red Sprangletop. Annual non-native grass, found on cultivated land and along streams, blooms May to September.

— Muhlenbergia asperifolia (Nees & Mey.) Parodi. Scratchgrass. Uncommon, perennial grass, with scaly rhizomes, blooms May to October.

— Muhlenbergia porteri Scribn. Bush Muhly. Common, perennial grass, found on mesas and rocky hills, blooms August to October.

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Oryzopsis hymenoides (R. & S.) Ricker. Indian Ricegrass. Infrequent, perennial grass, found on open plains and hills and often in juniper woodlands, blooms June to August.

Panicum arizonicum Scribn. & Merr. Arizona Panicum. Annual grass, found on rocky slopes and in sandy washes and canyon bottoms, blooms July to October.

Paspalum distichum L. Knotgrass. Rare, perennial grass, often with extensive creeping stolons, nodes of both culms and stolons usually pubescent, found in moist places, sometimes in shallow water, blooms June to September.

Poa bigelovii Vasey & Scribn. Bigelow's Bluegrass. Annual grass, found on rocky slopes and sandy washes, blooms early spring.

Poa fendleriana (Steud.) Vasey. (includes P. longiligula Scribn. & Williams). Mutton Grass. Rare, perennial grass, usually without rhizomes, blooms April to August.

Polypogon monspeliensis (L.) Desf. Rabbitfoot Grass. Annual grass, naturalized from Europe, blooms April to October.

Schismus barbatus (L.) Thell. Mediterranean Grass. Annual grass, naturalized from the Mediterranean region, blooms January to May.

Setaria grisebachii Fourn. Grisebach Bristlegrass. Annual grass, found on rocky slopes and in washes and open woodlands, blooms June to October.

Setaria leucopila (Scribn. & Berr.) K. Schum. Rare, perennial grass, blooms July to September.

Setaria macrostachya H.B.K. Plains Bristlegrass. Rare, perennial grass, found on dry, rocky soils, blooms May to October.

Setaria viridis (L.) Beauv. Green Bristlegrass, Grass Foxtail. Annual grass, naturalized from Europe, found mostly on lawns, roadsides, and waste places, blooms June to October.

Sitanion hystrix (Nutt.) J.G. Smith. Rare, perennial grass, found on open, sandy soil and rocky hills and in open pine forests, blooms March to September.

Sorghum halepense (L.) Pers. (=Elymus elymoides (Raf.) Swezey.) Johnson Grass. Perennial grass, coarse with scaly rhizomes, introduced from the Mediterranean region, a common weed of waste places, fields, and along irrigation ditches, blooms April to November.

Sporobolus airoides (Torr.) Torr. Alkali Sacaton. Uncommon, perennial grass, panicle with wide spreading branches, found often in alkali soil, blooms June to October.

Sporobolus cryptandrus (Torr.) Gray. Sand Dropseed. Rare, perennial grass, found on dry, open, sandy or rocky sites, blooms April to October.

Stipa neomexicana (Thurb.) Scribn. New Mexican Feathergrass. Frequent, perennial grass, found on dry, sandy, or rocky slopes and plains, blooms May to June.

Tridens muticus (Torr.) Nash. Slim Tridens. Infrequent, perennial grass, found on rocky slopes, desert grasslands, and oak woodlands, infrequent, blooms April to October.

POLEMONIACEAE—Phlox Family

Eriastrum eremicum (Jeps.) Mason. Annual herb, flower heads densely cobwebby, found on dry plains and mesas, blooms March to June.

Eriastrum eremicum (Jeps.) Mason var. yageri (Jones) Mason. Annual herb, similar to species above.

Gilia flavocincta A. Nels. (=G. tenuiflora Benth.). Annual herb, common on plains and in washes preferring sandy soil, blooms February to May.

Gilia sinuata Dougl. Annual herb, usually found in open, sandy places, flowers pale violet to pink or white, blooms March to June.

Ipomopsis longiflora (Torr.) V. Grant (=Gilia longiflora (Torr.) G. Don). White-flowered Gilia. Annual herb, flowers pale blue-violet to almost white, found often on dry plains and mesas, especially on limestone soils, blooms March to October.

Phlox amabilis Brand. Rare, perennial herb with a taproot, flowers pink, sometimes notched at the end, endemic to central Arizona, blooms March to May.

Phlox woodhousei (Gray) E. Nels. Rare, perennial herb, woody only at the base, flowers bright pink often fading to white and deeply notched, found in open woods, often on rocky slopes, blooms April to June and again in September.

POLYGALACEAE—Milkwort Family

Polygala rusbyi Greene. Rusby Milk Wort. Uncommon, perennial herb, flowers purple but the keel yellow, blooms April to July.

Polygala scoparioides Chodat. Rare, perennial herb, flowers greenish-white (upper petals and sepals white with greenish or brown center), blooms March to October.

POLYGONACEAE—Buckwheat Family

Eriogonum abertianum Torr. var. abertianum Torr. Uncommon, annual or biennial herb, calyx white or pink, blooms March to September.

Eriogonum abertianum Torr. var. neomexicanum[4] Rare, annual or biennial herb, found in foothills and mountains, blooms March to September.

Eriogonum deflexum Torr. var. deflexum Torr. Skeleton Weed. Annual herb, calyx white to pink, blooms most of the year at lower altitudes.

Eriogonum microthecum Nutt. var. foliosum (T. & G.) Reveal (=E. simpsonii Benth.). Infrequent, perennial herb, woody only at the base or sometimes well above the base, calyx white or pink, blooms June to September, the most common species in Arizona.

Eriogonum trichopes Torr. Little Trumpet. Annual, or sometimes biennial, herb, calyx yellow to green, blooms almost throughout the year.

