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Vascular Plant Inventory of Glen Canyon National Recreation Area

Natural Resource Technical Report NPS/SCPN/NRTR—2009/264

ON THE COVER

Glen Canyon National Recreation Area near 40-mile Ridge
Photo: Jim DeCoster

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Natural Resource Technical Report NPS/SCPN/NRTR—2009/264

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Abstract

Glen Canyon National Recreation Area (NRA) is located in the Canyonlands district of the Colorado Plateau in southeastern Utah and northern Arizona. Glen Canyon NRA encompasses 500,548 ha (1,236,880 acres) of warm-temperate desert shrub, salt desert shrub, sand desert shrub, pinyon-juniper woodlands, riparian, and hanging garden vegetation communities. A total of 780 taxa of vascular plants, representing 90 families, are vouchered from within the park boundaries; 129 of these taxa are additions to the flora of Glen Canyon NRA. An additional 75 previously reported, but unvouchered, taxa were also identified in this study.

Glen Canyon NRA is home to a number of rare and/or endemic species, including *Cycladenia humilis* Benth. var. *jonesii* (Eastw.) Welsh & Atwood, *Astragalus preussii* Gray var. *cutleri* Barneby, *Phacelia indecora* J.T. Howell, and *Carex specuicola* J.T. Howell. These species are of special interest to Glen Canyon NRA Natural Resource Division and Utah and Arizona Natural Heritage Programs, and are protected under the Endangered Species Act. About 40 species that occur in Glen Canyon NRA are endemic to the Colorado Plateau.

Non-native plant taxa make up about 11% of the flora of Glen Canyon NRA. Several non-native taxa, including *Brassica tournefortii* Gouan, *Cortaderia selloana* (J.A. & J.H. Schultes) Aschers. & Graebn., and *Saccharum ravennae* (L.) L., pose threats to both Glen Canyon NRA and its downstream neighbor, Grand Canyon NP.

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1 Introduction

The primary objective of this study is to document the vascular plant flora of Glen Canyon National Recreation Area (NRA). The secondary objective is to examine the rare, endemic, and nonnative species composition and distribution in Glen Canyon NRA(GLCA). Species that are rare, endemic, or nonnative often have management implications for land management agencies.

Local floras, such as the *Flora of Glen Canyon NRA*, serve as a baseline for the assessment of biological diversity, biogeographical comparisons, and future floristic change. Local floras also fill in gaps in species distributions. A limited number of local floras are available for the Colorado Plateau. A flora for GLCA will be useful to the National Park Service staff for management decisions as well as for educational purposes.

This project is part of the National Park Service Inventory and Monitoring (I&M) Program. The overall goal of the I&M Program is to assess the biotic components of the parks by filling in gaps in the knowledge base. The specific goal for biological inventories is to survey and document at least 90% of the vertebrate animals and vascular plants estimated to be present in each park (Stuart 2000). Prior to this project the flora of GLCA was thought to be about 80% complete (Spence, pers. comm. 2003 and Stuart 2000). This inventory will provide baseline information from which long-term strategies will be developed.

2 Background

2.1 Landscape description

Glen Canyon National Recreation Area (GLCA) encompasses 500,550 ha (1,236,880 acres) and is located mostly in southeastern Utah with a small portion in northern Arizona (fig. 1). The park can be loosely defined as the Colorado River and its tributaries, although the actual boundary line for the park cuts across plateaus and through canyons, and is not linked to any geologic or natural feature.

The elevation in GLCA ranges from 940 m (3080 ft) at Lee's Ferry, Arizona, to 2300 m (7580 ft) at Navajo Point, Utah. At full pool, Lake Powell is at 1130 m (3700 ft), covers 68,000 ha, includes 3161 km (1960 mi) of shoreline, and stretches in length for 299 km (189 mi). Above Lake Powell, GLCA is an intricate network of canyons, cliffs, and plateaus.

2.2 Previous work

Pre- and post-Glen Canyon Dam botanical works are summarized in Table 1. Historical botanical collections include those by Alice Eastwood in 1895 and Elzada U. Clover and Lois Jotter in 1938. Before the completion of Glen Canyon Dam in 1964, efforts to document the flora of the Colorado River Corridor through Glen Canyon resulted in plant lists by Xerpha M. Gaines, Seville Flowers and Delbert W. Lindsay, and Walter B. McDougall. Together these plant lists offer

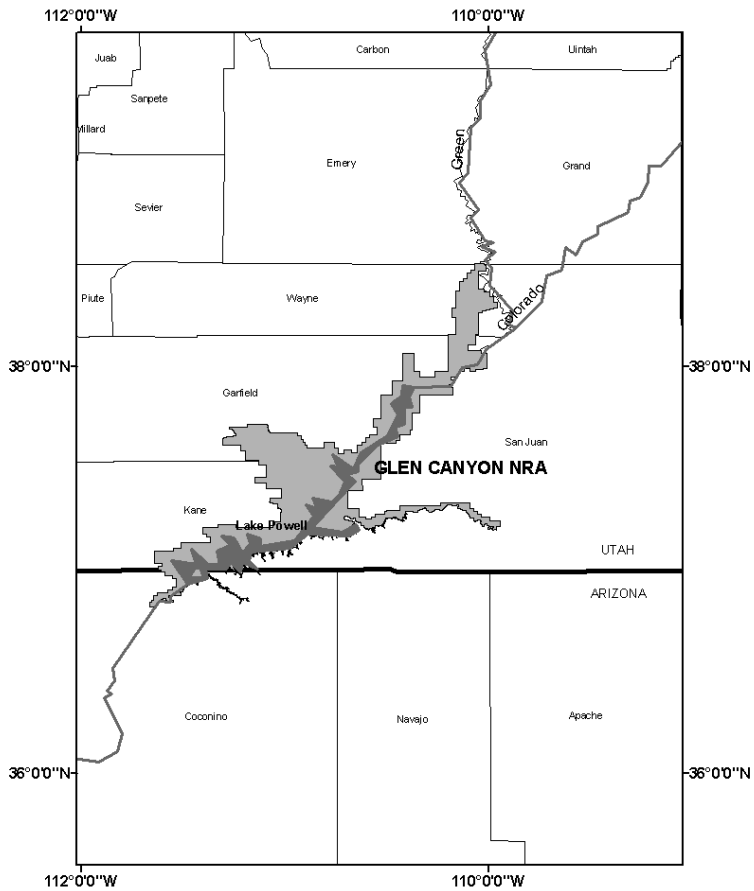

Figure 1. Glen Canyon NRA, Lake Powell, and the Colorado River.

Table 1. Past floristic work in Glen Canyon NRA

Pre/Post Glen Canyon Dam	Past Floristic work in Glen Canyon NRA	Area of focus	# of species	# of families	Herbarium Codes
PRE	Eastwood (1896)	Boot of Cedar Mesa and Hole-in-the-Rock road (Cottonwood Canyon)			
PRE	Clover and Jotter (1944)	Colorado River Corridor from Cataract Canyon to Grand Canyon	134	25	MICH
PRE	Gaines (1960)	Sand bars and terraces along the Colorado River between Hite and the mouth of Kane Creek	190	53	MNA
PRE	Flowers (1959) and Lindsay (1959)	Colorado River Corridor through Glen Canyon	296	59	UTC
PRE	McDougall (1959)	Glen Canyon Area	234	28	MNA
PRE	Scott and Roberston collections, Topping (1997)	Colorado River Corridor through Glen Canyon	65		ARIZ
POST	Welsh et al. (1978)	Kaiparowits Basin (W. of San Juan River arm and S. of Escalante River)			BRY
POST	Welsh (1984)	Glen Canyon NRA	533	68	BRY
POST	Shultz (1987)	Orange Cliffs	209	49	UTC, BRY, COLO
POST	Spence (1992)	Glen Canyon NRA	638	77	GLCA, ASC
POST	Fowler (1995)	Hanging gardens	52	23	RM, GLCA
POST	Spence and Zimmerman (1996)	Glen Canyon NRA	727	85	GLCA
POST	Spence (2005)	Glen Canyon NRA (significant collections 1992-2004)	25	17	GLCA

MICH = University of Michigan Herbarium, Ann Arbor, Michigan; MNA = Museum of Northern Arizona Herbarium, Flagstaff, Arizona; UTC = Intermountain Herbarium, Logan, Utah; ARIZ = University of Arizona Herbarium, Tucson, Arizona; BRY = Stanley L. Welsh Herbarium, Provo, Utah; COLO = University of Colorado Herbarium, Boulder, Colorado; GLCA = Glen Canyon NRA Herbarium, Page, Arizona; ASC = Deaver Herbarium, Flagstaff, Arizona; RM = Rocky Mountain Herbarium, Laramie, Wyoming.

the only documented look at the vegetation along the Colorado River Corridor through Glen Canyon, but reflect little more than three collection trips over one summer.

Pre-dam inventories resulted in a total of 485 documented species from 47 families. No known plant species has been globally extirpated, although some taxa reported from pre-dam collections may have been locally extirpated because they have not been collected again from within the boundaries of GLCA.

After the completion of Glen Canyon Dam, little floristic work was done until 1984, when Stanley L. Welsh of Brigham Young University did a flora for GLCA. In 1987 a flora of the Orange Cliffs was completed (Shultz et al. 1987). Most recently John Spence and Julie Zimmerman did a preliminary flora in 1996. For a complete list of all floristic work done in GLCA see Table 1.

2.3 Climate

Located in the center of the Colorado Plateau, GLCA experiences low precipitation, scattered throughout the year (Brown 1994, Spence 2001). Precipitation patterns for the lower elevations in GLCA are characterized by late fall rains with winter and summer droughts, while higher elevations experience a steady increase in precipitation from a winter low to a fall high (fig. 2). Annual precipitation varies greatly from year to year and decade to decade (fig. 3), ranging from about 3.5 to 28.5 cm (1.4 to 13.6 in) in the park itself. Average annual

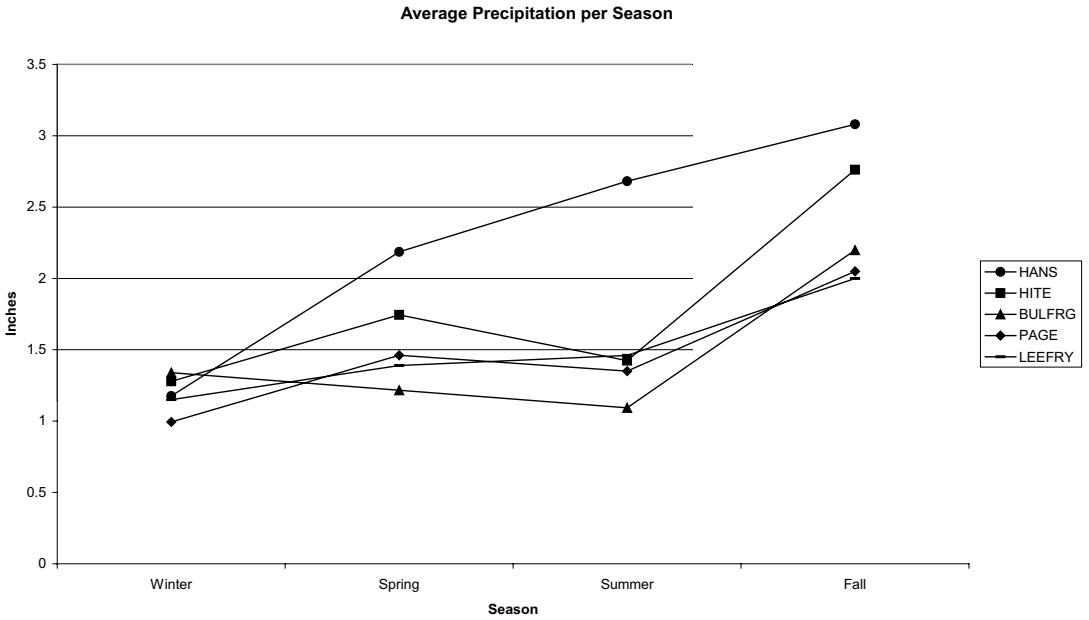

Figure 2. Seasonal precipitation for Glen Canyon NRA (in inches). (HANS = Hans Flat Ranger Station, Wayne County, Utah; HITE = Hite Marina, San Juan County, Utah; BULFRG = Bullfrog Marina, Garfield County, Utah; PAGE = Page, Arizona; LEEFRY = Lee's Ferry, Coconino County, Arizona)

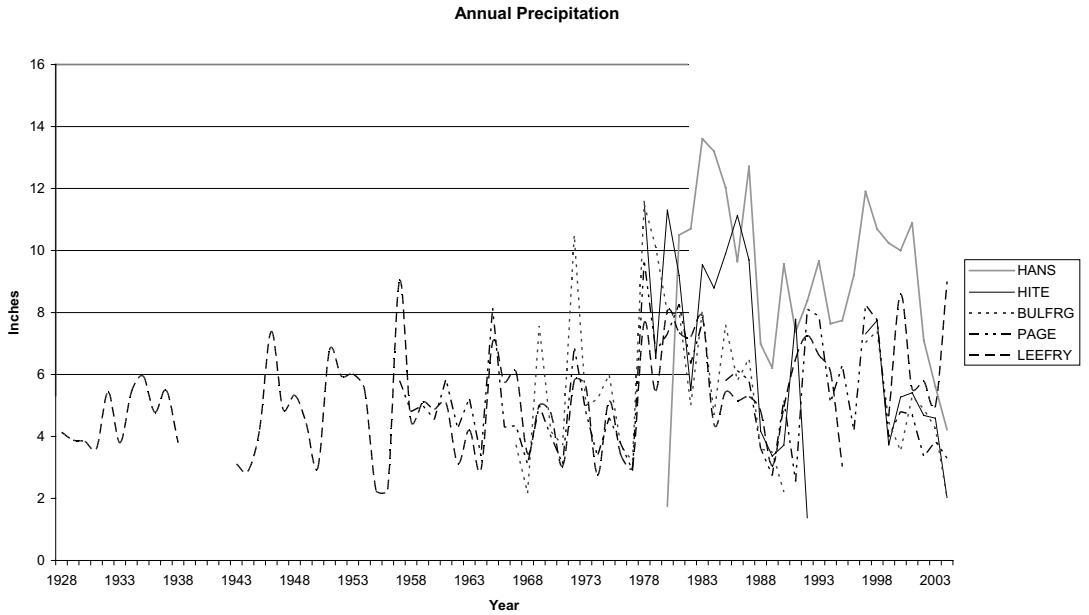

Figure 3. Average Annual Precipitation (1928-2004) for Glen Canyon NRA (in inches). (HANS = Hans Flat Ranger Station, Wayne County, Utah; HITE = Hite Marina, San Juan County, Utah; BULFRG = Bullfrog Marina, Garfield County, Utah; PAGE = Page, Arizona; LEEFRY = Lee's Ferry, Coconino County, Arizona)

precipitation is estimated at 16 cm (6.3 in) for low-elevations and 24 cm (9.4 in) for higher-elevations.

The coldest temperatures tend to occur in the month of January, with average lows ranging from 22° F (Hans Flat) to 37.8° F (Lee's Ferry). The warmest temperatures typically occur in the month of July, when average highs range from 87° F (Hans Flat) to 104° F (Lee's Ferry) (fig. 4). Note that Hite, Bull Frog, and Page weather stations are intermediate.

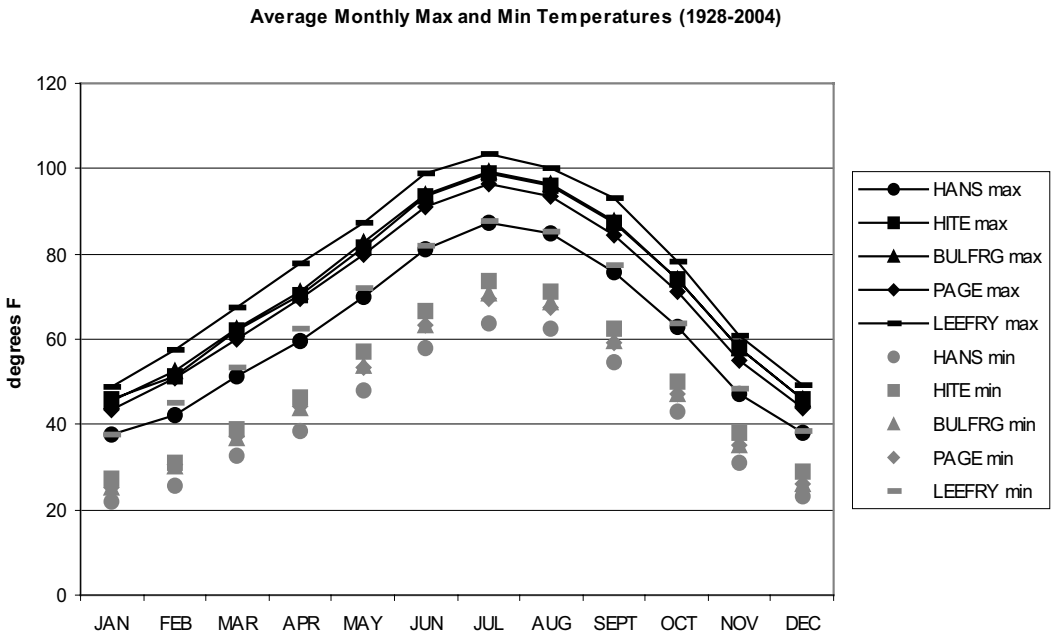

Figure 4. Average Monthly Max and Min Temperatures (1928-2004) for Glen Canyon NRA (in degrees Fahrenheit). (HANS = Hans Flat Ranger Station, Wayne County, Utah; HITE = Hite Marina, San Juan County, Utah; BULFRG = Bullfrog Marina, Garfield County, Utah; PAGE = Page, Arizona; LEEFRY = Lee's Ferry, Coconino County, Arizona)

Like the rest of the Colorado Plateau, low levels of annual precipitation and temperature extremes—hot summers and cold winters—are typical for GLCA. For most of the growing season, low-elevations of GLCA experience high temperatures, little moisture, and high rates of evapotranspiration (West 1983). Summer is a period of drought and stress for plants. Spring and, to a lesser extent, early fall have temperature and moisture conditions that are most favorable for plant growth.

2.4 Vegetation communities

GLCA has been considered to be part of the Great Basin Desert (Shreve 1942). The Great Basin Desert is dominated by big sagebrush (*Artemisia tridentata* Nutt.), sand sagebrush (*Artemisia filifolia* Torr.), and shadscale (*Atriplex confertifolia* (Torr. & Frém.) S. Wats.) Shrublands (Brown 1994). More recently, it has been shown that GLCA is part of the Colorado Plateau Floristic Region, which differs from the Great Basin Desert in that blackbrush (*Coleogyne ramosissima* Torr.) is the dominate vegetation type, and not sagebrush or shadscale (McLaughlin 1986, MacMahon 1979, and Spence et al. 1995). The blackbrush component of GLCA makes it similar to the higher elevations of the Mojave Desert.

Plant communities are natural groups defined by unique vegetation structure and dominant life forms. The distribution of a particular community depends largely on climate and substrate (Brown 1994). Tuhy and MacMahon (1988), Brown (1994), and Spence et al. (2002) developed three different vegetation classification systems that are pertinent to GLCA area. The most common vegetation types are warm desert shrub, salt desert shrub, and pinyon-juniper woodlands (fig 5). Less common vegetation types include sand community types, such as sand sagebrush shrubland and Indian ricegrass-galleta grasslands, sparsely vegetated slickrock, riparian areas, and springs and hanging gardens. Springs and hanging gardens are unique vegetation communities in an otherwise arid-desert landscape. They are well developed in GLCA and are thoroughly discussed in Spence (2004). Tuhy and MacMahon (1988) describe the species composition of each vegetation community found in GLCA.

2.5 Notable plant species

Rare and endemic plants. GLCA has a total of 40 endemic plants (Table 2). Of these species, ten are endemic to hanging gardens, which is considered a sensitive habitat. Few threats have been identified for most of these endemic plants. Together, the Arizona and Utah Natural Heritage Programs collect locality and occurrence information on 56 plant species in GLCA, many of which are endemic (Table 2). Twenty-two of these plants are considered rare by the state heritage programs and have a Global status of G1, G2, T1, T2 (meaning that there are fewer than 20 known occurrences for the species). Many of these rare plant populations have no known threats and therefore are not being considered as candidate species for federal listing under the Endangered Species Act (ESA), though three species are federally-listed as

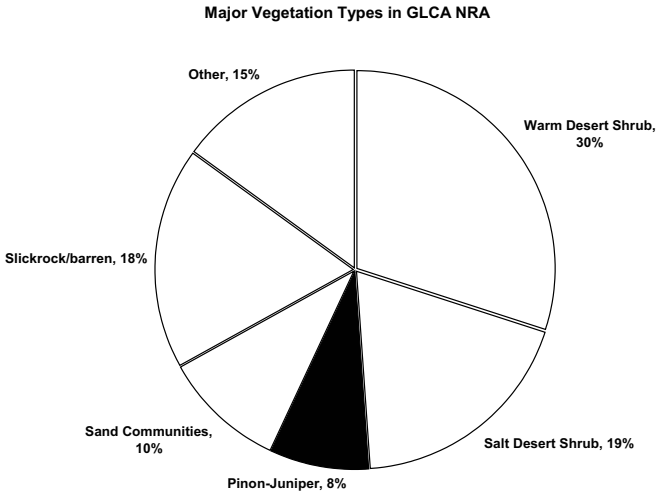

Figure 5. Major Vegetation Types in Glen Canyon NRA (Spence, unpub. 2005).

Table 2. List of Colorado Plateau endemic plants in Glen Canyon NRA with their associated ecology and global rank. Rare plants have a global ranking of G1 (species w/1-5 occurrences), G2 (species w/6-20 occurrences), T1 (subspecies w/1-5 occurrences), or T2 (subspecies w/6-20 occurrences). Rare Plant species marked with an asterisk (*) denote plant populations that are stable with no known threats. LT = Listed Threatened, LE = Listed Endangered.

Species	Ecology	Global Rank	Listed/Rare
Astragalus chamaeleuce var. laccoliticus	Restricted range	G4T1T2	Rare*
A. harrisonii	Globally known from only 10 locations	G2G3	Rare*
A. malacoides	Clay soils	G3	
A. moencoppensis	Clay soils	G3G4	
A. monumentalis	Cutler Formation	G4	
A. musiniensis	Globally known from 14 locations	G2	Rare*
A. preussii var. *cutleri[A. cutleri]*	Restricted to Permian derived soils	G4T1T2	Rare
Atriplex garrettii	Talus slope of Colorado River canyons	G3G4	
Camissonia atwoodii	Clay soils of Tropic Shale and Carmel Formations	G2	Rare*
Carex curatorum	Hanging gardens	G2	Rare
C. specuicola	Hanging gardens (sp. in review)	G2	LT
Ceanothus greggii var. *franklinii*	Cedar Mesa Sandstone (in GLCA NRA)	G5T1T2	Rare*
Cirsium rydbergii	Hanging gardens		
Cycladenia humilis var. *jonesii*	Restricted to clay and basal hills derived from Cutler, Chinle, and Summerville Formations	G3G4T2	LT
Cymopterus acaulis var. *higginsii*	Restricted to Tropic Shale	G5T2	Rare*
Dalea flavescens var. *epica*	Restricted to central Glen Canyon	G5	
Erigeron kachinensis	Seeps and Hanging gardens	G2	Rare
E. zothecinus	Seeps and Hanging gardens	G1	Rare
Euphorbia aaron-rossii	Restricted to Colorado and Little Colorado River Canyons	G1	Rare*
E. nephradenia	Restricted to Tropic Shale and Entrada Sandstone Formations	G2	Rare*
Gilia latifolia var. *imperialis*	Known only from 3 areas	G4T2	Rare*

Table 2 List of Colorado Plateau endemic plants in Glen Canyon NRA with their associated ecology and global rank. ***continued***

Species	Ecology	Global Rank	Listed/Rare
Heliomeris soliceps	Restricted to Tropic Shale Formations	G2	Rare*
Mimulus eastwoodiae	Seeps and Hanging gardens	G3	
Opuntia nicholii	Restricted to the Glen Canyon area	G4Q	
Perityle specuicola	Hanging gardens	G1	Rare
Phacelia howelliana	Restricted to clay and basalt hills	G2	Rare*
P. indecora	San Juan River Canyon	G1	Rare
P. pulchella var. *sabulonum*	Restricted to Tropic and Straight Cliff Shales	G5T1	Rare*
P. rafaelensis	Restricted to Carmel, Chinle, Summerville, and Moenkopi Formations	G3	
Phlox austromontana var. *lutescens*	Rimrock of Cedar mesa and other sandstones	G5T5	
Platanthera zothecina	Hanging gardens	G2	Rare
Primula specuicola	Hanging gardens	G4Q	
Psathyrotes pilifera	Gypsiferous substrates	G3?	
Psorothamnus thompsoniae var. *whitingii*	Desert shrub communities	G3?T2	Rare*
Sphaeralcea grossulariifolia var. *moorei*	taxonomic problems	G5T2T4	Rare*
S. janeae	Moenkopi and Cutler Formations	G1	Rare
Xylorhiza glabriuscula var. *linearifolia*	Grows on Chinle, Shinarump, and Moenkopi Formations	G4T1T2	Rare*
Yucca angustissima var. *toftiae*	Sandstone derived soils and hanging gardens	G5T3	
Zigadenus vaginatus	Hanging gardens	G2	Rare

threatened or endangered. The state heritage programs also collect locality and occurrence information on taxa that are listed as rare by the state-level ranking system.

Jones' Cycladenia (*Cycladenia humilis* Benth. var. *jonesii* (Eastw.) Welsh & Atwood) is a federally-listed threatened species. In GLCA populations are known from the Purple Hills, Garfield County, Utah. Globally, Jones' Cycladenia is endemic to Southeastern Utah and Northern Arizona (Utah Rare Plant Guide 2003). Jones' Cycladenia grows only on alluvium of gypsiferous and saline soils on the Chinle, Cutler, and Summerville Formations (Utah Rare Plant Guide 2003). The National Park Service has been responsible for annual monitoring of populations within the NRA.

Navajo sedge (*Carex specuicola* J. T. Howell) is a federally-listed threatened species. In Glen Canyon populations are known from hanging gardens in side canyons along the San Juan River. Navajo sedge is currently under review by Daniela Roth, Navajo Nation Heritage Botanist. Sherel Goodrich, author of Cyperaceae in *A Utah Flora* (Welsh et al. 2003), believes that all *C. specuicola* collections in Utah are actually the more common sedge species *C. parryana* Dewey. Goodrich states that the "features upon which *C. specuicola* is based seem too inconsistent and too random in Utah to separate that taxon from *C. parryana*."

The National Park Service is responsible for the annual monitoring of populations of plants that are federally-listed as Endangered (Arizona Rare Plant Committee 2002). See Appendix E for a description of federally-listed Endangered species in GLCA.

Copper Canyon milkvetch (*Astragalus preussii* Gray var. *cutleri* Barneby [*Astragalus cutleri* (Barneby) S. Welsh]) is an extremely rare plant (Global Status G4T1T2 and Utah Heritage Status S1S2) and is restricted to a few locations in San Juan County, Utah. Copper Canyon milkvetch grows on Permian-derived soils in warm desert shrub communities (Utah Rare Plant Guide 2003). Copper Canyon milkvetch is known from only two locations inside the park and is not currently monitored.

John Spence, NPS

Jones' Cycladenia (*Cycladenia humilis* var. *jonesii)* is a federally-listed threatened species.

Ten species known from Glen Canyon are endemic to hanging gardens (see Table 2). Alice Eastwood, possibly the first botanist to visit hanging gardens in Utah, described them as "a boreal oasis in the midst of a . . .desert" (Eastwood 1896). One group of species endemic to hanging gardens is composed of remnants of floras that were probably more widespread during the wetter and cooler Pleistocene, thus leading to hanging gardens being described as "relictual refugia" (Spence 1995, Welsh 1989, Welsh & Toft 1972). This group represents taxa associated with spatially distant plant communities, such as redbud (*Cercis orbiculata*) and Knowlton's hophornbeam (*Ostrya knowltonii*), which have affinities to deciduous forests; alcove rockdaisy (*Perityle specuicola*) Welsh & Neese, which has Madrean affinities; and cavedwelling primrose (*Primula specuicola*), Eastwood's monkeyflower (*Mimulus eastwoodiae*), and sheathed deathcamas (*Zigadenus vaginatus*), which have boreal-temperate affinities (Spence 2004, Welsh 1989, Welsh and Toft 1972). Welsh and Toft (1972) proposed that a second group of species endemic to hanging gardens seem to be the result of long-distance dispersal events into suitable habitats. The plants of hanging gardens thus appear to be derived from many sources, and together create a unique plant community in the arid-desert landscape of Glen Canyon NRA. Hanging gardens are dependent on having a continual water supply and are therefore very sensitive to annual precipitation. It is believed that the recent droughts may be causing hanging gardens to dry up (Roth, pers. comm. 2004).

Nonnative plants. *The Preliminary Flora for Glen Canyon NRA* (Spence and Zimmerman 1996) lists 57 plants that are categorized as "introduced to the U.S." by the USDA Plants Database (USDA 2004). In addition to these 57 plants, *A Utah Flora* (Welsh et al. 2003) defines the following seven species as introduced to Utah:

- creeping bentgrass (*Agrostis stolonifera* L., introduced to N. America prior to 1750),
- California poppy (*Eschscholzia californica* Cham., used in reclamation planting and therefore occurring outside its native range in the U.S.)
- common plantain (*Plantago major* L., adventive from Europe)
- curlytop knotweed (*Polygonum lapathifolium* L., adventive, or indigenous in part, from Eurasia)
- watercress (*Rorippa nasturtium-aquaticum* (L.) Hayek), introduced from Europe)
- buffalobur nightshade (*Solanum rostratum* Dunal, indigenous to central U.S., adventive elsewhere)
- water speedwell (*Veronica anagllis-aquatica* L., adventive from Europe).

This brings the total number of nonnative plant species, as defined by the USDA and *A Utah Flora*, to 64 species as of 1996 (Table 3).

While some of the 64 nonnative species in GLCA are harmless, many have a high potential to become invasive or noxious. Thirty-two species occur on State Noxious Status lists (Table 3). Plants with State Noxious Status are designated as legally noxious and are prohibited from entry into the state, unless accompanied by appropriate permits (Arizona Noxious Weed List 2005, Utah Noxious Weed List 2005).

The Southwest Exotic Mapping Program (SWEMP) acts as a central database for invasive weed information. The SWEMP team facilitates the yearly organization and publishing of a regional database and derived maps of invasive weeds of the southern

Colorado Plateau. Fifty-six species listed as "weed species" by SWEMP occur in Glen Canyon NRA (see Table 3) (Thomas and Wynne 2000, SWEPIC 2005).

The National Park Service (NPS) has been actively removing invasive weeds and has removed the following nine species from parts of GLCA, but they are by no means absent from the park: Russian thistle (*Acroptilon repens* (L.) DC.); camelthorn (*Alhagi maurorum* Medik.); black locust (*Robinia pseudoacacia* L.; Russian olive (*Elaeagnus angustifolia*); broadleaved pepperweed (*Lepidium latifolium* L.); dalmatian toadflax (*Linaria dalmatica* (L.) P. Mill.); ravennagrass (Saccharum ravennae (L.) L.); saltcedar (*Tamarix chinensis*); and mullein (*Verbascum thapsus* L.) (Spence, pers. comm. 2005).

2.6 Geology

The physiography and geology of the Glen Canyon area have been summarized by both Cooley (1958) and Potter and Pattison (1977). Glen Canyon is situated in the heart of the canyon country of the Colorado Plateau. Rocks of Glen Canyon range in age from Cretaceous (youngest) to Pennsylvanian (oldest) (see Figure 6 for geological strata). During the Tertiary these deposits were faulted, folded, and uplifted. By the mid-Miocene, the Colorado River drainage pattern was established (Potter and Pattison 1977). This first channeling event created the outer gorge as the Colorado River cut through Cretaceous/Jurassic rocks, including the Straight Cliff, Entrada, Summerville, and Morrison formations. Many members and formations in the outer gorge support rare and endemic plants, but the Tropic Shale has the most diversity, with seven endemic species (Table 2). The outer gorge and its rocks are visible throughout the Kaiparowits Plateau and support a wide variety of plant communities, including pinyon-juniper woodlands and warm-temperate desert shrub.

