



In Cooperation with the University of Arizona, School of Natural Resources

Vascular Plant and Vertebrate Inventory of Montezuma Castle National Monument



Southwest Biological Science Center
Open-File Report 2006-1163
November 2006

U.S. Department of the Interior
U.S. Geological Survey
National Park Service





In cooperation with the University of Arizona, School of Natural Resources

Vascular Plant and Vertebrate Inventory of Montezuma Castle National Monument

By Cecilia A. Schmidt, Charles A. Drost, and William L. Halvorson

Open-File Report 2006-1163

November, 2006



U.S. Department of the Interior
U.S. Geological Survey
National Park Service

USGS Southwest Biological Science Center
Sonoran Desert Research Station
University of Arizona
School of Natural Resources
125 Biological Sciences East
Tucson, Arizona 85721

U.S. Department of the Interior
Dirk Kempthorne, Secretary

U.S. Geological Survey
Mark Myers, Director

U.S. Geological Survey, Reston, Virginia: 2006

Note: This document contains information of a preliminary nature and was prepared primarily for internal use in the U.S. Geological Survey. This information is NOT intended for use in open literature prior to publication by the investigators named unless permission is obtained in writing from the investigators named and from the Station Leader.

Suggested Citation

Schmidt, C. A., C. A. Drost, and W. L. Halvorson 2006. Vascular Plant and Vertebrate Inventory of Montezuma Castle National Monument. USGS Open-File Report 2006-1163. U.S. Geological Survey, Southwest Biological Science Center, Sonoran Desert Research Station, University of Arizona, Tucson, AZ.



Printed on recycled paper

Cover photo: Montezuma Castle NM file photo

Authors

Cecilia A. Schmidt and William L. Halvorson
USGS Southwest Biological Science Center
Sonoran Desert Research Station
and School of Natural Resources
125 Biological Sciences East, Building 43
University of Arizona
Tucson, Arizona 85721

Charles A. Drost
USGS Southwest Biological Science Center
Colorado Plateau Research Station
2255 N. Gemini Drive
Flagstaff, Arizona 86001

U.S. Geological Survey SBSC Sonoran Desert Research Station Personnel

Charles van Riper III, Station Leader
Steve P. Gloss, Ecologist
William L. Halvorson, Research Ecologist
Cecil R. Schwalbe, Ecologist
Michael R. Kunzmann, Ecologist (Emeritus)
Kathryn Thomas, Ecologist
Pamela Nagler, Physical Scientist
Phil Rosen, Ecologist

Program and Expertise Areas of USGS and UA Personnel

Administration & Outreach
Kate Leonard
Jennifer Meador
Wendy Parrish
Emily Sherbrooke
Charles van Riper III

Avian Ecology
Claire Crow
Glenn Johnson
Chris O'Brien
Brian Powell
Charles van Riper III

Data Management
Brent Sigafus

Ecology of Amphibians & Reptiles
Kevin Baker
Cristina Jones
Dave Prival
Phil Rosen
Cecil Schwalbe
Brent Sigafus

Fire Management
Dennis Suhre
Cori Dolan
James Feldmann
Bill Halvorson

Invasive Species Research
Patricia Guertin
Jim Malusa
Phil Rosen
Cecil Schwalbe
Brent Sigafus
Dennis Suhre
Kathryn Thomas

Inventory & Monitoring
Patricia Guertin
Bill Halvorson
Pamela Nagler
Brian Powell
Cecilia Schmidt

Vegetation Mapping & Ecology
Patricia Guertin
Bill Halvorson
Jim Malusa
Kathryn Thomas

USGS Southwest Biological Science Center <http://sbsc.wr.usgs.gov>

USGS Southwest Biological Science Center, Sonoran Desert Research Station <http://sbsc.wr.usgs.gov/sdrs>

Table of Contents

Acknowledgements	vii
Executive Summary	ix
Chapter 1: Introduction to the Biological Inventories	1
Project Overview	1
Report Format and Data Organization	1
Chapter 2: Monument Overview	3
Monument Area and History	3
Natural Resources Overview	3
Natural Resource Management Issues	5
Chapter 3: Plants	7
Data Used to Create Plant Species List.....	7
Results and Discussion	7
Inventory Completeness	8
Chapter 4: Fishes	9
Data Used to Create Fish Species List.....	9
Results and Discussion	9
Inventory Completeness.....	9
Chapter 5: Amphibians and Reptiles	11
Data Used to Create Amphibian and Reptile Species List	11
Results and Discussion.....	11
Inventory Completeness	11
Chapter 6: Birds	13
Data Used to Create Bird Species List.....	13
Results and Discussion	13
Inventory Completeness	13
Chapter 7: Mammals	15
Data Used to Create Mammal Species List	15
Results and Discussion	15
Inventory Completeness.....	15
Chapter 8: Management Implications	17
Adjacent Land Development and Water	17
Non-native Species and Grasslands.....	17
Bats	17
Chapter 9: Additional Inventories and Research	19
Fish	19
Amphibians and Reptiles	19
Chapter 10: Literature Cited	21

List of Tables

Table 1. Summary of vascular plant and vertebrate inventories at Montezuma Castle NM.....	ix
Table 1.1 Museums that were queried (in 1998) for vertebrate voucher specimens with “Arizona” and “Montezuma Castle National Monument” in the collection location.....	2
Table 2.1. Average monthly climate data for Montezuma Castle NM, 1938–2005.....	3

List of Figures

Figure 2.1. Location of Montezuma Castle NM in Arizona and aerial photographs of the Castle and Well units.....	4
---	---

List of Appendices

Appendix A. Plant species observed or collected at Montezuma Castle NM, Castle unit.....	23
Appendix B. Plant species observed or collected at Montezuma Castle NM, Well unit.....	34
Appendix C. Fish species observed or collected at Montezuma Castle NM.....	43
Appendix D. Amphibian and reptile species observed or collected at Montezuma Castle NM.....	44
Appendix E. Bird species observed or collected at Montezuma Castle NM.....	45
Appendix F. Mammal species observed or collected at Montezuma Castle NM.....	50
Appendix G. Native fish species that have been extirpated (E) and non-native fish that no longer occur (NP) at Montezuma Castle NM.....	52
Appendix H. Amphibian and reptile species that may occur (P) or have been extirpated (E) at Montezuma Castle NM.....	52
Appendix I. Bird species that may occur at Montezuma Castle NM.....	53
Appendix J. Mammal species that may occur at Montezuma Castle NM.....	55
Appendix K. Voucher specimens from Montezuma Castle NM.....	55

Acknowledgements

Thanks to Superintendent Kathy Davis and all the staff at Montezuma Castle National Monument (NM) for their administrative support of our program. This project resulted from the collaboration of many people at the University of Arizona (UA), the National Park Service (NPS), and the U.S. Geological Survey (USGS) and was facilitated by the Desert Southwest Cooperative Ecosystem Studies Unit (DSCESU). Andy Hubbard at the Sonoran Desert Network (SDN) Inventory and Monitoring (I&M) program and Larry Norris at the DSCESU provided administrative support for this project. Additional administrative support was provided by Cecily Westphal of the School of Natural Resources at the University of Arizona. Superintendent Kathy Davis played an instrumental role in this project by providing important early initiative.

Debbie Angell, Pamela Anning, Ryan Reese and Zuleika Valdez assisted in data entry and database design. Special thanks to Kristen Beaupre for creating figure 2.1.

We would like to thank the numerous ecologists who have contributed their time and knowledge to further our understanding of the flora and fauna of Montezuma Castle National Monument. Each species list we compiled was the result of hundreds of hours of field work by these dedicated ecologists. In particular, we acknowledge the investigators and field staff on the earlier inventory study: Peter Rowlands and Nancy Brian (plants); Linn Montgomery, Gloria Hardwick, and Bill Leibfried (fish); Erika Nowak (amphibians and reptiles); Laura Ellison (mammals); and Mark Sogge and Matthew Johnson (birds).

We received reviews on earlier drafts of this report from Kathy Davis, Andy Hubbard, and Larry Norris.

All mistakes or omissions are the responsibility of the authors.

Executive Summary

We summarize past inventory efforts for vascular plants and vertebrates at Montezuma Castle National Monument (NM) in Arizona. We used data from previous research to compile complete species lists for the monument and to assess inventory completeness.

There have been 784 species recorded at Montezuma Castle NM (Table 1), of which 85 (11%) are non-native.

In each taxon-specific chapter we highlight areas of resources that contributed to species richness or unique species for the monument. Of particular importance are Montezuma Well and Beaver and Wet Beaver creeks and the surrounding

riparian vegetation, which are responsible for the monument having one of the highest numbers of bird species in the Sonoran Desert Network of park units. Beaver Creek is also home to populations of federally-listed fish species of concern. Other important resources include the cliffs along the creeks and around Montezuma Well (for cliff and cave roosting bats).

Based on the review of past studies, we believe the inventory for most taxa is nearly complete, though some rare or elusive species will be added with additional survey effort. We recommend additional inventory, monitoring and research studies.

Table 1. Summary of vascular plant and vertebrate inventories at Montezuma Castle NM.

Taxonomic group	Number of species recorded	Number of non-native species
Plants	472	72
Fish	9	5
Amphibians and Reptiles	34	3
Birds	211	4
Mammals	58	1
Totals	784	85

Chapter 1: Introduction to the Biological Inventories at Montezuma Castle National Monument

Project Overview

Inventory: A point-in-time effort to document the resources present in an area.

In the early 1990s, responding to criticism that it lacked basic knowledge of natural resources within parks, the National Park Service (NPS) initiated the Inventory and Monitoring Program (NPS 1992). The purpose of the program is to detect long-term changes in biological resources (NPS 1992). At the time of the program's inception, basic biological information, including lists of plants and animals, was absent or incomplete for many parks. In fact, as of 1994, more than 80% of national parks did not have complete inventories of major taxonomic groups (Stohlgren et al. 1995). The plant and animal communities and other natural resources of "cultural parks" like Montezuma Castle National Monument (NM) have been relatively neglected. However, these areas protect valuable biological communities. In many instances, the same features that drew early humans to the area also provide for rich biological communities, like the extensive riparian habitat at Montezuma Castle NM.

Species inventories have both direct and indirect value for management of the monument. Species lists are not only useful in resource interpretation and facilitating visitor appreciation of natural resources, but are also critical for making management decisions. Knowledge of which species are present, particularly sensitive species, and where they occur provides for informed planning and decision-making (e.g., locating new facilities). Thorough biological inventories provide a basis for choosing parameters to monitor and can provide baseline data for monitoring ecological populations and communities. In some cases, inventories may identify or provide data related to critical resources such as riparian areas that are valuable both intrinsically and as habitat for species of management interest.

An integrated, broad-based inventory of the vascular plants and vertebrates of Montezuma Castle NM 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 of the inventory included plants, fishes, amphibians and reptiles, birds, and mammals. The work was a collaborative effort of researchers from Northern Arizona University and the U.S. Geological Survey (USGS) Colorado Plateau Research Station in Flagstaff, Arizona. This report, prepared by staff of the University of Arizona, the USGS Sonoran Desert Research Station in Tucson, Arizona, and the USGS Colorado Plateau Research Station in Flagstaff, Arizona, provides a thorough review and update of the previous inventory work.

Goal

The purpose of this study was to compile a complete list of vascular plants and vertebrates from existing sources.

Administrative History

The study plan for this project was developed through a cooperative agreement among the NPS, University of Arizona (UA), and USGS. It was funded through Task Agreement UAZ-173 (under Desert Southwest CESU cooperative agreement number CA 124800002).

Report Format and Data Organization

This report is intended to be useful for internal planning and outreach, and education. We report only common names (listed in phylogenetic sequence) unless we reference a species that is not listed later in an appendix; in this case we present both common and scientific names. For each taxonomic group we include an appendix of all species that have been recorded in the monument (Appendices A–F), and species that were likely present historically or that we suspect are currently present and may be recorded with additional survey effort (except for plants; Appendices G–J). Species lists are in phylogenetic sequence and include

taxonomic order, family, genus, species, subspecies or variety (if applicable) and common name. Scientific and common names used throughout this document are current according to accepted authorities for each taxonomic group: Integrated Taxonomic Information System (ITIS 2004) and the PLANTS database (USDA 2004) for plants; Stebbins (2003) for amphibians and reptiles; American Ornithologists' Union (AOU 1998, 2003) for birds; and Baker et al. (2003) for mammals. Units of measurement are presented in accordance with the International System of Units.

Species Conservation Designations

We indicate species conservation designations by the following agencies: U.S. Fish and Wildlife

Service (responsible for administering the Endangered Species Act), Bureau of Land Management, U.S. Forest Service (Region 3), Arizona Game and Fish Department, and Partners in Flight (a partnership of dozens of federal, state and local governments, non-governmental organizations, and private industry).

Voucher Specimens

Although we did not collect voucher specimens for vertebrates, we searched for existing vouchers from Montezuma Castle NM in records from 23 natural history museums (Table 1.1; see Appendix K for results).

Table 1.1. Museums that were queried (in 1998) for vertebrate voucher specimens with “Arizona” and “Montezuma Castle National Monument” in the collection location. Collections in bold-faced type had specimens from Montezuma Castle NM.

Collection	Collection cont.
Brigham Young University	North Carolina State Museum of Natural Sciences
California Academy of Science	Oklahoma Museum of Natural History, Norman
Chicago Academy of Sciences	Peabody Museum, Yale University
Cincinnati Museum of Natural History & Science	Saguaro National Park
Cornell Vertebrate Collections, Cornell University	Strecker Museum, Baylor University, Waco
Fort Worth Museum of Science and History	Texas Cooperative Wildlife Collection
George Mason University (Fairfax, VA)	Tulane Museum of Natural History
Illinois Natural History Survey	U.S. National Museum
Marjorie Barrick Museum, University of Nevada-Las Vegas	University of Arizona
Michigan State University Museum (East Lansing)	University of Texas, Arlington
Milwaukee Public Museum	University of Texas, El Paso
Museum of Comparative Zoology, Harvard University	University of Illinois, Champaign-Urbana
Museum of Texas Tech University	University of Colorado Museum
Museum of Vertebrate Zoology, University of California, Berkeley	University of Michigan
Museum of Life Sciences, Louisiana State University, Shreveport	Walnut Canyon National Monument
Museum of Natural History, University of Kansas	Western Archaeological and Conservation Center, Tucson
Natural History Museum of Los Angeles County	Wupatki National Monument

Chapter 2: Monument Overview

Monument Area and History

Montezuma Castle National Monument is located in central Arizona, approximately 6 km northeast of the town of Camp Verde in the Verde Valley between Flagstaff and Phoenix (Figure 2.1). The monument was established in 1906 to protect Sinagua culture cliff dwellings, most notably the five-story, 20-room structure known as Montezuma Castle, perched on a limestone cliff face overlooking lower Beaver Creek. The monument consists of two separate units, the Castle and Well units, located about 8 km apart. The Well unit protects additional Sinagua and Hohokam sites and 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 (Blinn and Oberlin 1996). Montezuma Castle NM is a relatively small monument: the Castle unit comprises 230 ha, and the Well unit is 103 ha. Montezuma Castle NM has an average annual visitation of 800,000 (NPS 2005).

Natural Resources Overview

Physiography, Geology and Soils

Montezuma Castle NM is located in the Central Highlands Province in the Verde Valley bounded by the Mogollon Rim to the north and Fossil Creek to the south. Elevation at the monument varies from 955 m to 1,090 m. The Verde Valley is a down-faulted Cenozoic sedimentary basin in the transitional zone of central Arizona (Lindsay 2000). The Verde Valley is filled with Verde Formation sediment, a young lacustrine sediment

with limestone, classic, and evaporitic facies (Lindsay 2000). There are two types of soils at the monument: riverine bottomland soils composed of alluvium; and upland, rocky calcareous soils composed of limestone-derived soils (Rowlands 1999). For a complete soil survey, see Lindsay (2000).

Hydrology

Beaver Creek, a tributary to the Verde River, runs through the Castle unit and its tributary, Wet Beaver Creek, runs through the Well unit. Both Beaver and Wet Beaver creeks have intermittent water flow. Montezuma Well is a large, spring-fed limestone sink measuring approximately 91 m by 107 m. The main concerns about these water sources are high rates of withdrawal and non-point source pollution from urban development and agricultural and livestock runoff (Sprouse et al. 2002).

Climate

Montezuma Castle NM experiences an annual bimodal pattern of precipitation which is characterized by heavy summer (monsoon) storms brought about by moisture coming from the Gulf of Mexico, and less intense frontal systems coming from the Pacific Ocean in the winter. On average, approximately one-half of the annual precipitation falls from July through October (Table 2.1; WRCC 2005). The area's hot season occurs from May through September and maximum temperatures in July can exceed 40°C. Winter temperatures often dip below freezing and snow is occasional. Average annual precipitation total for the monument is 33.0 cm.

Table 2.1. Average monthly climate data for Montezuma Castle NM, 1938–2005. (Data from WRCC 2005).

Characteristic	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Maximum temperature (°C)	15.5	18.2	21.4	25.9	31.0	36.4	38.4	36.8	34.1	28.2	20.5	15.4	26.8
Minimum temperature (°C)	-3.2	-1.5	1.1	4.2	8.0	12.2	17.5	16.9	12.7	6.1	-0.2	-3.3	5.9
Precipitation (cm)	2.8	3.0	3.0	1.8	0.8	0.7	3.6	5.2	4.0	2.6	2.2	3.1	2.7

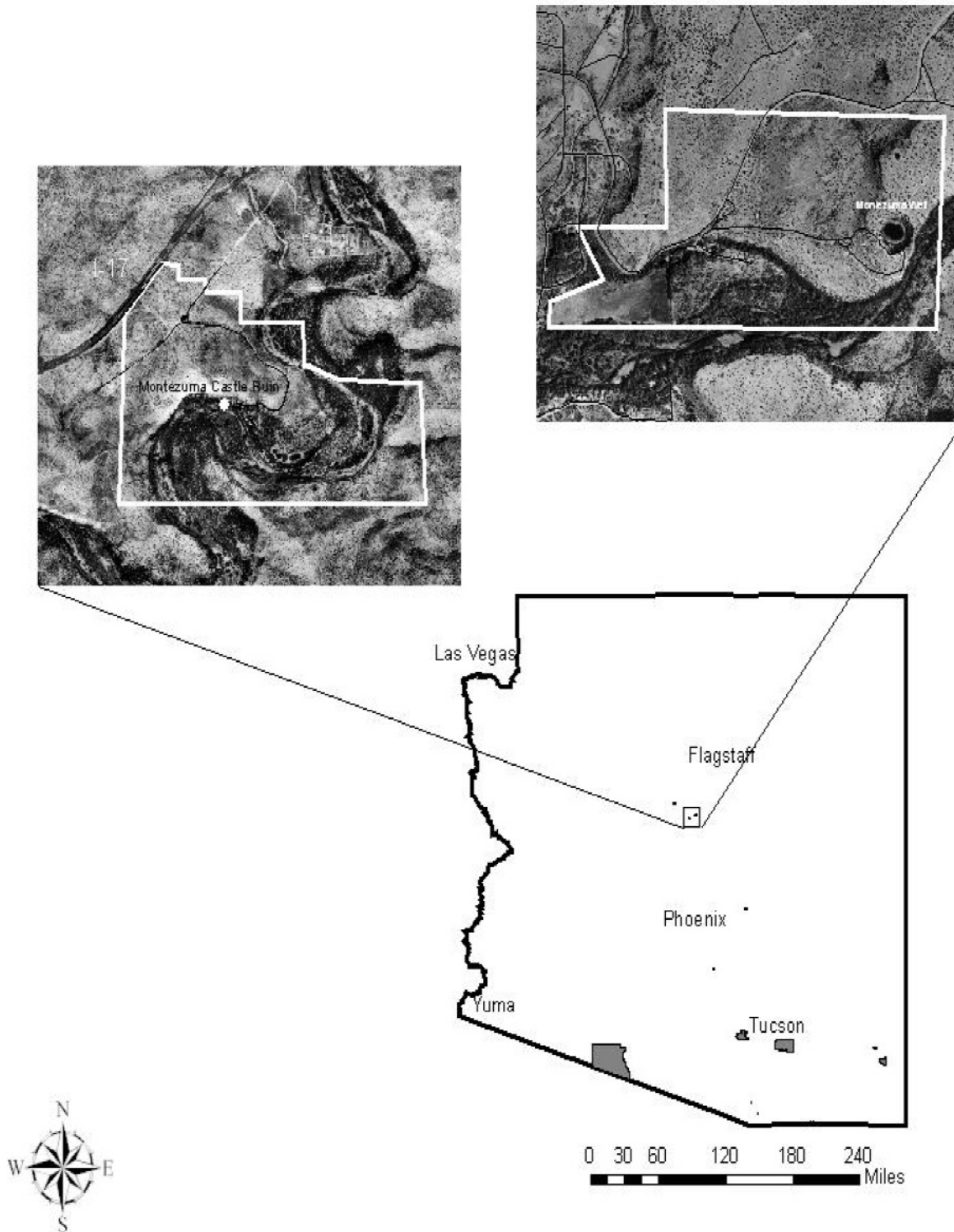


Figure 2.1. Location of Montezuma Castle NM in Arizona and aerial photographs of the Castle and Well units.