Eriogonum wrightii Torr. var. wrightii Torr. Wright Buckwheat. Uncommon, perennial herb with woody, branched stem, calyx white or pink, blooms June to October.

Polygonum aviculare L. Prostrate Knotweed, Common Knotweed. Annual herb with bluish-green aspect, flowers green but often with pink or purple margins, naturalized from Eurasia, found in roadsides and waste places, blooms April to October.

Polygonum punctatum Ell. Water Smartweed. Rare, normally a perennial herb with slender rhizomes, found in moist places, flowers greenish, blooms July to October.

Rumex crispus L. Curly Dock, Curly-leaf Dock. Rare, perennial herb with taproot, naturalized from Europe, found often along streams and ditches, flowers numerous in panicled racemes, blooms March to October.

Rumex hymenosepalus Torr. Canigre, Wild Rhubarb. Rare, perennial herb with a cluster of tuberous roots, flowers pinkish, often common and conspicuous in sandy places, blooms March and April.

PORTULACACEAE—Portulaca or Purslane Family

Calandrinia ciliata (R. & P.) DC. var. menziesii (Hook.) Macbr. Red Maids. Annual, somewhat fleshy herb, flowers red, or rarely white, blooms February to April.

POTAMOGETONACEAE—Pondweed Family

Potamogeton gramineus L. var. maximus Morong. Rare, perennial, aquatic herb with cylindrical (in cross section) stems and floating leaves on slender petioles.

Potamogeton nodosus Poir. Rare, perennial, aquatic herb.

Potamogeton pectinatus L. Sago Pondweed. Rare, perennial, aquatic herb with entire plant submerged.

[4]Variety not in Lehr (1978) and Lehr and Pinkava (1980, 1982).

PRIMULACEAE—Primrose Family

Androsace occidentalis Pursh. Rock Jasmine. Annual herb, corolla shorter than the calyx, flowers white, found often along streams, blooms February to April

Samolus parviflorus Raf. (=S. floribundus H.B.K.) Water Pimpernel. Rare, perennial herb, flowers white, found in wet soil along streams, blooms April to August.

RANUNCULACEAE—Crowfoot Family

Anemone tuberosa Rydb. Desert Windflower. Rare, perennial herb with tuberous roots, flowers pink or purple, found among rocks on mesas and foothills, blooms February to May.

Aquilegia chrysantha Gray. Columbine. Rare, perennial herb, flowers canary-yellow throughout, found in rich, moist soil, blooms April to September.

Clematis ligusticifolia Nutt. Clematis, Virgin's Bower. Rare, perennial vine, climbing by tendril-like petioles, found often along streams, petals none, blooms May to September.

Delphinium scaposum Greene. Barestem Larkspur. Infrequent, perennial herb with slender, woody, fibrous roots, sepals blue to light blue, upper petals white or nearly so, lower petals colored like the sepals.

RHAMNACEAE—Buckthorn Family

Rhamnus californica Esch. ssp. ursina (Greene) Wolf. California Buck Thorn. Uncommon, perennial shrub or small tree, bark gray, fruit a drupe (berrylike with two to four nutlets), black when mature, found mostly in chaparral and in open coniferous forests, flowers small and greenish in axillary clusters, blooms May to July.

Ziziphus obtusifolia (Hook. ex. T. & G.) A. Gray var. canescens (A. Gray) M.C. Johnst. (=Condalia lycioides (Gray) Weberb. var. canescens (Gray) Trel.). Thorn, Gray-leaved Abrojo, Gray-thorn. Frequent, perennial, much branched shrub with rigid, spiny twigs, flowers white and small, fruit an ellipsoid drupe, deep blue to black, often forms thickets on plains or slopes, blooms May to September.

ROSACEAE—Rose Family

Cowania mexicana D. Don. var. stansburiana (Torr.) Jeps. (=Purshia stansburiana Torr.) Cliff-rose, Quinine Bush. Uncommon, perennial shrub or small tree to 7 meters, but usually not over 3 meters tall, older bark gray and finely shreddy, petals white to pale yellow and aromatic, very common on dry slopes and mesas, often in pinyon-juniper woodlands, blooms April to September.

Rubus arizonensis Focke. Arizona Dewberry. Rare, perennial shrub, very prickly, fruits small, of rather few druplets, found often in partial shade along streams, blooms March to May.

RUBIACEAE—Madder Family

Galium aparine L. Bedstraw, Cleavers, Goosegrass Bedstraw. Annual herb with stems prostrate or scrambling over other plants, flowers white and small, found often in moist places, blooms May to September, presumably naturalized from Europe.

Galium microphyllum Gray (=Relbunium microphyllum (Gray) Hemsl.). Rare, perennial herb, leaves in whorls of four, flowers small and greenish-yellow, fruits purplish when ripe, blooms June to September.

Galium proliferum Gray. Great Basin Bedstraw. Annual herb, leaves mostly four in a whorl, flowers white or whitish, fruits densely hairy with hooked hairs, blooms April and May.

RUTACEAE—Rue Family

Ptelea trifoliata L. ssp. pallida (Greene) V.L. Bailey. (=P. pallida Greene). Rare, perennial shrub or small tree to 6 meters tall, bark of twigs straw-colored to light olive-colored, leaves yellowish-green, found mostly in canyons, blooms May and June.

Thamnosma texana (Gray) Torr. Uncommon, perennial shrub or nearly herbaceous herb with many ascending branches, flowers greenish-yellow tinged with purple, aromatic, found on dry rocky slopes and mesas, blooms March to June.

SALICACEAE—Willow Family[5]

Salix amygdaloides Anderss. Peach-leaf Willow. Uncommon, perennial small tree of 12 meters tall, blooms April to June.

Salix bonplandiana H.B.K. (includes S. laevigata Bebb and its var. araquipa (Jeps.) Ball). Bonpland Willow, Red Willow. Uncommon, perennial small tree to 15 meters tall.