Later in the Pliocene and Pleistocene, a second channel cutting through the rock formed the inner gorge (Potter and Pattison 1977). Triassic/Jurassic rocks, such as Navajo

Table 3. Nonnative plants species in Glen Canyon NRA (based on the1996 GLCA NRA Preliminary Flora) that are either listed on AZ, UT, CO, or NM Noxious Weed List or by Southwest Exotic Plant Mapping Program (SWEMP)

Family	Species	State Noxious Status	SWEMP
Amaranthaceae	*Amaranthus blitoides*		Listed
Amaranthaceae	*A. retroflexus*		Listed
Asteraceae	*Acroptilon repens*	AZ, NM	Listed
Asteraceae	*Cichorium intybus*	CO	Listed
Asteraceae	*Cirsium vulgare*	CO, NM	Listed
Asteraceae	*Lactuca serriola*		Listed
Asteraceae	*Sonchus asper*		Listed
Asteraceae	*Taraxacum officinale*		Listed
Asteraceae	*Tragopogon dubius*		Listed
Brassicaceae	*Capsella bursa-pastoris*	CO	Listed
Brassicaceae	*Descurainia sophia*	CO	Listed
Brassicaceae	*Draba verna*		Listed
Brassicaceae	*Lepidium latifolium*	CO, NM, UT	Listed
Brassicaceae	*Sisymbrium altissimum*		Listed
Cannabaceae	*Cannabis sativa*		Listed
Chenopodiaceae	*Bassia hyssopifolia*		Listed
Chenopodiaceae	*Salsola tragus*		Listed
Convolvulaceae	*Convolvulus arvensis*	UT	Listed
Elaeagnaceae	*Elaeagnus angustifolia*	CO, NM	Listed

Table 3 continued

Family	Species	State Noxious Status	SWEMP
Fabaceae	*Medicago sativa*		Listed
Fabaceae	*Melilotus alba*		Listed
Fabaceae	*M. officinalis*		Listed
Geraniaceae	*Erodium cicutarium*	CO	Listed
Lamiaceae	*Marrubium vulgare*		Listed
Lamiaceae	*Salvia aethiopis*	CO	Listed
Plantaginaceae	*Plantago lanceolata*		Listed
Poaceae	*Agropyron cristatum*		Listed
Poaceae	*Bromus catharticus*		Listed
Poaceae	*B. diandrus*		Listed
Poaceae	*B. japonicus*		Listed
Poaceae	*B. rubens*		Listed
Poaceae	*B. tectorum*	CO	Listed
Poaceae	*Cynodon dactylon*	UT	Listed
Poaceae	*Dactylis glomerata*		Listed
Poaceae	*Echinochloa crus-galli*		Listed
Poaceae	*Eragrostis curvula*		Listed
Poaceae	*Lolium pretense*		Listed
Poaceae	*Phleum pretense*		Listed
Poaceae	*Poa annua*		Listed
Poaceae	*Polypogon viridis*		Listed
Poaceae	*Saccharum ravennae*		Listed
Poaceae	*Schismus arabicus*		Listed
Poaceae	*S. barbatus*		Listed
Polygonaceae	*Polygonum aviculare*		Listed
Polygonaceae	*P. lapathifolium*		Listed
Polygonaceae	*P. persicaria*		Listed
Portulacaceae	*Portulaca oleracea*	AZ	
Scrophulariaceae	*Linaria dalmatica*	CO	Listed
Scrophulariaceae	*Verbascum thapsus*	CO	Listed
Ulmaceae	*Ulmus pumila*	NM	Listed
Zygophyllaceae	*Tribulus terrestris*	AZ, CO	Listed

Sandstone, Kayenta Formation, and Wingate Formation, are exposed in the inner gorge. Navajo Sandstone is the dominant rock in Glen Canyon and forms the vertical red cliffs surrounding lower Lake Powell. Wingate Sandstone forms the orange-red vertical cliffs (up to 100 m high) for which the Orange Cliffs are named (Chronic and Chronic 2004). The inner gorge supports warm-temperate desert shrub and hanging garden communities.

The Cutler Formation, which is Permian in age, is visible in various locations throughout the park, including Clay Hills Crossing, Muley Point, and the area around and north of Hite. The Cutler Formation has three major constituents (from youngest to oldest): White Rim Sandstone, Organ Rock, and Cedar Mesa Sandstone. Cutler Formation is rich with rare and endemic plant diversity. See Table 2 for rare and endemic plants and their associated geology.

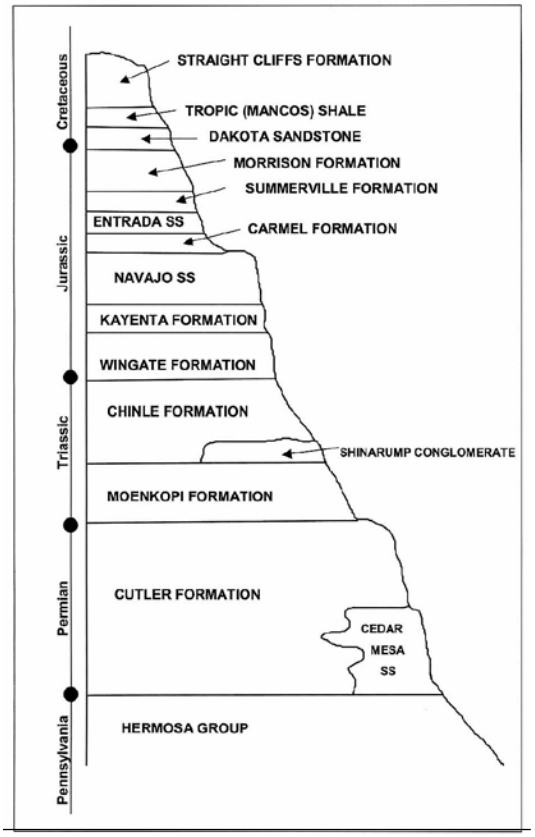

Figure 6. Glen Canyon NRA Geologic Column

Honaker Trail Formation and Paradox Formation are the oldest exposed rock layers in Glen Canyon. These rocks belong to the Hermosa group, are found in Cataract and San Juan River Canyons, and support warm desert and salt desert communities. The Hermosa group also includes gypsum and limestone components (Barnes 1978).

3 Methods

3.1 Sampling methods

We surveyed Glen Canyon NRA (GLCA) for two field seasons, May - October, 2003, and March - October, 2004. We made most of our trips to Glen Canyon NRA before mid-June and after late-July; few trips were made between mid-June and late-July. John Spence, Glen Canyon NRA Ecologist, identified areas to be targeted for intensive survey. Of those targeted areas, we surveyed the San Juan River corridor, Clay Hills Crossing area, Dark Canyon, the Escalante River corridor, Navajo Point area of the Kaiparowits Plateau, and Lee's Ferry. Targeted areas that we did not survey during this study include the Dirty Devil River corridor and lower Cataract Canyon.

We recorded the following data for each specimen collected: locality description, UTM coordinates determined with a global positioning system (GPS), elevation, habitat type, and associated species. However, the GPS could not receive sufficient signal when collecting in many side canyons and hanging gardens because the steep canyon walls prevented triangulation. In these situations we obtained coordinates and elevation using TOPO! (2000). We pressed, dried, mounted, and deposited voucher specimens at GLCA herbarium. Sets of duplicate specimens were deposited in Deaver Herbarium (ASC), Brigham Young University Herbarium (BRY), and San Juan College Herbarium (SJNM).

3.2 Herbarium searches

During this study we searched the entire Glen Canyon NRA herbarium and made concentrated searches for target species at Deaver Herbarium, Brigham Young Herbarium, and the Museum of Northern Arizona. We based the list of target species on previous observations of botanists (pre-dam and others) and species common to adjacent floras, including the *San Juan Flora* (Heil and O'Kane 2003), the *Flora for the Grand Staircase Escalante National Monument* (Fertig 2003), *Checklist of Plants for Canyonlands* (Schelz and Moran 2003), *Vascular Flora and Vegetation of Capitol Reef National Park, Utah* (Heil et al. 1993), *An Annotated Checklist of Vascular Plants of Grand Canyon* (Phillips et al. 1987), and subsequent additions (Ayers et al. 1994, Brian et al. 1999, Brian 2001). We ran queries on the collection databases of Deaver Herbarium, Arizona State University Herbarium, University of Arizona Herbarium, and the Desert Botanical Garden Herbarium (DBG), which collectively contained 245 GLCA records. Every specimen found in the combined database searches was inspected and verified, with annotations made when necessary.

3.3 Floristic composition

In order to understand how the flora of Glen Canyon NRA relates to surrounding areas, we compared the species checklist for Glen

Canyon NRA to the following surrounding floras:

- Capitol Reef (Heil et al. 1993)
- Grand Staircase-Escalante National Monument (Fertig 2003)
- Arches National Park (Schelz and Moran 2003)
- Canyonlands National Park
- Natural Bridges National Monument
- Bryce Canyon National Park (Spence and Buchanan 1993)
- Grand Canyon National Park (Phillips et al. 1987, Ayers et al. 1994, Brian et al. 1999, Brian 2001).

We chose to use the Otsuka Index (Simpson 1980) to determine the degree of similarity between the Glen Canyon NRA species checklist and that of the surrounding floras, because it minimizes the differences in size of the floras, as recommended in McLaughlin (1986). The formula for the Otsuka Index (S) is as follows:

$$S(o) = c/(a \times b)^{1/2}$$

Where c = number of species common to both floras, a = number of species in flora one, and b = number of species in flora two. The Otsuka Index values range from 0-1, with values close to 1 showing the highest degree of similarity. The floras were compared at the species level for the whole flora, and native and nonnative floras separately.

3.4 Vegetation communities

To determine what percentage of the flora of Glen Canyon NRA had been documented, we set up the following 0.1 hectare plots in pinyon-juniper communities:

- randomly distributed sample plots at Muley Point and Kaiparowits Plateau using random points generated with ArcGIS
- randomly distributed sample plots at Orange Cliffs and Purple Hills using random points generated from a random number table. We chose 3-4 digit numbers, with the first number indicating the number of miles to drive down the road; the second number indicating the direction of travel from the road (1=N, 2=NE, 3=E, 4=SE, 5=S, 6=SW, 7=W, 8=NW; 9 & 0 were discarded), and the third number indicating tenths of miles of travel on foot from the road.

For each plot we collected the following data: species present, prominence of each species, and height and cover for the dominant and co-dominant species of each layer (tree, shrub, forb, graminoids, and herb). Prominence was measured according to a visual scale of dominant, co-dominant, associate, uncommon, and rare.

We calculated species richness in pinyon-juniper communities using first order jackknife estimates. The formula for estimated species richness is as follows:

$$S(j) = S_o + a1(N-1)/N$$

(first order jackknife)

Where S_o = the total number of species observed in all plots in each community type, a1 = the number of species occurring only in one site in the collection, and N = the number of sites in the collection. First order jackknife estimates assume that the data is random and that the population is normally distributed.

John Spence provided the plot data from riparian, springs and seeps, and upland desert shrub types (including warm desert shrub, salt desert shrub, and sand shrub communities). First order species richness jackknife estimates were calculated to determine if the sampling effort had found 90% of the flora expected in riparian, springs and seeps, and warm desert shrub type communities of Glen Canyon NRA.

3.5 Pre/Post Glen Canyon dam floras

We documented the pre-Glen Canyon Dam flora using both published floristic work by Clover and Jotter (1944), McDougall (1959), Flowers (1959), Lindsey (1959), Gaines (1960), and Clark (1966), and electronic herbarium searches. We queried the collection databases of Deaver Herbarium, Arizona State University Herbarium, University of Arizona Herbarium, and Desert Botanical Garden Herbarium, which collectively contained 63 pre-dam records. From this we compiled a checklist of pre-dam plant species. Nomenclature was updated using the United States Department of Agriculture PLANTS database (2004). We compared pre-and post-dam floras at the species level.

4 Results

4.1 Vascular flora

To date, 769 species in 362 genera and 90 families have been vouchered from Glen Canyon NRA (GLCA), bringing the total number of specific and intraspecific taxa to 780 (Table 4). We added 129 previously unreported species to the flora. An annotated checklist of vascular plants is provided in Appendix A. The list includes information on life form, general distribution, and habitat for each taxon.

Ninety-one species listed on the Preliminary Flora of Glen Canyon National Recreation Area (Spence and Zimmerman 1996) were not included in this flora because

- previously reported voucher specimens were annotated to another taxon or deemed to be outside the park boundary
- the taxon was not encountered during the study period
- and/or no voucher specimen could be located (Appendix I)

The largest plant families were Asteraceae, Poaceae, Fabaceae, Brassicaceae, and Chenopodiaceae (fig. 7). Together these top five species-rich families account for 53% of the total taxa. In contrast, 28 families were represented by only one species each (e.g., Selaginellaceae, Ericaceae, Hydrangeaceae, Caprifoliaceae, Araliaceae, and Commelinaceae).

Table 4. Taxonomic composition of Glen Canyon NRA.

Division	Families	Genera	Species		
Class			Native	Exotic	Total species
Lycopodiophyta	1	1	1	0	1
Equisetophyta	1	1	4	0	4
Pteridophyta	2	5	5	0	5
Gnetophyta	1	1	3	0	3
Coniferophyta	2	4	4	1	5
Magnoliophyta					
Magnoliopsida	73	272	544	55	599
Liliopsida	10	78	134	30	163
Total	**90**	**362**	**693**	**85**	**780**

Habit descriptions in this study include annual herbs, biennial herbs, perennial herbs, shrubs, succulent shrubs, and trees. Perennial herbs are the most common life form in the study area and account for 53% of the taxa, while annual herbs account for 26% . The flora also includes 13% shrubs, 3% biennial herbs, and about 2.5% succulent shrubs and trees (fig. 8).

During this study, we vouchered the 56 taxa that the Arizona and Utah Natural Heritage Programs track. In addition to these previously reported taxa, several new rare plant species were added to the flora. Welsh's aster (*Symphyotrichum welshii* (Cronq.) Nesom) was collected from the hanging garden at the back (upstream end) of Explorer Canyon, Garfield Co, Utah. *Symphyotrichum welshii* has a global rank of G2 and a Utah State rank of S2. It is endemic to Utah and grows primarily in hanging gardens of side-canyons and in seepage areas. Three rare-plants species, Copper Canyon milkvetch (*Astragalus preussii* var. *cutleri*), drab phacelia (*Phacelia indecora*), and Navajo sedge (*Carex specuicola*), previously unreported by Spence and Zimmerman (1996), were added to the flora, although the park ecologist was aware of them before this study.

Eighty-six species, or 11% of the total flora, are not native to the Glen Canyon NRA region. The USDA Plants Database (USDA 2004) categorizes 70 of these plants as "introduced to the U.S.". In addition to nonnative plants recognized by the USDA Plants Database, A Utah Flora (Welsh et al. 2003) defines 16 more taxa as not being native to the Glen Canyon NRA region. Twenty-five nonnative taxa were added to the flora (Table 5). Of these newly reported nonnative taxa, the following have State Noxious Status: saltlover (*Halogeton glomeratus* (Bieb.) C.A. Mey.) (AZ, CO, NM), Mexican-fireweed (*Kochia scoparia* (L.) Schrad.) (CO), green bristlegrass (*Setaria viridis* (L.) Beauv.) (CO), and johnsongrass (*Sorghum halepense* (L.) Pers.) (CO, UT). Sixteen of the newly reported nonnative taxa are also listed by SWEMP as "weed species" (Table 5).

Numerous cultivated plants exist at Glen Canyon NRA park headquarters, Lee's Ferry (including Lonely Dell Ranch), and the park's six marinas and developed campgrounds.

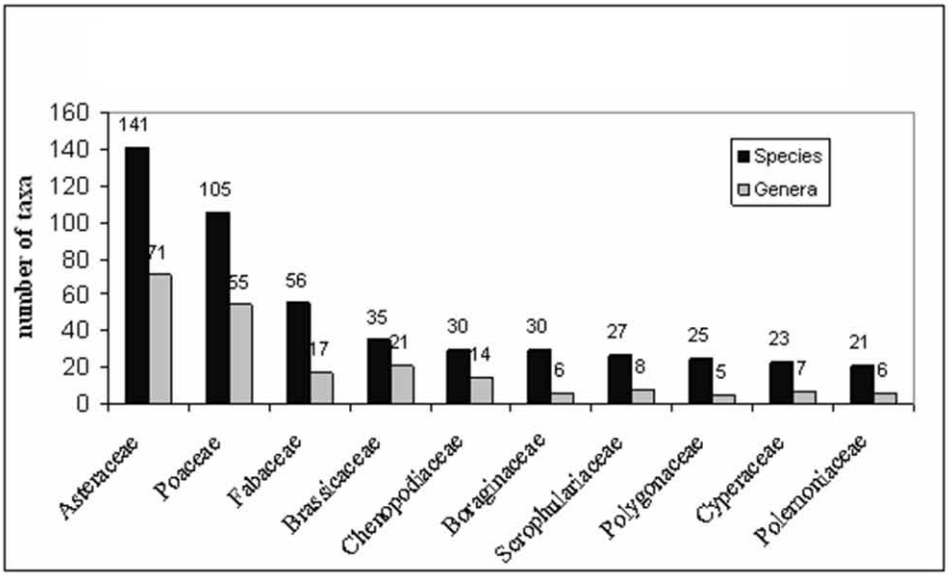

Figure 7. Number of genera and species in the ten best-represented flora families in Glen Canyon NRA.

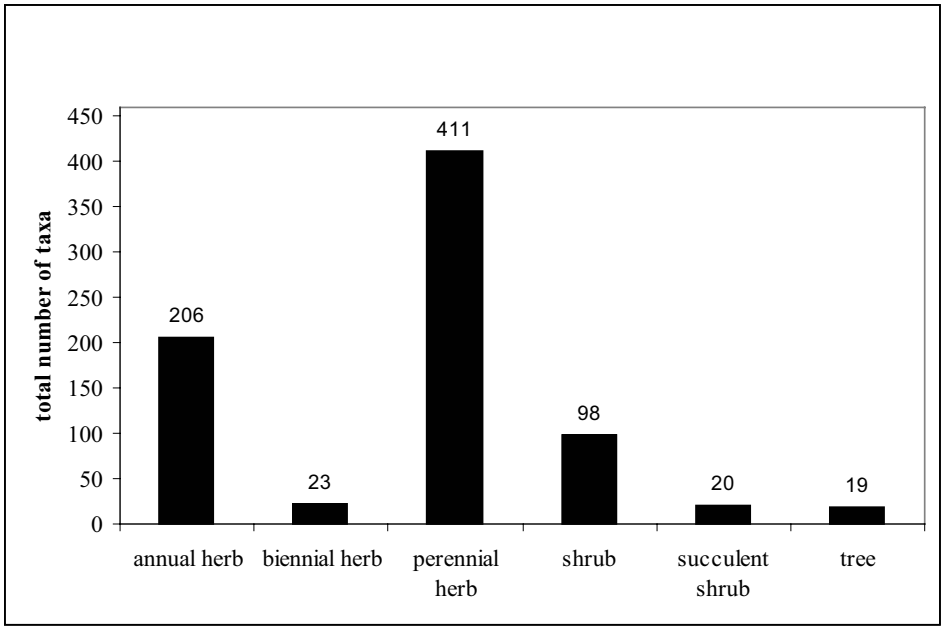

Figure 8. Composition of flora at Glen Canyon NRA by life form.

Arizona cypress (*Cupressus arizonica* Greene), ravennagrass (*Saccharum ravennae*), pampas grass (*Cortaderia selloana* (J.A. & J.H. Schultes) Aschers. & Graebn.) and desert willow (*Chilopsis linearis* (Cav.) Sweet) were the only cultivated plants vouchered from landscaping around the park. *Cupressus arizonica* was collected from Wahweap Campground. *Saccharum ravennae* was collected as an ornamental from Wahweap Marina/Campground and as an invasive plant from Llewellyn Gulch. *Chilopsis linearis* was collected from the Lee's Ferry Campground. *Cortaderia selloana*, a cultivated pampas grass, was collected as an invasive plant from mile 14.6 on the Colorado River.

4.2 Floristic composition

The Otsuka Similarity Index factors for comparing the flora of Glen Canyon with other national parks in the region are as follows: Canyonlands NP - 0.68, Grand Staircase-Escalante NM - 0.64, Arches NP -

Table 5. New records for nonnative plant species in Glen Canyon NRA. Plants listed as either State Noxious Status or Southwest Exotic Plant Mapping Program (SWEMP) are noted.

Family	Species	State Noxious Status	SWEMP
Aizoaceae	*Trianthema portulacastrum*		
Amaranthaceae	*Amaranthus albus*		
Asteraceae	*Pseudognaphalium luteoalbum*		
Brassicaceae	*Brassica nigra*		Listed
Brassicaceae	*B. tournefortii*		Listed
Brassicaceae	*Erysimum repandum*		Listed
Brassicaceae	*Sisymbrium irio*		Listed
Chenopodiaceae	*Chenopodium album* var. *album*		
Chenopodiaceae	*Halogeton glomeratus*	AZ, CO, NM	Listed
Chenopodiaceae	*Kochia scoparia*	CO	Listed
Fabaceae	*Medicago lupulina*		Listed
Fabaceae	*Trifolium fragiferum*		
Liliaceae	*Asparagus officinalis*		Listed
Oxalidaceae	*Oxalis corniculata*		
Poaceae	*Avena sativa*		Listed
Poaceae	*Bromus inermis*		Listed
Poaceae	*Elymus repens*		Listed
Poaceae	*Hordeum murinum* ssp. *glaucum*		
Poaceae	*Lolium arundinaceum*		
Poaceae	*Poa compressa*		Listed
Poaceae	*P. pratensis*		Listed
Poaceae	*Polypogon interruptus*		Listed
Poaceae	*Setaria viridis*	CO	Listed
Poaceae	*Sorghum halepense*	CO, UT	Listed
Scrophulariaceae	*Veronica biloba*		

0.62, Capitol Reef NP - 0.62, Natural Bridges NM - 0.58, Grand Canyon NP - 0.52, and Bryce Canyon NP- 0.39. Thus Glen Canyon is most floristically similar to Canyonlands NP, Grand Staircase-Escalante NM, and Arches NP, listed in descending order. When considering just the native species, the floristic similarities between Glen Canyon NRA and its surrounding parks are exactly the same as when considering the entire flora (both native and nonnative species) (Table 6). When considering just nonnative species, Glen Canyon NRA has the greatest floristic similarities with the following three parks: Grand Staircase-Escalante NM (0.67), Canyonlands NP (0.66), and Capitol Reef NP (0.60) (Table 6).

4.3 Vegetation communities

A total of 144 species were recorded in 35 pinyon-juniper community plots. Aside from *Pinus edulis* (31 plots) and *Juniperus osteosperma* (31 plots), *Gutierrezia sarothrae* (32 plots), the most commonly recorded species were *Ephedra viridis* Coville (24 plots), *Achnatherum hymenoides* (24 plots), *Lepidium montanum* Nutt. (20 plots), and *Artemisia bigelovii* Gray (18 plots). Fifty-six species occurred only in a single plot. First order jackknife estimates predict a total of 205 species for pinyon-juniper communities within Glen Canyon NRA. Based on this estimate, approximately 71% of pinyon-juniper community species have been captured in plots.

Table 6. Comparison of flora at Glen Canyon NRA to that of surrounding area parks. Glen Canyon NRA's floristic relationship to surrounding parks is expressed using the Otsuka Similarity Index. Otsuka Similarity Index values range between 1-100% (0.01-1.00), the higher the value the greater the floristic similarity. The highlighted boxes indicate the top three parks that are most floristically similar to GLCA NRA in each group. (NABR = Natural Bridges NP; ARCH = Arches NP; CANY = Canyonlands NP; CARE = Capitol Reef NP; BRYC = Bryce Canyon NP; GSENM = Grand Staircase-Escalante NM; GRCA = Grand Canyon NP)

Park	Entire flora	Native flora	Nonnative flora
NABR	0.58	0.58	0.58
ARCH	0.62	0.62	0.58
CANY	0.68	0.68	0.66
CARE	0.62	0.62	0.60
BRYC	0.39	0.38	0.55
GSENM	0.64	0.64	0.67
GRCA	0.52	0.52	0.55

A total of 172 species were recorded in 149 riparian community plots. The most commonly found riparian species were: *Equisetum hyemale* (67 plots), *Artemisia ludoviciana* Nutt. (57 plots), *Bromus tectorum* L. (57 plots), *Populus fremontii* (56 plots), *Juncus balticus* Willd. var. *montanus* Engelm. (53 plots), *Tamarix chinensis* (53 plots), *Salix exigua* (52 plots), and *Baccharis emoryi* (51 plots). Forty species occurred in only a single plot. First order jackknife estimates predict a total of 212 species for riparian communities within Glen Canyon NRA. Based on this estimate, approximately 81% of the riparian community species have been captured in plots.

A total of 155 species were recorded in 141 springs and seeps community plots. The most commonly found springs and seeps species were *Adiantum capillus-veneris* (86 plots), F*rangula betulifolia* (65 plots), *Solidago velutina* DC. (62 plots), *Quercus gambelii* (60 plots), *Epipactis gigantea* Dougl. ex Hook. (57 plots), *Cirsium rydbergii* (56 plots), and *Dichanthelium acuminatum* (51 plots). Thirty-nine species occurred in only a single plot. First order jackknife estimates predict a total of 194 species for spring communities within GLCA. Based on this estimate, approximately 80% of the spring community species have been captured in plots.

A total of 171 species were recorded in 69 upland desert shrub community-type plots (including warm desert shrub, salt desert shrub, and sand desert shrub). The most commonly found warm desert shrub species *Pleuraphis jamesii* (160 plots), *Coleogyne ramosissima* (147 plots), *Achnatherum hymenoides* (134 plots), *Vulpia octoflora* (Walt.) Rydb. (106 plots), and *Ephedra viridis* (103 plots). Twenty species occurred in only a single plot. First order jackknife estimates predict a total of 191 species for upland desert shrub communities within GLCA. Based on this estimate, approximately 89% of the desert shrub community species have been captured in plots.

4.4 Pre/Post Glen Canyon dam floras

The documented pre-Glen Canyon Dam Flora is comprised of 482 taxa in 240 genera and 70 families. Four hundred and sixteen species, or 86% of the pre-Glen Canyon Dam flora, were collected again after 1964. Of the taxa that were not collected again after the completion of the dam, 11% (51 voucher specimens) were annotated to taxa that were vouchered during this study and 3% (15 species) are currently considered extirpated from GLCA. See Appendix B for a list of extirpated species and a discussion of their present-day distributions.

5 Discussion

5.1 Vascular flora

This study lists 780 vouchered plant taxa and 75 unvouchered, but previously reported taxa in Glen Canyon NRA (GLCA). Forty-two plant species that are documented in both Canyonlands NP and Grand Canyon NP have not yet been reported from GLCA (Table 6). We made a special effort to find these plant species in the field and searched for them in the following collections: Glen Canyon NRA Herbarium, Deaver Herbarium, Stanley L. Welsh Herbarium, and the Museum of Northern Arizona Herbarium. Though these 42 species have not been documented in GLCA, it is very likely that they do occur

Table 7. Species occurring in both Canyonlands and Grand Canyon NP but not yet reported from Glen Canyon NRA. These species are to be expected in Glen Canyon NRA, especially from Cataract Canyon.

Family	Scientific Name
Apiaceae	*Pteryxia petraea*
Asclepiadaceae	*Asclepias tuberosa*
Asteraceae	*Antennaria parviflora*
Asteraceae	*Cirsium rothrockii*
Asteraceae	*Crepis runcinata*
Asteraceae	*Erigeron flagellaris*
Asteraceae	*Helianthella uniflora*
Asteraceae	*Machaeranthera bigelovii*
Brassicaceae	*Descurainia californica*
Brassicaceae	*Lepidium fremontii*
Brassicaceae	*L. perfoliatum*
Brassicaceae	*L. virginicum*
Chenopodiaceae	*Allenrolfea occidentalis*
Cucurbitaceae	*Cucurbita foetidissima*
Cyperaceae	*Carex subfusca*
Fabaceae	*Lathyrus lanszwertii*
Fabaceae	*Lotus utahensis*
Fabaceae	*Psoralidium tenuiflorum*
Fabaceae	*Vicia ludoviciana*
Gentianaceae	*Frasera speciosa*
Gentianaceae	*Gentiana affinis*
Grossulariaceae	*Ribes cereum*
Hydrangeaceae	*Philadelphus microphyllus*
Lamiaceae	*Dracocephalum parviflorum*
Malvaceae	*Malva neglecta*
Malvaceae	*Malvella leprosa*
Pinaceae	*Abies concolor*
Poaceae	*Bromus carinatus*
Poaceae	*Hordeum pusillum*
Poaceae	*Leptochloa fusca*
Polemoniaceae	*Phlox longifolia*
Ranunculaceae	*Ceratocephala testiculata*
Rhamnaceae	*Ceanothus fendleri*
Rosaceae	*Cercocarpus ledifolius*
Rosaceae	*Prunus persica*
Salicaceae	*Salix lucida*
Scrophulariaceae	*Castilleja miniata*
Scrophulariaceae	*Cordylanthus parviflorus*
Solanaceae	*Physalis hederifolia*
Verbenaceae	*Phyla cuneifolia*
Zygophyllaceae	*Kallstroemia californica*

within the park (Table 7). With a total of 856 reported taxa (including both vouchered species and reported but unvouchered species) and 898 probable taxa, the flora of Glen Canyon NRA is the largest national park flora in southeastern Utah and one of the largest floras on the Colorado Plateau.

Two major factors influence the large number of plant species present in GLCA. First, Glen Canyon supports a large variety of habitats. It's hanging gardens and springs are more species-rich than similar habitats in Grand Canyon, Arches, and Canyonlands National Parks (Spence 2004). Glen Canyon also hosts a number of species that are endemic to, or strongly associated with, geologic formations. Some examples include Jones' cycladenia (*Cycladenia humilis* var. *jonesii*) found only on Chinle Formation; beautiful phacelia (*Phacelia pulchella* var. *sabulonum*), broadleaf gilia (*Gilia latifolia* var. *imperialis*), and Atwood's evening-primrose *(Camissonia atwoodii*), found growing mainly on Tropic Shale Formations; and a number of hanging garden species that grow on Navajo Sandstone.

Secondly, Glen Canyon NRA's flora is influenced by several major floristic regions. Glen Canyon NRA's flora includes representatives of the

- Rocky Mountains (ex: *Acer grandidentatum* Nutt. and *Pseudotsuga menziesii* (Mirbel) Franco)
- Mexican or warm temperate affinities (*Psorothamnus spp*. and *Thamnosma montana* Torr. & Frém.)
- Great Plains (*Pleuraphis jamesii* Torr.)
- Boreal-temperate (*Juncus ssp*.)
- widely distributed cosmopolitan species of North America and Eurasia (*Lactuca* ssp., *Taraxacum officinalis* G.H. Weber ex Wiggers, and *Phragmites australis* (Cav.) Trin. ex Steud.)
- species endemic to the Colorado Plateau (see Table 2) (Welsh and Toft 1972, Spence 2004, McLaughlin 1989).

5.1.1 Threatened and endangered taxa

Welsh's Aster (*Symphyotrichum welshii*) is a globally rare plant that is new to the flora of GLCA. A hanging garden species, it was collected from Explorer Canyon, a side

canyon on the north side of the Escalante River. Welsh's Aster is most likely to be found in other side canyons along the Escalante River. Outside of Glen Canyon, it is known only from Utah, growing in seeps, hanging gardens, wet meadows, and stream banks in Beaver, Garfield, Kane, Piute, and Washington Counties.