Vegetation

Overall the monument supports scattered juniper at its higher elevations, and mesquite, acacia and creosote bush at its lower elevations. There is a rich cottonwood riparian association along Beaver Creek. According to Rowlands (1999):

The Castle unit of Montezuma Castle NM has eight biomes (after Brown et al. 1980):

- Plains grassland containing broom snakeweed–catclaw acacia–velvet mesquite association;
- Sonoran riparian and oasis forest containing velvet mesquite association;
- Sonoran savanna grassland containing threawn–mixed-scrub association;
- Chihuahuan desertscrub containing mariola–creosote bush association;
- Sonoran desertscrub containing creosote bush–mixed scrub association, creosote bush association, and crucifixion thorn association;
- Southwestern riparian deciduous forest and woodland containing Arizona sycamore–green ash association.
- Scrub-grassland containing New Mexico feathergrass–mixed scrub association;
- Interior southwestern swamp and riparian scrub containing desert willow association.

The Well unit of Montezuma Castle NM also has eight biomes (after Brown et al. 1980):

- Interior chaparral containing Sonoran scrub oak–skunkbush sumac association;
- Plains grassland containing broom snakeweed–catclaw acacia association;
- Scrub-grassland containing New Mexico feathergrass–mixed scrub association;
- Chihuahuan desertscrub containing mariola–broom snakeweed association;
- Sonoran desertscrub containing crucifixion thorn association;
- Southwestern riparian deciduous forest and woodland containing Arizona sycamore–green ash–Fremont cottonwood association;
- Sonoran riparian and oasis forest containing velvet mesquite association, velvet mesquite–catclaw acacia–broom snakeweed association, and fourwing saltbush–velvet mesquite association;

- Sonoran interior marshland containing softstem bulrush–beaked spikerush association.

Natural Resource Management Issues

Adjacent Land Use and Development

The area near the monument is experiencing rapid growth in human population and an associated increase in the number of housing developments near the monument. This creates many natural resource management challenges including the introduction of non-native species (e.g., plants used for landscaping), increased groundwater withdrawal, surface water pollution, and visual intrusions to the natural landscape.

Non-native Species

Because of the long-term anthropogenic disturbances in the area, non-native species have become an important natural resource issue (Rowlands 1999). Within the monument boundary non-native grasses such as red brome and ripgut brome have become well established. Saltcedar has also become established along the banks of Beaver and Wet Beaver creeks. In Beaver Creek non-native fish, crayfish, and the American bullfrog are likely causing declines in abundance or even extirpation of native fishes, amphibians, and some aquatic reptiles. Other non-native vertebrate species include the European starling and house sparrow. We address many of these non-native species in each of the following chapters.

Visitor Use

Visitor use and recreational activities (e.g., hiking, fishing) at the monument and surrounding lands is high and may be problematic. Because of the high visitation to the monument, natural resources such as soil stability and vegetation may be damaged by visitors hiking off-trail. In addition, high numbers of visitors using trails may affect animal movement patterns, especially for medium-sized and large mammals and snakes. Visitors may also introduce non-native plant species by dispersing seed attached to clothing or automobiles.

Chapter 3: Plants

There have been several vegetation surveys and plant species lists created for Montezuma Castle NM. Spangle and Sutton (1949) created the first species list for Montezuma Well based on collections made between March and November 1948. McDougall and Haskell (1960) created a key for plants occurring at both the Castle and Well units. Clark and Burgess (1966) studied species composition of perennial vegetation on the rim of Montezuma Well. An inventory of riparian trees at the Castle unit was completed by Reichenbacher (1990). A complete inventory of all plants in both units was completed by Jenkins et al. (1991). In 1994, Brian and Rowlands published an annotated vascular plant species list for the monument based on previous research and collections. Rowlands (1999) completed vegetation mapping and classification of both units. Halvorson and Guertin (2003) and Mau-Crimmins et al. (2004) mapped distribution of non-native plants at both units of the monument. Finally, the NPS Sonoran Desert Network (SDN) Inventory and Monitoring Network (unpublished data) conducted modular plot and transect vegetation surveys at both units of the monument.

A historical photograph survey was conducted by Richmond (1995), who found 103 photographs taken at the monument dating as far back as 1876. These photographs may serve as a historical review of vegetation changes at the monument.

Data Used to Create Plant Species List

The plant species lists for both units of the monument (Appendices A and B) are based on Brian and Rowlands (1994), Rowlands (1999), Halvorson and Guertin (2003), Mau-Crimmins et al. (2004), and the NPS SDN Inventory and Monitoring data (unpublished). Taken together, these lists represent a comprehensive list of the plants occurring at the monument.

Peebles' bluestar

In Brian and Rowlands (1994), woolly bluestar (*Amsonia tomentosa*) was included in their species list. We have changed this species to Peebles' bluestar (*Amsonia peeblesii*) based on information

provided by Peter Rowlands that woolly bluestar was a misidentification. Glenn Rink, a botanist at Northern Arizona University, also checked the specimen and confirmed the proper identification of the plant was Peebles' bluestar.

Results and Discussion

There have been 404 species of plants documented or recorded at the Castle unit; of these, 57 (14%) were non-native (Appendix A). There have been 338 species of plants documented or recorded at the Well unit; of these, 61 (18%) are non-native (Appendix B). In all, there have been 472 species of plants documented or recorded at both units of the monument (Appendix A and B); of these, 72 (15%) are non-native. The percentage of non-native plant species recorded in the monument is slightly lower than the percentage of non-native plants recorded at nearby Tuzigoot National Monument (Schmidt et al. 2005) which is also located in the Verde Valley. This percentage is relatively high compared to non-native plant species in other park units in the Sonoran Desert Network. One reason for the high number of non-native plant species is that the monument has undergone extensive disturbance since prehistoric times. Ancient Hohokam peoples and European settlers practiced agriculture and grazed cattle in the area (Rowlands 1999). Many of the non-native plant species that have invaded the monument are grasses, which have created an unnatural fire hazard (Rowlands 1999). According to Halvorson and Guertin (2003) and Mau-Crimmins et al. (2004) there are several non-native species that are widespread, including London rocket, redstem stork's bill, red brome, cheatgrass, and riggut brome. Rowlands (1999) found that the southeastern portion of the Well unit was the most disturbed area and the southeastern corner of the Castle unit was one of the areas least disturbed and in the most natural state.

Another worrisome occurrence is the apparent decline of mesquite bosque along Beaver Creek possibly due to the increase of groundwater pumping leading to lower groundwater levels (Rowlands 1999).

Inventory Completeness

The plant inventory for Montezuma Castle NM is considered to be complete due to the extensive studies conducted over more than five decades. However, new species, especially non-native species, will most likely continue to become established.

Chapter 4: Fishes

The most thorough fish surveys conducted on the sections of Beaver and Wet Beaver creeks within the monument were by Montgomery et al. (1995, 1996) from 1992 to 1994. They used electrofishing, trammel nets, and seining to collect fish.

Montgomery et al. (1995) also summarized the findings of incidental collections that were taken near the monument during the 1930s, 1960s and 1970s and an unpublished survey by the Arizona Game and Fish Department that was conducted in the 1980s.

Data Used to Create Fish Species List

The fish species list for the monument (Appendix C) is based on the findings of Montgomery et al. (1995, 1996).

Results and Discussion

Montgomery et al. (1995, 1996) documented nine species of fishes, including five non-natives (Appendix C). All four of the native species documented are federally listed Species of Concern. Over the last 60 years, a major shift in the fish community of Beaver Creek has occurred, from an assemblage of native species to a

community dominated by introduced non-native species, though a few native species persist in low to moderate numbers. The decline in native fish species is most likely due to predation and competition by non-native species and changes in water flow caused by human usage (Montgomery et al. 1995). High flood flows along Beaver Creek in the summer appear to temporarily reduce the number of introduced species and allow the native species to temporarily increase in numbers (Montgomery et al. 1995).

Inventory Completeness

The list of nine species from Montgomery et al. (1995, 1996) is considered to be complete. There are several species that may occur or have occurred in the past at the monument (Appendix G). The native fish — speckled dace, spikedace, and loach minnow — are now restricted to the Gila River system and have not been documented in Beaver Creek since the late 1930s (Montgomery et al. 1995). Spotted bass, largemouth bass, black bullhead and channel catfish were introduced in the area for sport fishing, but have not been documented in the area since the 1960s and 70s (Montgomery et al. 1995).

Chapter 5: Amphibians and Reptiles

The only known amphibian and reptile inventory was conducted at Montezuma Castle NM by Drost and Nowak (1998) from 1993 to 1994. They used pitfall traps, coverboards, funnel traps, and visual searches to record or document amphibians and reptiles at the monument. They also searched museum collections for voucher specimens. A study was conducted by Windes et al. (1997) that inventoried amphibians and reptiles of the Beaver Creek Wilderness; however, their study yielded no additional species than those recorded by Drost and Nowak (1998). A study was also conducted on the effects of relocations of rattlesnakes at the monument from 1994–1996 (Nowak and van Riper III 1999), and research is currently being conducted on the ecology of nuisance rattlesnakes and their prey by Erika Nowak. Nowak has also been collecting incidental observations of amphibians and reptiles since the completion of the inventory in 1996. A complete inventory was conducted at Tuzigoot NM which is located nearby in the Verde Valley (Schmidt et al. 2005).

Data Used to Create Amphibian and Reptile Species List

The amphibian and reptile species list for the monument (Appendix D) is based on Drost and Nowak (1998) and additional personal observations by Paul Super (NPS employee) and monument personnel.

Results and Discussion

There have been 34 species of amphibians and reptiles found at the monument, of which three are non-native (Appendix D). Amphibian diversity at the monument is low, consisting of two toads, one treefrog, and the introduced American bullfrog. The American bullfrog is apparently a recent arrival (it was not vouchered at the monument prior to the Drost and Nowak [1998] study) and was only found in low numbers (Drost and Nowak 1998). The lizard community at the monument is one of the most species rich (13 species) in the Sonoran Desert Network of park units. The population of Sonoran mud turtles at Montezuma

Well is also noteworthy for its very high density (Drost and Nowak 1998).

Although comprehensive historical survey data are not available for comparison, museum records show that lowland leopard frogs (which have declined throughout the southwest) once occurred in the vicinity of the monument but were not documented by Drost and Nowak (1998) and are believed to no longer occur in the area. Gila monsters also formerly occurred at the monument, but were not found by Drost and Nowak (1998). The Arizona toad is another species that may be extirpated from the monument. There are no specimen records to document its former occurrence at Montezuma Castle NM, but it formerly occurred in the area; appropriate habitat is present at the monument but none were found by Drost and Nowak (1998). Loss and decline of many species may be due to the loss of desert grasslands, invasion of non-native plant species, and changes in aquatic habitats (such as water flow and quality; Drost and Nowak 1998).

Inventory Completeness

Drost and Nowak (1998) conducted a relatively thorough inventory of the monument and Nowak (unpublished data) has continued to collect observational data on amphibians and reptiles at Montezuma Castle NM. Nowak has not, to date, detected any new species and she estimates that inventory completeness at the monument is at least 90–95%.

Possible Species

Here we identify species that have not been confirmed to occur at the monument (Appendix H), but that may occur there based on documentation from nearby Tuzigoot NM by Schmidt et al. (2005) and based on habitat and range (Drost and Nowak 1998).

Greater short-horned lizard

The greater short-horned lizard was documented by Drost and Nowak (1998) about a half mile southwest of the Well unit.

Snakes

There are six snake species that may occur at the monument. Five of these species (western blind snake, Sonoran whipsnake, Mexican garter snake, southwestern black-headed snake and western lyre snake) have been documented in the Verde Valley at Tuzigoot NM (Schmidt et al. 2005) and two (Sonoran whipsnake and western lyre snake) were found near the Well unit (Drost and Nowak 1998). One other species of snake that may occur at the monument (Mojave rattlesnake), occurs in the Verde Valley and if found at the monument would most likely occur at the Well unit.

Chapter 6: Birds

Several bird species lists have been created for Montezuma Castle NM and the surrounding area. The first was created by Jackson (1941) based on observations she made at the monument from 1936 to 1940. A compilation of bird observations at the monument was created by Frost (1947), and included the observations by Jackson (1941), as well as others. Another compilation was created by Sutton (1954) that included all past bird observations made in the entire Verde Valley. From 1973 to 1980 the National Audubon Society (No date) conducted Christmas bird counts near the monument. More recently, Sogge and Johnson (1998) conducted point counts and transect surveys at Montezuma Castle NM from 1991 to 1994. The list created by Sogge and Johnson (1998) was recently updated by Sogge et al. (In press). A comprehensive survey that took place from 2003 to 2004 at nearby Tuzigoot NM located in the Verde Valley, including point counts and transect surveys, was summarized by Schmidt et al. (2005). Finally, a study on yellow-billed cuckoos at the monument has just been completed by Matt Johnson.

Data Used to Create Bird Species List

The bird species list for the monument (Appendix E) is based solely on Sogge et al. (In press).

Results and Discussion

There have been 211 species of birds found at the monument (Appendix E), of which four are non-native and 41 species require open water (found at Montezuma Well): 22 species of ducks and geese (Anatidae), one grebe (Podicipedidae), four species of heron and egret (Ardeidae), four species of rail (Rallidae), seven species of “shorebirds” (Charadriidae and Scolopacidae), and three other species.

Based on the list created by Sogge et al. (In press), the bird community at Montezuma Castle NM is among the most species rich for park units in the Sonoran Desert Network. This high species richness is extraordinary for a park unit of its size, and Beaver and Wet Beaver creeks and Montezuma Well are the resources that account for this. The riparian areas adjacent to the creeks support a high number of riparian obligate birds such as summer tanager, song sparrow, Abert’s towhee, yellow warbler, yellow-breasted chat, and sensitive species (Arizona State Wildlife Species of Concern) including nesting common black-hawks, belted kingfishers, and yellow-billed cuckoos (also a candidate for listing under the Endangered Species Act). The dense stands of cottonwood and willow trees provide vital habitat for these species, yet these areas are rare in the southwest (Ohmart 1994). Research in the southwestern U.S. has consistently shown that areas with riparian trees have bird communities that are more diverse than adjacent sites (Carothers et al. 1974, Szaro and Jakle 1985, Strong and Bock 1990). This is due, in part, to the variety of microhabitats that riparian vegetation provides for nesting (Powell and Steidl 2000), cover, and foraging.

Inventory Completeness

The bird list for Montezuma Castle NM is near completion. We include a list of species that have been observed elsewhere in the Verde Valley that may also be present at the monument (Appendix I). Many of these species may be present only as flyovers (flying over the monument) en route to large open areas of water (i.e. Montezuma Lake), especially many of the “shorebirds” (families Scolopacidae and Recurvirostridae) and gulls (family Laridae).

Chapter 7: Mammals

The first known work conducted on mammals in the area was by Walter P. Taylor and Hartley H. T. Jackson in 1916 (Drost and Ellison 1996). Taylor and Jackson's research included interviewing local residents about their observations. More recently, Ellison and van Riper III (1996) studied small mammal community patterns in riparian floodplain and mesquite habitats. Drost and Ellison (1996) conducted a thorough inventory of all mammals, which included pitfall trapping for shrews, mist netting for bats, trapping for small and medium-sized mammals, visual surveys for large and aquatic mammals, Trailmaster camera stations, and track and sign surveys. Drost and Ellison (1996) also compared their results with results from Taylor and Jackson. In 2002 and 2003, Bucci and Petryszyn (2004) conducted mist netting and acoustic surveys for bats at the monument. In addition, Erika Nowak has been trapping small mammals at the Castle unit since 2003 in conjunction with a study of nuisance rattlesnake ecology.

Data Used to Create Mammal Species List

The mammal species list for the monument (Appendix F) is based on the documentations made by Drost and Ellison (1996) and Bucci and Petryszyn (2004).

Results and Discussion

There have been 58 species of mammal documented at the monument: 18 bats, 15 small terrestrial mammals (primarily rodents), and 25 medium to large mammals (Appendix F). Of the 58 species documented, only one was non-native. One reason for the monument's high number of mammal species may be its location near the northern edge of the Sonoran Desert and the southern edge of the Mogollon Rim. Many species from both ecosystems have been, or may be, found there. Several of the species documented by Drost and Ellison (1996) (cactus mouse, Piñon mouse, Stephens's woodrat and Harris' antelope squirrel) are at the edge of their geographic ranges. In addition, two species that may be present would be

at the edge of their geographic ranges (long-legged myotis and southern grasshopper mouse).

Beaver and Wet Beaver creeks and Montezuma Well provide a constant source of water for several mammals that are rare in Arizona: American beaver, muskrat, and river otter. The American beaver and river otter were trapped historically for their dense fur. In the early 1900s the American beaver population had declined and the southwestern subspecies of the river otter (*Lontra canadensis sonora*) was nearly, or possibly, trapped to extinction. Because habitats, in Arizona where the American beaver, muskrat and river otter occurred historically, have been altered due to dams, diversions, and other forms of habitat alteration, the monument (including Montezuma Well and the sections of Beaver and Wet Beaver creeks) appears to be important to the persistence of these species in Arizona.

The cliffs above Montezuma Well and along Beaver Creek, including the Castle itself, provide roosts for many cave and cliff bats. One species of bat that has been found to use these areas, the Townsend's big-eared bat, is a federally listed Species of Concern.

Inventory Completeness

The mammal list for Montezuma Castle NM is near completion. We believe all common and resident mammals have been documented; however, there are a few additional species that may occur at the monument (Appendix J) based on Drost and Ellison (1996).

Long-legged myotis and silver-haired bat

Both of these species have been documented in the Verde Valley and their ranges include the monument (Hoffmeister 1986), however, they have never been documented at the monument.

Western bonneted bat

This bat ranges widely throughout Arizona. It roosts in shallow caves and cliffs which are present at the monument; however this species has not been documented in the Verde Valley.

White-nosed coati

This species usually inhabits oak woodland in the southeastern portion of Arizona, however “stragglers and wanderers” may be found further north (Hoffmeister 1986).

Western spotted and hooded skunks

Both species have been documented in the Verde Valley. Western spotted skunks are uncommon throughout their range and the hooded skunk is uncommon through the northern part of its range. It is likely that the western spotted skunk is currently present or will be found in the future at the monument.

Golden-mantled ground squirrel

This species is common along the Mogollon Rim and, if found at the monument, it would be at the southernmost extent of its range.

Arizona pocket mouse and southern grasshopper mouse

Usually found in Mohave and Sonoran desertscrub, these species have been documented in the Verde Valley (Hoffmeister 1986). If found at the monument they would be at the northernmost part of their ranges.

Hispid pocket mouse

An isolated population of this species was documented in the Verde Valley (Hoffmeister 1986), but is believed to no longer occur in the area.

Plains harvest mouse

This wide-ranging species has been documented in the Verde Valley by Hoffmeister (1986). He found geographic overlap between this and the western

harvest mouse, which was captured by Drost and Ellison (1996) at Montezuma Castle NM.

House mouse

The house mouse was previously documented at the monument by Taylor and Jackson (Drost and Ellison 1996), however, recently none have been found at the monument. This species is closely associated with human development and as developments continue to increase near the monument this species may once again occur at the monument.

Species No Longer Present

There are two species that are believed to no longer be present at the monument; however, it may be premature to say that these species have been extirpated from the Verde Valley: Gunnison’s prairie dog (*Cynomys gunnisoni*) and pronghorn (*Antilocapra americana*).

Grizzly Bear, Ocelot, Jaguar and Mexican Gray Wolf

Four species have been extirpated from the Verde Valley: grizzly bear (*Ursus arctos*), ocelot (*Leopardus pardalis*), jaguar (*Panthera onca*) and Mexican gray wolf (*Canis lupus baileyi*). The last grizzly bear in Arizona is believed to have been killed in the mid 1920s (Hoffmeister 1986). The range of both the ocelot and jaguar has shrunk substantially. Currently they occur very rarely in Arizona and only in the extreme south and southeast portion of the state. The Mexican gray wolf was extirpated from Arizona, however, beginning in the 1990s they were reintroduced into central eastern Arizona. It is unlikely that this species will occur again at the monument because of urban development surrounding both the Castle and Well units.

Chapter 8: Management Implications

Based on data from previous studies and our knowledge of the natural resource issues at the monument, herein we address issues that affect management of the monument's natural resources.

Adjacent Land Development and Water

As the Verde Valley becomes increasingly developed, undisturbed areas will become scarce and likely restricted to inaccessible terrain. It is important to maintain the present, relatively undisturbed state of the southeast portion of the Castle unit by eliminating trespass grazing and other incompatible uses.

Water rights adjudication will be important to the future of water quality and quantity flowing through the monument. The seasonal pattern of flooding and drying may be important to maintaining native fish populations according to Montgomery et al. (1995). Communication with other agencies involved with water use and water resources in the Beaver Creek/Verde River drainage will help to maintain instream flows at the monument. Maintaining healthy riparian communities and aquatic habitats is particularly important for amphibians who are dependent on these communities. Measures to protect stream flow, water quality, the natural hydrologic regime, and native aquatic species (e.g., restoring native fish species) will benefit amphibians.