Salix gooddingii Ball. Goodding Willow. Uncommon, perennial tree, 6 to 10 meters tall, found along streams.

SAPINDACEAE—Soapberry Family

Sapindus saponaria L. var. drummondii (H. & A.) Benson. Western Soapberry, Jaboncillo. Uncommon, perennial small tree or shrub to 6 meters tall, pinnate leaves, flowers white, berries yellow, becoming dark in drying, found usually along streams, blooms May to August.

SAXIFRAGACEAE—Saxifrage Family

Ribes aureum Pursh. Golden Currant. Rare, perennial shrub, flowers fragrant and bright yellow or orange, berry mostly black or red, blooms March to June.

SCROPHULARIACEAE—Figwort Family

Castilleja chromosa A. Nels. Indian Paint Brush. Uncommon, perennial herb with a woody crown, flowers greenish-yellow, often with a red margin, blooms March to August.

Castilleja integra Gray. Indian Paint Brush. Rare, perennial herb with a woody root, flowersgreen but often red on the margins, blooms March to September.

Cordylanthus laxiflorus Gray. Bird Beak, Club Flower. Annual herb, roots yellow, flowers yellow when fresh, though drying purplish, found on dry mesas and slopes, blooms August to October.

Linaria dalmatica Miller. Toad Flax, Butter and Eggs. Uncommon, perennial herb with rhizomes, flowers yellow with darker yellow throat, naturalized from Europe, blooms July to August.

Maurandya antirrhiniflora H. & B. Blue Snapdragon Vine. Uncommon, perennial, vine-like herb, flowers purple, the palate yellowish with dark lines, found often on stony slopes among shrubs, blooms April to October.

Mimulus guttatus DC. Rare, perennial (usually) herb, often with stolons or creeping rhizomes and rooting at the nodes, flowers yellow usually spotted with red, found in wet places, blooms March to September.

Mimulus rubellus Gray. Red-stemmed Mimulus. Annual herb, flowers yellow or sometimes reddish, found often in sandy soil along streams, blooms March to July.

Penstemon eatonii Gray ssp. undosus (Jones) Keck. Rare, perennial herb, flowers scarlet, lips approximately equal.

Penstemon pseudospectabilis Jones ssp. connatifolius (A. Nels.) Keck. Rare, perennial herb, flowers pink or purple with yellowish tube and dark lines in the throat, blooms April to June and sometimes in the fall.

Penstemon thompsoniae (Gray) Rydb. Thompson Penstemon. Uncommon, perennial sub-shrub with prostrate or ascending stems from a woody base, flowers blue-violet with a bearded throat, blooms May and June.

Stemodia durantifolia (L.) Swartz. Annual herb, flowers violet-purple, found in wet soil along streams, blooms March to October.

Veronica anagallis-aquatica L. Water Speedwell. Rare, perennial herb, flowers blue to bluish-lilac, found in and around springs and streams, blooms March to September.

SIMAROUBACEAE—Quassia or Simarouba Family

Ailanthus altissima (Mill.) Swingle. Copal Tree, Tree of Heaven. Rare, perennial tree 5 to 20 meters tall, exhibits rapid growth, spreads by suckers as well as by seeds, introduced from Asia and frequently grown as an ornamental.

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[5]McDougall and Haskell (1960) indicate that Populus fremontii ssp. fremontii (Fremont Cottonwood) was present at Montezuma Castle National Monument, but today this species is no longer part of the Monument's flora.

SOLANACEAE—Nightshade Family

Chamaesaracha coronopus (Dunal) Gray. Small Groundcherry. Rare, perennial herb with slender, underground rhizomes, flowers white to cream with some purple tinge, found on dry plains and mesas, blooms April to December.

Datura meteloides DC. Sacred Datura, Tolguacha. Uncommon, perennial herb, flowers white, often suffused with lavender or purple, blooms April to October or throughout the year at low altitudes.

Lycium pallidum Miers. Rabbit Thorn. Rare, perennial shrub with spiny branches, flowers greenish, often tinged with purple, blooms April to June.

Nicotiana attenuata Torr. Rare, perennial herb, flowers white, blooms May to October.

Nicotiana trigonophylla Dunal var. trigonophylla Dunal. Desert Tobacco, Tabaquillo. Uncommon, biennial or perennial herb, flowers greenish-white, blooms year round.

Petunia parviflora Juss. Wild Petunia. Rare, annual herb, flowers pale blue to purple with a whitish tube, found in moist soil in stream beds and muddy flats, blooms April to September or nearly throughout the year at low altitudes.

Physalis acutifolia (Miers) Sandw. (=P.wrightii Gray.) Wright Ground-cherry. Annual herb, flowers whitish or pale yellow with a deeper yellow center, found in fields and along roadsides and ditches,blooms April to September.

Physalis hederaefolia Gray var. cordifolia (Gray) Waterfall. (=P. fendleri Gray). Fendler Ground-cherry. Rare, perennial herb with deep, fleshy rhizomes, flowers greenish-yellow with brownish center, blooms March to August.

Solanum douglasii Dunal. Rare, perennial herb, flowers white with green spots at the center, berry black, blooms nearly throughout the year.

Solanum eleagnifolium Cav. Silverleaf Nightshade, Trompillo, Horse-nettle. Common in disturbed areas. Perennial herb with tough, deep-seated rhizomes, flowers violet or blue, berries yellow or brown, blooms May to October.

TAMARICACEAE—Tamarisk Family

Tamarix ramosissima Ledeb. (=T. pendandra sensu K. & P.) Tamarisk, Salt Cedar. Rare, perennial shrub or small tree to 7 meters tall, flowers white or pink, naturalized from Europe and Asia, found mostly along streams, blooms March to August.