Copper Canyon milkvetch (*Astragalus preussii* var. *cutleri*) is known from only two localities in the park, and a handful of locations globally. We searched for the population of *A. preussii* var. *cutleri* at Clay Hills Crossing (NDA 22013) on two occasions during the spring of 2004, but were not able to locate it. The summer of 2005 was a good year for *A. preussii* var. *cutleri*, as it reappeared at several locations in Copper Canyon, UT, where it was believed to have been grazed nearly to extinction (Roth, pers. comm. 2005). It was also collected from Castle Creek, San Juan County, Utah in the early 1990's, but no one has collected at this location since. *Astragalus preussii* var. *cutleri* is a very rare plant; its status and threats inside the park should be further investigated. Also, it should be continually sought at both Clay Hills Crossing and Castle Creek.

Navajo sedge (*Carex specuicola*), a federally-listed rare plant, has been collected from both Slickhorn and John's Canyon along the San Juan River and is also known from hanging garden habitats in canyons of the Arizona portions of the Navajo Nation. The population in Slickhorn Canyon was located in 2003 and was present and in good condition. Unfortunately the John's Canyon population was not found in June 2005 (Roth, pers. comm. 2005). The two collections of *C. specuicola* in Glen Canyon, and all Utah collections of this species are currently under review. Sherel Goodrich, author of Cyperaceae in *A Utah Flora* (Welsh et al. 2003) believes that Utah collections of *C. specuicola* are actually the more common species *C. parryana*. John Spence (pers. comm. 2005) has suggested that *C. specuicola* be removed from the Glen Canyon flora, but we recommend waiting until the review is complete before removing this species from the flora list.

Bluff phacelia (*Phacelia indecora*), a globally-rare plant with a rank of G1, was collected from Point Lookout Canyon along the San Juan River by N. Duane Atwood (22560) in 1997. Bluff phacelia's type collection was made in 1919 from Bluff, San Juan County, Utah, and was not found again until the spring of 1998 (NatureServe 2005). Daniela Roth, Navajo Nation Heritage Botanist, has investigated known and new populations of Bluff phacelia along the San Juan River and believes that she relocated the Point Lookout Canyon population in June of 2005 (Roth, pers. comm. 2005). However, some debate exists over its taxonomy. Botanists, such as Arthur Cronquist, have considered collections of *P. indecora* to be depauperate specimens of the more common *P. lemmonii* (Cronquist et al. 1986), although Duane Atwood recognizes *P. indecora* as a viable taxonomic unit (Welsh et al. 2003). Systematic work needs to be done to solve the taxonomic issues with *P. indecora*. If systematic work supports specific status for *P. indecora*, populations within the park should be surveyed.

5.1.2 Nonnative species

A number of nonnative plants pose threats to GLCA's sensitive habitats, native plant communities, and landscape aesthetics. Russian olive (*Elaeagnus angustifolia*) and salt cedar (*Tamarix chinensis*) are present throughout the park's riparian communities. Ongoing efforts have focused on removing these species, including the removal of Russian olive from the Escalante River and saltcedar from Lee's Ferry. Nonnative plant species that threaten hanging garden habitats are discussed in Spence (2004). Twenty-six nonnative plant species are new to the flora of Glen Canyon NRA. The following is a discussion of four nonnative species in Glen Canyon that require more attention.

1. Asian or Sahara mustard (*Brassica tournefortii*), a native to arid and semi-arid deserts of North Africa, was collected from several locations in the southern part of Glen Canyon NRA, including the San Juan River arm. Personal observations and communications with John Spence (Ecologist, Glen Canyon NRA), Kate Watters (Backcountry vegetation specialist, Grand Canyon NP), and Ken Heil (Editor, San Juan Basin Flora Project) all describe an explosion of *Brassica tournefortii* in desert shrub and riparian communities in Glen Canyon NRA. *Brassica tournefortii*'s first New World appearance was in California in the

1920s (Brooks 2005). Since then it has spread through both the Mojave and Sonoran deserts and onto the Colorado Plateau. *Brassica tournefortii* readily invades sandy soil and can also dominate silty and rocky soils. Seed dispersal is accomplished through animal vectors and frequently as a tumbleweed. Suggested eradication methods focus on managing the seed bank (Brooks 2005), which is a fancy way of saying "don't let this plant get established". It already seems to be well established in southern portions of the park. This weed should be kept from spreading to new localities by physically pulling plants in early spring before they go to seed and by inspecting NPS heavy equipment for lodged plants. *Brassica tournefortii* has been collected in fruit as early as March 14th (MH 417).

2. Pampas grass (*Cortaderia selloana*) is a cultivated ornamental grown in Page, AZ. It was collected from Colorado River mile 14.6R in 1994 (Mike Kearsley s.n.). *Cortaderia selloana* has become established in two separate populations in the park, even though ornamental *C. selloana* are all carpellate and cannot produce viable seeds. Thus it is believed that plant material from Lake Powell National Golf Course blew over the rim into Glen Canyon. The known wild populations in the park are located in a seep about a quarter of a mile south of Glen Canyon Dam on river right, and a small cluster of 2-3 plants on river right about a half mile from the dam (Kate Watters, pers. comm. 2005). It has also been found in Grand Canyon NP and the source is thought to be from upstream in Glen Canyon. The two populations in Glen Canyon NRA should be removed as soon as possible.

3. Saltlover (*Halogeton glomeratus*) is listed on AZ, CO, and NM state noxious species lists, as well as on the SWEMP list. Native to Eurasia and Siberia, it is now known in the United States, covering millions of acres throughout at least eleven western states. In Glen Canyon NRA, *H. glomeratus* was collected from small roadside populations along the Flint Trail in the Orange Cliff area and along Road 230 towards Last Chance Creek near Padre Canyon. We did not encounter any large populations of *H. glomeratus* in Glen Canyon NRA during this study, but this species is notable for its ability to quickly and sporadically colonize disturbed areas (Dewey 2005). *Halogeton glomeratus* should be watched for, and removed when encountered.

4. Ravennagrass (*Saccharum ravennae*) is under reasonable control in Grand Canyon and parts of Glen Canyon NRA, including the San Juan River arm and the Colorado River below the dam. Intensive efforts to remove the plant have occurred in both parks (John Spence pers. comm. 2004); however, wild populations still exist in both Llewellyn Gulch and Bowns Canyon in Glen Canyon NRA. Ravennagrass was originally introduced to the area as a cultivated ornamental planted around buildings associated with Glen Canyon NRA, and is still planted as an ornamental at Wahweap Marina near the hotel (MH 669). Ravennagrass must be manually removed, which is a costly process. We strongly recommend that the ornamental plantings of Ravennagrass at Wahweap Marina be immediately removed and replaced with natives of similar structure such as Narrowleaf yucca (*Yucca angustissima*). This must be done to prevent further spread of this species, which threatens native habitats not only in Glen Canyon NRA but also those downstream in Grand Canyon NP.

5.2 Floristic composition

The flora of Glen Canyon NRA shows a strong similarity to that of Canyonlands and Arches National Parks. Floras within the Canyonlands portion of southeastern Utah and western Colorado exhibit similarity indices as high as 70% (McLaughlin 1986), although the Otsuka index of similarity used in this study show similarities ranging between 62-68% for these areas. For comparison, the Orange Cliff flora (part of Glen Canyon NRA) has a similarity of 56% with the nearby San Rafael Swell flora (Shultz et al. 1987). This similarity may be attributed to the fact that Glen Canyon NRA, Canyonlands NP, and Arches NP are all centered on the Colorado River Drainage. Waterways act as corridors for plant movement and dispersal, as discussed for Grand Canyon NP by Phillips et al. (1987). Thus the Colorado River is the pathway for plant distribution, both north and south, and most likely harbors a core flora that occurs along the river from Arches NP through Glen Canyon NRA. These three parks also share a common diversity as they are all part of the Canyonlands floristic section of the Colorado Plateau, which is reported as harboring the

richest endemic flora in the Intermountain Region (Holmgren 1972).

Glen Canyon NRA also shows strong floristic similarity to Grand Staircase Escalante National Monument (GSENM). Glen Canyon NRA's elevation range is 940-2310 m (3,080-7,580 ft), with most of the park being below 1525 m (5,000 ft), whereas GSENM's elevation range is 1370-2530 m (4,500-8,300 ft), with the monument averaging over 1525 m (5,000 ft). Since these parks occupy different elevational zones, the similarity between these floras is likely driven by their large shared boundary. This common boundary stretches along much of the Escalante River and most of the southwest border of Glen Canyon NRA. It also encompasses numerous drainages from the Kaiparowits Plateau, mainly in GSENM, down into tributaries of both Lake Powell (Colorado River) and the Escalante River. These drainages are corridors for plant dispersal and probably contribute to the high floristic similarity between these two parks.

In comparing the nonnative flora of Glen Canyon NRA with the surrounding parks, we found a slightly different pattern than that of the entire flora and the native flora. Glen Canyon NRA's nonnative flora is most floristically similar to the nonnative floras of GSENM (67%), Canyonlands NP (66%) and Capitol Reef NP (60%). Again it seems that the similarity between floras is driven more by shared drainages, boundaries, and geologic habitats than by elevation range.

Glen Canyon NRA is a large park that is not defined by any natural boundary (e.g. geologic, floristic, etc.), and it contains a number of different floristic units. The similarity index used in this study compares Glen Canyon NRA's flora as a whole to that of other park floras, thus similarities between floristic subunits are not exposed. As a consequence, Glen Canyon NRA shows low floristic similarity to Grand Canyon NP when, in fact , both parks share a number of floristic subunits. For example the flora of Glen Canyon NRA is likely very similar to the northern section of the inner canyon in Grand Canyon NP. Grand Canyon NP's broad elevation range and strong influence from both Mohave and Sonoran Deserts lowers its similarity index with Glen Canyon NRA.

5.3 Vegetation communities

Species richness plot data was collected for all major vegetation types in GLCA. The goal of this project was to document 90% of the vascular plant species occurring in the park. Jackknife estimates compared to actual observed species numbers showed that community plots alone captured between 71-89% of the expected number of species in each community. The combined species found in plots of pinyon-juniper woodlands, riparian, springs and seeps, and uplands shrub-grassland communities produces a list of about 420 taxa (taxa identified only to genus were not included in this count.) The flora of Glen Canyon NRA has 780 vouchered taxa and an additional 75 reported but unvouchered taxa, together a total of 856 taxa. According to the jackknife estimates, if the following number of species were documented in the respective community plots, 90% species richness would be achieved: 29 taxa in pinyon-juniper woodlands, 17 taxa in riparian communities, 15 taxa in spring and seep communities, and 2 taxa in upland shrub-grassland communities. At most this would mean adding an additional 63 taxa to the comprehensive community species total of 420 taxa. Obviously the documented flora of Glen Canyon NRA at 856 greatly exceeds that of jackknife estimates. This discrepancy indicates that community plot data (at least the numbers of plots that we were able to visit) and jackknife estimates used in this study were not effective ways to estimate species richness for the entire park.

At this time the most accurate indicator of whether 90% of the vascular flora is documented is John Spence's estimate that prior to this study about 80% of the park flora was documented. Prior to this study the Preliminary Flora of Glen Canyon had a total of 727 species. If 727 species represents 80%, then 90% would be 818 species. Again this study produced 780 vouchered taxa from a total of 767 species; therefore about 84% of the estimated species in GLCA has been vouchered. The total vouchered and reported species number is 842 species, or about 92% of the total estimated species expected to occur in the park. Therefore it is very important that the reported species listed in Appendix I be collected and vouchered.

The exact percent documentation of the flora of Glen Canyon is still unknown, but it can be shown that the flora is as well collected as floras in the surrounding area. The top ten most species-rich families listed in Figure 7 account for ~60% of the flora. These families are consistently the most species-rich throughout parks on the Colorado Plateau, and comprise similar proportions of each park flora (fig 9). Glen Canyon does not exhibit any significant lack in any of the most species-rich families, thereby suggesting that Glen Canyon NRA's flora is as well documented as other parks in the area. Small differences in proportions of Fabaceae, Brassicaceae, and Rosaceae suggest that new taxa from these families should be expected from GLCA (fig. 9).

5.4 Pre-/Post-Glen Canyon Dam floras

Most species listed in Appendix B that were collected before the completion of Glen Canyon Dam, but not after, should be expected along the Colorado River, either in Cataract Canyon or below the dam. Many of these species also occur in one or more of the surrounding parks, and according to *A Utah Flora* (Welsh et al. 2003), should be expected in the GLCA area. The creation of Lake Powell inundated acres of riparian, spring and seep, and desert shrub habitat, but all of these community types are still found widely throughout the park.

5.5 Recommendations for future floristic exploration

Two areas in the park would benefit from future floristic exploration. The first includes Navajo Point and the surrounding area of the Kaiparowits Plateau, whose difficult access prevents frequent botanical exploration. Two separate trips during the duration of this study produced around 10 species new to the park, and more new species are expected to be found in this area. The second area, Cataract Canyon and the Dirty Devil River corridor, was not adequately explored during the study and we expect that these trips to these areas will reveal numerous new plant records for the park, especially for those species listed in Table 7.

Because the top ten most species-rich families

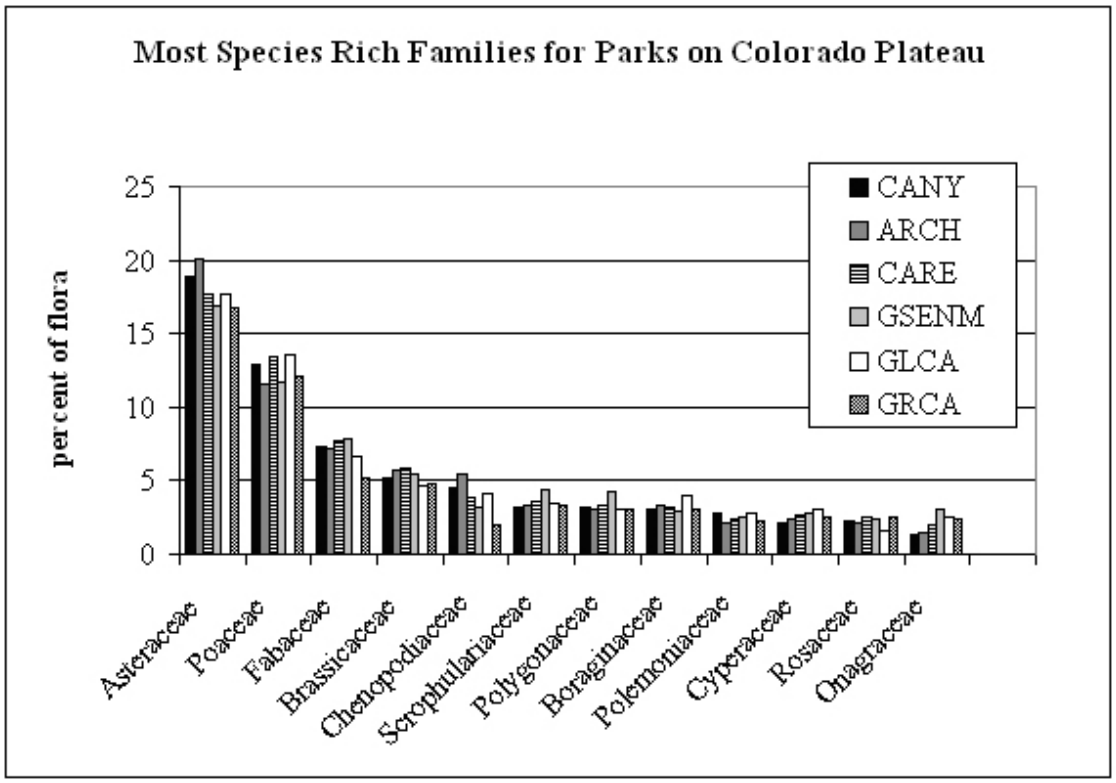

Figure 9. Most species-rich families for parks on the Colorado Plateau.

in GLCA yielded about 60% of all new taxa, our final recommendation is that the families indicated in Figure 7 be explored for possible new records. For the under-explored areas mentioned above, we make the following recommendations: (1) attention should be given to families with difficult taxonomy such as Poaceae, Fabaceae (*Astragalus spp.*), Boraginaceae (*Cryptantha spp.*), Cyperaceae, and Polemoniaceae (*Gilia spp.*), and (2) early and late season collecting could discover new species in families such as Brassicaceae and Poaceae.

Literature cited

Albee, B. J., L. M. Schultz, and S. Goodrich. 1988. Atlas of the vascular plants of Utah. Utah Museum of Natural History, Salt Lake City, Utah.

Arizona Rare Plant Committee. 2002. Arizona Rare Plant Field Guide: A Collaboration of Agencies and Organizations. Arizona Heritage Data Management System, Arizona Game and Fish Department, Phoenix, Arizona.

Ayers, T. J., R. W. Scott, L.E. Stevens, K. Warren, A. Phillips, M.D. Yard. 1994. Additions to the flora of Grand Canyon National Park - I. Journal of the Arizona-Nevada Academy of Science. 28(1/2):70-75.

AZ Noxious Weed List 2005. AZ Noxious Weed List. Arizona Department of Agriculture. From website on 24 January: (http://agriculture.state.az.us/PSD/quarantine2.html). Phoenix, Arizona.

Barnes, F. A. 1978. Canyon Country Geology for the Layman and Rockhound. Wasatch Publishers, Inc. Salt Lake City, Utah.

Benson, L. 1982. The Cacti of the United States and Canada. Stanford University Press, Stanford, California.

Brian, N. J. 2001. Additions to the flora of Grand Canyon National Park - III. Journal of the Arizona-Nevada Academy of Science. 33(2):151-153.

Brian, N. J., W. C. Hodgson, and A. M. Phillips. 1999. Additions to the flora of Grand Canyon National Park - II. Journal of the Arizona-Nevada Academy of Science. Glendale, Arizona 32(2):117-127.

Brooks, M. 2005. Brassica tournefortii (Saharan Mustard): Background information. California Invasive Plant Council. From website on 10 June: (http://groups.ucanr.org/ceppc/Desert_plants). Berkeley, California.

Brown, D.E. 1994. Biotic Communities Southwestern United States and Nothwestern Mexico. Univeristy of Utah Press, Salt Lake City, Utah.

Chronic, H., and L., Chronic. 2004. Pages of Stone: Geology of the Grand Canyon & Plateau Country National Parks & Monuments. 2nd ed. Seattle: The Mountaineers Books.

Clark, S. R. 1966. A Tabular Summary of Plant and Animal Resources of the Glen Canyon Area pp. 67-99. An Addendum in H.C. Cutler. Corn, Cucurbits and Cotton from Glen Canyon. Univ. Utah Anthro. Papers No. 80, Glen Canyon Ser. 30:67-99.

Clover, E. U., and L. Jotter. 1944. Floristic Studies in the Canyon in the Colorado and Tributaries. American Midland Naturalist. 32:591-642.

Cooley, M. E. 1958. Physiography of the Glen-San Juan Canyon Area. Plateau 31(2):21-33.

Cronquist, A., A. H. Holmgren, N. H. Holmgren, and J. L. Reveal. 1986. Intermountain Flora. Volumes 1, 3A, 3B, 4, 5, 6. Bronx, NY:New York Botanical Garden.

Dewey, S. 2005. Halogeton glomeratus. California Invasive Plant Council. From website on 10 June: (http://groups.ucanr.org/ceppc/Desert_plants). Berkeley, California.

Eastwood, A. 1896. Report of a collection of plants from San Juan County, in southeastern Utah. Proceedings of the California Academy of Science. 2(6):271-329.

Fertig, W. 2003. Annotated Checklist of the Flora of Grand Staircase-Escalante National Monument. Version 4.7 July. U.S. Department of Interior. Park Service. Unpublished document.

Flora of North America Editorial Committee. 1993. Flora of North America. Volumes 1, 2, 3, 4, and 22. Oxford University Press. New York, New York.

Flowers, S. 1959. Vegetation in Glen Canyon, pp. 21-61 In. A.M. Woodbury et al. Ecological studies of the flora and fauna in Glen Canyon. University of Utah Anthropological Papers, No. 40, Glen Canyon Series. 7:63-72.

Fowler, J. F. 1995. Biogeography of hanging gardens on the Colorado Plateau. PhD Thesis. University of Wyoming, Laramie.

Gaines, X.M. 1960. An annotated catalogue of Glen Canyon Plants. Museum of Northern Arizona Technical Series 4:1-18.

Gould, F.W. 1951. Grasses of the Southwestern United States. The University of Arizona Press, Tucson, Arizona.

Heil, K. and S. L. O'Kane, Jr. 2003. Catalog of the four corners flora Vascular plants of the San Juan River Drainage Arizona, Colorado, New Mexico and Utah. Harvard Papers in Botany. 7(2):231-379.

Heil, K. D., J. M. Porter, R. Fleming, and W. H.Romme. 1993. Vascular Flora and Vegetation of Capitol Reef National Park, Utah. Technical Report/NPS/NAUCARE/ NRTR-98/01.

Holmgren, N. H. 1972. Plant geography of the Intermountain Region. Pp. 77-161 In A. Cronquist et al., Intermountain flora. Vol. 1. Columbia University Press, New York.

Kearney, T. H., R. H. Peebles, and collaborators. 1951. Arizona flora. Ed. 2. with supplement (1960) by J.T. Howell, E. McMlintock and collaborators. University of California Press, Berkeley and Los Angeles, California.

Lindsay, D. S. 1959. Vascular plants collected in Glen Canyon. Appendix A In A.M. Woodbury. Ecological studes of the flora and fauna in Glen Canyon. University of Utah Anthropological Papers, No. 40, Glen Canyon Series. 25:176-195.

MacMahon, J. A. 1979. North American deserts: their floral and faunal components. Pp 21-81: In R.A. Perry and D.W. Goodall, eds. Arid-land ecosystmes: structure, functioning and management. Volume 1. Cambridge University Press.

McDougall, W.B. 1959. Plants of the Glen Canyon Area in the Herbarium of the Museum of Northern Arizona. Flagstaff, Arizona: Museum of Northern Arizona. Mimeographed.

McLaughlin, S.P. 1986. Floristic Analysis of the Southwestern United States. Great Basin Naturalist. 46(1):46-65.

McLaughlin, S.P. 1989. Natural floristic areas of the western United States. Journal of Biogeography. 16: 239-248.

McLaughlin, S.P. 1993. Apocynaceae. Journal of Arizona-Nevada Academy of Sience. 27:164-168.

NatureServe 2005. NatureServe Explorer Species Data. From website on 10 June: (http://www.natureserve.org). Arlington, Virginia.

Phillips, B.G., A.M. Phillips, and M.A.Schmidt Bernzott. 1987. Annotated Checklist of Vascular Plants of Grand Canyon National Park. Grand Canyon Natural History Association. Prescott, Arizona: Classic Printers.

Potter, L.D., and N.B. Pattison. 1977. Shoreline Surface Materials and Geologic Strata, Lake Powell. Lake Powell Research Project Bulletin. NSF. number 44.

Schelz, C., and M. Moran. 2003. Plants of Arches NP, Natural Bridges NM, and Canyonlands NP. Southeast Utah Group. U.S. Department of Interior, Park Service. Unpublished report.

Shreve, F. 1942. The Desert vegetation of North America. The Botanical Review. 4:195-246.

Shultz, L.M., E.E. Neely, and J.S. Tuhy. 1987. Flora of the Orange Cliffs of Utah. Great Basin Naturalist. 47(2):287-298.

Simpson, G.G. 1980. Why and how: some problems and methods in historical biology. Pergamon Press: Oxford.

Spence, J.R. 1992. Studies on the Flora of Glen Canyon National Recreation Area. Unpublished Final report to National Park Service, Glen Canyon NRA. Page, AZ.

Spence, J.R. 1993. A monitoring program for the endangered Pediocactus bradyi L. Benson, Lee's Ferry, Glen Canyon National Recreation Area. Unpublished report, National Park Service, Resource Management Division, Glen Canyon NRA. Page, AZ.

Spence, J.R. 1995. Characterization and possible orgins of isolated Douglas Fir stands on the Colorado Plateau. Pp. 71-82. In W.J. Waugh (ed.). Climate change in the Four Courners region. Proceedings of a symposium, Grand Junction, September

12-14. Dept. Energy NTIS CONF-9409325.

Spence, J.R. 2001. Climate of the central Colorado Plateau, Utah and Arizona: Characterization and recent trends. Pp. 187-203. In C. van Riper III, K.A. Thomas, and M.S. Stuart (eds.). Proceedings of the fifth biennial conference of research on the Colorado Plateau. U.S.D.I. U.S. Geological Survey Report Series USGSFRESC/COPL/2001/24.

Spence, J.R. 2004. Surveys of Springs in the Colorado River Drainage in Arches National Park, Canyonlands National Park, Glen Canyon National Recreation Area, and Grand Canyon National Park. Unpublished Final report to National Park Service, Glen Canyon NRA.

Spence, J.R. 2005. Notes on significant collections and additions to the flora of Glen Canyon National Recreation Area, Utah and Arizona, between 1992 and 2004. Western North American Naturalist 65: 103-111.

Spence, J.R. 2005. Personal Communication (Feburary 10, 2005)

Spence, J.R., and H. Buchanan. 1993. Checklist of the Vascular Plant of Bryce Canyon National Park, Utah. Great Basin Naturalist. 53(3):207-221.

Spence, J.R., J.A.C. Zimmerman. 1996. Preliminary Flora of Glen Canyon National Recreation Area. Unpublished report for National Park Service, Glen Canyon National Recreation Area.

Spence, J. R., W. H. Romme, L. Floyd-Hanna, and P. G. Rowlands. 2002. The Spence/Romme/Floyd-Hanna/Rowlands (SRFR) Classification. Unpublished report for National Park Service, Glen Canyon National Recreation Area.

Spence, J. R., W. H. Romme, L. Floyd-Hanna, and P. G. Rowlands. 1995. A preliminary vegetation classification for the Colorado Plateau. Pp. 193-213. In Van Riper III, C. (ed.). Proceedings of the second biennial conference on research in Colorado Plateau National Parks. National Park Service Trans. Proc. Ser. NPS/NRNAU/NRTP-95/11.

Stuart, M., ed. 2000. Biological inventory of national park areas on the southern Colorado Plateau. Colorado Plateau Cooperative Ecosystem Studies Unit and USGS/Colorado Plateau Field Station. Unpublished document.

SWEPIC. 2005. Weed Species. SWEPIC (Southwest Exotic Plant Inflormation Clearinghouse). USGS. From website on 24 January (http://usgs.srv/usgs.nau.edu/swepic/swemp/maps.html).

Thomas, K. A. and J. J. Wynne. 2000. The southwest exotic plant mapping program (SWEMP) Collaborator's manual. USGS Forest and Rangeland Ecosystem Science Center, Biological Resources Division, Colorado Plateau Field Station, Flagstaff, Arizona.

TOPO!. 2000. Utah: Seamless USGS Topographic Maps on CD-ROM. Software developed by Wildflower Productions (www.topo.com). San Francisco, California.

Topping, G. 1997. Glen Canyon and the San Juan Country. University of Idaho Press, Moscow, Idaho.

Tuhy J. S. and J. A. MacMahon. 1988. Vegetation and Relict Communities of Glen Canyon National Recreation Area. Unpublished final report for National Park Service, Glen Canyon National Recreation Area.

United States Department of Interior, National Park Service. 1991. (reprinted) Proposed General Management Plant (July 1979). Glen Canyon National Recreation Area/Arizona - Utah. Denver Service Center, Denver.

USDA. United States Department of Agriculture, Natural Resource Conservation Service.) 2004. The PLANTS Database, Version 3.5. From website on 15 August: (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Utah Noxious Weed List 2005. Utah Noxious Weed List. State of Utah Department of Agriculture and Food. From website on 24 January: (http://ag.utah.gov/plantind/nox_utah.html).

Utah Rare Plant Guide. 2003. Salt Lake City: Utah Native Plant Society, Inc.

Watters, Kate 2005. Personal Communication.

Welsh, S. L. 1984. Flora of Glen Canyon National Recreation Area. Unpublished Final report to National Park Service, Glen Canyon National Recreation Area.

Welsh, S. L. 1989. On the distribution of Utah's hanging gardens. The Great Basin Naturalist 49:1-30.

Welsh, S. L. & Toft, C. A. 1972. Biotic Communities of Hanging Gardens in Southeaster Utah. National Geographic Society Research Reports:663-681.

Welsh, S. L ., N. D. Atwood, and J. R. Murdock. 1978. Kaiparowits Flora. Great Basin Naturalist. 38:125-170.

Welsh, S. L., N. D. Atwood, L.G. Higgins, and S. Goodrich. 2003. A Utah Flora. Ed. 3. Printing Services Brighman Young University, Provo.

West, N. E., ed. 1983. Temperate Deserts and Semi-deserts. Ecosystems of the World. Volume 5. Elsevier Scientific Publishing Company, Amsterdam, The Netherlands.

Appendix A

Catalog of the vascular plants of Glen Canyon NRA, Arizona and Utah

Species are first arranged by divisions, e.g. Pteridophyta, Coniferophyta, and Magnoliophyta. Magnoliophyta is further divided into the classes Magnoliopsida (dicots) and Liliopsida (monocots). Taxa are finally arranged alphabetically by families, genera, and species. Nomenclature and common names follows *A Utah Flora* (Welsh et al. 2003) with updates from the USDA PLANTS database (2004). Species names preceded by an asterisk (*) denotes taxa non-native to the Glen Canyon NRA region. The following information is provided for each species, when available:

- common name
- plant duration and growth form (habit).
- distribution within the study area. Distribution ratings are based soley on the subjective observations of the author. These ratings are relevant only within the study site boundaries and are usually specific to any internal locality regions listed. Below are the distribution codes and definitions used in this study.
- where species can most likely be found.
- specimen information. Collection numbers follow the initials of the collector (Appendix 4). If no collection number is given the herbaria at which the collection is housed is given (GLCA HERB= Glen Canyon NRA Herbarium and ASC = Deaver Herbarium, Northern Arizona University, Flagstaff), for all other locations of vouchers refer to Appendix 5.
- subspecific taxa characteristics. When there are two subspecific taxa listed under the same species the characteristics that is used to separate the subspecific taxa is given.

Distributional Code	Distributional category description
W	Widespread throughout Glen Canyon National Recreation Area
C	Common throughout much of the park or to a particular part of the park
O	Occasional, widely scattered in the park
U	Uncommon, of limited distribution
R	Rare, of very limited distribution and only known from one or two locations in the park.

LYCOPODIOPHYTA:

Selaginellaceae

Selaginella mutica D.C. Eat. ex Underwood - BLUNTLEAF SPIKEMOSS
Perennial herb; O, rock crevices, Clearwater Canyon; JRS 5025.

EQUISETOPHYTA:

Equisetaceae

Equisetum ×ferrissii Clute (pro sp.) -
Perennial herb; C, riparian; MDW 257-B.

Equisetum arvense L. - Field Horsetail
Perennial herb; O, riparian; MH 245, MDW 258-B.

Equisetum hyemale L. var. *affine* (Engelm.) A.A. Eat. - Scouringrush Horsetail
Perennial herb; O, riparian; JF 892.

Equisetum laevigatum A. Braun - Smooth Horsetail
[*Equisetum kansanum* Schaffn.] Perennial herb; O, riparian; MH 204, MDW 259-B.

PTERIODOPHYTA:

Dryopteridaceae

Cystopteris utahensis Windham & Haufler - Utah Bladderfern
Perennial herb; U, moist shaded sites, Cow Canyon, Coyote Gulch, and Halls Creek; JRS 4977, 5224.

Pteridaceae

Adiantum capillus-veneris L. - Common Maidenhair
Perennial herb; C, hanging gardens; DG 10, 13.