Non-native Species and Grasslands

Mediterranean grasses and other exotic plants create seasonally high levels of fire fuels that increase to a maximum standing crop during the

summer months when lightning strikes are most likely. An integrated approach to vegetation management in the bottomlands utilizing all feasible aspects of weed control, including (where appropriate) chemical control and prescribed fire, would help maintain a natural system. Mechanical control of the annual weedy growth at the Well unit 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.

Some of the species declines that have occurred at the monument (including the Gila monster, Arizona cotton rat, and hispid pocket mouse) seem to be related to the 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 grassland habitats and native species in general (and reduction of non-natives such as red brome) would be beneficial.

Bats

Disturbances to breeding Townsend's big-eared bats at the Montezuma Well Swallet Cave should be avoided. Townsend's big-eared bat is a federal Species of Concern and is considered sensitive to disturbance at roost caves (Bucci and Petryszyn 2004). Any access to the cave at Montezuma Well should be timed to avoid the period when the bats have young (April through July).

Chapter 9: Additional Inventories and Research

No inventory is ever truly complete; species distributions expand and contract across boundaries, particularly in small park units such as Montezuma Castle NM. We recommend a complete inventory be conducted again in approximately 10 years to detect any changes in species status.

Fish

To help understand the native fish community in Beaver Creek further research is recommended including: 1) continued fish species composition and abundance monitoring, particularly in relation to flood events and periods of stream drawdown and; 2) marking native suckers to monitor age, growth rate, and movements. Monitoring and

research should be coordinated with Arizona Game and Fish Department, USDA Forest Service, or other agencies working in this section of the Verde River drainage.

Amphibians and Reptiles

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 the monument, this area would be a valuable site for continuing to collect information on population trends.

Chapter 10: Literature Cited

- American Ornithologists' Union (AOU). 1998. Checklist of North American birds, seventh edition. American Ornithologists' Union and Allen Press Inc., Lawrence, KS.
- American Ornithologists' Union (AOU). 2003. Forty-second supplement to the American Ornithologists' Union checklist of North American birds. *Auk* 117:847–858.
- Baker, R. J., L. C. Bradley, R. D. Bradley, J. W. Dragoo, M. D. Engstrom, R. S. Hoffmann, C. A. Jones, F. Reid, D. W. Rice, and C. Jones. 2003. Revised checklist of North American mammals north of Mexico, 2003. *Occasional Papers of the Museum of Texas Tech University* 229:1–23.
- Blinn, D., and G. E. Oberlin. 1996. Aquatic biota: invertebrates and algae. U.S. Geological Survey, Colorado Plateau Research Station, Flagstaff, AZ.
- Brian, N. J., and P. G. Rowlands. 1994. An annotated vascular plant species list for Montezuma Castle and Montezuma Well National Monuments, Arizona. U.S. Geological Survey, Colorado Plateau Research Station, Flagstaff, AZ.
- Brown, D. E., C. H. Lowe, and C. P. Pase. 1980. A digitized systematic classification for ecosystems with an illustrated summary of the natural vegetation of North America. General Technical Report RM-73, USDA Forest Service, Fort Collins, CO.
- Bucci, M., and Y. Petryszyn. 2004. Bat use of Montezuma Castle National Monument, Tonto National Monument, and Tuzigoot National Monument, Arizona. Report to Montezuma Castle National Monument, Camp Verde, AZ.
- Carothers, S. W., R. R. Johnson, and S. W. Aitchison. 1974. Population structure and social organization of Southwestern riparian birds. *American Zoologist* 14:97–108.
- Clark, A., and R. L. Burgess. 1966. The persistent perennial vegetation on the rim of Montezuma Well, Arizona. *Journal of the Arizona Academy of Science* 4: 35–42.
- Drost, C. A., and L. E. Ellison. 1996. Inventory and assessment of mammal communities in Montezuma Castle National Monument. U.S. Geological Survey, Colorado Plateau Field Station, Flagstaff, AZ.
- Drost, C. A., and E. M. Nowak. 1998. Inventory and assessment of amphibian and reptile communities at Montezuma Castle National Monument. U.S. Geological Survey, Colorado Plateau Field Station, Flagstaff, AZ.
- Ellison, L. E., and C. van Riper III. 1996. A comparison of small mammal communities at Montezuma Castle National Monument. National Park Service Technical Report NPS/NAUMOCA/NRTR-96/11.
- Frost, C. B. 1947. A check list of birds recorded in the Montezuma Castle Area. Unpublished list to Montezuma Castle National Monument, Camp Verde, AZ.
- Halvorson, W. L., and P. Guertin. 2003. USGS Weeds in the West project: status of introduced plants in southern Arizona parks. U.S. Geological Survey, Southwest Biological Science Center, Sonoran Desert Research Station, University of Arizona, Tucson, AZ.
- Heritage Data Management System (HDMS). 2004. Arizona Game and Fish Department. Accessed 5 March from: http://www.gf.state.az.us/w_c/edits/hdms_species_lists.html.
- Hoffmeister, D. F. 1986. *Mammals of Arizona*. The University of Arizona Press, Tucson, AZ.
- Integrated Taxonomic Information System (ITIS). 2004. Accessed on 20 March 2004. <http://www.itis.usda.gov/index.html>.
- Jackson, B. 1941. *Birds of Montezuma Castle*. Southwestern National Monuments Special Report No. 28.
- Jenkins, P., F. Reichenbacher, K. Johnson, A. Gondor. 1991. Vegetation inventory, classification, and monitoring for Montezuma Well, Montezuma Castle National Monument. Southwestern Field Biologists, Tucson, AZ.
- Latta, M. J., C. J. Beardmore, and T. E. Corman. 1999. Arizona Partners in Flight conservation plan. Technical Report 142. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, AZ.
- Lindsay, B. A. 2000. Soil survey of Montezuma Castle National Monument, Arizona (including Montezuma Well). U.S. Geological Survey, Sonoran Desert Field Station, University of Arizona, Tucson, AZ.
- Mau-Crimmins, T., A. Hubbard, and G. R. McPherson. 2004. Non-native plant mapping at Montezuma Castle and Tuzigoot National Monuments. National Park Service, Sonoran Desert Inventory and Monitoring Program, Tucson, AZ.
- McDougall, W. B., and H. S. Haskell. 1960. Seed Plants of Montezuma Castle National Monument. *Museum of Northern Arizona Bulletin* 35.

- Montgomery, W. L., G. G. Hardwick, and J. White. 1996. Montezuma Castle National Monument: fish monitoring. Report to Montezuma Castle National Monument, Camp Verde, AZ.
- Montgomery, W. L., W. C. Leibfried, and G. G. Hardwick. 1995. Beaver Creek aquatic study for Montezuma Castle National Monument: fish and herpetofauna. Final Report to Montezuma Castle National Monument, Camp Verde, AZ.
- National Audubon Society. *No date*. Christmas bird count data. Accessed November 7, 2005 from: <http://www.audubon.org/bird/abc/hr/index.html>.
- National Park Service (NPS). 1992. NPS-75: Natural resources inventory and monitoring guidelines. U.S. Dept. of Interior, Washington, D.C.
- National Park Service (NPS). 2005. NPS Visitation Database Reports. Accessed October 22, 2005 from: <http://www2.nature.nps.gov/NPstats/npstats.cfm>.
- Nowak, E., and C. van Riper III. 1999. Effects and effectiveness of rattlesnake relocation at Montezuma Castle National Monument. Technical Report Series USGSFRESC/COPL/1999/17, USGS Colorado Plateau Field Station, Flagstaff, AZ.
- Ohmart, R. D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. *Studies in Avian Biology* 15:272–285.
- Powell, B. F., and R. J. Steidl. 2000. Nesting habitat and reproductive success of southwestern riparian birds. *Condor* 102:823–831.
- Rappole, J. H. 1995. The ecology of migrant birds: a neotropical perspective. Smithsonian Institution Press, Washington, D.C.
- Reichenbacher, F. W. 1990. Inventory of riparian trees at Montezuma Castle, Montezuma Castle National Monument, Arizona. F. W. Reichenbacher & Associates, Tucson, AZ.
- Richmond, A. J. 1995. Historic photograph survey Montezuma Castle/Well National Monument 1879–1990. Technical Report NPS/NAUMOCA/NRTR-95/08. U.S. Geological Survey, Colorado Plateau Research Station, Flagstaff, AZ.
- Rowlands, P. G. 1999. Vegetation survey of Montezuma Castle National Monument. Unpublished report to Montezuma Castle National Monument, Camp Verde, AZ.
- Schmidt, C. A., B. F. Powell, and W. L. Halvorson. 2005. Vascular plant and vertebrate inventory of Tuzigoot National Monument. Final report to the National Park Service, Sonoran Desert Inventory and Monitoring Program, Tucson, AZ.
- Sogge, M. K., and M. J. Johnson. 1998. Montezuma Castle Avian Inventory 1991–1994. Final Project Report to Montezuma Castle National Monument, Camp Verde, AZ.
- Sogge, M. K., M. J. Johnson, and C. van Riper III. *In press*. The birds of Montezuma Castle National Monument, AZ. U.S. Geological Survey, Colorado Plateau Research Station, Flagstaff, AZ.
- Spangle, P., and M. Sutton. 1949. The botany of Montezuma Well. *Plateau* 22:11–19.
- Sprouse, T., R. Emanuel, and B. Tellman. 2002. Surface water quality monitoring overview and assessment. Unpublished report to the National Park Service, Sonoran Desert Network Inventory and Monitoring Program, Tucson, AZ.
- Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin, New York, NY.
- Stohlgren, T. J., J. F. Quinn, M. Ruggiero, and G. S. Waggoner. 1995. Status of biotic inventories in U.S. national parks. *Biological Conservation* 71:97–106.
- Strong, T. R., and C. E. Bock. 1990. Bird species distribution patterns in riparian habitats in southeastern Arizona. *Condor* 92:511–519.
- Sutton, M. 1954. Birds of the Verde Valley. National Park Service, Montezuma Castle National Monument, Camp Verde, AZ.
- Szaro, R. C., and M. D. Jakle. 1985. Avian use of a desert riparian island and its adjacent scrub habitat. *Condor* 87:511–519.
- United States Department of Agriculture (USDA). 2004. The PLANTS Database, Version 3.5. Accessed from: <http://plants.usda.gov>. National Plant Data Center, Natural Resources Conservation Service, Baton Rouge, LA.
- United States Fish and Wildlife Service (USFWS). 2002. Birds of conservation concern 2002. Division of Bird Management, Arlington, VA.
- Western Regional Climate Center (WRCC). 2005. Arizona climate summaries from Montezuma Castle National Monument, Arizona. Accessed October 22, 2005 from: <http://www.wrcc.dri.edu/summary/climsmaz.html>.
- Windes, J. D., M. J. Sredl, J. E. Wallace, and B. L. Christman. 1997. Wet Beaver Creek Wilderness herpetofauna inventory. Technical Report 107. Arizona Game and Fish Department, Nongame and Endangered Wildlife.

Appendix A. Plant species observed or collected at Montezuma Castle NM, Castle unit. Based on Brian and Rowlands (B&R; 1994), Rowlands (Row; 1999), Halvorson and Guertin (H&G; 2003), Mau-Crimmins et al. (Mau; 2004), and NPS (unpublished data). Species in bold-faced type are non-native.

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Aceraceae	<i>Acer negundo</i> L.	boxelder		X			
	<i>Acer negundo</i> var. <i>californicum</i> (Torr. & Gray) Sarg.	California boxelder	X				
Agavaceae	<i>Agave parryi</i> Engelm. var. <i>parryi</i>	Parry's agave	X				
	<i>Yucca baccata</i> Torr. var. <i>baccata</i>	banana yucca	X				
	<i>Yucca elata</i> (Engelm.) Engelm.	soaptree yucca		X			X
	<i>Yucca elata</i> var. <i>verdiensis</i> (McKelvey) Reveal	Verdi yucca	X				
Amaranthaceae	<i>Amaranthus powellii</i> S. Wats.	Powell's amaranth	X				
Anacardiaceae	<i>Rhus aromatica</i> Ait.	fragrant sumac					X
	<i>Rhus trilobata</i> Nutt.	skunkbush sumac	X	X			
	<i>Rhus trilobata</i> var. <i>trilobata</i> Nutt.	skunkbush sumac					X
	<i>Toxicodendron rydbergii</i> (Small ex Rydb.) Greene	western poison ivy	X				
Apiaceae	<i>Berula erecta</i> (Huds.) Coville	cutleaf waterparsnip	X				
	<i>Cymopterus multinervatus</i> (Coult. & Rose) Tidestrom	purplenerve springparsley	X				X
	<i>Cymopterus purpurascens</i> (Gray) M.E. Jones	widewing springparsley	X				
	<i>Daucus pusillus</i> Michx.	American wild carrot	X	X			X
	<i>Hydrocotyle verticillata</i> Thunb.	whorled marshpennywort	X				
	Apocynaceae	<i>Amsonia peeblesii</i> Woods.	Peebles' bluestar	X			
<i>Vinca major</i> L.		bigleaf periwinkle	X	X			
Asclepiadaceae	<i>Asclepias asperula</i> ssp. <i>capricornu</i> (Woods.) Woods.	antelopehorns	X				
	<i>Asclepias engelmanniana</i> Woods.	Engelmann's milkweed	X				
	<i>Asclepias subverticillata</i> (Gray) Vail	horsetail milkweed	X	X			
	<i>Funastrum cynanchoides</i> ssp. <i>cynanchoides</i> (Dcne.) Schlechter	fringed twinevine	X	X			
	Asteraceae	<i>Acourtia wrightii</i> (Gray) Reveal & King	brownfoot	X	X		
<i>Agoseris glauca</i> var. <i>laciniata</i> (D.C. Eat.) Smiley		false agoseris	X				
<i>Ambrosia confertiflora</i> DC.		wealeaf burr ragweed	X				
<i>Ambrosia psilostachya</i> DC.		Cuman ragweed	X				
<i>Artemisia ludoviciana</i> Nutt.		white sagebrush	X	X			X
<i>Aster</i> L.		aster					X
<i>Baccharis emoryi</i> Gray		Emory's baccharis	X				
<i>Baccharis pteronioides</i> DC.		yerba de pasmo					X
<i>Baccharis salicifolia</i> (Ruiz & Pavón) Pers.		mule's fat	X	X			
<i>Baccharis sarothroides</i> Gray		desertbroom	X	X			
<i>Baccharis wrightii</i> Gray		Wright's baccharis	X				
<i>Baileya multiradiata</i> Harvey & Gray ex Gray		desert marigold	X	X			
<i>Brickellia atractyloides</i> Gray		spearleaf brickellbush	X	X			X
<i>Brickellia californica</i> (Torr. & Gray) Gray		California brickellbush	X	X			
<i>Brickellia eupatorioides</i> var. <i>chlorolepis</i> (Woot. & Standl.) B.L. Turner		false boneset	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Asteraceae	<i>Brickellia microphylla</i> var. <i>watsonii</i> (B.L. Robins.) Welsh	Watson's brickellbush		X			
	<i>Centaurea melitensis</i> L.	Maltese star-thistle	X	X	X	X	
	<i>Chaetopappa ericoides</i> (Torr.) Nesom	rose heath	X	X			X
	<i>Cichorium intybus</i> L.	chicory	X	X			
	<i>Cirsium arizonicum</i> (Gray) Petrak	Arizona thistle	X				
	<i>Cirsium wheeleri</i> (Gray) Petrak	Wheeler's thistle	X				
	<i>Conyza canadensis</i> (L.) Cronq.	Canadian horseweed		X			
	<i>Conyza canadensis</i> var. <i>pusilla</i> (Nutt.) Cronq.	Canadian horseweed	X				
	<i>Encelia frutescens</i> (Gray) Gray	button brittlebush	X	X			X
	<i>Encelia virginensis</i> A. Nels.	Virgin River brittlebush	X				
	<i>Erigeron concinnus</i> (Hook. & Arn.) Torr. & Gray	Navajo fleabane	X	X			
	<i>Erigeron divergens</i> Torr. & Gray	spreading fleabane	X				X
	<i>Erigeron flagellaris</i> Gray	trailing fleabane	X				X
	<i>Gaillardia pinnatifida</i> Torr.	red dome blanketflower	X	X			
	<i>Grindelia nuda</i> var. <i>aphanactis</i> (Rydb.) Nesom	curlytop gumweed	X	X			
	<i>Gutierrezia microcephala</i> (DC.) Gray	threadleaf snakeweed	X				
	<i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby	broom snakeweed	X	X			X
	<i>Helianthus annuus</i> L.	common sunflower	X				X
	<i>Heliomeris multiflora</i> var. <i>multiflora</i> Nutt.	showy goldeneye	X				
	<i>Heterotheca subaxillaris</i> (Lam.) Britt. & Rusby	camphorweed		X	X	X	
	<i>Heterotheca villosa</i> (Pursh) Shinnars	hairy false goldenaster		X			
	<i>Heterotheca villosa</i> var. <i>foliosa</i> (Nutt.) Harms	hairy false goldenaster	X				
	<i>Hymenoclea monogyra</i> Torr. & Gray ex Gray	singlewhorl burrobrush	X	X			X
	<i>Hymenothrix loomisii</i> Blake	Loomis' thimblehead	X				
	<i>Lactuca serriola</i> L.	prickly lettuce			X	X	
	<i>Lactuca tatarica</i> var. <i>pulchella</i> (Pursh) Breitung	blue lettuce	X				
	<i>Layia glandulosa</i> (Hook.) Hook. & Arn.	whitedaisy tidytops	X				X
	<i>Machaeranthera canescens</i> var. <i>incana</i> (Lindl.) Gray	hoary tansyaster	X				
	<i>Machaeranthera gracilis</i> (Nutt.) Shinnars	slender goldenweed	X				
	<i>Malacothrix fendleri</i> Gray	Fendler's desertdandelion	X				
	<i>Melampodium leucanthum</i> Torr. & Gray	plains blackfoot	X	X			X
	<i>Packera neomexicana</i> var. <i>neomexicana</i> (Gray) W.A. Weber & A. Löve	New Mexico groundsel	X				
	<i>Packera quercetorum</i> (Greene) C. Jeffrey	Oak Creek ragwort	X				
	<i>Parthenium incanum</i> Kunth	mariola	X	X			X
	<i>Senecio flaccidus</i> var. <i>flaccidus</i> Less.	threadleaf ragwort	X				
	<i>Solidago velutina</i> DC.	threenerve goldenrod	X				
<i>Solidago wrightii</i> Gray	Wright's goldenrod	X	X				
<i>Sonchus asper</i> (L.) Hill	spiny sowthistle	X	X				
<i>Stephanomeria exigua</i> Nutt.	small wirelettuce	X					
<i>Stephanomeria minor</i> var. <i>minor</i> (Hook.) Nutt.	narrowleaf wirelettuce	X					

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS	
Asteraceae	<i>Stephanomeria pauciflora</i> (Torr.) A. Nels.	brownplume wirelettuce	X	X			X	
	<i>Symphotrichum divaricatum</i> (Nutt.) Nesom	southern annual saltmarsh aster	X					
	<i>Symphotrichum praealtum</i> var. <i>praealtum</i> (Poir.) Nesom	willowleaf aster	X					
	<i>Taraxacum laevigatum</i> (Willd.) DC.	rock dandelion	X	X				
	<i>Thymophylla acerosa</i> (DC.) Strother	pricklyleaf dogweed	X	X			X	
	<i>Thymophylla pentachaeta</i> var. <i>belenidium</i> (DC.) Strother	fiveneedle pricklyleaf	X					
	<i>Thymophylla pentachaeta</i> var. <i>pentachaeta</i> (DC.) Small	fiveneedle pricklyleaf					X	
	<i>Townsendia annua</i> Beaman	annual Townsend daisy	X					
	<i>Townsendia strigosa</i> Nutt.	hairy Townsend daisy	X				X	
	<i>Tragopogon dubius</i> Scop.	yellow salsify	X	X				
	<i>Uropappus lindleyi</i> (DC.) Nutt.	Lindley's silverpuffs	X				X	
	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook. f. ex Gray	golden crownbeard	X	X				
	<i>Verbesina encelioides</i> ssp. <i>exauriculata</i> (Robins. & Greenm.) J.R. Coleman	golden crownbeard	X					
	<i>Xanthium strumarium</i> L.	rough cocklebur	X	X	X	X		
	Berberidaceae	<i>Mahonia haematocarpa</i> (Woot.) Fedde	red barberry	X	X			X
	Betulaceae	<i>Alnus oblongifolia</i> Torr.	Arizona alder	X	X			
Bignoniaceae	<i>Chilopsis linearis</i> (Cav.) Sweet	desert willow		X				
	<i>Chilopsis linearis</i> ssp. <i>arcuata</i> (Fosberg) Henrickson	desert willow	X					
Boraginaceae	<i>Amsinckia menziesii</i> var. <i>intermedia</i> (Fisch & C.A. Mey.) Ganders	common fiddleneck	X				X	
	<i>Cryptantha confertiflora</i> (Greene)	basin yellow cryptantha	X	X			X	
	<i>Cryptantha crassisejala</i> (Torr. & Gray) Greene	thicksepal cryptantha	X				X	
	<i>Cryptantha nevadensis</i> A. Nels. & Kennedy	Nevada cryptantha	X				X	
	<i>Harpagonella</i> Gray	grapplinghook					X	
	<i>Lappula occidentalis</i> (S. Wats.) Greene	flatspine stickseed					X	
	<i>Lappula occidentalis</i> var. <i>cupulata</i> (Gray) Higgins	flatspine stickseed	X					
	<i>Lappula occidentalis</i> var. <i>occidentalis</i> (S. Wats.) Greene	flatspine stickseed	X	X			X	
	<i>Lithospermum incisum</i> Lehm.	narrowleaf stone seed	X	X				
	<i>Plagiobothrys</i> Fisch. & C.A. Mey.	popcornflower					X	
	<i>Tiquilia canescens</i> (DC.) A. Richards.	woody crinkle mat	X	X			X	
	Brassicaceae	<i>Arabis perennans</i> S. Wats.	perennial rockcross	X				
		<i>Brassica tournefortii</i> Gouan	Asian mustard				X	
<i>Capsella bursa-pastoris</i> (L.) Medik.		shepherd's purse	X	X			X	
<i>Chorispura tenella</i> (Pallas) DC.		crossflower	X	X			X	
<i>Descurainia pinnata</i> (Walt.) Britt.		western tansymustard	X				X	
<i>Descurainia sophia</i> (L.) Webb ex Prantl		herb sophia	X	X	X			
<i>Draba cuneifolia</i> Nutt. ex Torr. & Gray		wedgeleaf draba	X				X	
<i>Erysimum capitatum</i> var. <i>purshii</i> (Dur.) Rollins		Pursh's wallflower	X					
<i>Lepidium lasiocarpum</i> Nutt.		shaggyfruit pepperweed	X				X	
<i>Lepidium montanum</i> Nutt.		mountain pepperweed	X	X			X	