ULMACEAE—Elm Family

Celtis reticulata Torr. Net Leaf Hackberry, Palo Blanco. Infrequent, perennial shrub or small tree, calyx small, corolla none, fruit a drupe, found mostly along streams.

VERBENACEAE—Vervain Family

Aloysia wrightii (Gray) Heller (=Lippia cuneifolia (Torr.) Steud.). Oreganillo, Wright Lippia. Uncommon, perennial shrub, aromatic, flowers white, found on dry, rocky slopes, blooms August to October.

Glandularia gooddingii (Briq.) Solbrig (=Verbena gooddingii Briq. and its var. nepetifolia Tidestrom.). Annual or perennial herb, flowers pink, lavender, violet or blue, found on dry slopes and mesas, blooms nearly throughout the year.

Glandularia wrightii (Gray) Umber (=Verbena wrightii Gray).[6] Annual or perennial herb, flower blue or purple, blooms nearly throughout the year.

Tetraclea coulteri Gray. Uncommon, perennial herb, blooms April to August.

VIOLACEAE—Violet Family

Hybanthus verticillatus (Ort.) Baill. Green Violet. Uncommon, perennial herb, flowers greenish-white or yellowish with purplish tips, found on dry plains and mesas, blooms May to September.

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[6]Lehr (1978) states that this is not a member of the Arizona flora.

VISCACEAE—Mistletoe Family

Phoradendron tomentosum (DC.) Gray (=P. flavescens (Pursh) Nutt.). Inierto, Mistletoe. Rare, perennial herb, parasitic on cottonwood, sycamore, ash, hackberry, walnut, willow and mesquite, fruit white.

VITACEAE—Grape Family

Vitis arizonica Engelm. Canyon Grape, Parra del Monte. Uncommon, perennial herb, weakly climbing vine or bush, berries black at maturity, found often along streams and in canyons, blooms April to July.

ZANNICHELLIACEAE—Horned Pondweed Family

Zannichellia palustris L. Common Poolmat, Horned-pondweed. Rare, perennial herb, submerged aquatic, flowers enclosed by a spathe-like sheath.

ZYGOPHYLLACEAE—Caltrop Family

Kallstroemia californica (Wats.) Vail. California Caltrop. Annual herb, flowers yellow or orange, found on plains and mesas, often in sandy soil, blooms May to October.

Kallstroemia parviflora Norton. Annual herb, flowers pale yellow, found on plains and mesas, blooms July to October.

Larrea divaricata Cav. ssp. tridentata (Sesse & Moc. ex DC.) Felger & Lowe (=L. tridentata (Sesse & Moc. ex DC.) Cov.). Creosote Bush, Greesewood, Hediondilla, Governadora. Common, perennial shrub, strong-scented, evergreen, resinous, flowers yellow, fruit hairy, found on dry plains and mesas, flowers throughout the year but mostly from February to April. The Sonoran ecotype of the species (where the chromosome number is n=26) is present at Montezuma Castle National Monument. [Creosote Bush is the second most commonspecies, found in 76 vegetation units.]

Tribulus terrestris L. Cadillo, Abrojo de Flor, Puncture Vine, Caltrop. Annual herb, fruits armed with two to four spreading spines, naturalized from Europe, found often at roadsides or in fields, blooms March toOctober.

FISH	
Suckers (Family Catostomidae)	
Sonora Sucker (*Catostomus insignis*)	U (C at MOWE)
Desert Sucker (*Catostomus clarki*) [also called *Pantosteus clarki*]	C
Sunfishes (Family Centrarchidae)	
Green Sunfish (*Lepomis cyanellus*)	C (I)
Smallmouth Bass (*Micropterus dolomieu*)	C/A (I)
Spotted Bass (*Micropterus punctulatus*)	X (I)
Largemouth Bass (*Micropterus salmoides*)	(I)
Minnows (Family Cyprinidae)	
Longfin Dace (*Agosia chrysogaster*)	R
Red Shiner (*Cyprinella lutrensis*)	C/A (I)
Common Carp (*Cyprinus carpio*)	C (I)
Roundtail Chub (*Gila robusta*)	R
Spikedace (*Meda fulgida*)	X (Threatened)
Speckled Dace (*Rhinichthys osculus*)	X
Loach Minnow (*Rhinichthys cobitis*)	X (Threatened)
Tiaroga	
Catfishes (Family Ictaluridae)	
Black Bullhead (*Ameiurus melas*)	(I)
Yellow Bullhead (*Ameiurus natalis*)	U (I)
Channel Catfish (*Ictalurus punctatus*)	(I)
AMPHIBIANS	
True Toads (Family Bufonidae)	
Red-spotted Toad (*Bufo punctatus*)	R
Woodhouse's Toad (*Bufo woodhousii*)	C
Treefrogs (Family Hylidae)	
Canyon Treefrog (*Hyla arenicolor*)	U
True Frogs (Family Ranidae)	
Bullfrog (*Rana catesbeiana*)	R (I)