Argyrochosma limitanea (Maxon) Windham ssp. *limitanea* (Maxon) Windham - Southwestern False Cloak Fern
[*Pellaea limitanea* (Maxon) Morton] Perennial herb; U, rock crevices, canyon bottoms; MH 387.

Cheilanthes feei T. Moore - Slender Lipfern
Perennial herb; U, Kaiparowits Plateau; JRS 5647.

Pellaea glabella Mett. ex Kuhn - Searls' Prairie Clover
Perennial herb; U, crevices and hanging gardens; GR 4228.

Pellaea truncata Goodding - Spiny Cliffbrake
[*Pellaea longimucronata* auct. non Hook.] Perennial herb; U, rock crevices, Trail Canyon; SLW 11910.

GNETOPHYTA:

Ephedraceae

Ephedra cutleri Peebles - Cutler's Jointfir
Shrub; C, sandy flats, desert shrub to pinyon-juniper; MH 638.

Ephedra torreyana S. Wats. - Torrey's Jointfir
Shrub; W, dry sandy or rocky hillsides; MH 433.

Ephedra viridis Coville - Mormon Tea
Shrub; W, desert shrub to pinyon-juniper woodlands; MH 25, 115.

CONIFEROPHYTA:

Cupressaceae

Cupressus arizonica Greene - Arizona Cypress
Tree; O, Cultivated landscaping, Wahweap Campground; MH 661.

Juniperus osteosperma (Torr.) Little - Utah Juniper
[*Juniperus utahensis* (Engelm.) Lemmon] Tree; W, uplands, hillsides, mesas, and benches; MH 273.

Pinaceae

Pinus edulis Engelm. - Twoneedle Pinyon
Tree; W, mesas, benches, and hillsides; MH 559, JRS 5235.

Pinus monophylla Torr. & Frém. var. *fallax* (Little) Silba - Singleleaf Pinyon
[*Pinus edulis* Engelm. var. *fallax* Little] Tree; U, Kaiparowits Plateau; JRS 5657.

Pseudotsuga menziesii (Mirbel) Franco - Douglas-Fir
Tree; U, canyons, Miller's and Millard Canyons; JRS 5058.

MAGNOLIOPHYTA: MAGNOLIOPSIDA

Aceraceae

Acer glabrum Torr. - Rocky Mountain Maple
Tree; U, canyons, Happy Canyon; SLW 21847.

Acer grandidentatum Nutt. - Bigtooth Maple
Tree; U, canyons and Kaiparowits Plateau; MH 732.

Acer negundo L. - Boxelder
Tree; O, canyons, seeps, and springs; MH 203.

Aizoaceae

**Trianthema portulacastrum* L. - Desert Horsepurslane
Annual herb; O, disturbed sites; MH 352, 395.

Amaranthaceae

Amaranthus acanthochiton Sauer - Greenstripe
[*Acanthochiton wrightii* Torr.] Annual herb; R, saline wetlands, junction of San Juan and Colorado Rivers; KH 19267.

**Amaranthus albus* L. - Prostrate Pigweed
[*Amaranthus graecizans* auct. non L.] Annual herb; O, disturbed sites; MH 308, 571, 703.

**Amaranthus blitoides* S. Wats. - Mat Amaranth
Annual herb; O, disturbed sites; MH 284.

Amaranthus californicus (Moq.) S. Wats. - California Amaranth
Annual herb; U, disturbed areas; KH 21009.

Tidestromia lanuginosa (Nutt.) Standl. - Woolly Tidestromia
Annual herb; O, clayey soils, desert shrub; MH 364.

Anacardiaceae

Rhus glabra L. - Smooth Sumac
Shrub; U, canyon bottoms and hanging gardens, riparian; JRS 4972, SLW 21762.

Rhus trilobata Nutt. var. *simplicifolia* (Greene) Ba - Skunkbush Sumac
[*Rhus aromatica* Ait.] Shrub; C, canyons and uplands; NDA 3461, SLW 21861 & 22212.lvs. simple

Rhus trilobata Nutt. var. *trilobata* Nutt. - SKUNKBUSH SUMAC
Shrub; O, canyon bottoms, riparian; MH 150, 348.lvs. trifoliate

Toxicodendron rydbergii (Small ex Rydb.) Greene - Western Poison Ivy
[*Rhus radicans* L.] Perennial herb; O, canyon bottoms and hanging gardens, riparian; SLW 1486.

Apiaceae

Berula erecta (Huds.) Coville - Cutleaf Waterparsnip
Perennial herb; U, riparian, Scorpion Canyon; JRS 5227.

Cymopterus acaulis (Pursh) Raf.- plains springparsley
Perennial herb; MH 634

Cymopterus acaulis (Pursh) Raf. var. *fendleri* (Gray) Goodrich - Fendler's Springparsley
[*Cymopterus fendleri* Gray] Perennial herb; O, sandy soils, desert shrub to pinyon-juniper woodlands; MH 550, GR 1720.flwrs. whitish

Cymopterus acaulis (Pursh) Raf. var. *higginsii* (Welsh) Goodrich - Higgins' Springparsley
[*Cymopterus higginsii* Welsh] Perennial herb; U, shale soils, desert shrub; JRS 5223.flwrs. purple, growing on Tropic Shale

Cymopterus newberryi (Wats.) Jones - Sweetroot Springparsley
Perennial herb; O, sandy soils; MH 601, 455.

Cymopterus purpurascens (Gray) Jones - Widewing Springparsley
Perennial herb; O, canyons, Happy Canyon; SLW 21790.

Cymopterus purpureus Wats. - Purple Springparsley
Perennial herb; O, hillsides and mesas, pinyon-juniper woodlands; MH 175, 610.

Lomatium nevadense (S. Wats.) Coult. & Rose - Nevada Biscuitroot
Perennial herb; U, Kaiparowits Plateau; JRS 5655.

Lomatium parryi (Wats.) Macbr. - Utah Desertparsley
Perennial herb; U, rimrock, Muley Point; MH 516.

Apocynaceae

Amsonia jonesii Woods. - Jones' Bluestar
Perennial herb; U, desertshrub, San Juan River and Leroy Canyon; KH 21010.

Amsonia tomentosa Torr. & Frém. var. *stenophylla* Kearney & Peebles - Woolly Bluestar
[*Amsonia eastwoodiana* Rydb.] Perennial herb; C, canyon bottoms, hillsides, mesas, and benches; MH 47, 180, 196, 380, 529, 578.

Apocynum cannabinum L. - Indianhemp
[*Apocynum suksdorfii* Greene] Perennial herb; O, canyon bottoms, riparian; SLW 1482, KH 19283.

Cycladenia humilis Benth. var. *jonesii* (Eastw.) Welsh & Atwood - Jones' Waxydogbane
[*Cycladenia jonesii* Eastw.] Perennial herb; R, clayey soils, Purple Hills; BTW 1442.

Araliaceae

Aralia racemosa L. ssp. *bicrenata* (Woot. & Standl.) Welsh & Atwood - AMERICAN SPIKENARD
Perennial herb; R, Cow Canyon; JRS 4976.

Asclepiadaceae

Asclepias asperula (Dcne.) Woods. ssp. *asperula* (Dcne.) Woods. - SPIDER MILKWEED
Perennial herb; U, canyon bottoms, hillsides, and uplands, desert shrub to pinyon-juniper; MH 602, SLW 22807.

Asclepias cryptoceras S. Wats. - PALLID MILKWEED
Perennial herb; U, hillsides and mesas, pinyon-juniper woodlands, Flint Trail; SLW 9876.

Asclepias involucrata Engelm. ex Torr. - DWARF MILKWEED
[*Asclepias macrosperma* Eastw.] Perennial herb; O, sandy soils, desert shrub; MH 101, 506.

Asclepias latifolia (Torr.) Raf. - BROADLEAF MILKWEED
Perennial herb; O, canyon bottoms, hillsides, and uplands, desert shrub; MH 231, SLW 22316.

Asclepias rusbyi (Vail) Woods. - RUSBY'S MILKWEED
Perennial herb; U, canyon bottoms, Slickhorn Canyon; NDA 22593.

Asclepias subverticillata (Gray) Vail - HORSETAIL MILKWEED
[*Asclepias galioides* auct. non Kunth] Perennial herb; O, canyon bottoms; MH 223.

Funastrum cynanchoides (Dcne.) Schlechter ssp. *heterophyllum* (Vail) Kartesz, comb. nov. ined. - HARTWEG'S TWINEVINE
Perennial herb; O, riparian; MH 278.

Asteraceae

Acamptopappus sphaerocephalus (Harvey & Gray ex Gray) Gray - RAYLESS GOLDENHEAD
Shrub; C, uplands, desert shrub; MH 456.

Acourtia wrightii (Gray) Reveal & King - BROWNFOOT
[*Perezia wrightii* Gray] Perennial herb; U, canyon bottoms, Dry Rock Creek; SLW & NDA 11641.

**Acroptilon repens* (L.) Dc. - HARDHEADS
[*Centaurea repens* L.] Perennial herb; O, riparian, Lee's Ferry and San Juan River; MH 583, JM s.n.(GLCAHERB).

Ambrosia acanthicarpa Hook. - FLATSPINE BURR RAGWEED
[*Franseria acanthicarpa* (Hook.) Coville] Annual herb; U, disturbed sites, riparian; MH 341.

Ambrosia psilostachya Dc. - CUMAN RAGWEED

Perennial herb; U, disturbed sites, riparian; MH 715.

Artemisia bigelovii Gray - BIGELOW SAGE
Shrub; C, rimrock areas, pinyon-juniper woodlands; MH 370.

Artemisia campestris L. - FIELD SAGEWORT
Perennial herb; O, sandy sites; SLW 22409,NDA 3058.

Artemisia carruthii Wood ex Carruth. - CARRUTH'S SAGEWORT
Perennial herb; U, pinyon-juniper woodlands, Muley Point; SLW 22440.

Artemisia dracunculus L. – FALSE TARRAGON
Perennial herb; C, canyons; NDA 23338, JRS 5041.

Artemisia filifolia Torr. - SAND SAGEBRUSH
Shrub; O, sandy sites; SLW 22401, NDA 3118, AP 80-162.

Artemisia ludoviciana Nutt. - WHITE SAGEBRUSH
Perennial herb; W, canyons, uplands, and plateaus; MH 342.

Artemisia ludoviciana Nutt. ssp. *mexicana* (Willd. ex Spreng.) Keck - WHITE SAGEBRUSH
Perennial herb; O, Happy Canyon; JT 608.

Artemisia nova A. Nels. - BLACK SAGEBRUSH
Shrub; U, canyon bottoms, Long Canyon; JRS 5048.

Artemisia tridentata Nutt. ssp. *tridentata*- BASIN BIG SAGEBRUSH
Shrub; C, plateaus; NDA 3297a.plants 1-3m tall

Artemisia tridentata Nutt. ssp. *wyomingensis* Beetle & Young - WYOMING BIG SAGEBRUSH
Shrub; O, pinyon-juniper woodlands, Orange Cliffs; LMS 7347.plants <1m tall

Baccharis emoryi Gray - EMORY'S BACCHARIS
Shrub; C, riparian; SLW 22547.

Baccharis salicifolia (Ruiz & Pavón) Pers. - MULE'S FAT
[*Baccharis glutinosa* Pers.] Shrub; O, riparian; MH 700, NDA 23367.

Baccharis salicina Torr. & Gray - GREAT PLAINS FALSE WILLOW
Shrub; O, riparian; MH 404.

Baccharis wrightii Gray - WRIGHT'S BACCHARIS
Perennial herb; R, uplands, bench below Cedar Mesa; MH 670.

**Baileya multiradiata* Harvey & Gray ex Gray - DESERT MARIGOLD
Perennial herb; C, roadsides; JZ 15.

Bidens frondosa L. - DEVIL'S BEGGARTICK
Annual herb; O, canyon bottoms, riparian; MH 402.

Brickellia atractyloides Gray - SPEARLEAF BRICKELLBUSH
Shrub; O, hillsides; MH 485.

Brickellia longifolia S. Wats. - LONGLEAF BRICKELLBUSH
Shrub; C, canyon bottoms, washes, and hanging gardens, riparian; MH 390, AP 80-153.

Brickellia microphylla (Nutt.) Gray var. *scabra* Gray - ROUGH BRICKELLBUSH
Shrub; O, canyons, hillsides, and rocky outcrops; MH 389.

Brickellia oblongifolia Nutt. var. *linifolia* (D.C. Eat.) B.L. Robins. - NARROWLEAF BRICKELLBUSH
Shrub; O, hillsides, pinyon-juniper woodlands; MH 137.

Chaenactis macrantha D.C. Eat. - BIGHEAD DUSTYMAIDEN
Annual herb; C, sandy soils, desert shrub; MH 27.

Chaenactis stevioides Hook. & Arn. - STEVE'S DUSTYMAIDEN
Annual herb; W, canyon bottoms, benches, and hillsides, desert shrub; MH 16, 31.

Chaetopappa ericoides (Torr.) Nesom - ROSE HEATH
Perennial herb; C, hillsides, rocky slopes, and benches; MH 110.

Chloracantha spinosa (Benth.) Nesom - SPINY CHLORACANTHA
[*Aster spinosus* Benth.] Perennial herb; C, riparian, Lee's Ferry and San Juan River; MH 214, VM s.n. (GLCAHERB), JM s.n.(GLCAHERB).

Chrysothamnus baileyi Woot. & Standl. - BAILEY'S RABBITBRUSH
[*Chrysothamnus pulchellus* (Gray) Greene] Shrub; O, benches, Orange Cliffs; BN 694.

Chrysothamnus greenei (Gray) Greene - GREENE'S RABBITBRUSH
Shrub; O, benches, pinyon-juniper woodlands; LMS 7366.

Chrysothamnus linifolius Greene - SPEARLEAF RABBITBRUSH
Shrub; O, canyon bottoms, riparian; MH 237.

Chrysothamnus viscidiflorus (Hook.) Nutt. ssp. *viscidiflorus* var.*stenophyllus*(Gray) Hall - YELLOW RABBITBRUSH
[*Chrysothamnus viscidiflorus* (Hook.) Nutt. *ssp. stenophyllus* (Gray Hall),] Shrub; C, benches, mesas, and rocky outcrops, desert shrub to pinyon-juniper woodlands; MH 363, 729.

Cirsium arizonicum var. *arizonicum* (Gray) Petrak - ARIZONA THISTLE
Biennial herb; C, canyon bottom, washes, and drainages; MH 228, 677, 275.

Cirsium calcareum (M.E. Jones) Woot. & Standl. - CAINVILLE THISTLE
[*Cirsium pulchellum* (Greene) Woot. & Standl.] Perennial herb; O, canyon bottoms, riparian; MH 371.

Cirsium neomexicanum Gray - NEW MEXICO THISTLE
Biennial herb; O, roadsides, canyon bottoms, and hanging gardens; MH 41, 595, GR 1713.

Cirsium rydbergii Petrak - RYDBERG'S THISTLE
Perennial herb; C, hanging gardens; JF 826.

Cirsium undulatum (Nutt.) Spreng. - WAVYLEAF THISTLE
Perennial herb; U, canyon bottom; NDA 22567.

**Cirsium vulgare* (Savi) Ten. - BULL THISTLE
Biennial herb; U, disturbed sites, riparian, upstream from Lee's Ferry; MH 403.

Conyza canadensis (L.) Cronq. var. *glabrata* (Gray) Cronq. - CANADIAN HORSEWEED
Annual herb; O, canyon bottoms, disturbed sites; MH 716, 683, 697, JF 960.

Dicoria canescens Gray ssp. *brandegeei* (Gray) Kartesz, comb. Nov. ined. - DESERT TWINBUGS
[*Dicoria brandegeei* Gray] Annual herb; U, canyons, sandy sites; JRS 5004, 4983, SLW 22413.

Encelia frutescens (Gray) Gray var. *frutescens* (Gray) Gray - BUTTON BRITTLEBUSH
Shrub; C, talus slopes and slickrock, desert shrub; MH 114.

Enceliopsis nudicaulis (Gray) A. Nels. - NAKEDSTEM SUNRAY
Perennial herb; O, hillsides, desert shrub; MH 594,SLW 21927.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *consimilis* (Greene) Nesom & Baird var.*juncea* (Greene) Nesom & Baird - RUBBER RABBITBRUSH

[*Chrysothamnus nauseosus* (Pallas ex Pursh) Britt. *var. junceus* (Greene) Hall & Clements,] Shrub; O, canyon bottom, mesas, and benches; SLW 22523 Achene/ovary pilose; corolla pilose.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *consimilis* (Greene) Nesom & Baird var.*leiosperma* (Gray) Nesom & Baird - RUBBER RABBITBRUSH
[*Chrysothamnus nauseosus* (Pallas ex Pursh) Britt. *ssp. leiospermus* (Gray) Hall & Clements,] Shrub; O, canyon bottoms, Reflection Canyon; SLW 1182. Achene/ovary glabrous; flwrs <8mm long.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *consimilis* (Greene) Nesom & Baird var. *oreophila* (A. Nels.) Nesom & Baird - RUBBER RABBITBRUSH
[*Chrysothamnus nauseosus* (Pallas ex Pursh) Britt. *ssp. consimilis* (Greene) Hall & Clements,] Shrub; O, desert shrub; MH 362. Achene/ovary pilose; corolla glabrous, lobes >1mm; lvs 1 nerved.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *nauseosa* var.*bigelovii* (Gray) Nesom & Baird - RUBBER RABBITBRUSH
[*Chrysothamnus nauseosus* (Pallas ex Pursh) Britt. *var. bigelovii* (Gray) Hall & Clements,] Shrub; O, Canyon bottoms, Hite; SLW 22652. Achene/ovary glabrous; flwrs >8mm long.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *nauseosa* var.*glabrata* (Gray) Nesom & Baird - RUBBER RABBITBRUSH
[*Chrysothamnus nauesosus* (Pallas ex Pursh) Britt. *var. graveolens* (Nutt.) Piper,] Shrub; W, canyon bottoms, mesas, and benches; MH 719, KH 21003. Achene/ovary pilose; corolla glabrous, lobes >1mm; lvs 3-5 nerved.

Ericameria nauseosa (Pallas ex Pursh) Nesom & Baird ssp. *nauseosa* var. *hololeuca* (Gray) Nesom & Baird - RUBBER RABBITBRUSH
[*Chrysothamnus nauseosus* (Pallas ex Pursh) Britt. *var. gnaphaloides* (Greene) Hall & Clements,] Shrub; O, canyon bottoms; SLW 2836, NDA 17267. Achene/ovary pilose; corolla glabrous,lobes <1mm long.

Erigeron bellidiastrum Nutt. var. *bellidiastrum* - WESTERN DAISY FLEABANE
Annual herb; W, sandy soils, canyon bottoms; MH 52, 60, 88, 253, 294, 326.

Erigeron colomexicanus A. Nels. - RUNNING FLEABANE
Biennial herb; O, dry washes; MH 50.

Erigeron concinnus (Hook. & Arn.) Torr. & Gray var. *concinnus*- NAVAJO FLEABANE
[*Erigeron pumilus* Nutt. ssp. *concinnoides* Cronq.,] Perennial herb; O, hillsides, widespread; MH 171.

Erigeron concinnus (Hook. & Arn.) Torr. & Gray var. *condensatus* D.C. Eat. - NAVAJO FLEABANE
Perennial herb; O, widespread; SLW 22287, LMS 6895, 6913.

Erigeron divergens Torr. & Gray - SPREADING FLEABANE
Biennial herb; O, disturbed sites; MH 717, 147, JRS 5233.

Erigeron kachinensis Welsh & Moore - KACHINA FLEABANE
Perennial herb; U, seeps and hanging gardens; JRS 5014, KH 6109.

Erigeron religiosus Cronq. - CLEAR CREEK FLEABANE
Annual herb; U, sandy, moist soils in Navajo Sandstone; KH 19293, 21044.

Erigeron utahensis Gray var. *sparsifolius* (Eastwood) Cronquist - UTAH FLEABANE
Perennial herb; W, canyon bottoms, hillsides, and uplands; MH 401, 391. Stem base not densely white-pilose; involucre <8mm wide

Erigeron utahensis Gray var. *utahensis* - UTAH FLEABANE
Perennial herb; O, canyon bottoms; MH 331, 95. Stem base densely white-pilose; involucre >10mm wide

Erigeron zothecinus Welsh - LAKE POWELL FLEABANE
Perennial herb; U, hanging gardens, seeps, and springs; SLW 22115 (holotype).

Eurybia glauca (Nutt.) Nesom - GRAY ASTER
[*Aster glaucodes* Blake] Perennial herb; C, hanging gardens; MH 234, NDA 22568.

Euthamia occidentalis Nutt. - WESTERN GOLDENTOP
[*Solidago occidentalis* (Nutt.) Torr. & Gray] Perennial herb; C, canyon bottoms, riparian; MH 289.

Gaillardia pinnatifida Torr. - RED DOME BLANKETFLOWER
Perennial herb; O, uplands, desert shrub; MH 393, 675, 564,GR 1784.

Glyptopleura marginata D.C. Eat. - CARVESEED
Annual herb; U, desert shrub, Orange Cliffs; SLW 21966.

Gnaphalium palustre Nutt. - WESTERN MARSH CUDWEED
Annual herb; W, sand bars, lake shores, and pond margins; MH 687,662, EN 13480.

Grindelia fastigiata Greene - POINTED GUMWEED

Perennial herb; U, washes, Goodhope Bay; SLW 22569.

Grindelia nuda Wood var. *aphanactis* (Rydb.) Nesom - CURLYTOP GUMWEED
[*Grindelia aphanactis* Rydb.] Biennial herb; U, Flint Trail, Orange Cliffs; LMS 6992.

Gutierrezia microcephala (DC.) Gray - THREADLEAF SNAKEWEED
[*Gutierrezia lucida* (Greene) Greene] Shrub; U, uplands, Clay Hills Crossing; NDA 23356.

Gutierrezia sarothrae (Pursh) Britt. & Rusby - BROOM SNAKEWEED
Shrub; W, canyon bottoms, hillsides, washes, mesas, and benches; MH 684, 345.

Helianthus annuus L. - COMMON SUNFLOWER
Annual herb; O, disturbed sites, widespread; MH 267.

Helianthus anomalus Blake - WESTERN SUNFLOWER
Annual herb; C, sandy soils, desert shrub; MH 89, 277, 588.

Helianthus petiolaris Nutt. - PRAIRIE SUNFLOWER
Annual herb; O, disturbed sites, Halls Creek; PC (CARE 1753).

Heliomeris multiflora Nutt. var. *multiflora* Nutt. - SHOWY GOLDENEYE
Perennial herb; U, plateaus, Navajo Point; MH 728.

Heliomeris soliceps (Barneby) Yates - TROPICAL FALSE GOLDENEYE
[*Viguiera soliceps* Barneby] Annual herb; R, Tropic Shale in Kane Co.; NDA 5073.

Hesperodoria scopulorum (M.E. Jones) Greene - GRAND CANYON GLOWWEED
[*Haplopappus scopulorum* (M.E. Jones) Blake] Shrub; O, canyon bottoms, San Juan River; NDA 26030.

Heterotheca grandiflora Nutt. - TELEGRAPHWEED
Biennial herb; R, roadsides, Hwy 89 & Lakeshore Drive; JRS 5533.

Heterotheca villosa (Pursh) Shinner var. *minor* (Hook.) Semple - HAIRY FALSE GOLDENASTER
Perennial herb; W, widespread; MH 96, 224, JM s.n.

Hymenopappus filifolius Hook. var. *cinereus* (Rydb) Johnst. - FINELEAF HYMENOPAPPUS
Perennial herb; W, desert shrub to pinyon-juniper woodlands; MH 81.

Hymenoxys cooperi (Gray) Cockerell - COOPER'S RUBBERWEED

Biennial herb; U, shadscale community, near Big Water; DF 1155.

Hymenoxys richardsonii (Hook.) Cockerell var. *richardsonii* - PINGUE RUBBERWEED
Perennial herb; C, pinyon-juniper woodlands; MH 177.

Isocoma drummondii (Torr. & Gray) Greene - DRUMMOND'S GOLDENBUSH
[*Haplopappus rusbyi* (Greene) Cronq.] Shrub; O, canyon bottoms, riparian; MH 340, NDA 23351.

Iva acerosa (Nutt.) R.C. Jackson - COPPERWEED
[*Oxytenia acerosa* Nutt.] Perennial herb; O, canyon bottoms and washes, riparian; MH 266, VM s.n. (GLCAHERB).

**Lactuca canadensis* L. - CANADA LETTUCE
Biennial herb; U, hanging gardens, riparian; MH 327, JRS 5225.

**Lactuca serriola* L. - PRICKLY LETTUCE
Biennial herb; C, canyon bottoms, disturbed sites; MH 280.

**Lactuca tatarica* (L.) C.A. Mey - BLUE LETTUCE
Perennial herb; O, wet places; SLW 22354.

Laennecia schiedeana (Less.) Nesom - PINELAND MARSHTAIL
[*Conyza schiedeana* (Less.) Cronq.] Annual herb; U, disturbed sites, Lee's Ferry; MH 407.

Layia glandulosa (Hook.) Hook. & Arn. - WHITEDAISY TIDYTIPS
Annual herb; O, sandy soils, desert shrub; MH 446.

Lygodesmia arizonica S. Tomb - ARIZONA SKELETONPLANT
[*Lygodesmia grandiflora* (Nutt.) Torr. & Gray var. *arizonica* (S. Tomb) Welsh,] Perennial herb; O, canyons, benches, and uplands, widespread; MH 134, 447.

Machaeranthera canescens (Pursh) Gray - HOARY TANSYASTER
Perennial herb; MH 379, 690.

Machaeranthera canescens (Pursh) Gray var. *glabra* Gray - HOARY TANSYASTER
[*Aster cichoriaceus* (Greene) Blake] Perennial herb; C, widespread; MH 238, 332.

Machaeranthera canescens (Pursh) Gray ssp. *glabra* (Gray) B.L. Turner var. *aristata* (Eastw.) B.L. Turner - HOARY TANSYASTER

[*Machaeranthera canescens* (Pursh) Gray var. *aristata* (Eastw.) Turner, *Machaeranthera linearis* Greene] Perennial herb; C, canyon bottoms; MH 257, BP 80-168, SLW 11887.

Machaeranthera gracilis (Nutt.) Shinners - SLENDER GOLDENWEED
[*Haplopappus gracilis* (Nutt.) Gray] Annual herb; O, canyon bottoms, upstream from Lee's Ferry; MH 297.

Machaeranthera grindelioides (Nutt.) Shinners var. *grindelioides* (Nutt.) Shinners - RAYLESS TANSYASTER
Perennial herb; O, uplands and hillsides; MH 172, 562.

Machaeranthera pinnatifida (Hook.) Shinners ssp. *gooddingii* (A. Nels.) B.L. Turner & Hartm - GOODDING'S TANSYASTER
Perennial herb; U, rock faces and talus slopes, upstream from Lee's Ferry; MH 12.

Machaeranthera tanacetifolia (Kunth) Nees - TANSEYLEAF TANSYASTER
[*Aster tanacetifolius* Kunth] Annual herb; U, sandy and silty soils, Halls Creek and upstream from Lee's Ferry; MH 296.

Malacothrix glabrata (Gray ex D.C. Eat.) Gray - SMOOTH DESERTDANDELION
[*Malacothrix californica* DC.] Annual herb; O, sandy soils, stream banks to desert shrub; MH 105, 421.

Malacothrix sonchoides (Nutt.) Torr. & Gray - SOWTHISTLE DESERTDANDELION
Annual herb; O, canyon bottoms, Warm Creek; MH 461.

Packera multilobata (Torr. & Gray ex Gray) W.A. We - LOBELEAF GROUNDSEL
[*Senecio multilobatus* Torr. & Gray ex Gray] Perennial herb; C, uplands, desert shrub to pinyon-juniper; MH 133.

Pectis angustifolia Torr. - LEMONSCENT
Annual herb; U, canyon bottom, Long Canyon; JRS 5050.

Pectis papposa Harvey & Gray - MANYBRISTLE CINCHWEED
Annual herb; U, sandy soils, desert shrub; NDA 3129.

Perityle specuicola Welsh & Neese - ALCOVE ROCKDAISY
Perennial herb; R, hanging gardens, seeps, springs, and cliff bases; NDA 23313, 23319.

Petradoria pumila (Nutt.) Greene - GRASSY ROCKGOLDENROD
[*Solidago petradoria* Blake] Perennial herb; O, mesas and hillsides, pinyon-juniper woodlands; MH 625, JZ14.

Picrothamnus desertorum Nutt. - BUD SAGEBRUSH
[*Artemisia spinescens* D.C. Eat.] Shrub; U, uplands, silty, clayey, or gravelly soils; MH 468.

Platyschkuhria integrifolia (A. Gray) Rydb. var. *desertorum* (Jones) Ellison - DESERT BASINDAISY
Perennial herb; O, uplands, saline substrate; MH 599.

Pluchea sericea (Nutt.) Coville - ARROWWEED
[*Tessaria sericea* (Nutt.) Shinners] Shrub; C, Riparian, San Juan and Colorado Rivers; SLW. 22368, 21995,NDA 3815.

Prenanthella exigua (Gray) Rydb. - BRIGHTWHITE
Perennial herb; O, hillsides, desert shrub to pinyon-jupiner communities; MH 64, 584, JZ 1.

Psathyrotes pilifera Gray - HAIRYBEAST TURTLEBACK
Annual herb; U, upland, desert shrub, Lee's Ferry; MH 359, PW 1997.

**Pseudognaphalium luteoalbum* (L.) Hilliard & Burtt - JERSEY CUDWEED
[*Gnaphalium luteoalbum* L.] Annual herb; C, stream and lake margins; MH 199.

Pseudognaphalium stramineum (Kunth) W.A. Weber- COTTONBATTING PLANT
[*Gnaphalium chilense* Spreng. var. *confertifolium* Greene] Annual herb; C, stream and lake margins; MH 53.

Psilactis asteroides Gray - NEW MEXICO TANSYASTER
[*Machaeranthera asteroides* (Torr.) Greene] Perennial herb; O, uplands, desert shrub; KH 19292.

Psilostrophe sparsiflora (Gray) A. Nels. - GREENSTEM PAPERFLOWER
Perennial herb; O, uplands, desert shrub to pinyon-junipers communities, widespread; MH 582.

Senecio flaccidus Less. var. *flaccidus* Less. - THREADLEAF RAGWORT
Perennial herb; U, sandy substrates, desert shrub, Wahweap Bay overlook; MH 501.

Senecio spartioides Torr. & Gray - BROOMLIKE RAGWORT
Perennial herb; O, desert shrub to pinyon-juniper woodland; MH 730.lvs. simple & entire

Solidago canadensis L. var. *salebrosa* (Piper) M.E. Jones - SALEBROSA GOLDENROD

[*Solidago altissima* L.] Perennial herb; C, canyon bottoms, riparian; MH 235, 249, 383.

Solidago velutina Dc. - THREENERVE GOLDENROD
[*Solidago sparsiflora* Gray] Perennial herb; C, canyon bottoms and hanging gardens, riparian; JF 94, 322, 1016.

**Sonchus asper* (L.) Hill - SPINY SOWTHISTLE
Perennial herb; O, canyon bottoms, disturbed sites; MH 227, 279, 336, JF 790, 977.

Stenotus armerioides var. armerioides Nutt. - THRIFT MOCK GOLDENWEED
[*Haplopappus armerioides* (Nutt.) Gray] Perennial herb; O, uplands, pinyon-juniper woodlands; MH 179.

Stephanomeria exigua Nutt. - SMALL WIRELETTUCE
Perennial herb; O, uplands and canyons, desert shrub to pinyon-juniper woodlands; MH 87.

Stephanomeria minor (Hook.) Nutt. var. *minor*- NARROWLEAF WIRELETTUCE
[*Stephanomeria tenuifolia* (Raf.) Hall] Perennial herb; O, canyon bottoms and desert shrub uplands; JRS 5020, KH 19273.

Stephanomeria pauciflora (Torr.) A. Nels. - BROWNPLUME WIRELETTUCE
Perennial herb; O, sandy soils, beaches; MH 285.