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Brassicaceae	<i>Lepidium montanum</i> var. <i>glabrum</i> C.L. Hitchc.	mountain pepperweed	X				
	<i>Lesquerella gordonii</i> (Gray) S. Wats.	Gordon's bladderpod	X				
	<i>Lesquerella intermedia</i> (S. Wats.) Heller	mid bladderpod	X				
	<i>Lesquerella tenella</i> A. Nels.	Moapa bladderpod	X				
	<i>Matthiola longipetala</i> (Vent.) DC.	night scented stock					X
	<i>Rorippa nasturtium-aquaticum</i> (L.) Hayek	watercress	X	X			
	<i>Sisymbrium irio</i> L.	London rocket	X	X	X	X	X
	<i>Streptanthus carinatus</i> ssp. <i>arizonicus</i> (S. Wats.) Kruckeberg, Rodman & Worthington	lyreleaf jewelflower	X				X
	<i>Thelypodium wrightii</i> Gray	Wright's thelypody	X				
Cactaceae	<i>Echinocereus fendleri</i> var. <i>boyce-thompsonii</i> (Orcutt) L. Benson	Boyce Thompson hedgehog cactus	X	X			
	<i>Echinocereus fendleri</i> var. <i>fasciculatus</i> (Engelm. ex B.D. Jackson) N.P. Taylor	pinkflower hedgehog cactus					X
	<i>Escobaria vivipara</i> var. <i>arizonica</i> (Engelm.) D.R. Hunt	Arizona spinystar	X				
	<i>Opuntia engelmannii</i> Salm-Dyck var. <i>engelmannii</i>	cactus apple	X				
	<i>Opuntia leptocaulis</i> DC.	Christmas cactus	X	X			X
	<i>Opuntia macrocentra</i> var. <i>macrocentra</i> Engelm.	purple pricklypear	X				
	<i>Opuntia phaeacantha</i> Engelm.	tulip pricklypear		X			X
Campanulaceae	<i>Lobelia cardinalis</i> L.	cardinalflower	X				
	<i>Nemacladus glanduliferus</i> var. <i>orientalis</i> McVaugh	glandular threadplant	X				
Capparaceae	<i>Cleome lutea</i> var. <i>jonesii</i> J.F. Macbr.	Jones spiderflower	X				
	<i>Polanisia dodecandra</i> ssp. <i>trachysperma</i> (Torr. & Gray) Iltis	sandyseed clammyweed	X				
Caryophyllaceae	<i>Silene antirrhina</i> L.	sleepy silene	X				X
Celastraceae	<i>Canotia holacantha</i> Torr.	crucifixion thorn	X	X			X
Chenopodiaceae	<i>Atriplex canescens</i> (Pursh) Nutt.	fourwing saltbush	X	X			X
	<i>Atriplex canescens</i> (Pursh) Nutt. var. <i>canescens</i>	fourwing saltbush	X				
	<i>Chenopodium fremontii</i> S. Wats.	Fremont's goosefoot	X				
	<i>Krascheninnikovia lanata</i> (Pursh) A.D.J. Meeuse & Smit	winterfat	X	X			
	<i>Salsola tragus</i> L.	prickly Russian thistle	X	X			
Convolvulaceae	<i>Convolvulus arvensis</i> L.	field bindweed	X	X			
	<i>Convolvulus equitans</i> Benth.	Texas bindweed	X				
	<i>Evolvulus nuttallianus</i> J.A. Schultes	shaggy dwarf morning-glory	X				
Cucurbitaceae	<i>Cucurbita foetidissima</i> Kunth	Missouri gourd	X				
	<i>Marah gilensis</i> Greene	Gila manroot	X	X			X
Cupressaceae	<i>Cupressus arizonica</i> Greene	Arizona cypress	X				X
	<i>Juniperus monosperma</i> (Engelm.) Sarg.	oneseed juniper	X	X			
	<i>Juniperus osteosperma</i> (Torr.) Little	Utah juniper	X	X			X
Cyperaceae	<i>Carex aquatilis</i> Wahlenb.	water sedge	X				
	<i>Cyperus esculentus</i> L.	chufa flatsedge			X	X	
	<i>Eleocharis parishii</i> Britt.	Parish's spikerush	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Cyperaceae	<i>Schoenoplectus tabernaemontani</i> (K.C. Gmel.) Palla	softstem bulrush	X				
Ephedraceae	<i>Ephedra viridis</i> Coville	mormon tea	X	X			X
Euphorbiaceae	<i>Chamaesyce albomarginata</i> (Torr. & Gray) Small	whitemargin sandmat	X	X			
	<i>Chamaesyce capitellata</i> (Engelm.) Millsp.	head sandmat	X				
	<i>Chamaesyce chaetocalyx</i> (Boiss.) Woot. & Standl. var. <i>chaetocalyx</i>	bristlecup sandmat	X				
	<i>Chamaesyce fendleri</i> (Torr. & Gray) Small	Fendler's sandmat	X				
	<i>Chamaesyce polycarpa</i> (Benth.) Millsp. ex Parish	smallseed sandmat					X
	<i>Chamaesyce stictospora</i> (Engelm.) Small	slimseed sandmat	X				
	<i>Croton texensis</i> (Klotzsch) Muell.-Arg.	Texas croton	X	X			
	<i>Euphorbia brachycera</i> Engelm.	horned spurge	X				
	<i>Euphorbia spathulata</i> Lam.	warty spurge					X
	<i>Tragia ramosa</i> Torr.	branched noseburn	X				
Fabaceae	<i>Acacia greggii</i> Gray	catclaw acacia	X	X			X
	<i>Amorpha fruticosa</i> L.	desert false indigo	X	X			
	<i>Astragalus allochrous</i> var. <i>playanus</i> Isely	halfmoon milkvetch	X				
	<i>Astragalus amphioxys</i> Gray	Crescent milkvetch	X				
	<i>Astragalus calycosus</i> Torr. ex S. Wats.	Torrey's milkvetch		X			X
	<i>Astragalus calycosus</i> var. <i>scaposus</i> (Gray) M.E. Jones	Torrey's milkvetch	X				
	<i>Astragalus lentiginosus</i> Dougl. ex Hook.	freckled milkvetch		X			
	<i>Astragalus lentiginosus</i> var. <i>diphysus</i> (Gray) M.E. Jones	freckled milkvetch	X				X
	<i>Astragalus lentiginosus</i> var. <i>palans</i> (M.E. Jones) M.E. Jones	freckled milkvetch	X				
	<i>Astragalus newberryi</i> Gray	Newberry's milkvetch	X	X			
	<i>Astragalus nuttallianus</i> DC.	smallflowered milkvetch	X				X
	<i>Astragalus nuttallianus</i> var. <i>trichocarpus</i> Torr. & Gray	turkeypeas	X				
	<i>Astragalus subcinereus</i> Gray	Silver's milkvetch	X				
	<i>Astragalus tephrodes</i> Gray	ashen milkvetch					X
	<i>Astragalus tephrodes</i> var. <i>brachylobus</i> (Gray) Barneby	ashen milkvetch	X				
	<i>Caesalpinia drepanocarpa</i> (Gray) Fisher	sicklepod holdback	X	X			
	<i>Dalea formosa</i> Torr.	featherplume	X	X			X
	<i>Dalea searlsiae</i> (Gray) Barneby	Searls' prairie clover	X				
	<i>Desmanthus cooleyi</i> (Eat.) Trel.	Cooley's bundleflower	X				
	<i>Lathyrus eucosmus</i> Butters & St. John	bush vetchling					X
	Lotus corniculatus L.	birdfoot deervetch	X				X
	<i>Lotus humistratus</i> Greene	foothill deervetch	X				X
	<i>Lotus mearnsii</i> (Britt.) Greene	Mearns' bird's-foot trefoil	X				
	<i>Lupinus brevicaulis</i> S. Wats.	shortstem lupine	X				
	<i>Lupinus concinnus</i> J.G. Agardh	scarlet lupine					X
	<i>Lupinus sparsiflorus</i> Benth.	Mojave lupine					X
	Medicago lupulina L.	black medick	X	X			
	Medicago minima (L.) L.	burr medick	X	X			
	Medicago polymorpha L.	burclover	X	X			

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Fabaceae	<i>Medicago sativa</i> L.	alfalfa	X	X			
	<i>Melilotus indicus</i> (L.) All.	annual yellow sweetclover	X	X		X	
	<i>Melilotus officinalis</i> (L.) Lam.	yellow sweetclover	X	X	X	X	
	<i>Mimosa aculeaticarpa</i> Ortega	catclaw mimosa					X
	<i>Mimosa aculeaticarpa</i> var. <i>biuncifera</i> (Benth.) Barneby	catclaw mimosa	X	X			
	<i>Phaseolus angustissimus</i> Gray	slimleaf bean	X				
	<i>Prosopis velutina</i> Woot.	velvet mesquite	X	X			X
	<i>Rhynchosia senna</i> var. <i>texana</i> (Torr. & Gray) M.C. Johnston	Texas snoutbean	X				
	<i>Senna bauhinioides</i> (Gray) Irwin & Barneby	twinleaf senna	X	X			X
	<i>Trifolium repens</i> L.	white clover	X	X			
	<i>Vicia ludoviciana</i> Nutt.	Louisiana vetch	X	X			X
Fagaceae	<i>Quercus dunnii</i> Kellogg	Palmer oak	X				
	<i>Quercus turbinella</i> Greene	Sonoran scrub oak	X	X			
Fumariaceae	<i>Corydalis aurea</i> Willd.	scrambled eggs	X				X
	<i>Corydalis curvisiliqua</i> ssp. <i>occidentalis</i> (Engelm. ex Gray) W.A. Weber	curvepod fumewort	X				
Geraniaceae	<i>Erodium cicutarium</i> (L.) L'Hér. ex Ait.	redstem stork's bill	X	X	X	X	X
	<i>Erodium texanum</i> Gray	Texas stork's bill	X				X
Grossulariaceae	<i>Ribes aureum</i> Pursh	golden currant	X				
Hydrophyllaceae	<i>Eucrypta chrysanthemifolia</i> var. <i>bipinnatifida</i> (Torr.) Constance	spotted hideseed	X				
	<i>Eucrypta micrantha</i> (Torr.) Heller	dainty desert hideseed	X				
	<i>Phacelia crenulata</i> Torr. ex S. Wats.	cleftleaf wildheliotrope	X				X
	<i>Phacelia cryptantha</i> Greene	hiddenflower phacelia	X				
	<i>Phacelia distans</i> Benth.	distant phacelia	X				
	<i>Phacelia ivesiana</i> Torr.	Ives' phacelia	X				
	<i>Phacelia rotundifolia</i> Torr. ex S. Wats.	roundleaf phacelia	X				
Juglandaceae	<i>Juglans major</i> (Torr.) Heller	Arizona walnut	X	X			X
Juncaceae	<i>Juncus saximontanus</i> A. Nels.	Rocky Mountain rush	X				
	<i>Juncus torreyi</i> Coville	Torrey's rush	X				
	<i>Juncus xiphioides</i> E. Mey.	irisleaf rush	X				
Krameriaceae	<i>Krameria erecta</i> Willd. ex J.A. Schultes	littleleaf ratany	X	X			X
Lamiaceae	<i>Hedeoma drummondii</i> Benth.	Drummond's false pennyroyal	X				
	<i>Hedeoma nana</i> (Torr.) Briq.	dwarf false pennyroyal	X	X			X
	<i>Hedeoma oblongifolia</i> (Gray) Heller	oblongleaf false pennyroyal	X				X
	<i>Lamium amplexicaule</i> L.	henbit deadnettle					X
	<i>Marrubium vulgare</i> L.	horehound	X	X	X	X	X
	<i>Mentha spicata</i> L.	spearmint	X	X			
Liliaceae	<i>Salvia reflexa</i> Hornem.	lanceleaf sage	X				
	<i>Calochortus flexuosus</i> S. Wats.	winding mariposa lily	X	X			X
	<i>Calochortus nuttallii</i> Torr. & Gray	sego lily	X				
	<i>Dichelostemma capitatum</i> (Benth.) Wood ssp. <i>capitatum</i>	bluedicks	X	X			X
	<i>Dichelostemma capitatum</i> ssp. <i>pauciflorum</i> (Torr.) G. Keator	bluedicks	X				
	<i>Nolina microcarpa</i> S. Wats.	sacahuista	X				
Linaceae	<i>Linum lewisii</i> Pursh	prairie flax	X				
	<i>Linum puberulum</i> (Engelm.) Heller	plains flax	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS	
Loasaceae	<i>Mentzelia albicaulis</i> (Dougl. ex Hook.) Dougl. ex Torr. & Gray	whitestem blazingstar	X					
	<i>Mentzelia multiflora</i> (Nutt.) Gray var. <i>multiflora</i>	Adonis blazingstar	X					
	<i>Mentzelia pumila</i> Nutt. ex Torr. & Gray	dwarf mentzelia		X				
Lythraceae	<i>Lythrum californicum</i> Torr. & Gray	California loosestrife	X					
Malvaceae	<i>Abutilon parvulum</i> Gray	dwarf Indian mallow	X					
	<i>Malva neglecta</i> Wallr.	common mallow	X	X			X	
	<i>Sphaeralcea ambigua</i> Gray	desert globemallow	X	X				
	<i>Sphaeralcea grossulariifolia</i> (Hook. & Arn.) Rydb.	gooseberryleaf globemallow	X					
	<i>Sphaeralcea parvifolia</i> A. Nels.	smallflower globemallow	X				X	
	<i>Sphaeralcea rusbyi</i> Gray	Rusby's globemallow	X					
	Nyctaginaceae	<i>Allionia incarnata</i> L.	trailing windmills	X	X			
<i>Boerhavia coccinea</i> P. Mill.		scarlet spiderling	X		X	X		
<i>Boerhavia coulteri</i> (Hook. f.) S. Wats.		Coulter's spiderling	X					
<i>Boerhavia spicata</i> Choisy		creeping spiderling	X					
<i>Mirabilis multiflora</i> (Torr.) Gray		Colorado four o'clock		X				
<i>Mirabilis multiflora</i> (Torr.) Gray var. <i>multiflora</i>		Colorado four o'clock	X					
<i>Mirabilis pumila</i> (Standl.) Standl.		dwarf four o'clock	X					
Oleaceae	<i>Forestiera pubescens</i> Nutt.	stretchberry	X					
	<i>Forestiera pubescens</i> var. <i>pubescens</i> Nutt.	stretchberry					X	
	<i>Fraxinus velutina</i> Torr.	velvet ash	X	X			X	
	<i>Menodora scabra</i> Gray	rough menodora	X	X				
Onagraceae	<i>Gaura coccinea</i> Nutt. ex Pursh	scarlet beeblossom	X	X			X	
	<i>Gaura hexandra</i> Ortega	harlequinbush		X				
	<i>Gaura hexandra</i> ssp. <i>gracilis</i> (Woot. & Standl.) Raven & Gregory	harlequinbush	X					
	<i>Gaura mollis</i> James	velvetweed	X	X				
	<i>Oenothera albicaulis</i> Pursh	whitest evening-primrose	X				X	
	<i>Oenothera caespitosa</i> Nutt.	tufted evening-primrose	X				X	
	<i>Oenothera caespitosa</i> ssp. <i>marginata</i> (Nutt. ex Hook. & Arn.) Munz	tufted evening-primrose	X					
	<i>Oenothera flava</i> (A. Nels.) Garrett	yellow evening-primrose	X					
	Orchidaceae	<i>Epipactis gigantea</i> Dougl. ex Hook.	stream orchid	X				
	Papaveraceae	<i>Argemone pleiacantha</i> ssp. <i>ambigua</i> G.B. Ownbey	southwestern pricklypoppy	X				
Pedaliaceae		<i>Proboscidea parviflora</i> (Woot.) Woot. & Standl.	doubleclaw	X				
	Pinaceae	<i>Pinus edulis</i> Engelm.	twoneedle pinyon	X				
<i>Pinus monophylla</i> Torr. & Frém.		singleleaf pinyon	X					
Plantaginaceae	<i>Plantago major</i> L.	common plantain	X	X				
	<i>Plantago patagonica</i> Jacq.	woolly plantain	X				X	
	<i>Plantago rhodosperma</i> Dcne.	redseed plantain	X				X	
	<i>Plantago virginica</i> L.	Virginia plantain	X					
Platanaceae	<i>Platanus wrightii</i> S. Wats.	Arizona sycamore	X	X			X	
Poaceae	<i>Achnatherum hymenoides</i> (Roemer & J.A. Schultes) Barkworth	Indian ricegrass	X	X			X	
	<i>Andropogon gerardii</i> Vitman	big bluestem		X				
	<i>Aristida purpurea</i> Nutt.	purple threeawn	X	X			X	