REPTILES	
Pond Turtles, Terrapins and Box Turtles (Family Emydidae)	
Common Slider (*Trachemys scripta*)	U (I)
Mud and Musk Turtles (Family Kinosternidae)	
Sonoran Mud Turtle (*Kinosternon sonoriense*)	A
Softshell Turtles (Family Trionychidae)	
Spiny Softshell Turtle (*Apalone spinifera*) [formerly called *Trionyx spiniferus*]	R
Alligator and Glass Lizards (Family Anguidae)	
Arizona Alligator Lizard (*Elgaria kingii*) [formerly called *Gerrhonotus kingii*]	U
Geckos (Family Gekkonidae)	
Western Banded Gecko (*Coleonyx variegatus*)	R
Beaded Lizards (Family Helodermatidae)	
Gila Monster (*Heloderma suspectum*)	X ?
Iguanid Lizards (Family Iguanidae)	
Greater Earless Lizard (*Cophosaurus texanus*)	U
Collared Lizard (*Crotaphytus collaris*)	U
Greater Short-horned Lizard (*Phrynosoma hernandesi*) [formerly included with *Phrynosoma douglasii*]	R
Clark's Spiny Lizard (*Sceloporus clarkii*)	U
Desert Spiny Lizard (*Sceloporus magister*)	C
Eastern Fence Lizard (*Sceloporus undulatus*)	U
Tree Lizard (*Urosaurus ornatus*)	C/A
Side-blotched Lizard (*Uta stansburiana*)	A
Whiptails and relatives (Family Teiidae)	
Gila Spotted Whiptail (*Cnemidophorus flagellicaudus*)	U
Western Whiptail (*Cnemidophorus tigris*)	A
Desert Grassland Whiptail (*Cnemidophorus uniparens*)	C
Colubrid Snakes (Family Colubridae)	
Glossy Snake (*Arizona elegans*)	R
Ring-necked Snake (*Diadophis punctatus*)	U
Night Snake (*Hypsiglena torquata*)	R
Common Kingsnake (*Lampropeltis getula*)	R
Coachwhip (*Masticophis flagellum*)	R
Striped Whipsnake (*Masticophis taeniatus*)	U
Gopher Snake (*Pituophis melanoleucus*)	U
Long-nosed Snake (*Rhinocheilus lecontei*)	R

Western Patch-nosed Snake (*Salvadora hexalepis*)	U
Ground Snake (*Sonora semiannulata*)	U
Black-necked Garter Snake (*Thamnophis cyrtopsis*)	U
Western Lyre Snake (*Trimorphodon biscutatus*)	R
Coral Snakes and relatives (Family Elapidae)	
Sonoran Coral Snake (*Micruroides euryxanthus*)	R
Vipers (Family Viperidae)	
Western Diamond-back Rattlesnake (*Crotalus atrox*)	U
Black-tailed Rattlesnake (*Crotalus molossus*)	U
Mojave Rattlesnake (*Crotalus scutulatus*)	R

MAMMALS

Insectivores

Shrews (Family Soricidae)

- Desert Shrew (*Notiosorex crawfordi*) — R

Bats

Free-tailed Bats (Family Molossidae)

- Brazilian Free-tailed Bat (*Tadarida brasiliensis*) — U

Evening Bats (Family Vespertilionidae)

- Pallid Bat (*Antrozous pallidus*) — U
- Big Brown Bat (*Eptesicus fuscus*) — U
- Red Bat (*Lasiurus borealis*) — R
- California Myotis (*Myotis californicus*) — U
- Small-footed Myotis (*Myotis leibii*) — R
- Little Brown Myotis (*Myotis lucifugus*) — R
  [formerly separated out as *M. occultus*]
- Fringed Myotis (*Myotis thysanodes*) — R
- Cave Myotis (*Myotis velifer*) — U
- Yuma Myotis (*Myotis yumanensis*) — C
- Western Pipistrelle (*Pipistrellus hesperus*) — C
- Townsend's Big-eared Bat (*Plecotus townsendii*) — U

Rabbits, Hares, and Pikas

Rabbits and Hares (Family Leporidae)

- Black-tailed Jack Rabbit (*Lepus californicus*) — C
- Desert Cottontail (*Sylvilagus audubonii*) — C
- Eastern Cottontail (*Sylvilagus floridanus*) — U

Rodents

Beavers (Family Castoridae)

- Beaver (*Castor canadensis*) — U

New World Rats and Mice (Family Cricetidae)

- White-throated Woodrat (*Neotoma albigula*) — C
- Mexican Woodrat (*Neotoma mexicana*) — R
- Stephens' Woodrat (*Neotoma stephensi*) — U
- Muskrat (*Ondatra zibethicus*) — U
- Northern Grasshopper Mouse (*Onychomys leucogaster*) — U
- Brush Mouse (*Peromyscus boylii*) — A
- Cactus Mouse (*Peromyscus eremicus*) — A
- White-footed Mouse (*Peromyscus leucopus*) — R
- Deer Mouse (*Peromyscus maniculatus*) — U
- Western Harvest Mouse (*Reithrodontomys megalotis*) — U
- Arizona Cotton Rat (*Sigmodon arizonae*) — X

Porcupines (Family Erethizontidae)

- Porcupine (*Erethizon dorsatum*) — R

Pocket Gophers (Family Geomyidae)

- Botta's Pocket Gopher (*Thomomys bottae*) C

Kangaroo Rats, Pocket Mice and relatives (Family Heteromyidae)

- Ord's Kangaroo Rat (*Dipodomys ordii*) U
- Hispid Pocket Mouse (*Chaetodipus hispidus*) X
  [formerly called *Perognathus hispidus*]
- Rock Pocket Mouse (*Chaetodipus intermedius*) U
  [formerly called *Perognathus intermedius*]

Squirrels and relatives (Family Sciuridae)

- Harris' Antelope Squirrel (*Ammospermophilus harrisii*) U
- Arizona Gray Squirrel (*Sciurus arizonensis*) R
- Rock Ground Squirrel (*Spermophilus variegatus*) C
- Cliff Chipmunk (*Tamias dorsalis*) U

Carnivores

Dogs, Wolves and Foxes (Family Canidae)

- Coyote (*Canis latrans*) U
- Gray Fox (*Urocyon cinereoargenteus*) U

Cats (Family Felidae)

- Mountain Lion (*Puma concolor*) R
  [formerly called *Felis concolor*]
- Ocelot (*Leopardus pardalis*) X
- Bobcat (*Lynx rufus*) U
  [formerly called *Felis rufus*]

Weasels, Skunks and relatives (Family Mustelidae)