Stephanomeria runcinata Nutt. - DESERT WIRELETTUCE
Perennial herb; U, desert shrub, Escalante River; SLW 22129.

Stylocline micropoides Gray - WOOLLYHEAD NESTSTRAW
Annual herb; U, talus slopes and benches, desert shrub; BP 82-62, GR 1796.

Symphyotrichum ascendens (Lindl.) Nesom - WESTERN ASTER
[*Aster chilensis* Nees] Perennial herb; O, canyon bottoms, riparian; GR 4248, SLW 22351.

Symphyotrichum expansum (Poepp. ex Spreng.) Nesom - SOUTHWESTERN ANNUAL SALTMARSH ASTER
[*Aster subulatus* Michx., *Aster exilis* Ell., nomen dubium] Annual herb; O, Cow Canyon and Lee's Ferry; DH s.n. (ASC 059551), JRS 4966.

Symphyotrichum falcatum (Lindl.) Nesom - WHITE PRAIRIE ASTER
[*Aster falcatus* Lindl.] Perennial herb; O, Alcove and Bowns Canyon; JRS 5036, KH 21050.

Symphyotrichum frondosum (Nutt.) Nesom - SHORT-RAYED ALKALI ASTER

[*Aster frondosus* (Nutt.) Torr. & Gray] Annual herb; O, canyon bottoms; DG 9, NDA 26041.

Symphyotrichum lanceolatum (Willd.) Nesom ssp. *hesperium* (Gray) Nesom - WHITE PANICLE ASTER
[*Aster hesperius* Gray] Perennial herb; U, Coyote Gulch; MH 250.

Symphyotrichum welshii (Cronq.) Nesom - WELSH'S ASTER
Perennial herb; U, riparian, Explorer Canyon; MH 320.

**Taraxacum officinale* G.H. Weber ex Wiggers - COMMON DANDELION
Perennial herb; W, disturbed sites; MH 311.

Tetradymia canescens Dc. - SPINELESS HORSEBRUSH
Shrub; O, uplands, pinyon-juniper woodlands; MH 563.

Tetraneuris ivesiana- IVES' FOURNERVED DAISY
[*Hymenoxys acaulis* (Pursh) Parker *var. ivesiana* (Greene) Parker,] Perennial herb; W, uplands, pinyon-juniper woodlands; MH 63, 143, 557.

Thelesperma megapotamicum (Spreng.) Kuntze - HOPI TEA GREENTHREAD
Perennial herb; U, San Juan River; MH 216.

Thelesperma subnudum Gray var. *subnudum*- NAVAJO TEA
Perennial herb; O, uplands, desert shrub; MH 587, 600.

Thymophylla acerosa (DC.) Strother - PRICKLYLEAF DOGWEED
[*Dyssodia acerosa* DC.] Perennial herb; U, hillsides, Lee's Ferry; MH 7.

Thymophylla pentachaeta (DC.) Small var. *belenidium* (DC.) Strother - FIVENEEDLE PRICKLYLEAF
[*Dyssodia pentachaeta* (DC.) B.L. Robins. *var. belenidium* (DC.) Strother, *Dyssodia thurberi* (Gray) B.L. Robins] Perennial herb; C, canyons and hillsides, desert shrub; MH 8, GR 1680, 1786.

Townsendia annua Beaman - ANNUAL TOWNSEND DAISY
Annual herb; O, hills and benches, desert shrub; MH 30, GR 1802.

Townsendia incana Nutt. - HOARY TOWNSEND DAISY
Perennial herb; W, canyon bottoms to pinyon-juniper woodland; MH 151, 392, 536, NDA 22582.

**Tragopogon dubius* Scop. - YELLOW SALSIFY
Biennial herb; O, disturbed sites, canyon bottoms to pinyon-juniper woodlands; MH 636, PC (CARE 1922).

Vanclevea stylosa (Eastw.) Greene - PILLAR FALSE GUMWEED
Shrub; C, sandy soils, desert shrub; MH 369, HDH 11276.

Verbesina encelioides (Cav.) Benth. & Hook. f. ex Gray - GOLDEN CROWNBEARD
Annual herb; U, canyon bottoms, San Juan River; NDA 23259.

Wyethia scabra Hook. - BADLANDS MULE-EARS
Perennial herb; O, hillsides and canyons, desert shrub; MH 106, JM s.n. (GLCAHERB).

**Xanthium strumarium* L. - ROUGH COCKLEBURR
Annual herb; O, disturbed wet sites, bottomlands; MH 347.

Xylorhiza glabriuscula Nutt. - SMOOTH WOODYASTER
Perennial herb; U, Millard Canyon; SLW 21917.

Xylorhiza tortifolia (Torr. & Gray) Greene var. *imberbis* (Cronq.) T.J. Watson - IMBERBIS WOODYASTER
Shrub; O, uplands, desert shrub to pinyon-juniper woodlands; MH 125, 166, 467.

Berberidaceae

Mahonia fremontii (Torr.) Fedde - FREMONT'S MAHONIA
Shrub; O, canyon bottoms to pinyon-juniper woodland; MH 138, PC (CARE 1941).

Mahonia repens (Lindl.) G. Don - CREEPING BARBERRY
Shrub; O, streams and hanging gardens; NDA 4121, GR 4104.

Betulaceae

Betula occidentalis Hook. - WATER BIRCH
Shrub; O, canyon bottoms, riparian; MH 240.

Ostrya knowltonii Coville - KNOWLTON'S HOPHORNBEAM
Shrub; R, hanging gardens; JF 843,900.

Bignoniaceae

Chilopsis linearis (Cav.) Sweet - DESERT WILLOW
Tree; U, Cultivated landscaping, Lee's Ferry; MH 358.

Boraginaceae

Cryptantha abata I.M. Johnston - DENTNUT CRYPTANTHA
Perennial herb; O, canyon bottoms, Last Chance Creek; NDA 3747.

Cryptantha angustifolia (Torr.) Greene - PANAMINT CRYPTANTHA

Annual herb; C, desert shrub; MH 2, 706, JRS 5240.

Cryptantha barbigera (Gray) Greene - BEARDED CRYPTANTHA
Annual herb; O, Orange Cliffs; SLW 21965.

Cryptantha capitata (Eastw.) I.M. Johnston - CAPITATE CRYPTANTHA
Perennial herb; O, pinyon-juniper woodlands, Happy Canyon; LMS 6847.

Cryptantha cinerea (Greene) Cronq. - JAMES' CRYPTANTHA
[*Cryptantha jamesii* (Torr.) Payson] Perennial herb; C, sandy and clayey soils, desert shrub; MH 619.

Cryptantha circumscissa (Hook. & Arn.) I.M. Johnston - CUSHION CRYPTANTHA
Annual herb; W, desert shrub; MH 113, 483, 680, JRS 5213.

Cryptantha compacta Higgins - COMPACT CRYPTANTHA
Perennial herb; R, pinyon-juniper woodlands, Cleopatras Chair; MH 631.

Cryptantha confertiflora (Greene) Payson - BASIN YELLOW CRYPTANTHA
Perennial herb; C, uplands, desert shrub; MH 79, GR 1689.

Cryptantha crassisepala (Torr. & Gray) Greene var. *elachantha* I.M. Johnston - THICKSEPAL CRYPTANTHA
Annual herb; W, desert shrub; MH 448, 452, 453, 460, 472, 546, 560, 573, JRS 5211, GR 1715.

Cryptantha fendleri (Gray) Greene - SANDDUNE CRYPTANTHA
Annual herb; O, canyon bottoms, desert shrub, Lee's Ferry; DH s.n. (ASC 53652).

Cryptantha flava (A. Nels.) Payson - BRENDA'S YELLOW CRYPTANTHA
Perennial herb; C, uplands, desert shrub to pinyon-juniper woodlands; MH 469, 548.

Cryptantha flavoculata (A. Nels.) Payson - ROUGHSEED CRYPTANTHA
Perennial herb; O, mesas, pinyon-juniper woodlands, Big Ridge; LMS 6768.

Cryptantha fulvocanescens (S. Wats.) Payson - TAWNY CRYPTANTHA
Perennial herb; O, mesas and rim rock, pinyon-juniper woodlands; MH 549.

Cryptantha gracilis Osterhout - NARROWSTEM CRYPTANTHA
Annual herb; O, pinyon-jupiner woodlands; MH 651, 553.

Cryptantha holoptera (Gray) J.F. Macbr. - WINGED CRYPTANTHA
[*Cryptantha inequata* I.M. Johnston] Annual herb; U, Ticaboo Canyon; SLW 22028.

Cryptantha humilis (Gray) Payson - ROUNDSPIKE CRYPTANTHA
Perennial herb; O, desert shrub, Alstrum Point; NDA 3669.

Cryptantha micrantha var. *micrantha* (Torr.) I. M. Johnston - REDROOT CRYPTANTHA
Annual herb; C, hillsides and benches, desert shrub; MH 84, 454, 462, JZ 4, JRS 5212, GR 1652.

Cryptantha nevadensis A. Nels. & Kennedy - NEVADA CRYPTANTHA
Annual herb; O, hillsides, desert shrub, San Juan and John's Canyons; GR 1650, 1789.

Cryptantha osterhoutii (Payson) Payson - OSTERHOUT'S CRYPTANTHA
Perennial herb; U, desert shrub, Millard Canyon; SLW 21921.

Cryptantha pterocarya (Torr.) Greene var. *pterocarya*- WINGNUT CRYPTANTHA
Annual herb; C, canyonbottoms and bottomlands; MH 428, 449, 641, 650.

Cryptantha racemosa (S. Wats.) Greene - BUSHY CRYPTANTHA
Perennial herb; U, hillsides, desert shrub, Lee's Ferry; MH 3.

Cryptantha recurvata Coville - CURVENUT CRYPTANTHA
Annual herb; C, desert shrub; MH 26, 450, 491, GR 1649.

Cryptantha tenuis (Eastw.) Payson - CANYON CRYPTANTHA
Perennial herb; U, hanging garden, Alcove Canyon; KH 18600.

Heliotropium convolvulaceum (Nutt.) A. Gray var. *convolvulaceum* - PHLOX HELIOTROPE
Annual herb; O, sandy soil, desert shrub; MH 258.

Heliotropium curassavicum L. var. *obovatum* DC. - SEASIDE HELIOTROPE
Perennial herb; O, saline disturbed sites; MH 531, 713, NDA 23366.

Lappula occidentalis (S. Wats.) Greene var. *cupulata* (Gray) Higgins - FLATSPINE STICKSEED
Annual herb; C, bottomlands, disturbed sites; MH 154, 168, 424, 476, JRS 5216,5642.

Lithospermum incisum Lehm. - NARROWLEAF STONESEED
Perennial herb; O, pinyon-juniper woodlands; MH 508, 646.

Pectocarya heterocarpa (I.M. Johnston) I.M. Johnston - CHUCKWALLA COMBSEED
Annual herb; U, desert shrub, San Juan Co; KH 21385.

Tiquilia latior (I.M. Johnston) A. Richards. - MATTED CRINKLEMAT
[*Coldenia hispidissima* (Torr. & Gray) Gray] Perennial herb; C, uplands, hillsides, desert shrub; MH 213.

Brassicaceae

Arabis perennans S. Wats. - PERENNIAL ROCKCRESS
Perennial herb; O, pinyon-juniper woodlands; MH 627, JRS 5652.

Arabis pulchra M.E. Jones ex S. Wats. - BEAUTIFUL ROCKCRESS
Perennial herb; U, Millard Canyon; BTW 21841.

**Brassica nigra* (L.) W.D.J. Koch - BLACK MUSTARD
Annual herb; O, disturbed sites; MH 206.

**Brassica tournefortii* Gouan – SAHARAN MUSTARD or AFRICAN MUSTARD
Annual herb; C, roadsides and disturbed sites; MH 417, 708.

Caulanthus crassicaulis (Torr.) S. Wats. - THICKSTEM WILD CABBAGE
Perennial herb; U, desert shrub to pinyon-juniper woodlands, Purple Hills; BTW 1458.

Descurainia incana (Bernh. ex Fisch. & C.A. Mey.) Dorn ssp. *incisa* (Engelm.) Kartesz & Gandhi - MOUNTAIN TANSYMUSTARD
Biennial herb; O, sandy site, San Juan Canyon; GR 1668.

Descurainia pinnata (Walt.) Britt. - WESTERN TANSYMUSTARD
Annual herb; C, sandy soils, desert shrub; MH 146, 430, 457, 471, GR 1667.

**Descurainia sophia* (L.) Webb ex Prantl - HERB SOPHIA
Annual herb; O, beaches and disturbed sites; MH 425.

Dimorphocarpa wislizeni (Engelm.) Rollins - TOURISTPLANT
[*Dithyrea wislizeni* Engelm.] Annual herb; O, sandy soils, desert shrub; MH 503, GR 1654.

Draba cuneifolia Nutt. ex Torrey & A. Gray var. *cuneifolia*- WEDGELEAF DRABA
Annual herb; O, uplands, desert shrub to pinyon-juniper woodlands; MH 540, JRS 5221.

Erysimum capitatum (Dougl. ex Hook.) Greene var. *purshii* (Dur.) Rollins - PURSH'S WALLFLOWER
Perennial herb; O, sandy soils, desert shrub; MH 470, GR 1714.

**Erysimum repandum* L. - SPREADING WALLFLOWER
Annual herb; O, disturbed sites, Clay Hills; MH 533.

Hutchinsia procumbens (L.) Desv. - PROSTRATE HUTCHINSIA
Annual herb; U, wet sites and hanging gardens, Ribbon and Escalante Garden Canyons; SLW 22125, 21725.

Lepidium alyssoides Gray var. *junceum* Rollins - MESA PEPPERWORT
Perennial herb; U, stream banks, Lee's Ferry; CG s.n. 1947(type, Gray Herbarium).

Lepidium densiflorum Schrad. var. *ramosum* (A. Nels.) Thellung - MINER'S PEPPERWEED
Annual herb; W, disturbed areas; MH 420.

Lepidium lasiocarpum Nutt. var. *lasiocarpum* Nutt. - SHAGGYFRUIT PEPPERWEED
Annual herb; C, disturbed sites; MH 127, GR 1661, JRS 5207.

**Lepidium latifolium* L. - BROADLEAVED PEPPERWEED
Perennial herb; C, Riparian, upstream from Lee's Ferry; MH 288, 304, 718.

Lepidium montanum Nutt. var. *jonesii* (Rydb.) C.L. Hitchc. - JONES' PEPPERWEED
[*Lepidium jonesii* Rydb.] Perennial herb; W, upland, hills, mesas, benches, washes, and canyons, desert shrub to pinyon-juniperwoodlands; MH 15, 439, 444, 543, AP 80-142, GR 1670.

Lesquerella ludoviciana (Nutt.) S. Wats. - FOOTHILL BLADDERPOD
Perennial herb; U, pinyon-juniper woodlands, Purple Hills; JZ 3.

Lesquerella rectipes Woot. & Standl. - STRAIGHT BLADDERPOD
Perennial herb; W, pinyon-juniper woodlands; MH 517, SLW 22228, 21989.

**Malcolmia africana* Wats.; Wats. - AFRICAN MUSTARD
Annual herb; O, disturbed sites, desert shrub; MH 187, JRS 5215.

Physaria acutifolia Rydb. - SHARPLEAF TWINPOD
Perennial herb; C, canyons and uplands, desert shrub to pinyon-juniper; MH 632, JRS 4937.

Physaria chambersii Rollins - CHAMBERS' TWINPOD
Perennial herb; U, desert shrub, Last Chance Creek; NDA 3748.

Physaria newberryi Gray - NEWBERRY'S TWINPOD
Perennial herb; O, Happy Canyon; SLW 21793.

Rorippa palustris (L.) Besser ssp. *hispida* (Desvaux) Jonsel - HISPID YELLOWCRESS

[*Rorippa islandica* (Oeder) Borbás] Biennial herb; O, bottomlands, riparian; MH 702, JRS 4992.

Rorippa sinuata (Nutt.) A.S. Hitchc. - SPREADING YELLOWCRESS
Perennial herb; O, disturbed sites, Clay Hills Crossing; MH 532.

Rorippa sphaerocarpa (Gray) Britt. - ROUNDFRUIT YELLOWCRESS
Annual herb; U, disturbed sites; KH 18599.

Schoenocrambe linifolia (Nutt.) Greene - FLAXLEAF PLAINSMUSTARD
[*Sisymbrium linifolium* (Nutt.) Nutt. ex Torr. & Gray] Perennial herb; U, desert shrub, Last Chance Creek and Ribbon Canyon; SLW 21726, NDA 3514.

**Sisymbrium altissimum* L. - TALL TUMBLEMUSTARD
Annual herb; C, disturbed sites; MH 155, 569.

**Sisymbrium irio* L. - LONDON ROCKET
Annual herb; O, disturbed sites; MH 431.

Stanleya pinnata (Pursh) Britt. var. *pinnata* - DESERT PRINCESPLUME
Perennial herb; W, seleniferous soils, desert shrub to pinyon-juniper woodlands; MH 108, GR 1776.

Streptanthella longirostris (S. Wats.) Rydb. - LONGBEAK STREPTANTHELLA
Annual herb; W, desert shrub to pinyon-juniper woodlands; MH 422, 458, GR 1653.

Streptanthus cordatus Nutt. - HEARTLEAF TWISTFLOWER
Perennial herb; O, uplands, hills, and mesas; MH 182, 511.

Thelypodiopsis divaricata (Rollins) Welsh & Reveal - SPREADING THELYPODIOPSIS
Biennial herb; O, clayey soils, canyons and uplands; MH 607, BTW 21854, JRS 4934.

Thelypodium integrifolium (Nuttall ex Torrey & Gray) Endlicher - ENTIRELEAVED THELYPODY
Biennial herb; O, bottomland, riparian; MH 338, NDA 23321.

Cactaceae

Echinocactus polycephalus Engelm. & Bigelow - COTTONTOP CACTUS
Succulent shrub; R, benches, Lee's Ferry; MH 612.

Echinocereus engelmannii (Parry ex Engelm.) Lem. var. *variegatus* (Engelm. & Bigelow) Rumpl. - ENGELMANN'S HEDGEHOG CACTUS

Succulent shrub; O, rocky areas, desert shrub; MH 432, NDA 3556, BTW 1404.

Echinocereus triglochidiatus Engelm. var. *mojavensis* (Engelm. & Bigelow) L. Benson - MOJAVE KINGCUP CACTUS
[*Echinocereus mojavensis* (Engelm. & Bigelow) Rumpl.] Succulent shrub; W, rocky areas, desert shrub to pinyon-juniper woodlands; MH 498, 556 (determined by M. Baker).

Opuntia basilaris Engelm. & Bigel. - BEAVERTAIL PRICKLYPEAR
[*Opuntia brachyclada* Griffiths] Succulent shrub; O, benches, desert shrub; SLW 21999.

Opuntia erinacea Engelm. & Bigelow ex Engelm. var. *erinacea*- GRIZZLYBEAR PRICKLYPEAR
Succulent shrub; O, benches, desert shrub; GR 1679. Spines confined to upper half of pad

Opuntia erinacea Engelm. & Bigelow ex Engelm. var. *utahensis* (Engelm.) L. Benson - UTAH GRIZZLYBEAR PRICKLYPEAR
Succulent shrub; C, bottomlands and canyons, Great Bend Hanging Gardens and Clay Hills Crossing; MH 581, 711. Spines present over entire pad

Opuntia macrorhiza Engelm. - TWISTSPINE PRICKLYPEAR
Succulent shrub; O, benches, desert shrub to pinyon-juniper woodlands; MH 145 (determined by M. Baker).

Opuntia nicholii L. Benson - NAVAJO BRIDGE PRICKLYPEAR
Succulent shrub; O, benches and hills, desert shrub; WH 7367.

Opuntia phaeacantha Engelm. var. *major* Engelm. - MOJAVE PRICKLYPEAR
Succulent shrub; W, benches and canyons, desert shrub to pinyon-juniper; SLW 22450.

Opuntia pinkavae Parfitt - PINKAVA'S PRICKLYPEAR
Succulent shrub; U, sandy soils, desert shrub, Hole-in-the-Rock; MH 93 (determined by M. Baker).

Opuntia polyacantha - HAIRSPINE PRICKLYPEAR
Succulent shrub; W, desert shrub to pinyon-juniper; MH 558, BTW 1403. Spines not flexible or curving

Opuntia polyacantha Haw. var. *trichophora* (Engelm. & Bigelow) Coult. - HAIRSPINE PRICKLYPEAR
Succulent shrub; O, Three Gardens; SLW 12414. Spines flexible and curving

Opuntia whipplei Engelm. & Bigelow - WHIPPLE CHOLLA
Succulent shrub; R, desert shrub, Finger Rock; MH 721.

Pediocactus bradyi L. Benson - BRADY'S HEDGEHOG CACTUS
Succulent shrub. (See Appendix E for more information.)

Sclerocactus parviflorus Clover & Jotter - SMALLFLOWER FISHHOOK CACTUS
[*Sclerocactus whippleii* (Engelm. & Bigelow) Britt. & Rose *var. roseus* (Clover) L. Benson,] Succulent shrub; O, desert shrub to pinyon-juniper; MH 490, 566, GR 1677, 1794, NDA 3636.

Campanulaceae
Lobelia cardinalis L. - CARDINALFLOWER
Perennial herb; U, hanging gardens and seeps; JF 1067, SLW 11879.

Nemacladus glanduliferus Jepson var. *orientalis* McVaugh - GLANDULAR THREADPLANT
Annual herb; U, desert shrub, Lee's Ferry and just inside GLCA boundary down Hole-in-the-Rock-Road; MH 132.

Capparaceae
Cleome lutea Hook. - YELLOW SPIDERFLOWER
Annual herb; C, bottomlands and canyons, desert shrub; MH 153, GR 1723.

Cleomella palmeriana Jones - ROCKY MOUNTAIN STICKWEED
Annual herb; C, tropic shale formations; MH 365, 475.

Caprifoliaceae
Symphoricarpos longiflorus Gray - DESERT SNOWBERRY
Shrub; O, canyons and rock-outcrops; MH 181.

Caryophyllaceae
Arenaria eastwoodiae Rydb. - EASTWOOD'S SANDWORT
Perennial herb; O, mesas and hillsides, desert shrub to pinyon-juniper woodland; MH 94, 142.

Pseudostellaria jamesiana (Torr.) W.A. Weber & R.L. Hartman - TUBER STARWORT
[*Stellaria jamesiana* Torr.] Perennial herb; U, pinyon-juniper woodlands, Navajo Point; BJ 2004(GLCAHERB).

Silene antirrhina L. - SLEEPY SILENE
Annual herb; O, canyons, disturbed sites; MH 140.

Spergularia salina J.& K. Presl - SALT SANDSPURRY
[*Spergularia marina* (L.) Griseb.] Annual herb; U, riparian; KH 18507.

Celastraceae

Paxistima myrsinites (Pursh) Raf. - OREGON BOXLEAF
Shrub; U, Navajo Point; MH 726.

Chenopodiaceae

Atriplex argentea Nutt. - SILVERSCALE SALTBUSH
[*Atiplex argentea* Nutt. *var. rydbergii* (Standley) S. Welsh,] Annual herb; U, talus slope, desert shrub; KH 21410.

Atriplex canescens (Pursh) Nutt. var. *canescens* (Pursh) Nutt. - FOURWING SALTBUSH
Shrub; W, desert shrub to pinyon-juniper woodlands; MH 24.

Atriplex confertifolia (Torrey & Fremont) S. Watson - SHADSCALE SALTBUSH
[*Atriplex jonesii* Standl.] Shrub; W, benches and hillsides; MH 169, 526, 574, GR 1783.

Atriplex corrugata S. Wats. - MAT SALTBUSH
Shrub; C, Tropic Shale Formation; MH 474.

Atriplex gardneri (Moq.) D. Dietr. - GARDNER'S SALTBUSH
Shrub; C, clay soils, desert shrub to pinyon-juniper woodlands; MH 164, 605.

Atriplex garrettii Rydb. - GARRETT'S SALTBUSH
Shrub; U, talus slopes of canyons; MH 524, 575, NDA 23368.

Atriplex graciliflora M.E. Jones - SLENDERFLOWER SALTBUSH
Shrub; U, canyon bottoms, riparian; MH 659.

Atriplex navajoensis Hanson - NAVAJO SALTBUSH
Shrub; U, Lee's Ferry; SLW 22058, NDA 4351.

Atriplex obovata Moq. - MOUND SALTBUSH
Shrub; O, bottomlands and canyons; MH 344, GR 1683.

Atriplex saccaria S. Wats. - SACK SALTBUSH
Annual herb; O, bottomlands in saline clay soils; MH 523, 576.

**Bassia hyssopifolia* (Pallas) Kuntz - FIVEHORN SMOTHERWEED
Annual herb; O, moist disturbed sites; MH 265, 318.

**Chenopodium album* L. var. *album* L. - LAMBSQUARTERS
Annual herb; O, disturbed sites; MH 679.

Chenopodium desiccatum A. Nels. - ARIDLAND GOOSEFOOT
Annual herb; U, moist disturbed sites, Great Bend Hanging Garden; MH 712.

Chenopodium fremontii S. Wats. - FREMONT'S GOOSEFOOT
Annual herb; O, disturbed sites, desert shrub to pinyon-juniper woodlands; MH 660, JRS 5055.

Chenopodium incanum (S. Wats.) Heller var. *incanum*- MEALY GOOSEFOOT
Annual herb; O, disturbed sites, desert shrub to pinyon-juniper woodlands; MH 188, 222, 608.

Chenopodium leptophyllum (Moq.) Nutt. ex S. Wats. - NARROWLEAF GOOSEFOOT
Annual herb; O, bottomlands, riparian; LCH 14170.

Chenopodium salinum Standl. - ROCKY MOUNTAIN GOOSEFOOT
[*Chenopodium glaucum* L. *var. salinum* (Standl.) Boivin,] Annual herb; O, canyon bottoms, riparian; MH 316.

Corispermum americanum (Nuttall) Nuttall - AMERICAN BUGSEED
[*Corispermum hyssopifolium* L. p.p.] Annual herb; O, sandy soils; MH 91, 591.

Corispermum welshii Mosyakin - WELSH'S BUGSEED
Annual herb; U, sandy soils, Halls Creek; SLW 11797.

Cycloloma atriplicifolium (Spreng.) Coult. - WINGED PIGWEED
Annual herb; U, sandy soils, desert shrub; MH 195.

Grayia spinosa (Hook.) Moq - SPINY HOPSAGE
Shrub; O, hills, benches, and canyons, desert shrub; MH 45, GR 1718.

**Halogeton glomeratus* (Bieberstein) C.A. Meyer - SALTLOVER
Annual herb; O, disturbed sites and roadsides; MH 360.

Kochia americana Wats. - GREEN MOLLY
[*Bassia americana* (S. Watson) A.J. Watson] Perennial herb; O, canyon bottoms; MH 262.

**Kochia scoparia* (L.) Schrad. - MEXICAN-FIREWEED
[*Bassia scoparia* (L.) A.J. Scott] Annual herb; O, bottomlands, disturbed sites; MH 269.

Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit - WINTERFAT
[*Ceratoides lanata* (Pursh) J.T. Howell; *Eurotia lanata* (Pursh) Moq.] Shrub; O, uplands, mesas, and benches, desert shrub to pinyon-juniper woodlands; MH 487.

Monolepis nuttalliana (J.A. Schultes) Greene - NUTTALL'S POVERTYWEED

Annual herb; O, bottomlands, disturbed sites; MH 534, 606.

**Salsola paulsenii* Litv. - BARBWIRE RUSSIAN THISTLE
Annual herb; W, disturbed sites; MH 374.

**Salsola tragus* L. - PRICKLY RUSSIAN THISTLE
[*Salsola iberica* (Sennen & Pau) Botsch. ex Czerepanov, *Salsola australis* R. Br.] Annual herb; W, disturbed sites; MH 580.

Suaeda moquinii (Torr.) Greene - MOJAVE SEABLITE
[*Suaeda torreyana* S. Wats.] Shrub; O, bottomlands, riparian; MH 411.

Zuckia brandegeei (Gray) Welsh & Stutz ex Welsh - SILTBUSH
[*Grayia brandegeei* Gray] Shrub; O, clayey soils, canyons; NDA 22607.

Convolvulaceae
**Convolvulus arvensis* L. - FIELD BINDWEED
Perennial herb; O, disturbed sites; MH 160.

Evolvulus nuttallianus J.A. Schultes – SHAGGY DWARF MORNING-GLORY
Perennial herb; U, sandy soils, Lee's Ferry; JZ 8.

Cornaceae
Cornus sericea L. ssp. *sericea* L. - REDOSIER DOGWOOD
Shrub; O, hanging gardens and other moist sites; JRS 5237.

Crossosomataceae
Glossopetalon spinescens Gray var. *aridum* M.E. Jones - SPINY GREASEBUSH
Shrub; O, hills, mesas and benches, desert shrub to pinyon-juniper; MH 191.

Cucurbitaceae
Cucurbita palmata S. Wats. - COYOTE GOURD
Perennial herb; U, disturbed sites, Lee's Ferry; MH 613.

Cuscutaceae
Cuscuta denticulata Engelm. - DESERT DODDER
Perennial herb; U, growing on Ericameria, Blue Notch Canyon; MH 685.

Elaeagnaceae
**Elaeagnus angustifolia* L. - RUSSIAN OLIVE
Tree; O, riparian, San Juan and Escalante Rivers; MH 351,GR 1695.

Shepherdia argentea (Pursh) Nutt. - SILVER BUFFALOBERRY
Shrub; U, canyons, Last Chance Creek; NDA 3508.

Shepherdia rotundifolia Parry - ROUNDLEAF BUFFALOBERRY

Shrub; O, uplands and canyons, hillsides; MH 489.

Ericaceae

Arctostaphylos patula Greene - GREENLEAF MANZANITA
Shrub; R, canyon bottom, Dark Canyon; MH 382.

Euphorbiaceae

Chamaesyce fendleri T. & G. - FENDLER'S SANDMAT
[*Euphorbia fendleri* Torr. & Gray] Perennial herb; W, mesas, benches, and washes, desert shrub to pinyon-juniper woodlands; MH 126, 136, 264, 361, 375.

Chamaesyce glyptosperma (Engelm.) Small - RIBSEED SANDMAT
[*Euphorbia glyptosperma* Engelm.] Annual herb; O, canyon bottoms, disturbed sites; MH 699.

Chamaesyce hyssopifolia (L.) Small - HYSSOPLEAF SANDMAT
Annual herb; C, disturbed sites, Lee's Ferry; MH 398.

Chamaesyce maculata (L.) Small - SPOTTED SANDMAT
[*Euphorbia albomarginata* Torr. & Gray] Annual herb; U, disturbed sites, Lee's Ferry; MH 408.

Chamaesyce parryi (Engelm.) Rydb. - PARRY'S SANDMAT
[*Euphorbia parryi* Engelm.] Annual herb; U, sandy soils, desert shrub; MH 122, 259.

Chamaesyce prostrata (Ait.) Small - PROSTRATE SANDMAT
Annual herb; O, disturbed sites, Lee's Ferry; MH 355.

Chamaesyce serpyllifolia (Pers.) Small - THYMELEAF SANDMAT
Annual herb; O, disturbed sites; KH 21035.

Croton texensis (Klotzsch) Muell.-Arg. var. *utahensis* Cronq. - UTAH CROTON
Annual herb; O, sandy sites, desert shrub; MH 658, AP & BP 80-148.

Euphorbia aaron-rossii A & N Holmgren - MARBLE CANYON SPURGE
Perennial herb; R, canyon bottoms, Colorado River Canyon below Glen Canyon Dam; MH 9,JZ 13.

Euphorbia brachycera Engelm. - HORNED SPURGE
[*Euphorbia robusta* (Engelm.) Small ex. Britt. & Br.] Perennial herb; O, canyon bottoms, Steer Gulch; NDA 22010.