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Poaceae	<i>Aristida ternipes</i> Cav.	spidergrass					X
	<i>Aristida ternipes</i> var. <i>gentilis</i> (Henr.) Allred	spidergrass	X				
	<i>Avena fatua</i> L.	wild oat	X	X	X	X	X
	<i>Avena sativa</i> L.	common oat	X	X	X		
	<i>Bothriochloa barbinodis</i> (Lag.) Herter	cane bluestem	X				X
	<i>Bothriochloa saccharoides</i> (Sw.) Rydb.	silver bluestem	X				
	<i>Bouteloua aristidoides</i> (Kunth) Griseb.	needle grama	X				
	<i>Bouteloua barbata</i> Lag.	sixweeks grama	X				
	<i>Bouteloua curtipendula</i> (Michx.) Torr.	sideoats grama	X	X			X
	<i>Bouteloua eriopoda</i> (Torr.) Torr.	black grama	X	X			X
	<i>Bouteloua gracilis</i> (Willd. ex Kunth) Lag. ex Griffiths	blue grama	X	X			
	<i>Bromus carinatus</i> Hook. & Arn.	California brome	X	X	X		X
	<i>Bromus catharticus</i> Vahl	rescuegrass			X		
	<i>Bromus diandrus</i> Roth	ripgut brome			X		X
	<i>Bromus hordeaceus</i> ssp. <i>hordeaceus</i> L.	soft brome		X			
	<i>Bromus inermis</i> Leyss.	smooth brome		X			
	<i>Bromus rigidus</i> Roth	ripgut brome	X	X		X	
	<i>Bromus rubens</i> L.	red brome	X	X	X	X	X
	<i>Bromus tectorum</i> L.	cheatgrass	X	X	X	X	X
	<i>Cenchrus spinifex</i> Cav.	coastal sandbur	X	X			
	<i>Chloris virgata</i> Sw.	feather fingergrass			X		
	<i>Cynodon dactylon</i> (L.) Pers.	Bermudagrass	X	X	X	X	
	<i>Dasyochloa pulchella</i> (Kunth) Willd. ex Rydb.	low woollygrass	X	X			
	<i>Digitaria sanguinalis</i> (L.) Scop.	hairy crabgrass				X	
	<i>Echinochloa crus-galli</i> (L.) Beauv.	barnyardgrass	X	X	X	X	
	<i>Elymus elymoides</i> ssp. <i>elymoides</i> (Raf.) Swezey	squirreltail	X	X			
	<i>Elymus glaucus</i> Buckl.	blue wildrye	X	X			
	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> (Link) A. & D. Löve	slender wheatgrass	X	X			
	<i>Eragrostis cilianensis</i> (All.) Vign. ex Janchen	stinkgrass	X	X	X		
	<i>Eragrostis curvula</i> (Schrad.) Nees	weeping lovegrass			X		
	<i>Eragrostis lehmanniana</i> Nees	Lehmann lovegrass	X		X		X
	<i>Erioneuron pilosum</i> (Buckl.) Nash	hairy woollygrass	X	X			X
	<i>Hesperostipa neomexicana</i> (Thurb. ex Coult.) Barkworth	New Mexico feathergrass	X	X			X
	<i>Hilaria belangeri</i> (Steud.) Nash	curly-mesquite	X				
	<i>Hordeum jubatum</i> L.	foxtail barley	X	X			
	<i>Hordeum marinum</i> ssp. <i>gussonianum</i> (Parl.) Thellung	Mediterranean barley	X	X			
	<i>Hordeum murinum</i> L.	mouse barley			X		
	<i>Hordeum murinum</i> ssp. <i>glaucum</i> (Steud.) Tzvelev	smooth barley	X	X			X
	<i>Hordeum murinum</i> ssp. <i>leporinum</i> (Link) Arcang.	leporinum barley	X	X			
	<i>Leptochloa panicea</i> ssp. <i>brachiata</i> (Steudl.) N. Snow	mucronate sprangletop	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS	
Poaceae	<i>Muhlenbergia asperifolia</i> (Nees & Meyen ex Trin.) Parodi	scratchgrass	X	X				
	<i>Muhlenbergia porteri</i> Scribn. ex Beal	bush muhly	X	X			X	
	<i>Paspalum distichum</i> L.	knotgrass	X					
	<i>Pleuraphis mutica</i> Buckl.	tobosagrass	X	X			X	
	<i>Poa bigelovii</i> Vasey & Scribn.	Bigelow's bluegrass	X					
	<i>Poa fendleriana</i> (Steud.) Vasey	muttongrass	X				X	
	<i>Poa fendleriana</i> ssp. <i>longiligula</i> (Scribn. & Williams) Soreng	muttongrass					X	
	<i>Polypogon monspeliensis</i> (L.) Desf.	annual rabbitsfoot grass	X	X	X	X		
	<i>Polypogon viridis</i> (Gouan) Breistr.	beardless rabbitsfoot grass	X					
	<i>Schismus barbatus</i> (Loefl. ex L.) Thellung	common Mediterranean grass	X	X		X	X	
	<i>Schizachyrium</i> Nees	little bluestem					X	
	<i>Setaria grisebachii</i> Fourn.	Grisebach's bristlegrass	X					
	<i>Setaria leucopila</i> (Scribn. & Merr.) K. Schum.	streambed bristlegrass	X					
	<i>Setaria viridis</i> (L.) Beauv.	green bristlegrass	X	X		X		
	<i>Setaria vulpiseta</i> (Lam.) Roemer & J.A. Schultes	plains bristlegrass	X					
	<i>Sorghum halepense</i> (L.) Pers.	Johnsongrass	X	X	X	X	X	
	<i>Sporobolus airoides</i> (Torr.) Torr.	alkali sacaton	X	X				
	<i>Sporobolus contractus</i> A.S. Hitchc.	spike dropseed					X	
	<i>Sporobolus cryptandrus</i> (Torr.) Gray	sand dropseed	X	X				
	<i>Tridens muticus</i> (Torr.) Nash	slim tridens	X					
	<i>Urochloa arizonica</i> (Scribn. & Merr.) O. Morrone & F. Zuloaga	Arizona signalgrass	X					
	Polemoniaceae	<i>Eriastrum diffusum</i> (Gray) Mason	miniature woollystar					X
		<i>Eriastrum eremicum</i> (Jepson) Mason	desert woollystar	X				
<i>Gilia flavocincta</i> A. Nels.		lesser yellowthroat gilia	X				X	
<i>Gilia sinuata</i> Dougl. ex Benth.		rosy gilia	X					
<i>Ipomopsis longiflora</i> (Torr.) V. Grant		flaxflowered ipomopsis	X					
<i>Phlox amabilis</i> Brand		Arizona phlox	X					
<i>Phlox speciosa</i> ssp. <i>woodhousei</i> (Torr. ex Gray) Wherry		Woodhouse's phlox	X	X				
Polygalaceae	<i>Polygala rusbyi</i> Greene	Rusby's milkwort	X	X			X	
	<i>Polygala scoparioides</i> Chod.	broom milkwort	X					
	<i>Eriogonum abertianum</i> Torr. var. <i>abertianum</i>	Abert's buckwheat	X					
	<i>Eriogonum deflexum</i> Torr.	flatcrown buckwheat		X				
	<i>Eriogonum deflexum</i> Torr. var. <i>deflexum</i>	flatcrown buckwheat	X					
	<i>Eriogonum inflatum</i> Torr. & Frém.	desert trumpet					X	
	<i>Eriogonum microthecum</i> var. <i>simpsonii</i> (Benth.) Reveal	Simpson's buckwheat	X	X				
	<i>Eriogonum trichopes</i> Torr.	little desertrumpet	X				X	
	<i>Eriogonum wrightii</i> var. <i>wrightii</i> Torr. ex Benth.	bastardsage	X					
	<i>Polygonum aviculare</i> L.	prostrate knotweed	X	X	X	X		
	<i>Polygonum punctatum</i> Ell.	dotted smartweed	X					
	<i>Rumex crispus</i> L.	curly dock	X	X				
	<i>Rumex hymenosepalus</i> Torr.	canaigre dock	X					

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Portulacaceae	<i>Calandrinia ciliata</i> (Ruiz & Pavón) DC.	fringed redmaids	X				
Potamogetonaceae	<i>Potamogeton gramineus</i> L.	variableleaf pondweed	X				
	<i>Potamogeton nodosus</i> Poir.	longleaf pondweed	X				
	<i>Stuckenia pectinatus</i> (L.) Boerner	sago pondweed	X				
Primulaceae	<i>Androsace occidentalis</i> Pursh	western rockjasmine	X				
	<i>Samolus valerandi</i> ssp. <i>parviflorus</i> (Raf.) Hultén	seaside brookweed	X				
Ranunculaceae	<i>Anemone tuberosa</i> Rydb.	tuber anemone	X				X
	<i>Aquilegia chrysantha</i> Gray	golden columbine	X				
	<i>Clematis ligusticifolia</i> Nutt.	western white clematis	X				
	<i>Delphinium scaposum</i> Greene	tall mountain larkspur	X	X			
Rhamnaceae	<i>Frangula californica</i> ssp. <i>californica</i> (Eschsch.) Gray	California buckthorn		X			
	<i>Frangula californica</i> ssp. <i>ursina</i> (Greene) Kartesz & Gandhi	California buckthorn	X				
	<i>Ziziphus obtusifolia</i> (Hook. ex Torr. & Gray) Gray	lotebush		X			X
	<i>Ziziphus obtusifolia</i> var. <i>canescens</i> (Gray) M.C. Johnston	lotebush	X				
Rosaceae	<i>Purshia stansburiana</i> (Torr.) Henrickson	Stansbury cliffrose	X	X			X
	<i>Rubus arizonensis</i> Focke	Arizona dewberry	X				
Rubiaceae	<i>Galium aparine</i> L.	stickywilly	X	X			
	<i>Galium microphyllum</i> Gray	bracted bedstraw	X				
	<i>Galium proliferum</i> Gray	limestone bedstraw	X				X
Rutaceae	<i>Ptelea trifoliata</i> L.	common hoptree					X
	<i>Ptelea trifoliata</i> ssp. <i>pallida</i> (Greene) V. Bailey	pallid hoptree	X				
	<i>Thamnosma texana</i> (Gray) Torr.	rue of the mountains	X	X			
Salicaceae	<i>Salix amygdaloides</i> Anderss.	peachleaf willow	X				
	<i>Salix bonplandiana</i> Kunth	Bonpland willow	X				
	<i>Salix exigua</i> Nutt.	narrowleaf willow		X			
	<i>Salix gooddingii</i> Ball	Goodding's willow	X	X			
Sapindaceae	<i>Sapindus saponaria</i> L.	wingleaf soapberry		X			
	<i>Sapindus saponaria</i> var. <i>drummondii</i> (Hook. & Arn.) L. Benson	western soapberry	X				
Scrophulariaceae	<i>Castilleja applegatei</i> ssp. <i>martinii</i> (Abrams) Chuang & Heckard	wavyleaf Indian paintbrush	X	X			X
	<i>Castilleja integra</i> Gray	wholeleaf Indian paintbrush	X				
	<i>Cordylanthus laxiflorus</i> Gray	nodding bird's-beak	X				
	<i>Linaria dalmatica</i> (L.) P. Mill.	Dalmatian toadflax	X	X		X	X
	<i>Maurandella antirrhiniflora</i> (Humb. & Bonpl. ex Willd.) Rothm.	roving sailor	X	X			
	<i>Mimulus guttatus</i> DC.	seep monkeyflower	X				
	<i>Mimulus rubellus</i> Gray	little redstem monkeyflower	X				
	<i>Penstemon eatonii</i> ssp. <i>undosus</i> (M.E. Jones) Keck	Eaton's penstemon	X				
	<i>Penstemon pseudospectabilis</i> M.E. Jones	desert penstemon		X			
	<i>Penstemon pseudospectabilis</i> ssp. <i>connatifolius</i> (A. Nels.) Keck	desert beardtongue	X				X
	<i>Penstemon thompsoniae</i> (Gray) Rydb.	Thompson's beardtongue	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Scrophulariaceae	<i>Stemodia durantifolia</i> (L.) Sw.	whitewoolly twintip	X				
	<i>Verbascum thapsus</i> L.	common mullein			X	X	X
	<i>Veronica anagallis-aquatica</i> L.	water speedwell	X				X
Simaroubaceae	<i>Ailanthus altissima</i> (P. Mill.) Swingle	tree of heaven	X	X			
Solanaceae	<i>Calibrachoa parviflora</i> (Juss.) D'Arcy	seaside petunia	X				
	<i>Chamaesaracha coronopus</i> (Dunal) Gray	greenleaf five eyes	X				X
	<i>Datura wrightii</i> Regel	sacred thorn-apple	X				
	<i>Lycium pallidum</i> Miers	pale desert-thorn	X	X			X
	<i>Nicotiana attenuata</i> Torr. ex S. Wats.	coyote tobacco	X				
	<i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> Mertens & Galeotti	desert tobacco		X			
	<i>Nicotiana trigonophylla</i> var. <i>trigonophylla</i> Dunal	desert tobacco	X				
	<i>Physalis acutifolia</i> (Miers) Sandw.	sharpleaf groundcherry	X	X			
	<i>Physalis hederifolia</i> var. <i>fendleri</i> (Gray) Cronq.	Fendler's groundcherry	X				
	<i>Solanum douglasii</i> Dunal	greenspot nightshade	X				
	<i>Solanum elaeagnifolium</i> Cav.	silverleaf nightshade	X	X			
	Tamaricaceae	<i>Tamarix ramosissima</i> Ledeb.	saltcedar	X	X		
Ulmaceae	<i>Celtis laevigata</i> var. <i>reticulata</i> (Torr.) L. Benson	netleaf hackberry	X	X			X
	<i>Parietaria hespera</i> Hinton	rillita pellitory					X
Verbenaceae	<i>Aloysia wrightii</i> Heller ex Abrams	Wright's beebrush	X	X			
	<i>Glandularia gooddingii</i> (Briq.) Solbrig	southwestern mock vervain	X				
	<i>Glandularia wrightii</i> (Gray) Umber	Davis Mountain mock vervain	X				
	<i>Tetradlea coulteri</i> Gray	Coulter's wrinklefruit	X	X			
Violaceae	<i>Hybanthus verticillatus</i> (Ortega) Baill.	babyslippers	X	X			
Viscaceae	<i>Phoradendron tomentosum</i> (DC.) Engelm. ex Gray	Christmas mistletoe	X	X			
	<i>Vitis arizonica</i> Engelm.	canyon grape	X	X			
Zannichelliaceae	<i>Zannichellia palustris</i> L.	horned pondweed	X				
Zygophyllaceae	<i>Kallstroemia californica</i> (S. Wats.) Vail	California caltrop	X				
	<i>Kallstroemia parviflora</i> J.B.S. Norton	warty caltrop	X				
	<i>Larrea tridentata</i> (Sessé & Moc. ex DC.) Coville	creosote bush	X				X
	<i>Larrea tridentata</i> var. <i>tridentata</i> (Sessé & Moc. ex DC.) Coville	creosote bush		X			
	<i>Tribulus terrestris</i> L.	puncturevine	X	X			

Appendix B. Plant species observed or collected at Montezuma Castle NM, Well unit. Based on Brian and Rowlands (B&R; 1994), Rowlands (Row; 1999), Halvorson and Guertin (H&G; 2003), Mau-Crimmins et al. (Mau; 2004), and NPS (unpublished data). Species in bold-faced type are non-native.

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Agavaceae	<i>Yucca elata</i> (Engelm.) Engelm.	soaptree yucca		X			X
	<i>Yucca elata</i> var. <i>verdiensis</i> (McKelvey) Reveal	Verdi yucca	X				
Anacardiaceae	<i>Rhus aromatica</i> Ait.	fragrant sumac					X
	<i>Rhus trilobata</i> Nutt.	skunkbush sumac	X	X			
	<i>Toxicodendron rydbergii</i> (Small ex Rydb.) Greene	western poison ivy	X				
Apiaceae	<i>Berula erecta</i> (Huds.) Coville	cutleaf waterparsnip	X				
	<i>Cymopterus multineratus</i> (Coul. & Rose) Tidestrom	purpleneve springparsley	X				
	<i>Daucus pusillus</i> Michx.	American wild carrot	X				
	<i>Hydrocotyle verticillata</i> Thunb.	whorled marshpennywort	X				
Apocynaceae	<i>Apocynum cannabinum</i> L.	Indianhemp	X				
Asclepiadaceae	<i>Funastrum cynanchoides</i> ssp. <i>cynanchoides</i> (Dcne.) Schlechter	fringed twinevine	X	X			
	Asteraceae	<i>Acourtia wrightii</i> (Gray) Reveal & King	brownfoot	X	X		X
	<i>Ambrosia confertiflora</i> DC.	weakleaf burr ragweed	X				
	<i>Ambrosia psilostachya</i> DC.	Cuman ragweed	X				
	<i>Artemisia carruthii</i> Wood ex Carruth.	Carruth's sagewort	X				
	<i>Artemisia ludoviciana</i> Nutt.	white sagebrush	X	X			X
	<i>Aster</i> L.	aster					X
	<i>Baccharis emoryi</i> Gray	Emory's baccharis	X				X
	<i>Baccharis salicifolia</i> (Ruiz & Pavón) Pers.	mule's fat	X	X			
	<i>Baccharis sarothroides</i> Gray	desertbroom	X				
	<i>Bahia dissecta</i> (Gray) Britt.	ragleaf bahia	X				
	<i>Baileya pleniradiata</i> Harvey & Gray ex Gray	woolly desert marigold	X				
	<i>Bidens laevis</i> (L.) B.S.P.	smooth beggartick	X				
	<i>Brickellia atractyloides</i> Gray	spearleaf brickellbush	X	X			
	<i>Brickellia californica</i> (Torr. & Gray) Gray	California brickellbush	X	X			
	<i>Brickellia floribunda</i> Gray	Chihuahuan brickellbush	X				
	<i>Centaurea melitensis</i> L.	Maltese star-thistle	X	X	X	X	
	<i>Centaurea solstitialis</i> L.	yellow star-thistle				X	
	<i>Chaetopappa ericoides</i> (Torr.) Nesom	rose heath	X	X			
	<i>Chloracantha spinosa</i> (Benth.) Nesom	spiny chloracantha	X				
	<i>Cichorium intybus</i> L.	chicory	X	X			
	<i>Cirsium arizonicum</i> (Gray) Petrak	Arizona thistle	X				
	<i>Conyza canadensis</i> (L.) Cronq.	Canadian horseweed	X			X	
	<i>Encelia farinosa</i> Gray ex Torr.	goldenhills					X
	<i>Encelia frutescens</i> (Gray) Gray	button brittlebush	X				X
	<i>Encelia virginensis</i> A. Nels.	Virgin River brittlebush	X				
	<i>Erigeron concinnus</i> (Hook. & Arn.) Torr. & Gray	Navajo fleabane	X	X			
	<i>Erigeron divergens</i> Torr. & Gray	spreading fleabane	X				X
	<i>Gaillardia pinnatifida</i> Torr.	red dome blanketflower	X				
	<i>Gutierrezia microcephala</i> (DC.) Gray	threadleaf snakeweed	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Asteraceae	<i>Gutierrezia sarothrae</i> (Pursh) Britt. & Rusby	broom snakeweed	X	X			X
	<i>Helianthus annuus</i> L.	common sunflower	X		X	X	
	<i>Heterotheca subaxillaris</i> (Lam.) Britt. & Rusby	camphorweed		X		X	
	<i>Heterotheca villosa</i> (Pursh) Shinnars	hairy false goldenaster	X				
	<i>Hymenoclea monogyra</i> Torr. & Gray ex Gray	singlewhorl burrobrush	X	X			
	<i>Hymenothrix loomisii</i> Blake	Loomis' thimblehead	X				
	<i>Lactuca saligna</i> L.	willowleaf lettuce	X				
	<i>Lactuca serriola</i> L.	prickly lettuce	X		X	X	
	<i>Melampodium leucanthum</i> Torr. & Gray	plains blackfoot	X	X			
	<i>Packera neomexicana</i> var. <i>neomexicana</i> (Gray) W.A. Weber & A. Löve	New Mexico groundsel	X				
	<i>Parthenium incanum</i> Kunth	mariola	X	X			X
	<i>Senecio flaccidus</i> var. <i>flaccidus</i> Less.	threadleaf ragwort	X	X			
	<i>Solidago canadensis</i> var. <i>scabra</i> Torr. & Gray	Canada goldenrod	X				
	<i>Solidago velutina</i> DC.	threenerve goldenrod	X				
	<i>Solidago wrightii</i> Gray	Wright's goldenrod	X	X			
	<i>Sonchus asper</i> (L.) Hill	spiny sowthistle	X	X			
	<i>Stephanomeria minor</i> var. <i>minor</i> (Hook.) Nutt.	narrowleaf wirelettuce	X				
	<i>Stephanomeria pauciflora</i> (Torr.) A. Nels.	brownplume wirelettuce		X			
	<i>Symphotrichum divaricatum</i> (Nutt.) Nesom	southern annual saltmarsh aster	X				
	<i>Symphotrichum falcatum</i> var. <i>falcatum</i> (Lindl.) Nesom	white prairie aster	X				
	<i>Symphotrichum praealtum</i> var. <i>praealtum</i> (Poir.) Nesom	willowleaf aster	X				
	<i>Taraxacum laevigatum</i> (Willd.) DC.	rock dandelion			X		
	<i>Taraxacum officinale</i> G.H. Weber ex Wiggers	common dandelion	X				
	<i>Tragopogon dubius</i> Scop.	yellow salsify	X	X			
	<i>Uropappus lindleyi</i> (DC.) Nutt.	Lindley's silverpuffs	X				X
	<i>Verbesina encelioides</i> ssp. <i>exauriculata</i> (Robins. & Greenm.) J.R. Coleman	golden crownbeard	X				
	<i>Xanthium strumarium</i> L.	rough cocklebur	X		X	X	
Berberidaceae	<i>Mahonia haematocarpa</i> (Woot.) Fedde	red barberry	X	X			X
Betulaceae	<i>Alnus oblongifolia</i> Torr.	Arizona alder	X	X			X
Bignoniaceae	<i>Chilopsis linearis</i> (Cav.) Sweet	desert willow		X			
	<i>Chilopsis linearis</i> ssp. <i>arcuata</i> (Fosberg) Henrickson	desert willow	X				
Boraginaceae	<i>Amsinckia menziesii</i> (Lehm.) A. Nels. & J.F. Macbr.	Menzies' fiddleneck					X
	<i>Cryptantha</i> Lehm. ex G. Don	cryptantha					X
Boraginaceae	<i>Lappula occidentalis</i> var. <i>cupulata</i> (Gray) Higgins	flatspine stickseed	X				
	<i>Lappula occidentalis</i> var. <i>occidentalis</i> (S. Wats.) Greene	flatspine stickseed	X				X
	<i>Lithospermum incisum</i> Lehm.	narrowleaf stoneseed	X	X			
Brassicaceae	<i>Brassica tournefortii</i> Gouan	Asian mustard				X	