- Hog-nosed Skunk (*Conepatus mesoleucus*) U
- Striped Skunk (*Mephitis mephitis*) U
- Spotted Skunk (*Spilogale putorius*) R
  [The western spotted skunk is sometimes treated as a separate species (*Spilogale gracilis*)]
- River Otter (*Lontra canadensis*) R
  [Formerly called *Lutra canadensis*]
- Badger (*Taxidea taxus*) R

Raccoons and relatives (Family Procyonidae)

- Ringtail (*Bassariscus astutus*) U
- Raccoon (*Procyon lotor*) C

Bears (Family Ursidae)

- Black Bear (*Ursus americanus*) R

Ungulates

Pronghorns (Family Antilocapridae)

- Pronghorn (*Antilocapra americana*) X

Deer, Elk and relatives (Family Cervidae)	
— American Elk (*Cervus elaphus*)	C (I)
— Mule Deer (*Odocoileus hemionus*)	C
— White-tailed Deer (*Odocoileus virginianus*)	U
Peccaries and Pigs (Family Tayassuidae)	
Collared Peccary (*Pecari tajacu*) [formerly called *Tayassu tajacu*]	U

BIRDS

Loons and Grebes

Pied-billed Grebe (*Podilymbus podiceps*): Casual transient.

Herons and Egrets

Great Blue Heron (*Ardea herodias*): Uncommon visitor, all seasons.
Snowy Egret (*Egretta thula*): Casual visitor.
Green Heron (*Butorides striatus*): Rare fall visitor.
Black-crowned Night-heron (*Nycticorax nycticorax*): Uncommon resident.

Storks and Ibis

Wood Stork (*Mycteria americana*): Rare summer visitor.
White-faced Ibis (*Plegadis chihi*): Casual visitor.

Ducks, Geese, and Swans

Canada Goose (*Branta canadensis*): Irregular winter visitor.
Wood Duck (*Aix sponsa*): Uncommon breeding resident.
Green-winged Teal (*Anas crecca*): Uncommon winter visitor.
Mallard (*Anas platyrynchos*): Rare to casual breeding resident.
Northern Pintail (*Anas acuta*): Casual visitor.
Green-winged Teal (*Anas crecca*): Casual spring visitor.
Blue-winged Teal (*Anas discors*): Casual spring visitor
Cinnamon Teal (*Anas cyanoptera*): Rare winter and summer visitor.
Northern Shoveler (*Anas clypeata*): Casual winter transient.
Gadwall (*Anas strepera*): Casual visitor.
American Wigeon (*Anas americana*): Fairly common winter visitor.
Eurasian Wigeon (*Anas penelope*): Casual visitor.
Canvasback (*Aythya valisineria*): Casual transient.
Redhead (*Aythya americana*): Casual fall visitor.
Ring-necked Duck (*Aythya collaris*): Casual winter visitor.
Lesser Scaup (*Aythya affinis*): Rare winter visitor.
Bufflehead (*Bucephala albeola*): Casual winter visitor.
Hooded Merganser (*Lophodytes cucullatus*): Casual winter visitor.
Common Merganser (*Mergus merganser*): uncommon to rare visitor.
Ruddy Duck (*Oxyura jamaicensis*): Casual winter visitor.

New World Vultures

Black Vulture (*Coragyps atratus*):
Turkey Vulture (*Cathartes aura*): Fairly Common to uncommon visitor.

Kites, Eagles, Hawks and Falcons

Osprey (*Pandion haliaetus*): Rare year round resident.
Bald Eagle (*Haliaeetus leucocephalus*): Rare visitor.
Northern Harrier (*Circus cyaneus*): Rare transient.

Northern Goshawk (*Accipiter gentilis*):
Sharp-shinned Hawk (*Accipiter striatus*): Casual visitor
Cooper's Hawk (*Accipiter cooperii*): Uncommon breeding resident..
Common Black-hawk (*Buteogallus anthracinus*): Uncommon breeding visitor.
Harris Hawk (*Parabuteo unicinctus*):
Swainson's Hawk (*Buteo swainsoni*):
Red-tailed Hawk (*Buteo jamaicensis*): Uncommon breeding resident.
Ferruginous Hawk (*Buteo regalis*): One record at Montezuma Castle: 4/80.
Golden Eagle (*Aquila chrysaetos*)
American Kestrel (*Falco sparverius*): Uncommon breeding resident.
Merlin (*Falco columbarius*):
Peregrine Falcon (*Falco peregrinus*):

Gallinaceous Birds

Ring-necked Pheasant (*Phasianus colchicus*):
Gambel's Quail (*Callipepla gambelii*): Common permanent resident.

Coots and Rails

Virginia Rail (*Rallus limicola*): Casual winter transient.
Sora (*Sora porzana*): Casual summer transient.
Common Moorhen (*Gallinula chloropus*): Casual summer transient.
American Coot (*Fulica americana*):

Shorebirds

Killdeer (*Charadrius vociferus*): Uncommon permanent resident.
Black-bellied Plover (*Pluvialis squatarola*):
Baird's Sandpiper (*Calidris bairdii*):
Willet (*Catoptrophorus semipalmatus*):
Spotted Sandpiper (*Actitus macularia*): Common summer resident.
Common Snipe (*Gallinago gallinago*):
Wilson's Phalarope (*Phalaropus tricolor*):

Pigeons and Doves

Rock Dove (*Columba livia*): Uncommon transient.
White-winged Dove (*Zenaida asiatica*):
Mourning Dove (*Zenaida macroura*): Fairly common permanent resident.
Common Ground Dove (*Columbina passerina*):

Cuckoos and Roadrunners

Yellow-billed Cuckoo (*Coccyzus americanus*): Fairly Common breeding migrant.
Greater Roadrunner (*Geococcyx californianus*): Uncommon permanent resident.