Euphorbia nephradenia Barneby - PARIA SPURGE
Annual herb; U, Halls Creek; PC (CARE 2163).

Reverchonia arenaria Gray - SAND REVERCHONIA
Annual herb; U, sandy soils, E. of Big Water; NDA 2920.

Fabaceae

Astragalus amphioxys Gray var. *modestus* Barneby - CRESCENT MILKVETCH
Perennial herb; C, canyon bottoms and benches; MH 496, 527, 590, GR 1655.banner <16 mm long

Astragalus amphioxys Gray var. *vespertinus* (Sheldon) M.E. Jones - ALADDIN'S SLIPPERS
Perennial herb; C, canyon bottoms and benches; GR 1719.banner >19 mm long

Astragalus calycosus Torr. ex S. Wats. var. *calycosus*- TORREY'S MILKVETCH
Perennial herb; U, hillsides and mesas; MH 518.

Astragalus ceramicus Sheldon var. *ceramicus* Shelton - PAINTED MILKVETCH
Perennial herb; C, sandy soils, desert shrub to pinyon-juniper woodlands; MH 186, 555, 672.

Astragalus coltonii M.E. Jones - COLTON'S MILKVETCH
Perennial herb; O, desert shrub; NDA 540.

Astragalus desperatus M.E. Jones var. *desperatus* Jones - RIMROCK MILKVETCH
Perennial herb; W, desert shrub to pinyon-juniper woodlands; MH 36, 72, 98, 500, 633.

Astragalus eastwoodiae M.E. Jones - EASTWOOD'S MILKVETCH
Perennial herb; O, hillsides and mesas, Flint Trail; SLW 9664.

Astragalus fucatus Barneby - HOPI MILKVETCH
Perennial herb; O, sandy soils, desert shrub; NDA 21928.

Astragalus harrisonii Barneby - HARRISON'S MILKVETCH
Perennial herb; R, talus slope, Purple Hills; JZ 3.

Astragalus kentrophyta Gray - SPINY MILKVETCH
Perennial herb; U, sandy soils, canyons; SLW 22149.

Astragalus lentiginosus Dougl. ex Hook.
Perennial herb; MH 90

Astragalus lentiginosus Dougl. ex Hook. *var. diphysus* (A. Gray) M.E. Jones – FRECKLED MILKVETCH

Perennial herb; Canyon bottoms, Hall's Creek and Last Chance Creek; MH 495, PC (CARE 2217)

Astragalus lentiginosus Dougl. ex Hook. var. *palans* (M.E. Jones) M.E. Jones - FRECKLED MILKVETCH
[*Astragalus bryantii* Barneby] Perennial herb; O, canyons, hillside; KH 18488, GR 1787.racemes in fruit >8cm long

Astragalus lonchocarpus Torr. - RUSHY MILKVETCH
Perennial herb; O, Happy Canyon; LMS 6844.

Astragalus malacoides Barneby - KAIPAROWITS MILKVETCH
Perennial herb; U, canyon bottoms; SLW 22279.

Astragalus moencoppensis M.E. Jones - MOENKOPI MILKVETCH
Perennial herb; U, clayey soils on benches, desert shrub; MH 167, 604.

Astragalus mollissimus Torr. var. *thompsoniae* (S. Wats.) Barneby - WOOLLY LOCOWEED
[*Astragalus thompsoniae* S. Wats.] Perennial herb; C, uplands, canyons, desert shrub to pinyon-juniper woodlands; MH 71, 414, 505, GR 1791.

Astragalus monumentalis Barneby var. *cottamii* (Welsh) Isely - COTTAM'S MILKVETCH
[*Astragalus cottamii* Welsh] Perennial herb; U, slickrock, Muley Point and Slickhorn Canyon; MH 510, NDA 22588.

Astragalus musiniensis M.E. Jones - FERRON'S MILKVETCH
Perennial herb; U, hillsides and talus slopes; SLW 21938.

Astragalus newberryi Gray var. *newberryi*- NEWBERRY'S MILKVETCH
Perennial herb; O, desert shrub, Last Chance Canyon; NDA 23484.

Astragalus nidularis Barneby - BIRDNEST MILKVETCH
Perennial herb; U, desert shrub, Middle Moody Canyon; SLW 22265.

Astragalus nuttallianus DC. var. *micranthiformis* Barneby - TURKEYPEAS
Annual herb; O, benches and mesas, desert shrub; MH 23, 61.

Astragalus oophorus S. Wats. - EGG MILKVETCH
Perennial herb; O, pinyon-juniper woodlands; SLW 27443.

Astragalus pardalinus (Rydb.) Barneby - PANTHER MILKVETCH
Perennial herb; O, hillside and mesas, Flint Trail; SLW 9659.
Astragalus praelongus Sheldon var. *lonchopus* Barneby - STINKING MILKVETCH

Perennial herb; O, fine-textured substrates, desert shrub; MH 609, GR 1779.
Stipe 4-8mm long; San Juan Co.

Astragalus praelongus Sheldon var. *praelongus*- STINKING MILKVETCH
Perennial herb; O, clayey soils, desert shrub; SLW 22046.
Stipe <3mm long; Kane or Garfield Cos.

Astragalus preussii Gray var. *cutleri* Barneby - CUTLER'S MILKVETCH
[*Astragalus cutleri* (Barneby) S. Welsh] Perennial herb; R, desert shrub, Clay Hills Crossing; NDA 22013.
Flwrs white

Astragalus preussii Gray var. *preussii*- PREUSS' MILKVETCH
Perennial herb; O, clayey soils, desert shrub; MH 478, LCH 8323, NDA 4546.
Flwrs purple

Astragalus sabulonum Gray - GRAVEL MILKVETCH
Annual herb; O, hillsides and benches; MH 527, GR 1682.

Astragalus sesquiflorus S. Wats. - SANDSTONE MILKVETCH
Perennial herb; U, pinyon-juniper woodlands, Kaiparowits Plateau; JRS 5654.

Astragalus wingatanus S. Wats. - FORT WINGATE MILKVETCH
Perennial herb; U, hillsides and mesas, Flint Trail; LMS 6799.

Astragalus zionis M.E. Jones - ZION MILKVETCH
Perennial herb; U, canyon bottoms, Bowns Canyon; SLW 21757.

Caesalpinia repens Eastw. - CREEPING NICKER
Perennial herb; U, sandy soils; PC (CARE 2257).

Caragana arborescens Lam. - SIBERIAN PEASHRUB
Tree; O, C landscaping, Wahweap Campground; NDA 3435.

Dalea candida Michx. ex Willd. var. *oligophylla* (Torr.) Shinners - WHITE PRAIRIE CLOVER
[*Dalea oligophylla* (Torr.) Shinners, *Petalostemum candidus* Michx. var. *oligophyllus* (Torr.) F.J. Herm.] Perennial herb; O, hillsides and canyon bottoms; MH 315.

Dalea flavescens (S. Wats.) Welsh - CANYONLANDS PRAIRIE CLOVER
[*Petalostemon flavescens and Dalea epica* (S. Wats.) Welsh var. *epica* (Welsh) Chatterley, *Petalostemon flavescens* S. Wats.] Perennial herb; U, hillsides, desert shrub; MH 107, 194, NDA 22609.

Dalea searlsiae (Gray) Barneby - SEARLS' PRAIRIE CLOVER

Perennial herb; U, canyon bottoms, Escalante arm; GR 4219.

Glycyrrhiza lepidota Pursh - AMERICAN LICORICE
Perennial herb; O, riparian; MH 74.

Hedysarum boreale Nutt. - BOREAL SWEETVETCH
Perennial herb; U, canyon bottoms, Middle Moody Canyon; SLW 22288.

Lathyrus eucosmus Butters & St. John - BUSH VETCHLING
Perennial herb; U, washes, Lower San Juan Canyon; GR 1666.

Lupinus argenteus Pursh - SILVERY LUPINE
Perennial herb; O, pinyon-juniper woodlands; MH 622.

Lupinus pusillus Pursh ssp. *pusillus*- RUSTY LUPINE
Annual herb; C, sandy soils, desert shrub; MH 119, 459. Calyx tube strigose

Lupinus pusillus Pursh ssp. *rubens* (Rydb.) D. Dunn - RUSTY LUPINE
[*Lupinus rubens* Rydb.] Annual herb; U, sandy soils, Dry Rock Creek; SLW & NDA 11627. Calyx tube glabrous

**Medicago lupulina* L. - BLACK MEDICK
Perennial herb; U, riparian, Explorer Canyon; MH 337.

**Medicago sativa* L. - ALFALFA
Perennial herb; O, riparian, Coyote Gulch; MH 242.

**Melilotus alba* Medikus - WHITE SWEETCLOVER
Perennial herb; C, disturbed sites; AP 80-161.

**Melilotus officinalis* (L.) Lam. - YELLOW SWEETCLOVER
Perennial herb; C, disturbed sites; MH 272.

Parryella filifolia Torr. & Gray ex Gray - COMMON DUNEBROOM
Shrub; C, sandy sites, San Juan River; NDA 22549 & 23335.

Pediomelum megalanthum (Woot. & Standl.) Rydb. var. *megalanthum*-
INTERMOUNTAIN INDIAN BREADROOT
Perennial herb; O, pinyon-juniper woodlands, Muley Point; MH 538.

Peteria thompsoniae S. Wats. - THOMPSON'S PETERIA
Perennial herb; U, washes, Warm Creek; NDA & RA 2856.

Psoralidium junceum (Eastw.) Rydb. - RUSH LEMONWEED
Perennial herb; O, sandy soils, desert shrub; MH 617, JZ 9, NDA 22611.
Psoralidium lanceolatum (Pursh) Rydb. - LEMON SCURFPEA

Perennial herb; O, sandy soils, desert shrub to pinyon-juniper woodlands; MH 144.

Psorothamnus arborescens (Torr. ex Gray) Barneby - MOJAVE INDIGOBUSH
[*Dalea amoena* S. Wats.] Shrub; U, desert shrub, Kane Co.; MH 593.

Psorothamnus fremontii var. *fremontii* (Torr.) Barneby - FREMONT'S DALEA
[*Dalea fremontii* Torr. ex Gray] Shrub; O, benches, hillsides, and canyons, desert shrub; MH 83, JRS 4946.

Psorothamnus thompsoniae var. *thompsoniae*- THOMPSON'S DALEA
Shrub; O, sandy soils, desert shrub; MH 193. Calyx tube glabrous.

Psorothamnus thompsoniae (Vail) Welsh & Atwood var. *whitingii* (Kearney & Peebles) Barneby - WHITING'S DALEA
[*Dalea whitingii* Kearney & Peebles] Shrub; U, bottomlands, desert shrub, Clay Hills Crossing; MH 577. Calyx tube villous.

Sophora stenophylla Gray - FRINGELEAF NECKLACEPOD
Perennial herb; U, sandy sites, canyonbottoms, and benches; SLW 1695.

**Trifolium fragiferum* L. - STRAWBERRY CLOVER
Perennial herb; U, riparian, Escalante River; MH 268.

Fagaceae

Quercus gambelii Nutt. - GAMBEL OAK
Tree; C, canyons and higher mountain slopes; JF 227, 925, 1080.

Quercus havardii Rydb. var. *tuckeri* Welsh - HAVARD OAK
[*Quercus welshii* R.A. Denham nom. nov., *Quercus undulata* aut. not Torr.]
Shrub; C, sandy soils, desert shrub to pinyon-juniper woodlands; NDA 20797.

Quercus turbinella Greene - SONORAN SCRUB OAK
Shrub; U, canyonbottoms, riparian; MH 438.

Quercus ×pauciloba Rydb. *(pro sp.) [gambelii × turbinella]*-
Shrub; O, hanging gardens and mesas, Alcove Canyon and Muley Point; MH 545, KH 18500.

Fumariaceae

Corydalis aurea Willd. - SCRAMBLED EGGS
Annual herb; U, riparian, Castle Canyon; GR 1724.

Gentianaceae

Centaurium arizonicum (Gray) Heller - ARIZONA CENTAURY

[*Centaurium calycosum* (Buckl.) Fern.] Annual herb; U, riparian, Lee's Ferry; RKG 3965.

Centaurium exaltatum (Griseb.) W. Wight ex Piper - DESERT CENTAURY
Annual herb; O, riparian; MH 73, 293, 312, NDA 23325.

Frasera albomarginata S. Wats. - DESERT FRASERA
Perennial herb; O, uplands, Grand Bench; GR 4244, NDA 2728.

Frasera paniculata Torrey - TUFTED FRASERA
[*Swertia utahensis* (M.E. Jones) St. John] Perennial herb; O, sandy soils, desert shrub to pinyon-juniper; MH 565, 678.

Geraniaceae
**Erodium cicutarium* (L.) L'Hér. ex Ait. - REDSTEM STORK'S BILL
Annual herb; W, disturbed sites, desert shrub to pinyon-juniper; MH 418, SLW 21747.

Erodium texanum Gray - TEXAS STORK'S BILL
Annual herb; O, desert shrub, Lee's Ferry; JRS 5206.

Grossulariaceae
Ribes leptanthum Gray - TRUMPET GOOSEBERRY
Shrub; O, pinyon-juniper woodlands, Kaiparowits Plateau; MH 733.

Hydrangeaceae
Fendlera rupicola Gray - CLIFF FENDLERBUSH
Shrub; U, canyonbottom, Dark Canyon; MH 388.

Hydrophyllaceae
Nama hispidum Gray - BRISTLY NAMA
Annual herb; U, sandy shores and drainage bottoms, Llewyllin Canyon; SLW 21743.

Nama retrorsum J.T. Howell - BETATAKIN FIDDLELEAF
Annual herb; U, sandy soils, desert shrub; MH 507, NDA 2694.

Phacelia crenulata Torr. ex S. Wats.- CLEFTLEAF WILDHEIOTROPE
Annual herb; MH 519

Phacelia crenulata Torr. ex S. Wats. var. *angustifolia* Atwood - CLEFTLEAF PHACELIA
Annual herb; C, salt desert shrub; MH 28, 544. Lvs. Linear.

Phacelia crenulata Torr. ex S. Wats, var. *corrugata* (A. Nels.) Brand - CLEFTLEAF WILDHEIOTROPE

[*Phacelia corrugata* A. Nels.] Annual herb; C, desert shrub to pinyon-juniper woodlands; MH 17, 520. Lvs. not linear.

Phacelia demissa Gray var. *demissa* - INTERMOUNTAIN PHACELIA
Annual herb; C, moistly clayey soils, desert shrub to pinyon-juniper woodlands; MH 32, JRS 5218.

Phacelia howelliana D. Atwood - HARLEQUIN PHACELIA
Annual herb; U, Ribbon Canyon; SLW & NDA 11702.

Phacelia incana Brand - HOARY PHACELIA
Annual herb; U, pinyon-juniper woodlands, Cedar Mesa; MH 539.

Phacelia indecora J.T. Howell - DRAB PHACELIA
Annual herb; R, hanging gardens and alkaline soils, San Juan River; NDA 22560.

Phacelia integrifolia Torr. - GYPSUM PHACELIA
Annual herb; C, blackbrush communities; MH 502, 664.

Phacelia ivesiana Torr. - IVES' PHACELIA
Annual herb; C, sandy soils, desert shrub; MH 62, 423, JRS 5214.

Phacelia mammillarensis Atwood - NIPPLE BEACH PHACELIA
Annual herb; O, desert shrub, Kane Co; SLW & NDA 9809 (holotype), 11582.

Phacelia pulchella Gray var. *sabulonum* J.T. Howell - BEAUTIFUL PHACELIA
Annual herb; U, Tropic Shale, Kane Co.; AC 10012, NDA 2836, 2897.

Phacelia rafaelensis D. Atwood - PLATEAU PHACELIA
Biennial herb; U, desert shrub, Navajo Bridge vicinity; NDA & LCH 3814.

Phacelia rotundifolia Torr. ex S. Wats. - ROUNDLEAF PHACELIA
Annual herb; O, canyons, desert shrub; NDA 24650.

Lamiaceae

Hedeoma drummondii Benth. - DRUMMOND'S FALSE PENNYROYAL
Perennial herb; O, canyonbottoms; MH 381.

Hedeoma nana (Torr.) Briq. ssp. *nana* - DWARF FALSE PENNYROYAL
Perennial herb; O, hanging gardens; MH 69.

Lycopus americanus Muhl. ex W. Bart. - AMERICAN WATER HOREHOUND
Perennial herb; U, riparian, Colorado River -6.5 mile marsh; LES s.n. (GLCAHERB), JRS 4979.

**Marrubium vulgare* L. - HOREHOUND
Perennial herb; U, disturbed sites; MH 148.

Mentha arvensis L. - WILD MINT
Perennial herb; O, riparian, stream banks; MH 292.

Poliomintha incana (Torr.) Gray - FROSTED MINT
Shrub; O, sandy soils, desert shrub; MH 616, JZ 6.

Linaceae

Linum aristatum Engelm. - BRISTLE FLAX
Annual herb; O, sandy soils; MH 547, 589.

Linum australe Heller - SOUTHERN FLAX
Annual herb; U, canyon bottoms, Ribbon Canyon; MH 68.

Linum kingii- KING'S FLAX
Perennial herb; U, canyon bottoms, Dark Canyon; EHA s.n. (ASC 62815).

Linum perenne L. - BLUE FLAX
[*Linum perenne* L. *var. lewisii* (Pursh) Eat. & J. Wright,] Perennial herb; U, disturbed sites, pinyon-juniper woodlands, Kaiparowits Plateau; MH 731.

Linum puberulum (Engelm.) Heller - PLAINS FLAX
Annual herb; U, hillsides, John's Canyon; GR 1804.

Linum subteres (Trel.) Winkl. - SPRUCEMONT FLAX
Perennial herb; U, sandy soils, Muley Point; SLW 22238.

Loasaceae

Mentzelia albicaulis (Dougl. ex Hook.) Dougl. ex To - WHITESTEM BLAZINGSTAR
Annual herb; W, hills, benches, mesas, and canyons; MH 77, 620, JRS 5220,5208.

Mentzelia marginata (Osterhout) Thompson & Prigge - COLORADO BLAZINGSTAR
[*Mentzelia cronquistii* H.J. Thompson & Prigge] Perennial herb; C, uplands and disturbed sites; MH 174, 373, BTW 1511.

Mentzelia multiflora (Nutt.) Gray - ADONIS BLAZINGSTAR
Perennial herb; O, hillsides, benches, and washes, desert shrub; GR 1785.

Mentzelia pterosperma Eastw. - WINGSEED BLAZINGSTAR
Perennial herb; O, hills, mesas, benches, and canyon bottoms, desert shrub; SLW 22591.

Mentzelia pumila Nutt. ex Torr. & Gray var. *lagarosa* Thorne - DWARF MENTZELIA
Biennial herb; U, canyonbottom, Colorado River -14L; AP 80-162.

Malvaceae

Sphaeralcea ambigua Gray - DESERT GLOBEMALLOW
Perennial herb; O, desert shrub, Lee's Ferry; MH 14.

Sphaeralcea coccinea (Nutt.) Rydb. - SCARLET GLOBEMALLOW
Perennial herb; W, hills, mesas, benches, and canyons; MH 603, 623.

Sphaeralcea grossulariifolia (Hooker & Arn.) Rydb. - GOOSEBERRYLEAF GLOBEMALLOW
Perennial herb; W, hillsides, benches, and mesas, desert shrub; MH 86, 674, GR 1790.

Sphaeralcea leptophylla (Gray) Rydb. - SCALY GLOBEMALLOW
Perennial herb; O, hillsides and canyons, desert shrub; MH 229, 464, 585.

Sphaeralcea parvifolia A. Nels. - SMALLFLOWER GLOBEMALLOW
Perennial herb; W, hills, mesas, benches, and canyons; SLW 22193.

Molluginaceae

**Mollugo cerviana* (L.) Ser. - THREADSTEM CARPETWEED
Annual herb; U, sandy soils, desert shrub; NDA 10684.

Nyctaginaceae

Abronia fragrans Nutt. ex Hook. - SNOWBALL SAND VERBENA
[*Abronia elliptica* A. Nels.] Perennial herb; W, washes, canyon bottoms, and hillsides; MH 102, 384, GR 1648.

Abronia nana S. Wats. - DWARF SAND VERBENA
Perennial herb; U, benches, desert shrub; NDA 3750.

Allionia incarnata L. - TRAILING WINDMILLS
Perennial herb; O, washes and canyon bottoms, desert shrub; MH 394.

Boerhavia coccinea P. Mill. - SCARLET SPIDERLING
Perennial herb; U, canyon bottoms, Lee's Ferry; MH 397.

Mirabilis alipes (S. Wats.) Pilz - WINGED FOUR O'CLOCK
Perennial herb; O, clayey soils, desert shrub; MH 29.

Mirabilis linearis (Pursh) Heimerl - NARROWLEAF FOUR O'CLOCK

[*Oxybaphus linearis* (Pursh) B.L. Robins.] Perennial herb; C, benches and canyon bottoms, desert shrub; MH 103, 385.

Mirabilis multiflora (Torr.) Gray - COLORADO FOUR O'CLOCK
Perennial herb; C, mesas, washes, and canyon bottoms; MH 561.

Tripterocalyx carnea (Greene) L.A. Gal. var. *wootonii* (Standl.) L.A. Gal. - WOOTON'S SANDPUFFS
[*Tripterocalyx wootonii* Standl.] Annual herb; O, benches, desert shrub; NDA 3967, BFH 121005.

Tripterocalyx micranthus (Torr.) Hook. - SMALLFLOWER SANDVERBENA
[*Tripterocalyx pedunculatus* (M.E. Jones) Standl.] Annual herb; O, sandy soils, desert shrub to pinyon-juniper woodland; MH 624.

Oleaceae

Forestiera pubescens Nutt. - STRETCHBERRY
[*Forestiera neomexicana* Gray] Shrub; O, riparian and hanging gardens; MH 152, GR 1694, JF 246.

Fraxinus anomala Torr. ex S. Wats. - SINGLELEAF ASH
Tree; W, hills, mesas, benches, washes, and canyon bottoms; MH 162, JF 431.

**Fraxinus velutina* Torr. - VELVET ASH
Tree; U, dry wash, Clay Hills Crossing; MH 586.

Onagraceae

Calylophus lavandulifolius (Torr. & Gray) Raven - LAVENDERLEAF SUNDROPS
Perennial herb; O, benches and hillsides, pinyon-juniper woodlans; MH 512.

Camissonia atwoodii Cronq. - ATWOOD'S EVENING-PRIMROSE
Annual herb; U, Tropic Shale in salt desert shrub; NDA 5957.

Camissonia boothii (Dougl. ex Lehm.) Raven - BOOTH'S EVENING-PRIMROSE
Annual herb; U, desert shrub, Warm Creek; JM s.n. (GLCAHERB).

Camissonia brevipes (Gray) Raven - YELLOW CUPS
Annual herb; U, benches, desert shrub, Kane Co.; NDA 17449, KH 18546.

Camissonia eastwoodiae (Munz) P.H. Raven - GRAND JUNCTION CAMISSONIA
Annual herb; C, Tropic Shale, Kane Co.; MH 442, JRS 5219.

Camissonia multijuga (S. Wats.) Raven - FROSTSTEM SUNCUP
Annual herb; O, desert shrub, Kane Co.; NDA 3741, SLW 22052.

Camissonia parvula (Nutt. ex Torr. & Gray) Raven - LEWIS RIVER SUNCUP

Annual herb; U, pinyon-juniper woodlands, Kaiparowits Plateau; JRS 5643.

Camissonia scapoidea (Nutt. ex Torr. & Gray) Raven - PAIUTE SUNCUP
Annual herb; U, sandy soils, Lee's Ferry; JZ 10.

Camissonia walkeri (A. Nels.) Raven - WALKER'S SUNCUP
Annual herb; C, hillsides, desert shrub to pinyon-juniper woodlands; MH 34, 221, 317, 528, 705, GR 1681, 1798.

Epilobium ciliatum Raf. - FRINGED WILLOWHERB
Perennial herb; O, riparian; MH 212, 255, DG 8, JRS 5236.

Epilobium hornemannii Reichenb. - HORNEMANN'S WILLOWHERB
Perennial herb; U, riparian, Chopslot Canyon; DG 7.

Gaura coccinea Nutt. ex Pursh - SCARLET BEEBLOSSOM
Perennial herb; U, canyon bottoms and hillside, San Juan River; MH 215.

Gaura mollis James - VELVETWEED
[*Gaura parviflora* Dougl. ex Lehm.] Annual herb; U, riparian and disturbed sites; MH 295.

Gayophytum ramosissimum Torr. & Gray - PINYON GROUNDSMOKE
Annual herb; U, pinyon-juniper woodlands, Kaiparowits Platuea; JRS 5643.

Oenothera albicaulis Pursh - WHITEST EVENING-PRIMROSE
Annual herb; O, sandy soils, desert shrub; WW 93.

Oenothera caespitosa Nutt. ssp. *macroglottis* (Rydb.) W.L. Wagner - TUFTED EVENING-PRIMROSE
Perennial herb; O, canyon bottoms, Gooseneck Bend; KH 18520. Hypanthium 7-14.5cm long; petals 3-6cm long

Oenothera caespitosa Nutt. ssp. *navajoensis* W.L. Wagner, Stockh, W.M. Klein - NAVAJO EVENING-PRIMROSE
Perennial herb; W, hills, mesas, benches; MH 163. Hypanthium 3-8cm long; petals 2-4cm long

Oenothera elata Kunth - HOOKER'S EVENING-PRIMROSE
[*Oenothera hookeri* Torr. & Gray] Biennial herb; U, riparian, Lee's Ferry; TH s.n. (ASC 35476).

Oenothera longissima Rydb. - LONGSTEM EVENING-PRIMROSE
Biennial herb; O, riparian and dry washes; MH 233, 310.

Oenothera pallida Lindl. ssp. *pallida* Lindl. - PALE EVENING-PRIMROSE

Perennial herb; W, benches, hillsides, mesas, and canyons; MH 85, 300, 426, GR 1657, 1781.

Orobanchaceae

Orobanche cooperi (Gray) Heller - DESERT BROOMRAPE
[*Orobanche ludoviciana* Nutt. *var. cooperi* (Gray) G. Beck,] Annual herb; O, sand soils, desert shrub; MH 592, SLW 11931.

Orobanche fasciculata Nutt. - CLUSTERED BROOMRAPE
Annual herb; O, hillsides, mesas, and benches, Orange Cliffs and Rock Creek; MH 645.

Oxalidaceae

**Oxalis corniculata* L. - CREEPING WOODSORREL
Perennial herb; O, weed in lawn, Wahweap Marina; MH 666.

Papaveraceae

Argemone corymbosa Greene var. *arenicola* (G.B. Ownbey) Shinners - MOJAVE PRICKLYPOPPY
Annual herb; U, sandy soil, Lone Rock; MH 473, 657.

Plantaginaceae

**Plantago lanceolata* L. - NARROWLEAF PLANTAIN
Perennial herb; O, disturbed sites, riparian; MH 281.

**Plantago major* L. - COMMON PLANTAIN
Perennial herb; O, disturbed sites, riparian; MH 210.

Plantago patagonica Jacq. - WOOLLY PLANTAIN
[*Plantago purshii* Roemer & J.A. Schultes] Annual herb; C, hills, mesas, and benches, desert shrub to pinyon-juniper woodlands; MH 78, GR 1716.

Polemoniaceae

Eriastrum diffusum (Gray) Mason - MINIATURE WOOLLYSTAR
Annual herb; U, canyon bottoms; MH 10.

Gilia flavocincta A. Nels. - LESSER YELLOWTHROAT GILIA
Annual herb; U, Two-Mile Canyon; JRS 4936.

Gilia hutchinsifolia Rydb. - DESERT PALE GILIA
Annual herb; U, hillsides, Orange Cliffs Road; SLW 21948.

Gilia inconspicua (Sm.) Sweet (Greene) V. Grub. - SHY GILIA
[*Gilia clokeyi* Mason] Annual herb; W, hills, benches, and washes; MH 44, 82, KH 21388, GR 1777.

Gilia latifolia S. Wats. - BROADLEAF GILIA
Annual herb; U, clayey soils, desert shrub; KC s.n. (GLCAHERB), SLW 22507.

Gilia leptomeria Gray - SAND GILIA
Annual herb; W, canyon bottoms, hillsides, uplands, and mesas, desert shrub to pinyon-juniper; MH 488, 521, 629, 649, GR 1800.

Gilia sinuata Dougl. ex Benth. - ROSY GILIA
[*Gilia inconspicua* (Sm.) Sweet var. *sinuata* (Dougl. ex Benth.) Gray,] Annual herb; W, canyon bottoms, hillsides, uplands, and mesas, desert shrub to pinyon-juniper woodlands; MH 427, 554, 648, JRS 5217, 5658.

Gilia subnuda Torr. ex Gray - CORAL GILIA
Biennial herb; W, canyon bottoms and uplands, desert shrub to pinyon-juniper; MH 377, 378, 652.

Ipomopsis aggregata (Pursh) V. Grant - SCARLET GILIA
[*Gilia aggregata* (Pursh) Spreg.] Biennial herb; C, canyon bottoms and hanging gardens; MH 256, JF 1039.

Ipomopsis arizonica (Greene) Wherry - ARIZONA IPOMOPSIS
Biennial herb; U, Happy Canyon; LMS 6852.

Ipomopsis congesta (Hook.) V. Grant - BALLHEAD IPOMOPSIS
[*Gilia congesta* Hook.] Perennial herb; O, Steven's Canyon; SLW 22297.

Ipomopsis gunnisonii (Torr. & Gray) V. Grant - SANDDUNE IPOMOPSIS
[*Gilia gunnisonii* Torr. & Gray] Annual herb; C, bottomlands, desert shrub; MH 51, 481, JZ 7, GR 1656.

Ipomopsis longiflora (Torr.) V. Grant ssp. *longiflora* (Torr.) V. Grant - FLAXFLOWERED IPOMOPSIS
[*Gilia longiflora* (Torr.) G. Don] Annual herb; U, canyon bottom, San Juan River; NDA 22492.

Ipomopsis polycladon (Torr.) V. Grant - MANYBRANCHED IPOMOPSIS
[*Gilia polycladon* Torr.] Annual herb; C, washes, mesas, canyons, and hillsides, desert shrub; MH 522, GR 1722, 1797, JRS 52221.

Ipomopsis pumila (Nutt.) V. Grant - DWARF IPOMOPSIS
Annual herb; O, sandy soils, desert shrub; MH 504.

Ipomopsis roseata (Rydb.) V. Grant - ROSY IPOMOPSIS
[*Gilia roseata* Rydb.] Perennial herb; O, mesas, pinyon-juniper woodlands; MH 537.

Langloisia setosissima (Torr. & Gray ex Torr.) Greene - GREAT BASIN LANGLOISIA
Annual herb; O, benches, desert shrub, Kane Co.; NDA 5072, 24566.

Leptodactylon pungens (Torr.) Torr. ex Nutt. - GRANITE PRICKLY PHLOX
Perennial herb; O, canyons and uplands; MH 621, PC (CARE 2789).

Phlox austromontana Coville - MOUNTAIN PHLOX
[*Phlox austromontana* Coville var. *lutescens* Welsh,] Perennial herb; O, canyons, hills, and benches; MH 183.

Phlox gracilis (Hook.) Greene - SLENDER PHLOX
Annual herb; U, Kaiparowits Plateau; JRS 5646.

Phlox hoodii Richards. ssp. *canescens* (Torr. & Gray) Wherry - CARPET PHLOX
Perennial herb; U, pinyon-juniper woodlands; MH 176.

Polygalaceae
Polygala acanthoclada Gray - DESERT POLYGALA
Shrub; O, bottomlands and mesas, desert shrub to pinyon-juniper woodlands; MH 525, NDA 22604.

Polygala subspinosa S. Wats. - SPINY MILKWORT
Perennial herb; U, hillsides, pinyon-juniper woodlands, Middle Moody Canyon; MH 611.