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Brassicaceae	<i>Capsella bursa-pastoris</i> (L.) Medik.	shepherd's purse	X	X			
	<i>Descurainia pinnata</i> (Walt.) Britt.	western tansymustard	X				X
	<i>Descurainia sophia</i> (L.) Webb ex Prantl	herb sophia	X	X	X		
	<i>Draba cuneifolia</i> Nutt. ex Torr. & Gray	wedgeleaf draba	X				
	<i>Lepidium lasiocarpum</i> Nutt.	shaggyfruit pepperweed	X				X
	<i>Lesquerella arizonica</i> S. Wats.	Arizona bladderpod	X				
	<i>Lesquerella gordonii</i> (Gray) S. Wats.	Gordon's bladderpod	X				
	<i>Lesquerella tenella</i> A. Nels.	Moapa bladderpod					X
	<i>Rorippa nasturtium-aquaticum</i> (L.) Hayek	watercress	X	X			
	<i>Sisymbrium irio</i> L.	London rocket	X	X	X	X	X
Cactaceae	<i>Streptanthus carinatus</i> ssp. <i>arizonicus</i> (S. Wats.) Kruckeberg, Rodman & Worthington	lyreleaf jewelflower	X				
	<i>Echinocereus fendleri</i> var. <i>boyce-thompsonii</i> (Orcutt) L. Benson	Boyce Thompson hedgehog cactus	X				
	<i>Echinocereus fendleri</i> var. <i>fasciculatus</i> (Engelm. ex B.D. Jackson) N.P. Taylor	pinkflower hedgehog cactus					X
	<i>Escobaria vivipara</i> var. <i>arizonica</i> (Engelm.) D.R. Hunt	Arizona spinystar	X	X			
	<i>Escobaria vivipara</i> var. <i>vivipara</i> (Nutt.) Buxbaum	spinystar					X
	<i>Opuntia engelmannii</i> Salm-Dyck var. <i>engelmannii</i>	cactus apple	X				
	<i>Opuntia leptocaulis</i> DC.	Christmas cactus	X				X
	<i>Opuntia macrocentra</i> var. <i>macrocentra</i> Engelm.	purple pricklypear	X	X			
	<i>Opuntia macrorhiza</i> Engelm.	twistspine pricklypear					X
	<i>Opuntia macrorhiza</i> Engelm. var. <i>macrorhiza</i>	twistspine pricklypear			X		
Campanulaceae	<i>Opuntia phaeacantha</i> Engelm.	tulip pricklypear			X		X
	<i>Opuntia phaeacantha</i> var. <i>major</i> Engelm.	Mojave pricklypear	X				
Capparaceae	<i>Lobelia cardinalis</i> L.	cardinalflower	X				
	<i>Cleome lutea</i> var. <i>jonesii</i> J.F. Macbr.	Jones spiderflower	X				
Caryophyllaceae	<i>Polanisia dodecandra</i> ssp. <i>trachysperma</i> (Torr. & Gray) Iltis	sandyseed clammyweed	X				
	<i>Silene antirrhina</i> L.	sleepy silene					X
Celastraceae	<i>Canotia holacantha</i> Torr.	crucifixion thorn	X				
Chenopodiaceae	<i>Atriplex canescens</i> (Pursh) Nutt.	fourwing saltbush	X	X			
	<i>Chenopodium berlandieri</i> var. <i>sinuatum</i> (J. Murr) H.A. Wahl	pitseed goosefoot	X				
	<i>Chenopodium fremontii</i> S. Wats.	Fremont's goosefoot	X				
	<i>Krascheninnikovia lanata</i> (Pursh) A.D.J. Meeuse & Smit	winterfat	X	X			
	<i>Salsola tragus</i> L.	prickly Russian thistle	X	X			
	<i>Convolvulus arvensis</i> L.	field bindweed	X	X			X
Convolvulaceae	<i>Convolvulus equitans</i> Benth.	Texas bindweed	X				
	<i>Ipomoea hederacea</i> Jacq.	ivyleaf morning-glory	X	X			
Cucurbitaceae	<i>Cucurbita foetidissima</i> Kunth	Missouri gourd	X	X			
Cupressaceae	<i>Juniperus coahuilensis</i> (Martinez) Gaussen ex R.P. Adams	redberry juniper	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS	
Cupressaceae	<i>Juniperus monosperma</i> (Engelm.) Sarg.	oneseed juniper	X	X			X	
	<i>Juniperus osteosperma</i> (Torr.) Little	Utah juniper	X	X			X	
Cyperaceae	Cyperus esculentus L.	chufa flatsedge	X		X	X		
	<i>Cyperus niger</i> Ruiz & Pavón	black flatsedge	X					
	<i>Eleocharis parishii</i> Britt.	Parish's spikerush	X					
	<i>Eleocharis rostellata</i> (Torr.) Torr.	beaked spikerush	X					
	<i>Schoenoplectus tabernaemontani</i> (K.C. Gmel.) Palla	softstem bulrush	X					
	Ephedraceae	<i>Ephedra viridis</i> Coville	mormon tea	X	X			X
Equisetaceae	<i>Equisetum hyemale</i> var. <i>affine</i> (Engelm.) A.A. Eat.	scouringrush horsetail	X					
	Euphorbiaceae	<i>Acalypha neomexicana</i> Muell.-Arg.	New Mexico copperleaf	X				
<i>Chamaesyce albomarginata</i> (Torr. & Gray) Small		whitemargin sandmat	X					
<i>Chamaesyce capitellata</i> (Engelm.) Millsp.		head sandmat	X					
<i>Chamaesyce chaetocalyx</i> (Boiss.) Woot. & Standl. var. <i>chaetocalyx</i>		bristlecup sandmat	X					
<i>Chamaesyce fendleri</i> (Torr. & Gray) Small		Fendler's sandmat	X					
<i>Chamaesyce maculata</i> (L.) Small		spotted sandmat	X					
<i>Chamaesyce serpyllifolia</i> ssp. <i>serpyllifolia</i> (Pers.) Small		thymeleaf sandmat	X					
<i>Euphorbia brachycera</i> Engelm.		horned spurge	X					
<i>Tragia ramosa</i> Torr.		branched noseburn	X					
Fabaceae		<i>Acacia greggii</i> Gray	catclaw acacia	X	X			X
		<i>Amorpha fruticosa</i> L.	desert false indigo	X	X			
		<i>Astragalus calycosus</i> Torr. ex S. Wats.	Torrey's milkvetch		X			X
		<i>Astragalus calycosus</i> var. <i>scaposus</i> (Gray) M.E. Jones	Torrey's milkvetch	X				X
	<i>Astragalus lentiginosus</i> Dougl. ex Hook.	freckled milkvetch		X				
	<i>Astragalus lentiginosus</i> var. <i>diphysus</i> (Gray) M.E. Jones	freckled milkvetch	X					
	<i>Astragalus lentiginosus</i> var. <i>palans</i> (M.E. Jones) M.E. Jones	freckled milkvetch	X					
	<i>Astragalus nuttallianus</i> DC.	smallflowered milkvetch	X				X	
	<i>Astragalus tephrodes</i> var. <i>brachylobus</i> (Gray) Barneby	ashen milkvetch	X					
	<i>Caesalpinia drepanocarpa</i> (Gray) Fisher	sicklepod holdback	X	X				
	<i>Calliandra humilis</i> Benth.	dwarf stickpea					X	
	Fabaceae	<i>Dalea formosa</i> Torr.	featherplume	X	X			
		<i>Desmanthus cooleyi</i> (Eat.) Trel.	Cooley's bundleflower	X				
		<i>Hoffmannseggia glauca</i> (Ortega) Eifert	Indian rushpea	X				
		Lotus corniculatus L.	birdfoot deervetch	X	X			
<i>Lotus meansii</i> (Britt.) Greene		Mearns' bird's-foot trefoil	X					
<i>Lupinus brevicaulis</i> S. Wats.		shortstem lupine	X					
Medicago polymorpha L.		burclover	X	X				
Medicago sativa L.		alfalfa	X	X				
Melilotus indicus (L.) All.		annual yellow sweetclover	X	X	X	X		
Melilotus officinalis (L.) Lam.		yellow sweetclover	X	X	X	X		
<i>Mimosa aculeaticarpa</i> Ortega		catclaw mimosa					X	

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Fabaceae	<i>Mimosa aculeaticarpa</i> var. <i>biuncifera</i>						
	(Benth.) Barneby	catclaw mimosa	X	X			
	<i>Phaseolus angustissimus</i> Gray	slimleaf bean	X	X			
	<i>Prosopis velutina</i> Woot.	velvet mesquite	X	X			X
	<i>Senna bauhinioides</i> (Gray) Irwin & Barneby	twinleaf senna	X				
	<i>Vicia ludoviciana</i> Nutt.	Louisiana vetch	X				
Fagaceae	<i>Quercus turbinella</i> Greene	Sonoran scrub oak	X	X			
Fumariaceae	<i>Corydalis aurea</i> Willd.	scrambled eggs	X				X
	<i>Corydalis curvisiliqua</i> ssp. <i>occidentalis</i> (Engelm. ex Gray) W.A. Weber	curvepod fumewort	X				
Geraniaceae	<i>Erodium cicutarium</i> (L.) L'Hér. ex Ait.	redstem stork's bill	X	X	X	X	X
	<i>Erodium texanum</i> Gray	Texas stork's bill	X				X
Grossulariaceae	<i>Ribes aureum</i> Pursh	golden currant	X				
Hydrophyllaceae	<i>Eucrypta chrysanthemifolia</i> var. <i>bipinnatifida</i> (Torr.) Constance	spotted hideseed	X				
	<i>Eucrypta micrantha</i> (Torr.) Heller	dainty desert hideseed	X				
	<i>Phacelia crenulata</i> Torr. ex S. Wats.	cleftleaf wildheliotrope	X				
	<i>Phacelia rotundifolia</i> Torr. ex S. Wats.	roundleaf phacelia	X				
Juglandaceae	<i>Juglans major</i> (Torr.) Heller	Arizona walnut	X	X			
Juncaceae	<i>Juncus xiphioides</i> E. Mey.	irisleaf rush	X				
Krameriaceae	<i>Krameria erecta</i> Willd. ex J.A. Schultes	littleleaf ratany	X	X			X
Lamiaceae	<i>Hedeoma drummondii</i> Benth.	Drummond's false pennyroyal	X				
	<i>Lamium amplexicaule</i> L.	henbit deadnettle					X
	<i>Marrubium vulgare</i> L.	horehound	X	X	X	X	X
	<i>Mentha spicata</i> L.	spearmint	X	X			
	<i>Salvia reflexa</i> Hornem.	lanceleaf sage	X				
Liliaceae	<i>Calochortus flexuosus</i> S. Wats.	winding mariposa lily	X				
	<i>Dichelostemma capitatum</i> (Benth.) Wood ssp. <i>capitatum</i>	bluedicks	X				X
Linaceae	<i>Linum lewisii</i> Pursh	prairie flax	X				
	<i>Linum puberulum</i> (Engelm.) Heller	plains flax	X				
Loasaceae	<i>Mentzelia multiflora</i> (Nutt.) Gray var. <i>multiflora</i>	Adonis blazingstar	X				
Lythraceae	<i>Lythrum californicum</i> Torr. & Gray	California loosestrife	X	X			
Malvaceae	<i>Abutilon parvulum</i> Gray	dwarf Indian mallow	X				
	<i>Malva neglecta</i> Wallr.	common mallow	X	X			
	<i>Malva parviflora</i> L.	cheeseweed mallow			X		
	<i>Sida abutilifolia</i> P. Mill.	spreading fanpetals	X				
	<i>Sphaeralcea ambigua</i> Gray	desert globemallow	X	X			
	<i>Sphaeralcea grossulariifolia</i> (Hook. & Arn.) Rydb.	gooseberryleaf globemallow	X				
	<i>Sphaeralcea parvifolia</i> A. Nels.	smallflower globemallow	X				
	<i>Sphaeralcea rusbyi</i> Gray	Rusby's globemallow	X				
Moraceae	<i>Morus microphylla</i> Buckl.	Texas mulberry	X				
Nyctaginaceae	<i>Allionia incarnata</i> L.	trailing windmills	X	X			
	<i>Boerhavia coccinea</i> P. Mill.	scarlet spiderling	X		X	X	
	<i>Boerhavia erecta</i> L.	erect spiderling	X				
	<i>Mirabilis bigelovii</i> Gray	wishbone-bush	X				
	<i>Mirabilis multiflora</i> (Torr.) Gray	Colorado four o'clock		X			
	<i>Mirabilis multiflora</i> (Torr.) Gray var. <i>multiflora</i>	Colorado four o'clock	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Nyctaginaceae	<i>Mirabilis pumila</i> (Standl.) Standl.	dwarf four o'clock		X			
Oleaceae	<i>Fraxinus velutina</i> Torr.	velvet ash	X	X			X
	<i>Menodora scabra</i> Gray	rough menodora	X	X			
Onagraceae	<i>Gaura coccinea</i> Nutt. ex Pursh	scarlet beeblossom	X				
	<i>Gaura mollis</i> James	velvetweed	X				
	<i>Oenothera albicaulis</i> Pursh	whitest evening-primrose	X				X
	<i>Oenothera caespitosa</i> ssp. <i>marginata</i> (Nutt. ex Hook. & Arn.) Munz	tufted evening-primrose	X				
	<i>Oenothera elata</i> ssp. <i>hirsutissima</i> (Gray ex S. Wats.) W. Dietr.	Hooker's evening-primrose	X				
Orchidaceae	<i>Epipactis gigantea</i> Dougl. ex Hook.	stream orchid	X				
Papaveraceae	<i>Argemone polyanthemus</i> (Fedde) G.B. Ownbey	crested pricklypoppy	X	X			
Plantaginaceae	<i>Plantago lanceolata</i> L.	narrowleaf plantain	X	X			X
	<i>Plantago major</i> L.	common plantain	X	X			
	<i>Plantago patagonica</i> Jacq.	woolly plantain	X				
Platanaceae	<i>Platanus wrightii</i> S. Wats.	Arizona sycamore	X	X			X
Poaceae	<i>Agrostis stolonifera</i> L.	creeping bentgrass	X	X			
	<i>Aristida pansa</i> Woot. & Standl.	Wooton's threeawn					X
	<i>Aristida purpurea</i> Nutt.	purple threeawn	X	X			X
	<i>Aristida purpurea</i> var. <i>longiseta</i> (Steud.) Vasey	Fendler threeawn	X				
	<i>Aristida purpurea</i> var. <i>nealleyi</i> (Vasey) Allred	blue threeawn	X				
	<i>Aristida ternipes</i> Cav.	spidergrass	X				
	<i>Avena fatua</i> L.	wild oat	X	X	X	X	
	<i>Bothriochloa barbinodis</i> (Lag.) Herter	cane bluestem	X				
	<i>Bouteloua aristidoides</i> (Kunth) Griseb.	needle grama	X				
	<i>Bouteloua curtipendula</i> (Michx.) Torr.	sideoats grama	X	X			
	<i>Bouteloua eriopoda</i> (Torr.) Torr.	black grama	X	X			X
	<i>Bromus anomalus</i> Rupr. ex Fourn.	nodding brome	X				
	<i>Bromus carinatus</i> Hook. & Arn.	California brome			X		
	<i>Bromus catharticus</i> Vahl	rescuegrass			X		
	<i>Bromus diandrus</i> Roth	rippgut brome			X		X
	<i>Bromus inermis</i> Leyss.	smooth brome	X				
	<i>Bromus rigidus</i> Roth	rippgut brome	X	X		X	
	<i>Bromus rubens</i> L.	red brome	X	X	X	X	X
	<i>Bromus tectorum</i> L.	cheatgrass	X	X	X	X	
	<i>Cenchrus spinifex</i> Cav.	coastal sandbur	X				
	<i>Chloris virgata</i> Sw.	feather fingergrass			X		
	<i>Cynodon dactylon</i> (L.) Pers.	Bermudagrass	X	X	X	X	X
	<i>Digitaria californica</i> (Benth.) Henr.	Arizona cottontop					X
	<i>Digitaria sanguinalis</i> (L.) Scop.	hairy crabgrass				X	
	<i>Echinochloa colona</i> (L.) Link	jungle rice			X		
	<i>Echinochloa crus-galli</i> (L.) Beauv.	barnyardgrass		X	X	X	
	<i>Elymus elymoides</i> ssp. <i>elymoides</i> (Raf.) Swezey	squirreltail	X	X			
	<i>Elymus glaucus</i> Buckl.	blue wildrye	X				
	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i> (Link) A. & D. Löve	slender wheatgrass	X				
	<i>Enneapogon desvauxii</i> Desv. ex Beauv.	nineawn pappusgrass	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Poaceae	Eragrostis cilianensis (All.) Vign. ex Janchen	stinkgrass	X	X			
	Eragrostis curvula (Schrad.) Nees	weeping lovegrass			X	X	
	Eragrostis lehmanniana Nees	Lehmann lovegrass	X	X	X		
	<i>Erioneuron pilosum</i> (Buckl.) Nash	hairy woollygrass	X				
	<i>Hesperostipa comata</i> (Trin. & Rupr.) ssp. <i>comata</i>	needle and thread	X				
	<i>Hesperostipa neomexicana</i> (Thurb. ex Coult.) Barkworth	New Mexico feathergrass	X	X			
	<i>Hilaria belangeri</i> (Steud.) Nash	curly-mesquite					X
	Hordeum marinum ssp. gussonianum (Parl.) Thellung	Mediterranean barley	X	X			
	Hordeum murinum L.	mouse barley	X		X		
	Hordeum murinum ssp. leporinum (Link) Arcang.	leporinum barley	X	X			
	Lolium arundinaceum (Schreb.) S.J. Darbyshire	tall fescue	X	X			
	Lolium pratense (Huds.) S.J. Darbyshire	meadow ryegrass	X	X			
	<i>Muhlenbergia asperifolia</i> (Nees & Meyen ex Trin.) Parodi	scratchgrass	X				
	<i>Muhlenbergia porteri</i> Scribn. ex Beal	bush muhly	X	X			X
	<i>Muhlenbergia repens</i> (J. Presl) A.S. Hitchc.	creeping muhly	X				
	<i>Muhlenbergia rigens</i> (Benth.) A.S. Hitchc.	deergass	X				
	<i>Panicum obtusum</i> Kunth	vine mesquite	X				
	<i>Panicum virgatum</i> L.	switchgrass	X				
	<i>Pascopyrum smithii</i> (Rydb.) A. Löve	western wheatgrass	X	X			
	Paspalum dilatatum Poir.	dallisgrass	X	X			
	Pennisetum glaucum (L.) R. Br.	pearl millet	X	X			
	<i>Pleuraphis mutica</i> Buckl.	tobosagrass	X	X			X
	<i>Poa bigelovii</i> Vasey & Scribn.	Bigelow's bluegrass	X				
	<i>Poa fendleriana</i> (Steud.) Vasey	muttongrass	X				
	Polypogon monspeliensis (L.) Desf.	annual rabbitsfoot grass	X	X	X	X	
	Polypogon viridis (Gouan) Breistr.	beardless rabbitsfoot grass	X				
	<i>Pseudoroegneria spicata</i> (Pursh) A. Löve ssp. <i>spicata</i>	bluebunch wheatgrass	X				
	Schismus barbatus (Loefl. ex L.) Thellung	common Mediterranean grass				X	
	<i>Schizachyrium</i> Nees	little bluestem					X
	<i>Setaria leucopila</i> (Scribn. & Merr.) K. Schum.	streambed bristlegrass	X				
	<i>Setaria parviflora</i> (Poir.) Kerguélen	marsh bristlegrass	X	X			
	Setaria viridis (L.) Beauv.	green bristlegrass				X	
	<i>Setaria vulpiseta</i> (Lam.) Roemer & J.A. Schultes	plains bristlegrass	X				
	Sorghum halepense (L.) Pers.	Johnsongrass	X	X	X	X	
	<i>Sporobolus contractus</i> A.S. Hitchc.	spike dropseed	X				X
	<i>Sporobolus cryptandrus</i> (Torr.) Gray	sand dropseed	X	X			X
	<i>Tridens muticus</i> (Torr.) Nash	slim tridens	X	X			
	<i>Tridens muticus</i> var. <i>elongatus</i> (Buckl.) Shinnars	slim tridens	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Polemoniaceae	<i>Eriastrum eremicum</i> (Jepson) Mason	desert woollystar	X				
	<i>Gilia sinuata</i> Dougl. ex Benth.	rosy gilia	X				
	<i>Ipomopsis longiflora</i> (Torr.) V. Grant	flaxflowered ipomopsis	X				
	<i>Phlox speciosa</i> ssp. <i>woodhousei</i> (Torr. ex Gray) Wherry	Woodhouse's phlox	X				
Polygalaceae	<i>Polygala rusbyi</i> Greene	Rusby's milkwort	X				
	<i>Polygala scoparioides</i> Chod.	broom milkwort	X				
Polygonaceae	<i>Eriogonum abertianum</i> Torr. var. <i>abertianum</i>	Abert's buckwheat	X				
	<i>Eriogonum microthecum</i> var. <i>simpsonii</i> (Benth.) Reveal	Simpson's buckwheat	X	X			
	<i>Eriogonum wrightii</i> Torr. ex Benth.	bastardsage		X			
	<i>Eriogonum wrightii</i> var. <i>wrightii</i> Torr. ex Benth.	bastardsage	X				
	<i>Polygonum aviculare</i> L.	prostrate knotweed			X		
	<i>Polygonum punctatum</i> Ell.	dotted smartweed	X				
	<i>Rumex crispus</i> L.	curly dock	X	X			X
	<i>Rumex hymenosepalus</i> Torr.	canaigre dock	X				
Portulacaceae	<i>Claytonia perfoliata</i> ssp. <i>perfoliata</i> Donn ex Willd.	miner's lettuce	X				
Potamogetonaceae	<i>Potamogeton gramineus</i> L.	variableleaf pondweed	X				
	<i>Potamogeton nodosus</i> Poir.	longleaf pondweed	X				
	<i>Stuckenia pectinatus</i> (L.) Boerner	sago pondweed	X				
Primulaceae	<i>Samolus valerandi</i> ssp. <i>parviflorus</i> (Raf.) Hultén	seaside brookweed	X				
Pteridaceae	<i>Adiantum capillus-veneris</i> L.	common maidenhair	X				
	<i>Astrolepis integerrima</i> (Hook.) Benham & Windham	hybrid cloakfern	X				
	<i>Cheilanthes feei</i> T. Moore	slender lipfern	X				
Ranunculaceae	<i>Anemone tuberosa</i> Rydb.	tuber anemone	X				X
	<i>Aquilegia chrysantha</i> Gray	golden columbine	X	X			
	<i>Clematis ligusticifolia</i> Nutt.	western white clematis	X				
	<i>Delphinium scaposum</i> Greene	tall mountain larkspur	X	X			
Rhamnaceae	<i>Frangula californica</i> ssp. <i>californica</i> (Eschsch.) Gray	California buckthorn		X			X
	<i>Frangula californica</i> ssp. <i>ursina</i> (Greene) Kartesz & Gandhi	California buckthorn	X				
	<i>Ziziphus obtusifolia</i> (Hook. ex Torr. & Gray) Gray	lotebush		X			X
	<i>Ziziphus obtusifolia</i> var. <i>canescens</i> (Gray) M.C. Johnston	lotebush	X				
Rosaceae	<i>Purshia mexicana</i> (D. Don) Henrickson	Mexican cliffrose					
	<i>Purshia stansburiana</i> (Torr.) Henrickson	Stansbury cliffrose	X				
	<i>Rubus arizonensis</i> Focke	Arizona dewberry	X				
	<i>Rubus discolor</i> Weihe & Nees	Himalayan blackberry	X	X			
Rubiaceae	<i>Galium aparine</i> L.	stickywilly	X	X			
	<i>Galium microphyllum</i> Gray	bracted bedstraw	X				
Rutaceae	<i>Thamnosma texana</i> (Gray) Torr.	rue of the mountains	X				
Salicaceae	<i>Populus fremontii</i> S. Wats.	Fremont cottonwood		X			
	<i>Populus fremontii</i> S. Wats. ssp. <i>fremontii</i>	Fremont cottonwood	X				
	<i>Salix bonplandiana</i> Kunth	Bonpland willow	X				