Owls

Common Barn -Owl (*Tyto alba*):
Western Screech Owl (*Otus kennicottii*): Uncommon permanent resident.

Great Horned Owl (*Bubo virginianus*): Uncommon permanent resident.
Short-eared Owl (*Asio flammeus*):
Elf Owl (*Micrathene whitneyi*):
Northern Pygmy Owl (*Glaucidium gnoma*):
Northern Saw-whet Owl (*Aegolius acadicus*):

Goatsuckers

Lesser Nighthawk (*Chordeiles acutipennis*):
Common Nighthawk (*Chordeiles minor*): Rare summer resident.
Common Poorwill (*Phalaenoptilus nuttallii*): Rare summer and fall resident.

Swifts

Vaux's Swift (*Chaetura vauxi*):
White-throated Swift (*Aeronautes saxatalis*): Fairly common spring and summer resident.

Hummingbirds

Black-chinned Hummingbird (*Archilochus alexandri*):Common summer resident.
Anna's Hummingbird (*Calypte anna*): Casual summer visitor.
Costa's Hummingbird (*Calypte costae*): Casual spring visitor.
Broad-tailed Hummingbird (*Selasphorus platycercus*): Casual spring transient.
Rufous Hummingbird (*Selasphorus rufus*): Rare spring and fall transient.

Kingfishers

Belted Kingfisher (*Ceryle alcyon*): Uncommon permanent resident.

Woodpeckers

Lewis Woodpecker (*Melanerpes lewis*):
Gila Woodpecker (*Melanerpes uropygialis*): Fairly common permanent resident.
Red-naped Sapsucker (*Sphyrapicus varius* nuchalis): Casual fall transient.
Williamson's Sapsucker (*Sphyrapicus thyroideus*):
Ladder-backed Woodpecker (*Picoides scalaris*): Uncommon permanent resident.
Northern (*red shafted*) Flicker (*Colaptes auratus* cafer): Fairly common permanent resident.

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Tyrant Flycatchers

Olive-sided Flycatcher (*Contopus borealis*): Casual spring transient.
Western Wood-pewee (*Contopus sordidulus*): Fairly common transient.
Willow Flycatcher (*Empidonax traillii*): Casual summer transient.
Gray Flycatcher (*Empidonax wrightii*): Rare spring and summer transient.
Western Flycatcher (*Empidonax difficilis*): Casual spring transient.
Black Phoebe (*Sayornis nigricans*): Common to fairly common permanent resident.
Say's Phoebe (*Sayornis saya*): Rare to uncommon permanent resident.
Ash-throated Flycatcher (*Myiarchus cinerascens*): Uncommon spring and summer resident.
Brown-crested Flycatcher (*Myiarchus tyrannulus*): Fairly common spring and summer.
Cassin's Kingbird (*Tyrannus vociferans*): Uncommon spring and summer visitor.
Western Kingbird (*Tyrannus verticalis*): Rare spring and summer resident.
Vermillion Flycatcher (*Pyrocephalus rubinus*):

Larks

Horned Lark (*Eremophila alpestris*):

Swallows

Purple Martin (*Progne subis*):
Violet-green Swallow (*Tachcineta thalassina*): Fairly common spring and summer resident.
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*): Uncommon visitor.
Bank Swallow (*Riparia riparia*):
Cliff Swallow (*Hirundo pyrrhonota*): Fairly common breeder.

Crows and Jays

Steller's Jay (*Cyanocitta stelleri*):
Scrub Jay (*Aphelocoma caerulescens*): Rare permanent resident.
Pinyon Jay (*Gymnorhinus cyanocephalus*): Incidental visitor.
American Crow (*Corvus brachyrhynchos*): Casual transient.
Common Raven (*Corvus corax*): Common permanent resident.

Chickadees and Titmice

Mountain Chickadee (*Parus gambeli*):
Bridled Titmouse (*Parus wollweberi*): Fairly common permanent resident.
Plain Titmouse (*Parus inornatus*): Casual permanent resident.
Verdin (*Auriparus flaviceps*): Rare to uncommon permanent resident.
Bushtit (*Psaltriparus minimus*): Fairly common permanent resident.

Nuthatches

White-breasted Nuthatch (*Sitta carolinensis*): Seasonal transient.
Pygmy Nuthatch (*Sitta pygmaea*): Casual winter visitor.

Wrens

Rock Wren (*Salpinctes obsoletus*): Fairly common permanent resident.
Canyon Wren (*Catherpes mexicanus*): Fairly common permanent resident.
Bewick's Wren (*Thryomanes bewickii*): Common to fairly common resident.

Cactus Wren (*Campylorhynchus brunneicapillus*):
House Wren (*Troglodytes aedon*): Casual transient.
Marsh Wren (*Cistothorus palustris*): Casual winter transient.

Kinglets, Gnatcatchers, and Thrushes

Ruby-crowned Kinglet (*Regulus calendula*): Fairly common winter and spring resident.
Blue-gray Gnatcatcher (*Polioptila caerulea*): Casual winter and fall, uncommon breeding.
Western Bluebird (*Sialia mexicana*): Fairly common winter resident, uncommon spring and fall.
Mountain Bluebird (*Sialia montanus*):
Townsend's Solitaire (*Myadestes townsendi*): Casual winter and spring resident.
Hermit Thrush (*Catharus guttatus*): Casual spring and fall visitor.
American Robin (*Turdus migratorius*): Common winter, spring and fall, Fairly common breeding.

Mockingbirds and Thrashers

Northern Mockingbird (*Mimus polyglottus*): Fairly common spring and summer resident.
Brown Thrasher (*Toxostoma rufum*):
Sage Thrasher (*Oreoscoptes montanus*): Rare year round transient.
Crissal Thrasher (*Toxostoma crissale*): Uncommon permanent resident.