Polygonaceae
Chorizanthe brevicornu Torr. - BRITTLE SPINEFLOWER
Annual herb; O, rocky hillsides, desert shrub; MH 615, GR 1659.

Eriogonum alatum Torr. - WINGED BUCKWHEAT
Perennial herb; O, uplands and hills, desert shrub to pinyon-juniper woodland; MH 197.

Eriogonum bicolor Jones - PRETTY BUCKWHEAT
Perennial herb; U, hillsides, pinyon-juniper woodlands; MH 178.

Eriogonum cernuum Nutt. var. *cernuum*- NODDING BUCKWHEAT
Annual herb; O, bottomlands and mesas, desert shrub; MH 567, BP 80-171.

Eriogonum corymbosum Bentham var. *aureum* (M.E. Jones) Reveal - CRISPLEAF BUCKWHEAT
Shrub; O, washes and hillsides, desert shrub; MH 410. flwrs yellow.

Eriogonum corymbosum Bentham var. *corymbosum* - CRISPLEAF BUCKWHEAT

[*Eriogonum corymbosum* Benth. var. *divaricatum* Torr. & Gray,] Shrub; C, canyons, washes, hillsides, and benches; MH 409. Flwrs white; leaf blade longer than broad.

Eriogonum corymbosum Benth. var. *orbiculatum* (S. Stokes) Reveal & Brotherson - CRISPLEAF BUCKWHEAT
Shrub; O, canyon bottoms and beaches, desert shrub; HDH 11275, NJW 1978 (* verified by J. Reveal). Flwrs white; leaf blade as long as broad.

Eriogonum deflexum Torrey in Ives var. *deflexum* Torr. in Ives - FLATCROWN BUCKWHEAT
Annual herb; C, canyon bottoms, desert shrub; MH 263.

Eriogonum inflatum Torr. & Frém. - DESERT TRUMPET
Annual herb; C, canyon bottoms, hillsides, and benches, desert shrub; MH 4, 301, GR 1664.

Eriogonum leptocladon Torr. & Gray var. *papiliunculi* Reveal- SAND BUCKWHEAT
Shrub; O, sandy soils, desert shrub; MH 276.

Eriogonum leptophyllum (Torr. & Gray) Woot. & Standl. - SLENDERLEAF BUCKWHEAT
Shrub; U, desert shrub, San Juan Co.; SLW 22415.

Eriogonum microthecum Nutt. var. *simpsonii* (Benth.) Reveal - SIMPSON'S BUCKWHEAT
[*Eriogonum microthecum* Nutt. var. *foliosum* (Torr. & Gray) Reveal,] Shrub; C, pinyon-juniper woodlands; MH 628, 735.

Eriogonum ovalifolium Nutt. var. *purpureum* (Nutt.) Dur. - CUSHION BUCKWHEAT
Perennial herb; U, clayey soils, pinyon-juniper woodlands; MH 189.

Eriogonum palmerianum Reveal - PALMER'S BUCKWHEAT
Annual herb; C, canyons, hillsides, and mesas; MH 65, 117, 185.

Eriogonum racemosum Nutt. - REDROOT BUCKWHEAT
Perennial herb; U, pinyon-juniper woodlands, Kaiparowits Plateau; MH 723.

Eriogonum scabrellum Reveal - WESTWATER BUCKWHEAT
Annual herb; U, Tropic Shale, desert shrub; SLW 10932.

Eriogonum shockleyi S. Wats. var. *shockleyi*- SHOCKLEY'S BUCKWHEAT

[*Eriogonum shockleyi* S. Wats. var. *longilobum* (M.E. Jones) Reveal,]
Perennial herb; O, hills, mesas, and benches, desert shrub to pinyon-juniper woodlands; MH 412, 413, 479.

Eriogonum umbellatum Torr. var. *subaridum* S. Stokes - SULPHUR-FLOWER BUCKWHEAT
Perennial herb; U, C landscaping and Kaiparowits Plateau; MH 663, 722.

Eriogonum wetherillii Eastw. - WETHERILL'S BUCKWHEAT
Annual herb; C, benches, hillsides, and canyon bottoms, desert shrub; MH 76, 530.

**Polygonum aviculare* L. - PROSTRATE KNOTWEED
Annual herb; O, disturbed sites; MH 99, 270, 298.

**Polygonum lapathifolium* L. - CURLYTOP KNOTWEED
Annual herb; C, canyon bottoms in moist soils; MH 200.

Rumex hymenosepalus Torr. - CANAIGRE DOCK
Perennial herb; O, sandy soils, desert shrub; MH 434, GR 1673.

Rumex maritimus L. - GOLDEN DOCK
Annual herb; O, disturbed sites, Clay Hills take-out; MH 568, 701.

Rumex salicifolius Weinm. - WILLOW DOCK
Perennial herb;U, salt desert shrub communities; KH 18575.

Stenogonum flexum (M.E. Jones) Reveal & J.T. Howell - BENT TWO-WHORL BUCKWHEAT
[*Eriogonum flexum* M.E. Jones] Annual herb; C, clayey soils, desert shrub to pinyon-juniper woodlands; MH 165, 477, 597.

Portulacaceae

Portulaca halimoides L. - SILKCOTTON PURSLANE
[*Portulaca parvula* Gray] Annual herb; U, Muley Point; SLW 22435.

**Portulaca oleracea* L. - LITTLE HOGWEED
Annual herb; U, disturbed sites; MH 305.

Talinum brevifolium Torr. - PYGMY FLAMEFLOWER
Perennial herb; O, disturbed sites, Lee's Ferry; MH 535.

Primulaceae

Dodecatheon pulchellum (Raf.) Merr. - DARKTHROAT SHOOTINGSTAR
Perennial herb; U, seeps and springs; MH 492.

Primula specuicola Rydb. - CAVEDWELLING PRIMROSE
Perennial herb; C, hanging gardens; JF 109, 438, 771, 806, GR 1687.

Ranunculaceae

Anemone tuberosa Rydb. - TUBER ANEMONE
Perennial herb; O, canyon bottoms; MH 70.

Aquilegia micrantha Eastw. - MANCOS COLUMBINE
Perennial herb; C, hanging gardens; MH 190.

Clematis ligusticifolia Nutt. - WESTERN WHITE CLEMATIS
Perennial herb; O, riparian; DG 12.

Delphinium nuttallianum Pritz - TWOLOBE LARKSPUR
Perennial herb; U, Kaiparowits Plateau; BJ s.n. (GLCAHERB).

Delphinium scaposum Greene - TALL MOUNTAIN LARKSPUR
[*Delphinium andersonii* Gray var. *scaposum* (Greene) Welsh,] Perennial herb; C, mesas, benches, and hillsides, desert shrub to pinyon-juniper woodlands; MH 59, 104, 552.

Ranunculus cymbalaria Pursh - ALKALI BUTTERCUP
Perennial herb; O, riparian, Lake Canyon; JRS 4944.

Rhamnaceae

Ceanothus gregii Gray var. *franklinii* Welsh - DESERT CEANOTHUS
Shrub; O, rimrock, Muley Point; MH 515, SLW 22244 (type).

Frangula betulifolia (Greene) V. Grub. ssp. *obovata* (Kearney & Peebles) Kartesz & Gandhi - OBOVATE BUCKTHORN
[*Rhamnus betulifolia* Greene] Shrub; O, canyon bottoms and hanging gardens, riparian; MH 482.

Rosaceae

Amelanchier utahensis Koehne - UTAH SERVICEBERRY
Shrub; O, canyon bottoms and uplands; MH 100, JRS 5231.

Cercocarpus intricatus S. Wats. - LITTLELEAF MOUNTAIN MAHOGANY
Shrub; O, rimrock, Muley Point; MH 509.

Cercocarpus montanus Raf. - ALDERLEAF MOUNTAIN MAHOGANY
Shrub; O, pinyon-juniper woodlands, Orange Cliffs; LMS 6933.

Coleogyne ramosissima Torr. - BLACKBRUSH
Shrub; W, uplands; MH 435.

Fallugia paradoxa (D. Don) Endl. ex Torr. - APACHE PLUME
Shrub; C, canyons and washes; MH 499.

Petrophyton caespitosum (Nutt.) Rydb. - MAT ROCKSPIREA
Perennial herb; C, hanging gardens; DG 18.

Potentilla paradoxa Nutt. - PARADOX CINQUEFOIL
Perennial herb; O, canyon bottoms, Grand Bend Canyon; MH 714.

Potentilla rivalis Nutt.(Gray) W.A. Weber & A. Löve - BROOK CINQUEFOIL
Biennial herb; O, lake margins; MH 198.

Purshia stansburiana (Torr.) Henrickson - STANSBURY CLIFFROSE
[*Purshia mexicana* (D. Don) Henrickson var. *stansburiana* (Torr.) Welsh,]
Shrub; W, canyon bottoms, washes, and uplands; MH 116, GR 1793.

Purshia tridentata (Pursh) DC. - ANTELOPE BITTERBRUSH
Shrub; O, pinyon-juniper woodlands; LCH 13219.

Rosa woodsii Lindl. - WOODS' ROSE
Shrub; O, hanging gardens and canyon bottoms, riparian; JF 782, PC (CARE 2998).

Rubus neomexicanus Gray - NEW MEXICO RASPBERRY
Shrub; O, hanging gardens; JF 913.

Rubiaceae

Galium aparine L. - STICKYWILLY
Annual herb; U, canyon bottoms, Cow Canyon; JRS 4975.

Galium bifolium S. Wats. - TWINLEAF BEDSTRAW
Annual herb; U, pinyon-juniper woodlands, Kaiparowits Plateau; SLW 27453.

Galium coloradoense W. Wight - COLORADO BEDSTRAW
[*Galium multiflorum* Kellogg var. *coloradoense* (W. Wight) Cronq.,]
Perennial herb; O, canyon bottoms and hillsides, Dark Canyon; MH 386.
Leaves 5-10 times longer than broad.

Galium multiflorum Kellogg - SHRUBBY BEDSTRAW
Perennial herb; C, canyon bottoms, hillsides, mesas, and uplands; MH 109, 541, 673, JRS 5230. Leaves <5 times longer than broad.

Galium proliferum Gray - LIMESTONE BEDSTRAW
Annual herb; U, hanging gardens; MH 66, SLW 22162.

Rutaceae

Ptelea trifoliata L. ssp. *pallida* (Greene) V.L. Bailey - PALLID HOPTREE
Shrub; U, canyon bottoms, Finger Rock, Colorado River –7 mi; MH 400, 436.

Thamnosma montana Torr. & Frém. - TURPENTINEBROOM
Shrub; U, desert shrub, southern part of the park; NDA 3145.

Salicaceae

Populus fremontii S. Wats. - FREMONT COTTONWOOD
Tree; O, canyon bottom, riparian; SLW 21748.

Salix exigua Nutt. - NARROWLEAF WILLOW
Shrub; C, canyon bottoms, riparian; MH 218.

Salix gooddingii Ball - GOODDING'S WILLOW
Tree; O, riparian; MH 232, NDA 22587.

Salix lutea Nutt. - YELLOW WILLOW
Tree; O, riparian; SLW 21776.

Santalaceae

Comandra umbellata (L.) Nutt. ssp. *pallida* (A. DC.) Piehl - PALE BASTARD TOADFLAX
[*Comandra pallida* A. DC.] Perennial herb; C, canyon bottoms, mesas, and benches; MH 49.

Saxifragaceae

Heuchera rubescens Torr. - PINK ALUMROOT
Perennial herb; U, Corral Ridge; MH 734.

Lithophragma tenellum Nutt. - SLENDER WOODLAND-STAR
Perennial herb; O, Navajo Point; BJ (GLCAHERB).

Scrophulariaceae

Castilleja applegatei Fern. ssp. *martinii* (Abrams) Chuang & Heckard - WAVYLEAF INDIAN PAINTBRUSH
Perennial herb; C, canyons, hillsides, and mesas, desert shrub to pinyon-juniper; MH 463, 514, GR 1660.

Castilleja linariifolia Benth. - WYOMING INDIAN PAINTBRUSH
Perennial herb; C, canyon bottoms and hanging gardens, riparian; MH 201, 247, JF 102,316, 1066.

Castilleja minor (Gray) Gray ssp. *minor* (Gray) Gray - LESSER INDIAN PAINTBRUSH
[*Castilleja exilis* A. Nels.] Annual herb; O, canyon bottoms, riparian; MH 246.

Castilleja scabrida Eastw. - ROUGH INDIAN PAINTBRUSH
Perennial herb; O, mesas, Orange Cliffs; SLW 21838.

Collinsia parviflora Lindl. - MAIDEN BLUE EYED MARY
Annual herb; O, Navajo Point; JRS 5646.

Cordylanthus wrightii Gray - WRIGHT'S BIRD'S BEAK
Annual herb; O, sandy soils, desert shrub to pinyon-juniper woodlands; MH 368.

Mimulus eastwoodiae Rydb. - EASTWOOD'S MONKEYFLOWER
Perennial herb; O, hanging gardens; DG 14.

Mimulus glabratus Kunth - ROUNDLEAF MONKEYFLOWER
Perennial herb; U, hanging gardens, Escalante River; SLW 22122.

Mimulus guttatus Dc. - SEEP MONKEYFLOWER
Annual herb; U, 50 mile Canyon; NDA 3205.

Mimulus rubellus Gray - LITTLE REDSTEM MONKEYFLOWER
Annual herb; O, disturbed sites, Waterhole Flat; MH 156.

Pedicularis centranthera Gray - DWARF LOUSEWORT
Perennial herb; O, mesas, pinyon-juniper woodlands; MH 542.

Penstemon ambiguus Torr. var. *laevissimus* (Keck) N. Holmgren - PINK PLAINS BEARDTONGUE
Perennial herb; C, sandy soils, desert shrub; MH 97.

Penstemon angustifolius Nutt. ex Pursh var. *venosus*- BROADBEARD BEARDTONGUE
Perennial herb; O, pinyon-juniper woodlands, Orange Cliffs; MH 618.

Penstemon carnosus Pennell - FLESHY BEARDTONGUE
Perennial herb; U, pinyon-juniper woodlands, Orange Cliffs; LMS 7390.

Penstemon comarrhenus Gray - DUSTY BEARDTONGUE
Perennial herb; O, uplands and mesas, pinyon-juniper woodlands; MH 637.

Penstemon cyanocaulis Payson - BLUESTEM BEARDTONGUE
Perennial herb; O, hillsides and mesas, Flint Flat; JT 556.

Penstemon eatonii Gray ssp. *eatonii*- EATON'S PENSTEMON
Perennial herb; W, canyon bottoms and mesas, desert shrub to pinyon-juniper woodland; MH 497, 626. Herbage glabrous.

Penstemon eatonii Gray ssp. *undosus* (M.E. Jones) Keck - EATON'S PENSTEMON
Perennial herb; O, canyon bottoms, desert shrub; GR 1684. Herbage finely puberulent.

Penstemon palmeri Gray - PALMER'S PENSTEMON
Perennial herb; O, canyons, Middle Moody Canyon; SLW 22278.

Penstemon rostriflorus Kellogg - BRIDGE PENSTEMON
Perennial herb; U, Corral Ridge; MH 736.

Penstemon strictiformis Rydb. - MANCOS PENSTEMON
Perennial herb; O, pinyon-juniper woodlands, Orange Cliffs; MH 639.

Penstemon utahensis Eastw. - UTAH PENSTEMON
Perennial herb; C, uplands hillsides and canyons; MH 170, GR 1780.

**Verbascum thapsus* L. - COMMON MULLEIN
Biennial herb; O, disturbed sites, Lee's Ferry; MH 614.

Veronica americana Schwein. ex Benth. - AMERICAN SPEEDWELL
Perennial herb; O, moist sites, Colorado River -6 miles; JRS 5005.

**Veronica anagallis-aquatica* L. - WATER SPEEDWELL
Perennial herb; C, riparian; MH 211, 254, 303.

**Veronica biloba* L. - TWOLOBE SPEEDWELL
Annual herb; O, weed in lawn, Wahweap Marina; MH 668.

Veronica peregrina L. - NECKWEED
Annual herb; O, riparian, San Juan River and Stevens Canyon; NDA 22487, SLW 22299.

Solanaceae

Calibrachoa parviflora (Juss.) D'Arcy - SEASIDE PETUNIA
[*Petunia parviflora* Juss.] Annual herb; U, lake shore, Cottonwood Canyon; MH 67.

Datura wrightii Regel - SACRED THORN-APPLE
[*Datura meteloides* auct. p.p. non Dunal] Perennial herb; O, washes, desert shrub; MH 584, NDA 22559.

Lycium andersonii Gray - WATER JACKET
Shrub; O, canyon hillsides, desert shrub; MH 480, GR 1792.

Lycium pallidum Miers - PALE DESERT-THORN
Shrub; U, Slickhorn Canyon; JM s.n. (GLCAHERB).

Nicotiana obtusifolia Mertens & Galeotti var. *obtusifolia* - DESERT TOBACCO
[*Nicotiana trigonophylla* Dunal] Perennial herb; O, cliff bases and rock crevices, desert shrub; MH 22, 486.

Solanum elaeagnifolium Cav. - SILVERLEAF NIGHTSHADE
Perennial herb; O, disturbed sites, San Juan River; MH 225.

**Solanum ptychanthum* Dunal - WEST INDIAN NIGHTSHADE
[*Solanum nigrum* L.] Annual herb; O, disturbed sites; MH 207, 282.

Solanum triflorum Nutt. - CUTLEAF NIGHTSHADE
Annual herb; O, disturbed sites; MH 682.

Tamaricaceae
**Tamarix chinensis* Lour. - FIVESTAMEN TAMARISK
[*Tamarix pentandra* Pallas] Shrub; W, riparian; MH 141.

Ulmaceae
Celtis laevigata Willd. var. *reticulata* (Torr.) L. Benson - NETLEAF HACKBERRY
[*Celtis reticulata* Torr.] Tree; O, canyon bottoms and hanging gardens; JF 114, 132.

**Ulmus pumila* L. - SIBERIAN ELM
Tree; U, disturbed sites; MH 283.

Urticaceae
Parietaria pensylvanica Muhl. ex Willd. - PENNSYLVANIA PELLITORY
Annual herb; O, hanging gardens and canyon bottoms, moist places; MH 38, 698.

Verbenaceae
Verbena bracteata Lag. & Rodr. - BIGBRACT VERBENA
Perennial herb; O, disturbed sites; MH 159, 261, 572.

Violaceae
Viola nephrophylla Greene - NORTHERN BOG VIOLET
Perennial herb; O, hanging gardens and canyon bottoms, riparian; MH 322, EGN 1.

Viscaceae
Arceuthobium divaricatum Engelm. - PINYON DWARF MISTLETOE
Perennial herb; O, parasite on pinyon pines; MH 642, JRS 5235.

Phoradendron juniperinum Engelm. ex Gray - JUNIPER MISTLETOE
Perennial herb; O, parasite on junipers; MH 643.

Vitaceae

Parthenocissus vitacea (Knerr) A.S. Hitchc. - WOODBINE
Perennial herb; O, canyon bottoms and hanging gardens, riparian; NDA 22575, MH 248, JF 275.

Zygophyllaceae

**Tribulus terrestris* L. - PUNCTUREVINE
Annual herb; O, disturbed sites; MH 350.

MAGNOLIOPHYTA: LILIOPSIDA

Agavaceae

Agave utahensis Engelm. var. *kaibabensis* (McKelvey) Breitung - KAIBAB AGAVE
Succulent shrub; R, sandstone outcrop; MH 720.

Yucca angustissima Engelm. ex Trel. var. *angustissima*- NARROWLEAF YUCCA
Succulent shrub; C, sandy sites; MH 121, 123. Scape & infl.<1.8m tall.

Yucca angustissima Engel. Ex Trel. var. *toftiae* (Welsh) Reveal - TOFT'S YUCCA
[*Yucca toftiae* Welsh] Succulent shrub; O, sandstone outcrops and hanging gardens; SLW 11935a (holotype), 22116. Scape & infl.>2m tall.

Yucca baileyi Woot. & Standl. - NAVAJO YUCCA
Succulent shrub; U, canyons and uplands; SLW 22304, NDA 3563.

Yucca harrimaniae- SPANISH BAYONET
Succulent shrub; U, hillsides and mesas, pinyon-juniper woodlands, Flint Trail; SLW 9878.

Commelinaceae

Tradescantia occidentalis (Britt.) Smyth - PRAIRIE SPIDERWORT
Perennial herb; U, canyons, moist soils, Cottonwood Canyon; NDA 22613.

Cyperaceae

Carex aquatilis Wahlenb. - WATER SEDGE
Perennial herb; O, canyon bottoms, riparian; VM 78.

Carex aurea Nutt. - GOLDEN SEDGE
Perennial herb; W, hanging gardens and other wet sites; MH 37, 415, 688, JRS 5239.

Carex curatorum Stacey - KAIBAB SEDGE
Perennial herb; C, hanging gardens; MH 686, 694, 696.

Carex hassei L. H. Bailey - SALT SEDGE
Perennial herb; U, hanging gardens; JRS 4899, 5023a (determined by M. Fritz).

Carex hystericina Muhl. ex Willd. - BOTTLEBRUSH SEDGE
Perennial herb; O, riparian; MH 244.

Carex occidentalis Bailey - WESTERN SEDGE
Perennial herb; U, riparian; BTW 1466.

Carex pellita Muhl ex Willd. - WOOLLY SEDGE
[*Carex lanuginosa* auct. non Michx.] Perennial herb; C, riparian; MH 40, 42, JRS 4881.

Carex praegracilis W. Boott - CLUSTERED FIELD SEDGE
Perennial herb; U, riparian, Lone Rock; MH 656 (determined by G. Rink).

Carex rossii Boott - ROSS' SEDGE
Perennial herb; U, riparian; JRS 5018.

Carex specuicola J.T. Howell - NAVAJO SEDGE
Perennial herb; R, handing gardens; AC2 00-216.

Carex utriculata Boott - NORTHWEST TERRITORY SEDGE
[*Carex rostrata* Stokes *var. utriculata* (Boott) Bailey,] Perennial herb; U, riparian; KH 18581.

Cladium californicum (Wats.) O'Neill - CALIFORNIA SAWGRASS
Perennial herb; R, hanging gardens; JF 242, KH 18605.

Cyperus squarrosus L. - BEARDED FLATSEDGE
[*Cyperus aristatus* Rottb.] Annual herb; O, riparian; MH 324.

Cyperus strigosus L. - STRAWCOLORED FLATSEDGE
Perennial herb; O, riparian; MH 335.

Eleocharis palustris (L.) Roemer & J.A. Schultes - COMMON SPIKERUSH
[*Eleocharis macrostachya* Britt.] Perennial herb; W, riparian; MH 19, 39, 139, 334.

Eleocharis rostellata (Torr.) Torr. - BEAKED SPIKERUSH
Perennial herb; O, riparian; MH 58, 323.

Fimbristylis thermalis S. Wats. - HOT SPRINGS FIMBRY
[*Fimbristylis spadicea* auct. non (L.) Vahl] Perennial herb; U, riparian, north of Iceberg Canyon; NDA 3311.

Schoenoplectus acutus (Muhl. ex Bigelow) A.& D. Löve - HARDSTEM BULRUSH
[*Scirpus acutus* Muhl. ex Bigelow] Perennial herb; O, riparian; MH 653, 709.

Schoenoplectus maritimus (L.) Lye - COSMOPOLITAN BULRUSH
[*Scirpus paludosus* A. Nels.] Perennial herb; C, riparian, newly exposed beaches; MH 367, 443, 655.

Schoenoplectus pungens Vahl var. *longispicatus* (Britton) Cronq. - COMMON THREESQUARE
Perennial herb; C, riparian; MH 21, 57, 319.

Schoenoplectus tabernaemontani C.C. Gmelin - SOFTSTEM BULRUSH
[*Scirpus validus* Vahl] Perennial herb; O, riparian; MH 252.

Scirpus microcarpus J.& K. Presl - PANICLED BULRUSH
Perennial herb; U, riparian, Coyote Gulch; MH 243.

Juncaceae

Juncus articulatus L. - JOINTLEAF RUSH
Perennial herb; O, riparian, Colorado River below Glen Canyon Dam; MH 1, 287.

Juncus balticus Willd. var. *montanus* Engelm. - MOUNTAIN RUSH
[*Juncus arcticus* Willd.] Perennial herb; W, riparian; MH 20, KH 19287.

Juncus bufonius L. - TOAD RUSH
Annual herb; O, riparian; MH 48.

Juncus ensifolius Wikstr. - SWORDLEAF RUSH
Perennial herb; O, riparian; NDA 22586.

Juncus longistylis Torr. - LONGSTYLE RUSH
Perennial herb; O, riparian; MH 209, JRS 5232.

Juncus nodosus L. - KNOTTED RUSH
Perennial herb; O, canyon bottoms and hanging gardens, riparian; JRS 5012, 4900.

Juncus saximontanus A. Nels. - ROCKY MOUNTAIN RUSH
Perennial herb; O, ripairan; KH 19280.

Juncus tenuis Willd. - POVERTY RUSH
Perennial herb; O, riparian; MH 416, 691.

Juncus torreyi Coville - TORREY'S RUSH
Perennial herb; O, riparian; VM s.n. (GLCAHERB); MH 286.

Liliaceae

Allium macropetalum Rydb. - LARGEFLOWER ONION

Perennial herb; U, sandy soils, near Lee's Ferry; JZ 5.

Allium nevadense S. Wats. - NEVADA ONION
Perennial herb; O, desert shrub to pinyon-juniper woodlands; SLW 21930.

Allium textile A. Nels. & J.F. Macbr. - TEXTILE ONION
Perennial herb; O, clayey soils, desert shrub to pinyon-juniper woodlands; SLW 21832.

Androstephium breviflorum S. Wats. - PINK FUNNEL LILY
Perennial herb; U, clayey soils, benches; RWA 322, NDA 4548.

**Asparagus officinalis* L. - GARDEN ASPARAGUS
Perennial herb; U, riparian, Lee's Ferry; MH 356.

Calochortus aureus S. Wats. - GOLDEN MARIPOSA LILY
Perennial herb; U, benches, Orange Cliffs; SLW 21956.

Calochortus flexuosus S. Wats. - WINDING MARIPOSA LILY
Perennial herb; C, canyons and uplands, desert shrub; NDA 3729.

Calochortus nuttallii Torr. & Gray - SEGO LILY
Perennial herb; U, canyons, mesas, and hillside; PC (CARE 2452).

Eremocrinum albomarginatum (M.E. Jones) M.E. Jones - LONELY LILY
Perennial herb; U, bottomlands and benches, desert shrub; MH 118, GR 1690, 1721.

Maianthemum stellatum (L.) Link - STARRY FALSE LILY OF THE VALLY
[*Smilacina stellata* (L.) Desf.] Perennial herb; O, riparian, hanging gardens; SLW 22353, KH 18586.

Zigadenus paniculatus (Vail) Welsh & Atwood - FOOTHILL DEATHCAMAS
Perennial herb; U, sandy soil, blackbrush communities; MH 192.

Zigadenus vaginatus (Rydb.) J.F. Macbr. - SHEATHED DEATHCAMAS
Perennial herb; O, hanging gardens; JF 1032.

Orchidaceae

Epipactis gigantea Dougl. ex Hook. - STREAM ORCHID
Perennial herb; O, hanging gardens and seeps; MH 493, DG 5, NDA 22600, 22583, JF 926.

Platanthera zothecina (Higgins & Welsh) Kartesz & Gandhi- ALCOVE BOG ORCHID

[*Habenaria zothecina* Higgins & Welsh] Perennial herb; U, hanging gardens; JF 311, 503, 813, 931.

Poaceae

Achnatherum aridum (M.E. Jones) Barkworth - MORMON NEEDLEGRASS
[*Stipa arida* M.E. Jones] Perennial herb; U, hillsides and canyon bottoms; KH 18490.

Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth - INDIAN RICEGRASS
[*Stipa hymenoides* Roemer & J.A. Schultes, *Oryzopsis hymenoides* Roemer & J.A. Schultes) Ricker ex Piper] Perennial herb; W, hills, mesas, benches, and canyons; MH 124.

Achnatherum lettermanii (Vasey) Barkworth - LETTERMAN'S NEEDLEGRASS
[*Stipa lettermanii* Vasey] Perennial herb; U, canyons, Millard Canyon; JRS 5235.

Achnatherum parishii (Vasey) Barkworth var. *parishii*- PARISH'S NEEDLEGRASS
[*Stipa coronata* Thurb.] Perennial herb; U, canyons, Middle Moody Canyon; SLW 22281.

Achnatherum speciosum (Trin. & Rupr.) Barkworth - DESERT NEEDLEGRASS
[*Stipa speciosa* Trin. & Rupr.] Perennial herb; C, canyon bottoms and hillsides; MH 46, 671.

Achnatherum × *bloomeri* (Boland.) Barkworth -
[*Stipa x bloomeri* Boland.] Perennial herb; O, canyon bottoms and hillsides, Lee's Ferry and Slickhorn Canyon; NDA 5210, 22591.

**Agropyron cristatum* (L.) Gaertn. - CRESTED WHEATGRASS
Perennial herb; O, disturbed sites; MH 376.

**Agrostis stolonifera* L. - CREEPING BENTGRASS
[*Agrostis alba* auct. non L.] Perennial herb; C, riparian; MH 205, 241, 274, 290, 291, 321, JRS 5238.

Andropogon gerardii Vitman - BIG BLUESTEM
Perennial herb; U, riparian, poor specimen; NDA 4355.

Andropogon glomeratus (Walt.) B.S.P. - BUSHY BLUESTEM
Perennial herb; O, riparian; MH 695.

Aristida adscensionis L. - SIXWEEKS THREEAWN
Annual herb; U, canyon bottom, Hall's Creek; PC (CARE 2596).

Aristida arizonica Vasey - ARIZONA THREEAWN
Perennial herb; U, canyon bottoms, San Juan Arm; KH 21011.

Aristida purpurea Nutt. – PURPLE THREEAWN
Perennial herb; MH 313.

Aristida purpurea Nutt. var. *longiseta* (Steud.) Vasey - FENDLER THREEAWN
[*Aristida longiseta* Steud.] Perennial herb; C, sandy washes; MH 128, 465, GR 1672. Awn 4-8cm long; panicles open.

Aristida purpurea Nutt. var. *nealleyi* (Vasey) Allred - BLUE THREEAWN
[*Aristida glauca* (Nees) Walp.] Perennial herb; W, rocky sopes, mesas, and benches; MH 5, 80, GR 1663, 1788, 1801. Awn 1.5-3.5cm long; panicles contracted.

**Avena sativa* L. - COMMON OAT
Annual herb; U, disturbed sites; KH 19278.

Bothriochloa barbinodis (Lag.) Herter - CANE BLUESTEM
[*Andropogon barbinodis* Lag.] Perennial herb; O, canyon bottoms, riparian; MH 346, NDA 23340.

Bothriochloa laguroides (DC.) Herter ssp. *torreyana* (Steud.) Allred & Gould - SILVER BEARDGRASS
[**Bothriochloa saccharoides* (Sw.) Rydb.] Perennial herb; U, canyon bottoms, dry washes; JRS 5053, SLW 22356, NDA 3165.

Bothriochloa springfieldii (Gould) Parodi - SPRINGFIELD'S BEARDGRASS
Perennial herb; U, canyon bottom, riparian, Great Bend Hanging Garden; MH 710.

Bouteloua aristidoides (Kunth) Griseb. - NEEDLE GRAMA
Annual herb; O, washes, Lee's Ferry; MH 396.

Bouteloua barbata Lag. - SIXWEEKS GRAMA
Annual herb; O, canyon bottoms, riparian; MH 299, 399, NDA 23352.

Bouteloua curtipendula (Michx.) Torr. - SIDEOATS GRAMA
Perennial herb; O, hillsides and canyon bottoms; MH 466.

Bouteloua eriopoda (Torr.) Torr. - BLACK GRAMA
Perennial herb; O, pinyon-juniper woodlands, Taylor Flat; LCA 775.