Family	Scientific name	Common name	B&R	Row	H&G	Mau	NPS
Salicaceae	<i>Salix exigua</i> Nutt.	narrowleaf willow	X				
	<i>Salix gooddingii</i> Ball	Goodding's willow	X	X			
Sapindaceae	<i>Sapindus saponaria</i> L.	wingleaf soapberry		X			
	<i>Sapindus saponaria</i> var. <i>drummondii</i> (Hook. & Arn.) L. Benson	western soapberry	X				
Scrophulariaceae	<i>Castilleja applegatei</i> ssp. <i>martinii</i> (Abrams) Chuang & Heckard	wavyleaf Indian paintbrush	X				
	<i>Cordylanthus laxiflorus</i> Gray	nodding bird's-beak	X				
	<i>Mimulus guttatus</i> DC.	seep monkeyflower	X				
	<i>Mimulus rubellus</i> Gray	little redstem monkeyflower	X				
	<i>Penstemon eatonii</i> ssp. <i>undosus</i> (M.E. Jones) Keck	Eaton's penstemon	X				
	<i>Penstemon pseudospectabilis</i> M.E. Jones	desert penstemon		X			X
	<i>Penstemon pseudospectabilis</i> ssp. <i>connatifolius</i> (A. Nels.) Keck	desert beardtongue	X				
	<i>Verbascum thapsus</i> L.	common mullein	X	X	X	X	
	Simaroubaceae	<i>Ailanthus altissima</i> (P. Mill.) Swingle	tree of heaven	X	X		
	Solanaceae	<i>Chamaesaracha coronopus</i> (Dunal) Gray	greenleaf five eyes	X			
<i>Datura innoxia</i> P. Mill.		pricklyburr	X	X			
<i>Lycium pallidum</i> Miers		pale desert-thorn	X	X			
<i>Nicotiana obtusifolia</i> var. <i>obtusifolia</i> Mertens & Galeotti		desert tobacco		X			
<i>Nicotiana trigonophylla</i> var. <i>trigonophylla</i> Dunal		desert tobacco	X				
<i>Solanum elaeagnifolium</i> Cav.		silverleaf nightshade	X	X			
Tamaricaceae		<i>Tamarix ramosissima</i> Ledeb.	saltcedar	X	X		
Typhaceae	<i>Typha latifolia</i> L.	broadleaf cattail	X				
Ulmaceae	<i>Celtis laevigata</i> var. <i>reticulata</i> (Torr.) L. Benson	netleaf hackberry	X	X			X
	Urticaceae	<i>Parietaria hespera</i> Hinton	rillita pellitory	X			X
	<i>Parietaria pennsylvanica</i> Muhl. ex Willd.	Pennsylvania pellitory	X				X
Verbenaceae	<i>Aloysia wrightii</i> Heller ex Abrams	Wright's beebrush	X				
	<i>Glandularia bipinnatifida</i> var. <i>bipinnatifida</i> (Nutt.) Nutt.	Dakota mock vervain	X				
	<i>Glandularia gooddingii</i> (Briq.) Solbrig	southwestern mock vervain	X	X			X
	<i>Verbena bracteata</i> Lag. & Rodr.	bigbract verbena	X				
Vitaceae	<i>Parthenocissus vitacea</i> (Knerr) A.S. Hitchc.	woodbine	X	X			
	<i>Vitis arizonica</i> Engelm.	canyon grape	X	X			X
Zannichelliaceae	<i>Zannichellia palustris</i> L.	horned pondweed	X				
Zygophyllaceae	<i>Kallstroemia californica</i> (S. Wats.) Vail	California caltrop	X				
	<i>Larrea tridentata</i> (Sessé & Moc. ex DC.) Coville	creosote bush					X
	<i>Larrea tridentata</i> var. <i>tridentata</i> (Sessé & Moc. ex DC.) Coville	creosote bush	X	X			
	<i>Tribulus terrestris</i> L.	puncturevine	X	X		X	

Appendix C. Fish species observed or collected at Montezuma Castle NM. Based on Montgomery et al. (1995, 1996).
Species in bold-faced type are non-native.

Family	Scientific name	Common name	ESA ^a	BLM ^b	USFS ^c	AZG&F ^d
Catostomidae	<i>Catostomus insignis</i>	Sonora sucker	SC	X		
	<i>Catostomus clarkii</i>	desert sucker	SC	X		
Centrarchidae	<i>Lepomis cyanellus</i>	green sunfish				
	<i>Micropterus dolomieu</i>	smallmouth bass				
Cyprinidae	<i>Agosia chrysogaster</i>	longfin dace	SC	X		
	<i>Cyprinella lutrensis</i>	red shiner				
	<i>Cyprinus carpio</i>	common carp				
	<i>Gila robusta</i>	roundtail chub	SC		X	X
Ictaluridae	<i>Ameiurus natalis</i>	yellow bullhead				

^a ESA = Endangered Species Act: SC = Species of Concern (HDMS 2004).

^b BLM = Bureau of Land Management: Sensitive species (HDMS 2004).

^c USFS = U.S. Forest Service: Sensitive species (HDMS 2004).

^d AZG&F = Arizona Game and Fish Department: Wildlife Species of Concern (HDMS 2004).

Appendix D. Amphibian and reptile species observed or collected at Montezuma Castle NM. Based on Drost and Nowak (1998), unless indicated otherwise. Species in bold-faced type are non-native.

Taxon	Family	Scientific name	Common name	
Amphibian	Bufonidae	<i>Bufo woodhousii</i>	Woodhouse's toad	
		<i>Bufo punctatus</i>	red-spotted toad	
	Hylidae	<i>Hyla arenicolor</i>	canyon treefrog	
	Ranidae	<i>Rana catesbeiana</i>	American bullfrog	
Reptile	Kinosternidae	<i>Kinosternon sonoriense</i>	Sonoran mud turtle	
	Emydidae	<i>Trachemys scripta</i>	pond slider	
	Trionychidae	<i>Trionyx spiniferus</i> ^a	spiny softshell	
	Eublepharidae	<i>Coleonyx variegatus</i>	western banded gecko	
	Crotaphytidae	<i>Crotaphytus collaris</i>	eastern collared lizard	
	Phrynosomatidae	<i>Cophosaurus texanus</i>	greater earless lizard	
		<i>Sceloporus magister</i>	desert spiny lizard	
		<i>Sceloporus clarkii</i>	Clark's spiny lizard	
		<i>Sceloporus undulatus</i>	eastern fence lizard	
		<i>Uta stansburiana</i>	common side-blotched lizard	
		<i>Urosaurus ornatus</i>	ornate tree lizard	
		Teiidae	<i>Cnemidophorus uniparens</i>	desert grassland whiptail
			<i>Cnemidophorus flagellicaudus</i>	Gila spotted whiptail
			<i>Cnemidophorus tigris</i>	western whiptail (tiger whiptail)
		Anguidae	<i>Elgaria kingii</i>	Madrean alligator lizard
	Helodermatidae	<i>Heloderma suspectum</i> ^b	Gila monster	
	Colubridae	<i>Diadophis punctatus</i>	ring-necked snake	
		<i>Masticophis flagellum</i>	coachwhip	
		<i>Masticophis taeniatus</i>	striped whipsnake	
		<i>Salvadora hexalepis</i>	western patch-nosed snake	
<i>Pituophis catenifer</i>		gopher snake		
<i>Arizona elegans</i>		glossy snake		
<i>Lampropeltis getula</i>		common kingsnake		
<i>Rhinocheilus lecontei</i>		long-nosed snake		
<i>Thamnophis cyrtopsis</i>		black-necked garter snake		
<i>Sonora semiannulata</i>		western ground snake		
<i>Hypsiglena torquata</i>		night snake		
Elapidae		<i>Micruroides euryxanthus</i>	Sonoran coral snake	
Viperidae		<i>Crotalus atrox</i>	western diamond-backed rattlesnake	
	<i>Crotalus molossus</i>	black-tailed rattlesnake		

^a Based on sighting by Paul Super (1994, unpublished notes).

^b Based on sighting by park personnel

Appendix E. Bird species observed or collected at Montezuma Castle NM. Based on Sogge et al. (In press). Underlined species are Neotropical migrants (Rappole 1995). Species in bold-faced type are non-native.

Order	Family	Scientific name	Common name	ESA ^a	USFS ^b	AZG&F ^c	APF ^d	USFWS ^e
Anseriformes								
	Anatidae	<u>Anser albifrons</u>	greater white-fronted goose					
		<u>Chen caerulescens</u>	snow goose					
		<u>Branta canadensis</u>	Canada goose					
		<u>Aix sponsa</u>	wood duck					
		<u>Anas strepera</u>	gadwall					
		<u>Anas penelope</u>	Eurasian wigeon					
		<u>Anas americana</u>	American wigeon					
		<u>Anas platyrhynchos</u>	mallard					
		<u>Anas discors</u>	blue-winged teal					
		<u>Anas cyanoptera</u>	cinnamon teal					
		<u>Anas clypeata</u>	northern shoveler					
		<u>Anas acuta</u>	northern pintail					
		<u>Anas crecca</u>	green-winged teal					
		<u>Aythya valisineria</u>	canvasback					
		<u>Aythya americana</u>	redhead					
		<u>Aythya collaris</u>	ring-necked duck					
		<u>Aythya affinis</u>	lesser scaup					
		<u>Bucephala albeola</u>	bufflehead					
		<u>Bucephala clangula</u>	common goldeneye					
		<u>Lophodytes cucullatus</u>	hooded merganser					
		<u>Mergus merganser</u>	common merganser					
		<u>Oxyura jamaicensis</u>	ruddy duck					
Galliformes								
	Phasianidae	Phasianus colchicus	ring-necked pheasant					
	Odontophoridae	<u>Callipepla gambelii</u>	Gambel's quail					
Podicipediformes								
	Podicipedidae	<u>Podilymbus podiceps</u>	pie-billed grebe					
Ciconiiformes								
	Ardeidae	<u>Ardea herodias</u>	great blue heron					
		<u>Egretta thula</u>	snowy egret			X		
		<u>Butorides virescens</u>	green heron					
		<u>Nycticorax nycticorax</u>	black-crowned night-heron					
	Threskiornithidae	<u>Plegadis chihi</u>	white-faced ibis	SC	X			
	Ciconiidae	<u>Mycteria americana</u>	wood stork	LE				
	Cathartidae	<u>Cathartes aura</u>	turkey vulture					
Falconiformes								
	Accipitridae	<u>Pandion haliaetus</u>	osprey			X		
		<u>Haliaeetus leucocephalus</u>	bald eagle	LT	X	X		
		<u>Circus cyaneus</u>	northern harrier					
		<u>Accipiter striatus</u>	sharp-shinned hawk		X			
		<u>Accipiter cooperii</u>	Cooper's hawk					
		<u>Accipiter gentilis</u>	northern goshawk	SC	X	X		
		<u>Buteo gallus anthracinus</u>	common black-hawk		X	X	X	
		<u>Parabuteo unicinctus</u>	Harris's hawk					
		<u>Buteo swainsoni</u>	Swainson's hawk					
		<u>Buteo jamaicensis</u>	red-tailed hawk					
		<u>Buteo regalis</u>	ferruginous hawk	SC		X		

Order	Family	Scientific name	Common name	ESA ^a	USFS ^b	AZG&F ^c	APF ^d	USFWS ^e
Falconiformes								
	Accipitridae	<i>Buteo lagopus</i>	rough-legged hawk					
		<i>Aquila chrysaetos</i>	golden eagle					
	Falconidae	<i>Falco sparverius</i>	American kestrel					
		<i>Falco columbarius</i>	merlin					
		<i>Falco peregrinus</i>	peregrine falcon	SC		X		X
Gruiformes								
	Rallidae	<i>Rallus limicola</i>	Virginia rail					
		<i>Porzana carolina</i>	sora					
		<i>Gallinula chloropus</i>	common moorhen					
		<i>Fulica americana</i>	American coot					
Charadriiformes								
	Charadriidae	<i>Pluvialis squatarola</i>	black-bellied plover					
		<i>Charadrius vociferus</i>	killdeer					
	Scolopacidae	<i>Catoptrophorus semipalmatus</i>	willet					
		<i>Actitis macularis</i>	spotted sandpiper					
		<i>Calidris bairdii</i>	Baird's sandpiper					
		<i>Gallinago gallinago</i>	common snipe					
		<i>Phalaropus tricolor</i>	Wilson's phalarope					
Columbiformes								
	Columbidae	<i>Columba livia</i>	rock pigeon					
		<i>Zenaida asiatica</i>	white-winged dove					
		<i>Zenaida macroura</i>	mourning dove					
		<i>Columbina passerina</i>	common ground-dove					
Cuculiformes								
	Cuculidae	<i>Coccyzus americanus</i>	yellow-billed cuckoo	C	X	X	X	X
		<i>Geococcyx californianus</i>	greater roadrunner					
Strigiformes								
	Tytonidae	<i>Tyto alba</i>	barn owl					
	Strigidae	<i>Megascops kennicottii</i>	western screech-owl					
		<i>Bubo virginianus</i>	great horned owl					
		<i>Glaucidium gnoma</i>	northern pygmy-owl					
		<i>Micrathene whitneyi</i>	elf owl					X
		<i>Asio flammeus</i>	short-eared owl					
Caprimulgiformes								
	Caprimulgidae	<i>Chordeiles acutipennis</i>	lesser nighthawk					
		<i>Chordeiles minor</i>	common nighthawk					
		<i>Phalaenoptilus nuttallii</i>	common poorwill					
Apodiformes								
	Apodidae	<i>Chaetura vauxi</i>	Vaux's swift					
		<i>Aeronautes saxatalis</i>	white-throated swift					
	Trochilidae	<i>Lampornis clemenciae</i>	blue-throated hummingbird					
		<i>Archilochus alexandri</i>	black-chinned hummingbird					
		<i>Calypte anna</i>	Anna's hummingbird					
		<i>Calypte costae</i>	Costa's hummingbird				X	
		<i>Selasphorus platycercus</i>	broad-tailed hummingbird					
		<i>Selasphorus rufus</i>	rufous hummingbird					
Coraciiformes								
	Alcedinidae	<i>Ceryle alcyon</i>	belted kingfisher			X		

Order	Family	Scientific name	Common name	ESA ^a	USFS ^b	AZG&F ^c	APF ^d	USFWS ^e
Piciformes								
	Picidae	<i>Melanerpes lewis</i>	Lewis's woodpecker					
		<i>Melanerpes erythrocephalus</i>	red-headed woodpecker					
		<i>Melanerpes uropygialis</i>	Gila woodpecker					X
		<i>Sphyrapicus thyroideus</i>	Williamson's sapsucker					
		<i>Sphyrapicus nuchalis</i>	red-naped sapsucker					
		<i>Picoides scalaris</i>	ladder-backed woodpecker					
		<i>Colaptes auratus</i>	northern flicker					
Passeriformes								
	Tyrannidae	<i>Camptostoma imberbe</i>	northern beardless-tyrannulet					
		<i>Contopus cooperi</i>	olive-sided flycatcher	SC				
		<i>Contopus sordidulus</i>	western wood-pewee					
		<i>Empidonax traillii</i>	willow flycatcher			X		
		<i>Empidonax wrightii</i>	gray flycatcher					
		<i>Empidonax occidentalis</i> or <i>difficilis</i>	western flycatcher					
		<i>Sayornis nigricans</i>	black phoebe					
		<i>Sayornis saya</i>	Say's phoebe					
		<i>Pyrocephalus rubinus</i>	vermillion flycatcher					
		<i>Myiarchus cinerascens</i>	ash-throated flycatcher					
		<i>Myiarchus tyrannulus</i>	brown-crested flycatcher					
		<i>Tyrannus vociferans</i>	Cassin's kingbird					
		<i>Tyrannus verticalis</i>	western kingbird					
	Laniidae	<i>Lanius ludovicianus</i>	loggerhead shrike	SC	X			
	Vireonidae	<i>Vireo bellii</i>	Bell's vireo		X			X
		<i>Vireo vicinior</i>	gray vireo					
		<i>Vireo plumbeus</i>	plumbeous vireo					
		<i>Vireo huttoni</i>	Hutton's vireo					
		<i>Vireo gilvus</i>	warbling vireo					
	Corvidae	<i>Cyanocitta stelleri</i>	Steller's jay					
		<i>Aphelocoma californica</i>	western scrub-jay					
		<i>Aphelocoma ultramarina</i>	Mexican jay					
		<i>Gymnorhinus cyanocephalus</i>	pinyon jay					
		<i>Corvus brachyrhynchos</i>	American crow					
		<i>Corvus corax</i>	common raven					
	Alaudidae	<i>Eremophila alpestris</i>	horned lark					
	Hirundinidae	<i>Progne subis</i>	purple martin				X	
		<i>Tachycineta thalassina</i>	violet-green swallow					
		<i>Stelgidopteryx serripennis</i>	northern rough-winged swallow					
		<i>Riparia riparia</i>	bank swallow					
		<i>Petrochelidon pyrrhonota</i>	cliff swallow					
	Paridae	<i>Poecile gambeli</i>	mountain chickadee					
		<i>Baeolophus wollweberi</i>	bridled titmouse					
		<i>Baeolophus ridgwayi</i>	juniper titmouse					
	Remizidae	<i>Auriparus flaviceps</i>	verdin					
	Aegithalidae	<i>Psaltriparus minimus</i>	bush-tit					
	Sittidae	<i>Sitta carolinensis</i>	white-breasted nuthatch					
		<i>Sitta pygmaea</i>	pygmy nuthatch					
	Certhiidae	<i>Certhia americana</i>	brown creeper					
	Troglodytidae	<i>Campylorhynchus brunneicapillus</i>	cactus wren					
		<i>Salpinctes obsoletus</i>	rock wren					