Pipits and Wagtails

American Pipit (*Anthus rubescens*):

Waxwings

Cedar Waxwing (*Bombycilla cedrorum*):

Silky Flycatchers

Phainopepla (*Phainopepla nitens*): Common spring and summer resident.

Shrikes

Loggerhead Shrike (*Lanius ludovicianus*): Rare summer visitor.

Starlings

Europeon Starling

Vireos

Hutton's Vireo (*Vireo huttoni*):
Bell's Vireo (*Vireo bellii*): Uncommon summer resident.
Gray Vireo (*Vireo vicinior*): Rare spring summer and fall transient.
Solitary Vireo (*Vireo solitarius*): Casual in the winter and fall, rare transient otherwise.
Warbling Vireo (*Vireo gilvus*): Casual spring and fall transient, rare summer breeder.

Wood Warblers

Orange-crowned Warbler (*Vermivora celata*): Uncommon spring and fall transient.
Nashville Warbler (*Vermivora ruficapilla*): Casual fall transient.
Virginia's Warbler (*Vermivora virginiae*): Casual spring transient.
Lucy's Warbler (*Vermivora luciae*): Common spring and summer resident.

Yellow Warbler (*Dendroica petechia*): Fairly common spring and summer resident.

Yellow-rumped Warbler (*Dendroica coronata*): Fairly common spring and fall resident.

Black-throated Gray Warbler (*Dendroica nigrescens*):

Townsends's Warbler (*Dendroica townsendi*):

Grace's Warbler (*Dendroica graciae*):

Hooded Warbler (*Wilsonia citrina*):

Golden-winged Warbler (*Vermivora chrysoptera*):

Northern Waterthrush (*Seiurus noveboracensis*): Casual fall transient.

Wilson's Warbler (*Wilsonia pusilla*): Uncommon spring and fall transient, casual summer.

MacGillivray's Warbler (*Oporornis tolmiei*): Casual spring, summer and fall visitor.

Common Yellowthroat (*Geothlypis trichas*): Uncommon summer and fall resident.

Yellow-breasted Chat (*Icteria virens*): Fairly common spring and summer resident.

Tanagers

Summer Tanager (*Piranga rubra*): Uncommon spring, Fairly common summer and fall.

Hepatic Tanager (*Piranga flava*): Casual summer transient.

Western Tanager (*Piranga ludoviciana*): Uncommon spring transient, casual summer and fall.

Grosbeaks and Allies

Northern Cardinal (*Carinalis cardinalis*): Fairly common permanent resident.

Black-headed Grosbeak (*Pheucticus melanocephalus*): Rare spring and fall, casual summer.

Blue Grosbeak (*Guiraca caerulea*): Uncommon spring and summer resident, rare fall.

Indigo Bunting (*Passerina cyanea*): Rare spring and summer transient.

Lazuli Bunting (*Passerina amoena*): Uncommon spring and summer transient, rare fall.

Sparrows and Towhees

Green-tailed Towhee (*Piplio chlorurus*): Casual spring and fall transient.

Spotted Towhee (*Pipilo erythrophthalmus*): Uncommon spring and summer breeder .

Canyon Towhee (*Piplio fuscus*): Uncommon permanent breeder.

Abert's Towhee (*Pipilo aberti*): Fairly Common permanent resident.

Rufous-crowned Sparrow (*Aimophila ruficeps*): Casual winter, spring and fall transient.

Chipping Sparrow (*Spizella passerina*): Casual during winter, uncommon in the spring, rare during the summer, fairly common during the fall.

Brewer's Sparrow (*Spizella breweri*): Casual spring and fall visitor.

Black-chinned Sparrow (*Spizella atrogularis*):

Lark Sparrow (*Chondestes grammacus*): Casual spring and fall transient, uncommon summer resident.

Black-throated Sparrow (*Amphispiza bilineata*): Common summer resident.

Sage Sparrow (*Amphispiza belli*):

Vesper Sparrow (*Pooecet es* gramineus):

Song Sparrow (*Melospiza melodia*): Rare winter and fall, uncommon spring and summer breeder.

Lincoln's Sparrow (*Melospiza lincolnii*): Rare spring and fall transient.

White-crowned Sparrow (*Zonotrichia leucophrys*): Abundant winter, spring and fall resident.

Dark-eyed Junco (*Junco hyemalis*): Common winter and fall resident, uncommon in the spring.

Blackbirds and Orioles

Red-winged Blackbird (*Agelaius phoeniceus*): Irregular winter, spring and summer transient.

Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*): Casual spring transient.

Brewer's Blackbird (*Euphagus cyanocephalus*): Rare spring and fall transient.

Western Meadowlark (*Sturnella neglecta*):

Great-tailed Grackle (*Quiscalus mexcanus*): Uncommon spring summer transient.

Brown-headed Cowbird (*Molothrus ater*): Fairly common summer resident.

Hooded Oriole (*Icterus cucullatus*): Uncommon spring summer resident.

Northern Oriole (*Icterus galbula* bullockii): Uncommon spring summer resident.

Scott's Oriole (*Icterus parisorum*): Uncommon spring and summer transient.

Finches and Allies

Red Crossbill (*Loxia curvirostra*):

Purple Finch (*Carpodacus purpureus*): Casual winter transient.

Cassin's Finch (*Carpodacus cassinii*): Casual winter transient.

House Finch (*Carpodacus mexicanus*): Common permanent resident.

Lesser Goldfinch (*Carduelis psaltria*): Fairly common summer resident, uncommon during the rest of the year.

American Goldfinch (*Carduelis tristas*): Casual winter and summer transient.

Evening Grosbeak (*Coccothraustes vespertinus*):

Old World Weaver Finches

House Sparrow (*Passer domesticus*): Rare transient.

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