Order	Family	Scientific name	Common name	ESA ^a	USFS ^b	AZG&F ^c	APF ^d	USFWS ^e
Passeriformes								
	Troglodytidae	<i>Catherpes mexicanus</i>	canyon wren					
		<i>Thryomanes bewickii</i>	Bewick's wren					
		<i>Troglodytes aedon</i>	house wren					
		<i>Cistothorus palustris</i>	marsh wren					
	Regulidae	<i>Regulus calendula</i>	ruby-crowned kinglet					
	Sylviidae	<i>Poliottila caerulea</i>	blue-gray gnatcatcher					
	Turdidae	<i>Sialia mexicana</i>	western bluebird					
		<i>Sialia currucoides</i>	mountain bluebird					
		<i>Myadestes townsendi</i>	Townsend's solitaire					
		<i>Catharus guttatus</i>	hermit thrush					
		<i>Turdus migratorius</i>	American robin					
	Mimidae	<i>Mimus polyglottos</i>	northern mockingbird					
		<i>Oreoscoptes montanus</i>	sage thrasher					
		<i>Toxostoma rufum</i>	brown thrasher					
		<i>Toxostoma crissale</i>	crissal thrasher					X
	Sturnidae	<i>Sturnus vulgaris</i>	European starling					
	Motacillidae	<i>Anthus rubescens</i>	American pipit					
	Bombycillidae	<i>Bombycilla cedrorum</i>	cedar waxwing					
	Ptilonotidae	<i>Phainopepla nitens</i>	phainopepla					
	Parulidae	<i>Vermivora chrysoptera</i>	golden-winged warbler					
		<i>Vermivora celata</i>	orange-crowned warbler					
		<i>Vermivora ruficapilla</i>	Nashville warbler					
		<i>Vermivora virginiae</i>	Virginia's warbler					
		<i>Vermivora luciae</i>	Lucy's warbler				X	
		<i>Dendroica petechia</i>	yellow warbler					
		<i>Dendroica caerulescens</i>	black-throated blue warbler					
		<i>Dendroica coronata</i>	yellow-rumped warbler					
		<i>Dendroica nigrescens</i>	black-throated gray warbler					
		<i>Dendroica townsendi</i>	Townsend's warbler					
		<i>Dendroica graciae</i>	Grace's warbler					
		<i>Seiurus noveboracensis</i>	northern waterthrush					
		<i>Oporornis tolmiei</i>	MacGillivray's warbler					
		<i>Geothlypis trichas</i>	common yellowthroat					
		<i>Wilsonia citrina</i>	hooded warbler					
		<i>Wilsonia pusilla</i>	Wilson's warbler					
		<i>Icteria virens</i>	yellow-breasted chat					
	Thraupidae	<i>Piranga flava</i>	hepatic tanager					
		<i>Piranga rubra</i>	summer tanager					
		<i>Piranga ludoviciana</i>	western tanager					
	Emberizidae	<i>Pipilo chlorurus</i>	green-tailed towhee					
		<i>Pipilo maculatus</i>	spotted towhee					
		<i>Pipilo fuscus</i>	canyon towhee					
		<i>Pipilo aberti</i>	Abert's towhee					
		<i>Aimophila ruficeps</i>	rufous-crowned sparrow					
		<i>Spizella arborea</i>	American tree sparrow					
		<i>Spizella passerina</i>	chipping sparrow					
		<i>Spizella breweri</i>	Brewer's sparrow					
		<i>Spizella atrogularis</i>	black-chinned sparrow					
		<i>Poocetes gramineus</i>	vesper sparrow					

Order	Family	Scientific name	Common name	ESA ^a	USFS ^b	AZG&F ^c	APF ^d	USFWS ^e
Passeriformes								
	Emberizidae	<i>Chondestes grammacus</i>	lark sparrow					
		<i>Melospiza lincolni</i>	Lincoln's sparrow					
		<i>Amphispiza bilineata</i>	black-throated sparrow					
		<i>Amphispiza belli</i>	sage sparrow					
		<i>Melospiza melodia</i>	song sparrow					
		<i>Zonotrichia albicollis</i>	white-throated sparrow					
		<i>Zonotrichia leucophrys</i>	white-crowned sparrow					
		<i>Junco hyemalis</i>	dark-eyed junco					
	Cardinalidae	<i>Cardinalis cardinalis</i>	northern cardinal					
		<i>Pheucticus melanocephalus</i>	black-headed grosbeak					
		<i>Passerina caerulea</i>	blue grosbeak					
		<i>Passerina amoena</i>	lazuli bunting					
		<i>Passerina cyanea</i>	indigo bunting					
	Icteridae	<i>Agelaius phoeniceus</i>	red-winged blackbird					
		<i>Sturnella neglecta</i>	western meadowlark					
		<i>Xanthocephalus xanthocephalus</i>	yellow-headed blackbird					
		<i>Euphagus cyanocephalus</i>	Brewer's blackbird					
		<i>Quiscalus mexicanus</i>	great-tailed grackle					
		<i>Molothrus ater</i>	brown-headed cowbird					
		<i>Icterus cucullatus</i>	hooded oriole					
		<i>Icterus bullockii</i>	Bullock's oriole					
		<i>Icterus parisorum</i>	Scott's oriole					
	Fringillidae	<i>Carpodacus purpureus</i>	purple finch					
		<i>Carpodacus cassinii</i>	Cassin's finch					
		<i>Carpodacus mexicanus</i>	house finch					
		<i>Loxia curvirostra</i>	red crossbill					
		<i>Carduelis pinus</i>	pine siskin					
		<i>Carduelis psaltria</i>	lesser goldfinch					
		<i>Carduelis tristis</i>	American goldfinch					
		<i>Coccothraustes vespertinus</i>	evening grosbeak					
	Passeridae	<i>Passer domesticus</i>	house sparrow					

^a ESA = Endangered Species Act: SC = Species of Concern, LT = Listed as Threatened, LE = Listed as Endangered, C = Candidate species (HDMS 2005).

^b USFS = U.S. Forest Service: Sensitive species (HDMS 2004).

^c AZG&F = Arizona Game and Fish Department: Wildlife Species of Concern (HDMS 2004).

^d APF = Arizona Partners in Flight: Priority species (Latta et al. 1999).

^e USFWS = U.S. Fish and Wildlife Service: Bird of Conservation Concern (USFWS 2002).

Appendix F. Mammal species observed or collected at Montezuma Castle NM. Based on Drost and Ellison (D&E; 1996) and Bucci and Petryszyn (B&P; 2004). Species in bold-face type are non-native.

Order	Family	Scientific name	Common name	D&E	B&P	ESA ^a	BLM ^b	USFS ^c	AZG&F ^d
Insectivora									
	Soricidae	<i>Notiosorex crawfordi</i>	Crawford's desert shrew	X					
Chiroptera									
	Vespertilionidae	<i>Myotis occultus</i>	Arizona myotis		X	SC	X		
		<i>Myotis yumanensis</i>	Yuma myotis	X	X	SC			
		<i>Myotis auricolus</i>	southwestern myotis		X				
		<i>Myotis velifer</i>	cave myotis	X	X	SC	X		
		<i>Myotis thysanodes</i>	fringed myotis	X	X	SC	X		
		<i>Myotis californicus</i>	California myotis	X	X				
		<i>Myotis ciliolabrum</i>	western small-footed myotis	X	X	SC	X		
		<i>Pipistrellus hesperus</i>	western pipistrelle	X	X				
		<i>Eptesicus fuscus</i>	big brown bat	X	X				
		<i>Euderma maculatum</i>	spotted bat		X	SC		X	X
		<i>Lasiurus blossevillii</i>	western red bat		X				X
		<i>Lasiurus cinereus</i>	hoary bat		X				
		<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	X	X	SC			
		<i>Idionycteris phyllotis</i>	Allen's big-eared bat		X	SC	X		
		<i>Antrozous pallidus</i>	pallid bat	X	X				
	Molossidae	<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	X	X				
		<i>Nyctinomops femorosaccus</i>	pocketed free-tailed bat		X		X		
		<i>Nyctinomops macrotis</i>	big free-tailed bat		X	SC	X		
Carnivora									
	Ursidae	<i>Ursus americanus</i>	American black bear	X					
	Procyonidae	<i>Procyon lotor</i>	northern raccoon	X					
		<i>Bassariscus astutus</i>	ringtail	X					
	Mustelidae	<i>Taxidea taxus</i>	American badger	X					
		<i>Lontra canadensis</i>	southwestern river otter	X		SC		X	X
	Mephitidae	<i>Mephitis mephitis</i>	striped skunk	X					
		<i>Conepatus mesoleucus</i>	white-backed hog-nosed skunk	X					
	Canidae	<i>Canis latrans</i>	coyote	X					
		<i>Urocyon cinereoargenteus</i>	common gray fox	X					
	Felidae	<i>Felis catus</i>	feral cat	X					
		<i>Puma concolor</i>	mountain lion	X					
		<i>Lynx rufus</i>	bobcat	X					
Rodentia									
	Sciuridae	<i>Spermophilus variegatus</i>	rock squirrel	X					
		<i>Ammospermophilus harrisi</i>	Harris' antelope squirrel	X					
		<i>Neotamias dorsalis</i>	cliff chipmunk	X					
		<i>Sciurus arizonensis</i>	Arizona gray squirrel	X		SC			
	Geomyidae	<i>Thomomys bottae</i>	Botta's pocket gopher	X					
	Heteromyidae	<i>Chaetodipus intermedius</i>	rock pocket mouse	X		SC			
		<i>Dipodomys ordii</i>	Ord's kangaroo rat	X					
	Castoridae	<i>Castor canadensis</i>	American beaver	X					
	Muridae	<i>Reithrodontomys megalotis</i>	western harvest mouse	X					
		<i>Peromyscus eremicus</i>	cactus mouse	X		SC		X	
		<i>Peromyscus maniculatus</i>	deer mouse	X					
		<i>Peromyscus leucopus</i>	white-footed mouse	X					
		<i>Peromyscus boylii</i>	brush mouse	X					

Order	Family	Scientific name	Common name	D&E	B&P	ESA ^a	BLM ^b	USFS ^c	AZG&F ^d
Rodentia									
	Muridae	<i>Peromyscus truei</i>	pinon mouse	X					
		<i>Onychomys leucogaster</i>	northern grasshopper mouse	X					
		<i>Neotoma albigula</i>	western white-throated woodrat	X					
		<i>Neotoma mexicana</i>	Mexican woodrat	X		SC			
		<i>Neotoma stephensi</i>	Stephens' woodrat	X					
		<i>Ondatra zibethicus</i>	common muskrat	X					
	Erethizontidae	<i>Erethizon dorsatum</i>	North American porcupine	X					
Lagomorpha									
	Leporidae	<i>Lepus californicus</i>	black-tailed jackrabbit	X					
		<i>Sylvilagus floridanus</i>	eastern cottontail	X					
		<i>Sylvilagus audubonii</i>	desert cottontail	X					
Artiodactyla									
	Tayassuidae	<i>Pecari tajacu</i>	collared peccary	X					
	Cervidae	<i>Cervus canadensis</i>	wapiti	X					
		<i>Odocoileus hemionus</i>	mule deer	X					
		<i>Odocoileus virginianus</i>	white-tailed deer	X					

^aESA = Endangered Species Act; SC = Species of Concern (HDMS 2005).

^bBLM = Bureau of Land Management: Sensitive species (HDMS 2005).

^cUSFS = U.S. Forest Service: Sensitive species (HDMS 2005).

^dAZG&F = Arizona Game and Fish Department: Wildlife Species of Concern (HDMS 2005).

Appendix G. Native fish species that have been extirpated (E) and non-native fish that no longer occur (NP) at Montezuma Castle NM. Based on Montgomery et al. (1995). Species in bold-faced type are non-native.

Family	Scientific name	Common name	Status
Centrarchidae	<i>Micropterus punctulatus</i>	spotted bass	NP
	<i>Micropterus salmoides</i>	largemouth bass	NP
Cyprinidae	<i>Meda fulgida</i>	spikedace	E
	<i>Rhinichthys osculus</i>	speckled dace	E
	<i>Rhinichthys cobitis</i>	loach minnow	E
Ictaluridae	<i>Ameiurus melas</i>	black bullhead	NP
	<i>Ictalurus punctatus</i>	channel catfish	NP

Appendix H. Amphibian and reptile species that may occur (P) or have been extirpated (E) at Montezuma Castle NM. Based on Drost and Nowak (D&N; 1998) and observations from nearby Tuzigoot NM (Schmidt et al. 2005; Sch).

Taxon	Family	Scientific name	Common name	D&N	Sch
Amphibian	Bufonidae	<i>Bufo microscaphus</i>	Arizona toad	E	
		<i>Rana yavapaiensis</i>	lowland leopard frog	E	
Reptile	Phrynosomatidae	<i>Phrynosoma hernandesi</i>	greater short-horned lizard	P	
	Leptotyphlopidae	<i>Leptotyphlops humilis</i>	western blind snake		P
	Colubridae	<i>Masticophis bilineatus</i>	Sonoran whipsnake		P
		<i>Thamnophis eques</i>	Mexican garter snake		P
		<i>Tantilla hobartsmithi</i>	southwestern black-headed snake		P
		<i>Trimorphodon biscutatus</i>	western lyre snake	P	P
Viperidae	<i>Crotalus scutulatus</i>	Mojave rattlesnake	P		

Appendix I. Bird species that may occur at Montezuma Castle NM. Based on Sogge et al. (Sog; In press), and observations from near the monument by the National Audubon Society Christmas Bird Count (CBC; No date), Tuzigoot inventory (Schmidt et al. 2005;Sch), and Larry Norris (LN). Underlined species are Neotropical migrants (Rappole 1995).

Order	Family	Scientific name	Common name	Sog	CBC	Sch	LN
Anseriformes							
	Anatidae	<i>Cygnus columbianus</i>	tundra swan			X	
		<u><i>Mergus serrator</i></u>	red-breasted merganser	X			
Gaviiformes							
	Gaviidae	<i>Gavia immer</i>	common loon			X	
Podicipediformes							
	Podicipedidae	<u><i>Podiceps nigricollis</i></u>	eared grebe		X	X	
		<u><i>Aechmophorus occidentalis</i></u>	western grebe			X	
Pelecaniformes							
	Pelecanidae	<u><i>Pelecanus erythrorhynchos</i></u>	American white pelican			X	
	Phalacrocoracidae	<u><i>Phalacrocorax auritus</i></u>	double-crested cormorant			X	
Ciconiiformes							
	Ardeidae	<u><i>Botaurus lentiginosus</i></u>	American bittern			X	
		<u><i>Ixobrychus exilis</i></u>	least bittern			X	
		<i>Ardea alba</i>	great egret			X	
		<u><i>Egretta caerulea</i></u>	little blue heron			X	
		<u><i>Bubulcus ibis</i></u>	cattle egret	X		X	
Falconiformes							
	Accipitridae	<i>Buteo albonotatus</i>	zone-tailed hawk			X	
	Falconidae	<i>Caracara cheriway</i>	crested caracara			X	
		<u><i>Falco mexicanus</i></u>	prairie falcon		X	X	
Gruiformes							
	Rallidae	<i>Rallus longirostris yumanensis</i>	Yuma clapper rail			X	
Charadriiformes							
	Recurvirostridae	<u><i>Himantopus mexicanus</i></u>	black-necked stilt			X	
		<u><i>Recurvirostra americana</i></u>	American avocet			X	
	Scolopacidae	<u><i>Tringa melanoleuca</i></u>	greater yellowlegs			X	
		<u><i>Tringa flavipes</i></u>	lesser yellowlegs			X	
		<u><i>Tringa solitaria</i></u>	solitary sandpiper			X	
		<u><i>Numenius americanus</i></u>	long-billed curlew			X	
		<u><i>Limosa fedoa</i></u>	marbled godwit			X	
		<u><i>Calidris mauri</i></u>	western sandpiper			X	
		<u><i>Calidris minutilla</i></u>	least sandpiper			X	
		<u><i>Limnodromus scolopaceus</i></u>	long-billed dowitcher			X	
		<u><i>Phalaropus lobatus</i></u>	red-necked phalarope			X	
	Laridae	<u><i>Larus pipixcan</i></u>	Franklin's gull			X	
		<u><i>Larus philadelphia</i></u>	Bonaparte's gull			X	
		<u><i>Larus delawarensis</i></u>	ring-billed gull			X	
		<u><i>Larus californicus</i></u>	California gull			X	
		<u><i>Xema sabini</i></u>	Sabine's gull			X	
		<u><i>Sterna forsteri</i></u>	Forster's tern			X	
		<u><i>Chlidonias niger</i></u>	Black tern			X	
Columbiformes							
	Columbidae	<i>Columbina inca</i>	Inca dove		X	X	
Cuculiformes							
	Cuculidae	<i>Crotophaga sulcirostris</i>	groove-billed ani	X			

Order	Family	Scientific name	Common name	Sog	CBC	Sch	LN
Strigiformes							
	Strigidae	<i>Asio otus</i>	long-eared owl			X	
		<i>Aegolius acadicus</i>	northern saw-whet owl			X	
Apodiformes							
	Trochilidae	<i>Stellula calliope</i>	calliope hummingbird			X	
Piciformes							
	Picidae	<i>Melanerpes formicivorus</i>	acorn woodpecker		X	X	
		<i>Sphyrapicus varius</i>	yellow-bellied sapsucker		X	X	
		<i>Picoides pubescens</i>	downy woodpecker		X		X
		<i>Picoides villosus</i>	hairy woodpecker		X	X	
Passeriformes							
	Tyrannidae	<i>Empidonax hammondi</i>	Hammond's flycatcher			X	
		<i>Empidonax oberholseri</i>	dusky flycatcher			X	
		<i>Myiarchus tuberculifer</i>	dusky-capped flycatcher			X	
	Hirundinidae	<i>Tachycineta bicolor</i>	tree swallow			X	
		<i>Hirundo rustica</i>	barn swallow			X	
	Sittidae	<i>Sitta canadensis</i>	red-breasted nuthatch		X		
	Troglodytidae	<i>Troglodytes troglodytes</i>	winter wren			X	
	Regulidae	<i>Regulus satrapa</i>	golden-crowned kinglet		X		
	Sylviidae	<i>Polioptila melanura</i>	black-tailed gnatcatcher			X	
	Turdidae	<i>Catharus ustulatus</i>	Swainson's thrush	X		X	
	Mimidae	<i>Toxostoma bendirei</i>	Bendire's thrasher			X	
		<i>Toxostoma curvirostre</i>	curve-billed thrasher		X		
		<i>Toxostoma lecontei</i>	Le Conte's thrasher	X		X	
	Parulidae	<i>Dendroica occidentalis</i>	hermit warbler			X	
		<i>Cardellina rubrifrons</i>	red-faced warbler			X	
		<i>Myioborus pictus</i>	painted redstart			X	
	Emberizidae	<i>Passerculus sandwichensis</i>	savannah sparrow		X	X	
		<i>Calamospiza melanocorys</i>	lark bunting	X	X	X	
		<i>Passerella iliaca</i>	fox sparrow		X		
		<i>Calcarius ornatus</i>	chestnut-collared longspur		X		
	Icteridae	<i>Sturnella magna</i>	eastern meadowlark			X	
		<i>Quiscalus quiscula</i>	common grackle			X	
		<i>Molothrus aeneus</i>	bronzed cowbird	X		X	
	Fringillidae	<i>Carduelis lawrencei</i>	Lawrence's goldfinch		X	X	

Appendix J. Mammal species that may occur at Montezuma Castle NM. Based on Drost and Ellison (1996).

Order	Family	Scientific name	Common name
Chiroptera	Vespertilionidae	<i>Myotis leibii</i>	eastern small-footed myotis
		<i>Lasionycteris noctivagans</i>	silver-haired bat
	Molossidae	<i>Eumops perotis</i>	western bonneted bat
Carnivora	Procyonidae	<i>Nasua narica</i>	white-nosed coati
	Mephitidae	<i>Spilogale gracilis</i>	western spotted skunk
		<i>Mephitis macroura</i>	hooded skunk
Rodentia	Sciuridae	<i>Spermophilus lateralis</i>	golden-mantled ground squirrel
	Heteromyidae	<i>Perognathus amplus</i>	Arizona pocket mouse
		<i>Chaetodipus hispidus</i>	hispid pocket mouse
		<i>Reithrodontomys montanus</i>	Plains harvest mouse
	Muridae	<i>Onychomys torridus</i>	southern grasshopper mouse
		<i>Mus musculus</i>	house mouse

Appendix K. Voucher specimens from Montezuma Castle NM.

Taxon	Common name	Collection no.	Collection ^a	Date collected	Collector
Amphibian	Arizona toad		FWMSH	08/14/77	W. Voss
Reptile	Sonoran mud turtle	1012	WACC		
	greater earless lizard	27882	UI	06/14/51	D. M. Smith and H. M. Smith
	Clark's spiny lizard	12421	CAS	01/01/50	D. E. Kidd
	ornate tree lizard	6508	UC	04/23/53	T. P. Maslin
	western patch-nosed snake	11726	CAS	05/09/49	H. K. Gloyd and K. Gloyd
	black-necked garter snake	84308	UI	08/07/55	D. M. Smith, R. Urbano and F. A. Shannon
Bird	gray flycatcher	383	UA		
Mammal	pronghorn	9057	WACC	03/00/59	

^aCAS = Chicago Academy of Science, FWMSH = Fort Worth Museum of Science and History, UA = University of Arizona, UC = University of Colorado Museum, UI = University of Illinois Museum of Natural History, WACC = Western Archaeological Conservation Center.