Bouteloua gracilis (Willd. ex Kunth) Lag. ex Grif - BLUE GRAMA
Perennial herb; C, benches, mesas, and canyon bottoms; MH 635, PC (CARE 2607).

**Bromus diandrus* Roth - RIPGUT BROME
[*Bromus rigidus* Roth var.*gussonei* (Parl.) Coss. & Durieu,] Annual herb; C, disturbed sites, riparian; MH 18.

**Bromus inermis* Leyss. - SMOOTH BROME
Perennial herb; U, disturbed sites, Waterhole Flat; MH 149.

**Bromus japonicus* Thunb. - JAPANESE BROME
Annual herb; O, disturbed sites, canyon bottoms; MH 226, 681.

Bromus marginatus Nees Ex Steud. - MOUNTAIN BROME
[*Bromus carinatus* Hook. & Arn.] Perennial herb; O, canyon bottom, riparia; MH 35, 437.

**Bromus rubens* L. - RED BROME
Annual herb; C, disturbed sites, canyon bottoms; MH 6.

**Bromus tectorum* L. - CHEATGRASS
Annual herb; W, hillsides, mesas, benches, washes, canyon bottoms, and hanging gardens; JF 794, 877.

Calamagrostis scopulorum M.E. Jones - DITCH REEDGRASS
Perennial herb; O, hanging gardens, Road to Purple Hills, past Moody Canyon. MH 693.

Cenchrus spinifex Cav. - COASTAL SANDBUR
[*Cenchrus incertus* M.A. Curtis] Annual herb; U, disturbed sites, Wahweap Housing Area; JRS 5056.

**Cortaderia selloana* (J.A. & J.H. Schultes) Aschers - URUGUAYAN PAMPAS GRASS
Perennial herb; U, riparian, Colorado River -14.6 miles; MK s.n. (GLCAHERB).

**Cynodon dactylon* (L.) Pers. - BERMUDAGRASS
Perennial herb; O, riparian, Colorado River miles -6.5; JRS 5007.

**Dactylis glomerata* L. - ORCHARDGRASS
Perennial herb; U, riparian, Grand Bench; NDA 4262.

Dasyochloa pulchella (Kunth) Willd. ex Rydb. - LOW WOOLLYGRASS
[*Tridens pulchellus* (Kunth) A.S. Hitchc.] Perennial herb; O, hillsides and benches, desert shrub to pinyon-juniper woodlands; MH 484, 579.

Dichanthelium acuminatum (Sw.) Gould & C.A. Clark- TAPERED ROSETTE GRASS

[*Panicum acuminatum* Sw.] Perennial herb; C, canyon bottoms and hanging gardens, riparian; MH 56, 202, JF 263, 337, 969, 992.

Dichanthelium oligosanthes (J.A. Schultes) Gould - HELLER'S ROSETTE GRASS
[*Panicum oligosanthes* J.A. Schultes] Perennial herb; O, canyon bottoms; GR 4247.

Distichlis spicata (L.) Greene - INLAND SALTGRASS
[*Distichlis stricta*,] Perennial herb; O, canyon bottoms, riparian; MH 13, 184.

**Echinochloa crus-galli* (L.) Beauv. - BARNYARDGRASS
Annual herb; U, disturbed sites, canyon bottoms, riparian; MH 307, 667.

Elymus canadensis L. - CANADA WILDRYE
Perennial herb; C, canyon bottoms and hanging gardens, riparian; MH 372, JF 880, 986.

Elymus elymoides (Raf.) Swezey - SQUIRRELTAIL
Perennial herb; C, canyon bottoms, mesas, and benches; MH 92, 112, 129, 551, 598, 647.

Elymus lanceolatus (Scribn. & J.G. Sm.) Gould - STREAMBANK WHEATGRASS
Perennial herb; U, pinyon-juniper woodlands, Bull Ridge; MH 725.

**Elymus repens* (L.) Gould - QUACKGRASS
Perennial herb; U, moist soils, disturbed sites, Fence Canyon; MH 271.

Elymus trachycaulus (Link) Gould ex Shinners ssp. *trachycaulus* (Link) Gould ex Shinner - SLENDER WHEATGRASS
Perennial herb; O, hanging gardens and stream banks, riparian; MH 43, 406.

Enneapogon desvauxii Desv. ex Beauv. - NINEAWN PAPPUSGRASS
Perennial herb; U, benches, desert shrub, Hole-in-the-Rock; SLW 19390.

**Eragrostis curvula* (Schrad.) Nees - WEEPING LOVEGRASS
Perennial herb; U, disturbed sites, Lee's Ferry; MH 349.

Eragrostis mexicana (Hornem.) Link ssp. *virescens* (C. Presl.) Koch & E. Sanchez - MEXICAN LOVEGRASS
Annual herb; O, canyon bottoms and hanging gardens, riparian; MH 302, 325, 707.

Eragrostis pectinacea (Michx.) Nees ex Steud. - TUFTED LOVEGRASS
Annual herb; U, benches, desert shrub, Hole-in-the-Rock; SLW 19391.

Erioneuron pilosum (Buckl.) Nash - HAIRY WOOLLYGRASS

Perennial herb; U, canyon bottoms, Middle Moody Canyon; SLW 22289.

Glyceria striata (Lam.) A.S. Hitchc. - FOWL MANNAGRASS
Perennial herb; U, canyon bottoms, riparian, Willow Gulch; JRS 5226.

Hesperostipa comata (Trin. & Rupr.) Barkworth ssp. *comata*- NEEDLE AND THREAD
[*Stipa comata* Trin. & Rupr.] Perennial herb; C, canyon bottoms, mesas, and benches; MH 135, SLW 21717.

Hesperostipa neomexicana (Thurb. ex Coult.) Barkworth - NEW MEXICO FEATHERGRASS
[*Stipa neomexicana* (Thurb. ex Coult.) Scribn.] Perennial herb; O, mesas, Orange Cliffs Road; SLW 21978.

Hordeum jubatum L. - FOXTAIL BARLEY
Perennial herb; U, canyon bottoms, Hall's Creek Drainage; PC (CARE 2658).

**Hordeum murinum* L. ssp. *glaucum* (Steud.) Tzvelev - SMOOTH BARLEY
[*Hordeum stebbinsii* Covas] Annual herb; O, disturbed sites and canyon bottoms; MH 54, 419.

Imperata brevifolia Vasey - CALIFORNIA SATINTAIL
Perennial herb; U, canyon bottoms, riparian, Wilson's Creek; JRS 5229.

Leersia oryzoides (L.) Sw. - RICE CUTGRASS
Perennial herb; U, riparian, Colorado River -9 mile; VM 176.

Leymus salinus (M.E. Jones) A. Löve ssp. *salinus*- SALINE WILDRYE
[*Elymus salinus* M.E. Jones] Perennial herb; C, hillsides, mesas, and benches, desert shrub to pinyon-juniper woodlands; MH 173, 676.

Leymus triticoides (Buckl.) Pilger - BEARDLESS WILDRYE
[*Elymus triticoides* Buckl.] Perennial herb; U, benches and hanging gardens; SLW 11695.

**Lolium arundinaceum* (Schreb.) S.J. Darbyshire - TALL FESCUE
Perennial herb; U, riparian, Colorado River -9 mile; VM 120.

**Lolium pratense* (Huds.) S.J. Darbyshire - MEADOW RYEGRASS
[*Festuca pratensis* Huds.] Perennial herb; O, riparian, San Juan River; MH 219.

Lycurus phleoides Kunth - COMMON WOLFSTAIL
Perennial herb; U, canyon bottoms, Baker's Ranch; PC (CARE 2664).

Muhlenbergia andina (Nutt.) A.S. Hitchc. - FOXTAIL MUHLY
Perennial herb; C, hanging gardens and canyon bottoms, riparian; JF 876, JRS 4955.

Muhlenbergia asperifolia (Nees & Meyen ex Trin.) Parodi - SCRATCHGRASS
Perennial herb; C, canyon bottoms, riparian; MH 343.

Muhlenbergia pauciflora Buckl. - NEW MEXICO MUHLY
[*Sporobolus asperifolius* (Nees & Meyen ex Trin.) Nees] Perennial herb; O, canyon bottoms, mesas, and benches; SLW 22439, NDA 23332.

Muhlenbergia porteri Scribn. ex Beal - BUSH MUHLY
Perennial herb; U, canyon hillsides, Colorado River -7 mile; JM s.n. (GLCAHERB).

Muhlenbergia pungens Thurb. - SANDHILL MUHLY
Perennial herb; O, sandy soils, hillsides, washes, and canyon bottoms; MH 260.

Muhlenbergia racemosa (Michx.) B.S.P. - MARSH MUHLY
Perennial herb; U, springs and hanging gardens, LeRay Cove; KH 19279.

Muhlenbergia thurberi Rydb. - THURBER'S MUHLY
Perennial herb; C, dry or moist sites of hanging gardens; MH 692.

Monroa squarrosa (Nutt.) Torr. - FALSE BUFFALOGRASS
Annual herb; U, disturbed sites, pinyon-juniper woodlands; LMS 7342.

Panicum capillare L. - WITCHGRASS
Annual herb; C, disturbed sites, riparian; MH 333, 357, 405.

Panicum obtusum Kunth - VINE MESQUITE
Perennial herb; O, sandy sites along rivers, riparian; MH 220, 306.

Panicum virgatum L. - SWITCHGRASS
Perennial herb; O, canyon bottoms and hanging gardens, riparian; MH 251, NDA 22590, 23347, JF 253.

Pascopyrum smithii (Rydb.) A. Löve(Gray) W.A. Weber & A. Löve - WESTERN WHEATGRASS
[*Elymus smithii* (Rydb.) Gould] Perennial herb; O, canyonbottoms; MH 217, JRS 4947.

Phalaris arundinaceae L. - REED CANARYGRASS
Perennial herb; U, riparian, San Juan River; MH 239.

**Phleum pratense* L. - TIMOTHY
Perennial herb; U, Muley Point; LCH 14236a.

Phragmites australis (Cav.) Trin. ex Steud. - COMMON REED
[*Phragmites communis* Trin.] Perennial herb; C, riparian; MH 339.

Pleuraphis jamesii Torr. - JAMES' GALLETA
[*Hilaria jamesii* (Torr.) Benth.] Perennial herb; O, washes; MH 130, SLW 21912.

Poa bigelovii Vasey & Scribn. - BIGELOW'S BLUEGRASS
Annual herb; U, canyon bottoms, riparian, Navajo Canyon; GR 1685.

**Poa compressa* L. - CANADA BLUEGRASS
Perennial herb; U, benches, pinyon-juniper woodlands, Orange Cliffs; MH 640.

Poa fendleriana (Steud.) Vasey - MUTTONGRASS
Perennial herb; C, canyon bottoms and talus slopes; SLW 21937, JRS 4949.

**Poa pratensis* L. - KENTUCKY BLUEGRASS
Perennial herb; U, disturbed sites, Waterhole Flat; MH 158.

Poa secunda J. Presl - SANDBERG BLUEGRASS
[*Poa canbyi* (Scribn.) T.J. Howell] Perennial herb; U, pinyon-juniper woodlands; SLW 27451.

**Polypogon interruptus* Kunth - DITCH RABBITSFOOT GRASS
Perennial herb; O, disturbed sites, riparian; KH 18513.

**Polypogon monspeliensis* (L.) Desf. - ANNUAL RABBITSFOOT GRASS
Annual herb; W, riparian; MH 131.

**Polypogon viridis* (Gouan) Breistr. - BEARDLESS RABBITSFOOT GRASS
[*Polypogon semiverticillatus* (Forsk.) Hyl.] Perennial herb; C, canyon bottoms and hanging gardens, moist places; MH 208, 236, DG 4.

Pseudoroegneria spicata (Pursh) A. Löve ssp. *spicata*- BLUEBUNCH WHEATGRASS
[*Elymus spicatus* (Pursh) Gould] Perennial herb; O, canyon bottoms; NDA 23487.

×*Pseudelymus saxicola* (Scribn. & J.G. Sm.) Barkworth & D.R. Dewey - FOXTAIL WHEATGRASS
Perennial herb; U, pinyon-juniper woodlands, Bull Ridge; MH 727.

**Saccharum ravennae* (L.) L. - RAVENNAGRASS
[*Erianthus ravennae* (L.) Beauv.] Perennial herb; O, landscaping (Wahweap Marina) and riparian (Lewellyn, Bowns, and San Juan River Canyons); MH 669, 689.

**Schismus arabicus* Nees - ARABIAN SCHISMUS
Annual herb; W, widespread; MH 11, 33, 55, NDA 4560.

**Schismus barbatus* (Loefl. ex L.) Thellung - COMMON MEDITERRANEAN GRASS
[*Festuca barbata* Loefl. ex L.] Annual herb; C, uplands and hillsides, desert shrub; GR 1662.

Schizachyrium scoparium (Michx.) Nash - LITTLE BLUESTEM
Perennial herb; O, canyon bottoms, LeRay Cover; KH 19276.

**Setaria viridis* (L.) Beauv. - GREEN BRISTLEGRASS
Annual herb; O, disturbed sites, Lee's Ferry; MH 353.

Sorghastrum nutans (L.) Nash - INDIANGRASS
Perennial herb; U, canyon bottoms, riparian; JRS 5039.

**Sorghum halepense* (L.) Pers. - JOHNSONGRASS
Perennial herb; U, disturbed sites, Lee's Ferry; MH 354.

Spartina gracilis Trin. - ALKALI CORDGRASS
Perennial herb; O, canyonbottoms, Cow Canyon; SLW 22363, JRS 4964.

Sphenopholis obtusata (Michx.) Scribn. - PRAIRIE WEDGESCALE
Annual herb; U, canyon bottoms and hanging gardens, riparian; NDA 2890.

Sporobolus airoides (Torr.) Torr. - ALKALI SACATON
Perennial herb; O, canyon bottoms and hillsides; MH 161, 230.

Sporobolus compositus (Poir.) Merr. var. *compositus*- COMPOSITE DROPSEED
[*Sporobolus asper* (Michx.) Kunth] Perennial herb; U, sandy sites, Long Canyon; JRS 5052.

Sporobolus contractus A.S. Hitchc. - SPIKE DROPSEED
Perennial herb; O, canyon bottoms; KH 21007.

Sporobolus cryptandrus (Torr.) Gray - SAND DROPSEED
Perennial herb; O, mesas, Hole-in-the-Rock and Waterhole Flat; LCH 14088, JT 501.

Sporobolus flexuosus (Thurb. ex Vasey) Rydb. - MESA DROPSEED

Perennial herb; O, canyon bottoms; JRS 4999, NDA 23348.

Sporobolus giganteus Nash - GIANT DROPSEED
Perennial herb; U, canyon bottoms, Steer Canyon; NDA 23345.

**Thinopyrum ponticum* (Podp.) Z-W. Liu & R.-C. Wang - RUSH WHEATGRASS
[*Elymus elongatus* (Host) Runemark, *Agropyron elongatum* (Host) Beauv.]
Perennial herb; U, canyon bottoms, Cow Canyon; JRS 6965, SLW 22362.

Tridens muticus (Torr.) Nash - SLIM TRIDENS
Perennial herb; U, canyon bottoms, San Juan River; NDA 23270.

Vulpia octoflora (Walt.) Rydb. - SIXWEEKS FESCUE
[*Festuca octoflora* Walt.] Annual herb; W, benches, mesas, hillsides, and canyon bottoms; SLW 3985, 21818.

Potamogetonaceae
Potamogeton foliosus Raf. - LEAFY PONDWEED
Perennial herb; U, ponds, Explorer Canyon; MH 328.

Potamogeton natans L. - FLOATING PONDWEED
Perennial herb; U, ponds, Explorer Canyon; MH 329.

Potamogeton pusillus L. - SMALL PONDWEED
Perennial herb; U, ponds, Explorer Canyon; NDA 1972 (GLCAHERB).

Typhaceae
Typha domingensis Pers. - SOUTHERN CATTAIL
Perennial herb; O, riparian; MH 366.

Typha latifolia L. - BROADLEAF CATTAIL
Perennial herb; U, riparian, Davis Gulch; NDA 4250.

Zannichelliaceae
Zannichellia palustris L. - HORNED PONDWEED
Perennial herb; U, ponds; JRS 4954.

Appendix B

List of reported, but not vouchered, vascular plants of Glen Canyon NRA

Species are first arranged by divisions: Pteridophyta, Coniferophyta, and Magnoliophyta. Magnoliophyta is further divided into the classes Magnoliopsida (dicots) and Liliopsida (monocots). Taxa are finally arranged alphabetically by families, genera, and species. Nomenclature and common names follow the USDA PLANTS database (2004). Species names preceded by a plus sign (+) denotes taxa that are not likely to occur in GLCA NRA while an asterisk (*) denotes a non-native taxa. The following information is provided for each species, when available:

- A. Common name
- B. Relevant synonyms in brackets
- C. Whether the species occurs in the Glen Canyon NRA region in "Atlas of vascular plants of Utah" (Albee, et al. 1988). This is denoted by "atlas"
- D. Reason why the species is not included on the 2005 flora
- E. Distribution of the species both in Utah and potentially in Glen Canyon NRA
- F. A list of neighboring parks where the species is known to occur (see Appendix D for park codes and park names)

CONIFEROPHYTA

Pinaceae

Pinus ponderosa P.& C. Lawson - PONDEROSA PINE

No voucher for this species could be found. John Spence reports that there are two known trees in the park, one just north of Coyote Gulch and the other on a north-facing cliff near the Great Bend, San Juan Arm. Occurs in BRYC, NABR, CALA, GRCA, CARE, GSENM.

MAGNOLIOPHYTA: MAGNOLIOPSIDA

Aizoaceae

Sesuvium verrucosum Raf. - VERRUCOSE SEAPURSLANE

No voucher for this species could be found. This species is to be expected in the park from low saline and riparian areas in San Juan and Wayne Counties, Utah. Occurs in CALA, GSENM.

Amaranthaceae

**Amaranthus retroflexus* L. - REDROOT AMARANTH

No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in NABR, GSENM.

Apiaceae

**Apium graveolens* L. - WILD CELERY

No voucher for this species could be found. Reported by John Spence from Horse-shoe bend along the Colorado River, Arizona. Occurs in GRCA at Havasu Canyon.

Lomatium foeniculaceum (Nutt.) Coult. & Rose - DESERT BISCUITROOT

No voucher for this species could be found. It is possible that this species could occur within the park in sagebrush and mountain brush communities in Kane County, Utah. Occurs in GRCA, GSENM.

Apocynaceae

+*Amsonia palmeri* Gray - PALMER'S BLUESTAR

Previous voucher annotated to an unknown taxa. Kearney and Peebles (1960) state that *A. palmeri* occurs at Lee's Ferry but a more recent treatment of Apocynaceae (McLaughlin 1993) show that in Arizona *A. palmeri* is known from only the following counties: Cochise, Graham, Maricopa, Mohave, Pinal, and Yavapai.

Asclepiadaceae

Asclepias labriformis M.E. Jones - UTAH MILKWEED

atlas No voucher for this species could be found. This species is to be expected in the park from washes of Garfield, San Juan, and Wayne Counties. Occurs in CALA, CARE, GSENM.

Asclepias speciosa Torr. - SHOWY MILKWEED

No voucher for this species could be found. Reported by JRS from East End Spring on Navajo Point, Wilson Creek, and between Glen Canyon Dam and Lee's Ferry along the Colorado River. Occurs in BRYC, ARCH, CALA, GRCA, CARE, GSENM.

Asteraceae

Agoseris glauca (Pursh) Raf. - PALE AGOSERIS

atlas No voucher for this species could be found. This species is to be expected above 1220 m (4000 ft) in Glen Canyon NRA. Occurs in BRYC, GRCA, CARE, GSENM.

Ambrosia confertiflora Dc. - WEAKLEAF BURR RAGWEED

[*Franseria confertifolia* (DC.) Rydb.]; No voucher for this species could be found. It is possible that this species could occur above Lee's Ferry along the Colorado River. Occurs in GRCA.

Ambrosia tomentosa Nutt. - SKELETONLEAF BURR RAGWEED

atlas No voucher for this species could be found. It is possible that this species could occur along streams in Garfield County, Utah. Occurs in CALA.

Artemisia frigida Willd. - PRAIRIE SAGEWORT

atlas No voucher for this species could be found. This species is to be expected in the park from shadscale, sagebrush, or pinyon-juniper communities. Occurs in BRYC, NABR, CALA, GRCA, CARE.

Brickellia californica (Torr. & Gray) Gray - CALIFORNIA BRICKELLBUSH

atlas No voucher for this species could be found. This species is to be expected in the park from rock-outcrops in Coconino, Garfield, Kane, and San Juan Counties. Occurs in NABR, CALA, GRCA, CARE, GSENM.

**Cichorium intybus* L. - CHICORY

atlas No voucher for this species could be found. This species is to be expected in the park from disturbed sites in Kane and San Juan Counties. Occurs in GRCA, GSENM.

Cirsium wheeleri (Gray) Petrak - WHEELER'S THISTLE

No voucher for this species could be found. This species is to be expected in the park from mountain brush and pinyon-juniper communities in Garfield, Kane, and San Juan Counties. Occurs in GRCA, GSENM.

Ericameria parryi (Gray) Nesom & Baird - PARRY'S RABBITBRUSH

[*Chrysothamnus parryi* (Gray) Greene]; No voucher for this species could be found. This species is to be expected in the park from sagebrush and pinyon-juniper communitites in Garfield, Kane, and Wayne Counties. Occurs in BRYC, ARCH, GRCA, CARE, GSENM.

Erigeron eatonii Gray - EATON'S FLEABANE

atlas No voucher for this species could be found. This species is to be expected above 1680 m (5,500 ft) in Glen Canyon NRA. Occurs in BRYC, GRCA, CARE, GSENM.

Gaillardia spathulata Gray - WESTERN BLANKETFLOWER

atlas No voucher for this species could be found. This species is to be expected in the park from desert shrub communities of Garfield, San Juan, and Wayne Counties. Occurs in ARCH, CALA, CARE, GSENM.

Grindelia squarrosa (Pursh) Dunal - CURLYCUP GUMWEED
No voucher for this species could be found. This species is to be expected in the park from desert shrub or sagebrush communities. Occurs in BRYC, CALA, GRCA, CARE, GSENM.

Helianthella microcephala (Gray) Gray - PURPLEDISK HELIANTHELLA
No voucher for this species could be found. This species is to be expected in the park from desert shrub to pinyon-juniper communities. Occurs in NABR, GRCA, CARE, GSENM.

Heliomeris longifolia (Robins. & Greenm.) Cockerell - LONGLEAF FALSE GOLDENEYE
[*Viguiera longifolia* (Robins. & Greenm.) Blake];**atlas** No voucher for this species could be found. This species is to be expected in the park from salt desert shrub and pinyon-juniper communities in Coconino, Kane and San Juan Counties. Occurs in GRCA, GSENM.

+*Isocoma acradenia* (Greene) Greene - ALKALI GOLDENBUSH
[*Haplopappus acradenius* (Greene) Blake]; No voucher for this species could be found. This species is not included in "A Utah Flora" (2003), although it is listed on the USDA Plants Database as occurring in Utah. In Arizona *I. acradenia* is known from southern counties as well as Grand Canyon in Coconino County. The distribution of *I. acradenia* in Grand Canyon is from Colorado River mile 47 to the Grand Wash Cliffs.

Iva axillaris Pursh - POVERTYWEED
No voucher for this species could be found. This species is to be expected in the park from riparian areas. Occurs in BRYC, CALA, CARE, GSENM.

Malacothrix torreyi Gray - TORREY'S DESERTDANDELION
Previous voucher annotated to *M. sonchoides*. It is possible that this species could occur in desert shrub communities of Coconino and Garfield Counties. Occurs in GRCA at Pasture Wash on the South Rim..

Pseudognaphalium canescens (DC.) W.A. Weberssp. *canescens* - WRIGHT'S CUDWEED
[*Gnaphalium wrightii* Gray]; Previous voucher annotated to *P. palustre*. In Utah known from Ponderosa pine and live oak communities above 1370 m (4,500 ft) This species is to be expected in the park above 1370 m (4,500 ft). Occurs in GRCA, GSENM.

Senecio serra Hook. - TALL RAGWORT
Previous vouchers annotated to *S. multilobatus* and *S. spartioides*. In Utah known from above 1680 m (5,500 ft) in sagebrush to spruce-fir communities. It is possible that this species will be found in the park on the Kaiparowits Plateau.

Stenotus acaulis (Nutt.) Nutt. - STEMLESS MOCK GOLDENWEED
[*Haplopappus acaulis* (Nutt.) Gray];**atlas** No voucher for this species could be found. This species is to be expected in the park from sagebrush or pinyon-juniper communities in Garfield and Kane Counties. Occurs in BRYC, CALA, CARE, GSENM.

Stephanomeria parryi Gray - PARRY'S WIRELETTUCE
No voucher for this species could be found. This species is known from Nipple Springs Road, one of only two known localities in Utah. In Arizona this species is known only from a collection near Kingman. Occurs in GRCA, GSENM.

Xylorhiza venusta (M.E. Jones) Heller - CHARMING WOODYASTER
No voucher for this species could be found. This species is to be expected in the park from salt desert shrub communities in Garfield, San Juan, and Wayne Counties. Occurs in ARCH, NABR, CALA, CARE.

Boraginaceae
Cryptantha bakeri (Greene) Payson - BAKER'S CRYPTANTHA
No voucher for this species could be found. This species is to be expected in the park from sagebrush or pinyon-juniper communities in Garfield, Kane, or San Juan Counties. Occurs in BRYC, GSENM.

Cryptantha utahensis (Gray) Greene - SCENTED CRYPTANTHA
No voucher for this species could be found. This species is to be expected in the park from desert shrub communities below 1100 m (3600 ft) in Kane County. Occurs in GRCA in the Inner Gorge below Marble Canyon.

Cryptantha wetherillii (Eastw.) Payson - WETHERILL'S CRYPTANTHA
No voucher for this species could be found. This species is to be expected in the park from salt desert shrub or pinyon-juniper communities in Garfield, San Juan, or Wayne Counties. Occurs in ARCH.

Brassicaceae
**Capsella bursa-pastoris* (L.) Medik. - SHEPHERD'S PURSE
No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in BRYC, GRCA, CARE, GSENM.

+*Draba verna* L. - SPRING DRABA
No voucher for this species could be found. In Utah this species is known only from northwestern counties.

Lesquerella fendleri (Gray) S. Wats. - FENDLER'S BLADDERPOD
No voucher for this species could be found. This species is to be expected in the park from pinyon-juniper woodlands in San Juan County.

Rorippa nasturtium-aquaticum (L.) Hayek - WATERCRESS
[*Nasturtium officianale* Ait. f.]; No voucher for this species could be found. This species was reported by John Spence from Upper Fence Canyon, Horse-Shoe Bend Colorado River and Scorpion Canyon. Occurs in ARCH, NABR, GRCA, CARE, GSENM.

Cactaceae
+*Opuntia chlorotica* Engelm. & Bigelow - DOLLARJOINT PRICKLYPEAR
Previous voucher Clover 4335 from 1938 was annotated to an unknown taxa. Clover's 1938 collection from Lee's Ferry is housed at the University of Michigan Herbarium. Communication with Tony A. Reznicek, curator of vascular plants at the University of Michigan Herbarium, revealed that this collection was not filed under *O. chlorotica* and that it was likely annotated by Lyman Benson in 1964. Furthermore in Utah *O. chlorotica* is known only from Washington County and in

Arizona it is known from Grand Canyon NP. Occurs in GRCA in the Inner Gourge and at higher locations.

Cannabaceae

**Cannabis sativa* L. - MARIJUANA

No voucher for this species could be found. This species is to be expected in the park from disturbed areas around Lake Powell, though all previously known populations have been extripated. Occurs in GRCA.

Capparaceae

Cleome serrulata Pursh - ROCKY MOUNTAIN BEEPLANT

No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in NABR, CALA, GRCA, CARE, GSENM.

Caryophyllaceae

Paronychia sessiliflora Nutt. - CREEPING NAILWORT

No voucher for this species could be found. This species is to be expected in the park from desert shrub to pinyon-juniper communities in Garfield, San Juan and Wayne Counties. Occurs in BRYC, GRCA, CARE.

Chenopodiaceae

**Atriplex rosea* L. - TUMBLING SALTWEED

No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in CALA, GRCA, CARE, GSENM.

Sarcobatus vermiculatus (Hook.) Torr. - GREASEWOOD

atlas No voucher for this species could be found. This species was reported by John Spence from Middle Moody Canyon. Occurs in BRYC, ARCH, NABR, CALA, CARE, GSENM.

Cuscutaceae

+*Cuscuta cephalanthi* Engelm. - BUTTONBUSH DODDER

Voucher DEB 138 annotated to unknown taxa. Known in Utah from Cache, Salt Lake, and Uintah Counties but not from the Glen Canyon NRA region.

+*Cuscuta indecora* Choisy - BIGSEED ALFALFA DODDER

No voucher for this species could be found. Known in Utah from Box Elder, Cache, Davis, Millard, Salt Lake, Uintah, and Utah Counties but not from the Glen Canyon NRA region.

Fabaceae

Lathyrus brachycalyx Rydb. - BONNEVILLE PEA

No voucher for this species could be found. This species is to be expected in the park from sandy soils of Coconino, Garfield, Kane, and San Juan Counties. Occurs in BRYC, ARCH, CALA, GRCA, CARE, GSENM.

Hydrophyllaceae

Eucrypta micrantha (Torr.) Heller - DAINTY DESERT HIDESEED

No voucher for this species could be found. This species was reported by John Spence from the Colorado River between Glen Canyon Dam and Lee's Ferry. Occurs in GRCA, GSENM.

Phacelia heterophylla Pursh - VARILEAF PHACELIA

No voucher for this species could be found. This species is to be expected in the park from pinyon-juniper woodlands. Occurs in NABR, GSENM.

Lamiaceae

**Salvia aethiopis* L. - MEDITERRANEAN SAGE

No voucher for this species could be found. This species is to be expected in the park from disturbed sites in Coconino and Kane Co., but this species is not yet reported in Utah. All previously known populations have been extripated. Occurs in GRCA in the vicinity of Grand Canyon Village.

Salvia dorrii (Kellogg) Abrams - PURPLE SAGE

No voucher for this species could be found. This species is to be expected in the park from desert shrub communities in Coconino and Kane Counties. Occurs in GRCA, GSENM.

Malvaceae

Sphaeralcea rusbyi Gray - RUSBY'S GLOBEMALLOW

Prevous voucher annotated to *S. parvifolia*. In Utah this species is known only from Washington County, though it possibly occurs in Glen Canyon NRA above and around Lee's Ferry, Coconino Co., Arizona.

Onagraceae

Oenothera cavernae Munz - CAVEDWELLING EVENING-PRIMROSE

No voucher for this species could be found. This species is to be expected in the park from desert shrub communities in Coconino, Kane and San Juan Counties. The Arizona Flora reported this species as occurring north and west of Navajo Bridge. Occurs in GRCA.

+*Oenothera coronopifolia* Torr. & Gray - CROWNLEAF EVENING-PRIMROSE

Previous vouchers annotated to *Camissonia boothii* and *O. pallida*. In Utah only known to grown above 2,000 m (6,500 ft). Occurs in BRYC, GRCA, CARE.

Papaveraceae

Eschscholzia californica Cham. - CALIFORNIA POPPY

No voucher for this species could be found. This species is to be expected along roads in Glen Canyon NRA. This species is used in reclamation seedings. Occurs in GRCA.

Polemoniaceae

Eriastrum eremicum (Jepson) Mason - DESERT WOOLLYSTAR

No voucher for this species could be found. In Utah known only from Washington County, though it possibly in occurs in Glen Canyon NRA above and around Lee's Ferry, Coconino Co., AZ. Occurs in GRCA.

Leptodactylon watsonii (Gray) Rydb. - WATSON'S PRICKLY PHLOX

Previous voucher annotated to *Phlox austromontana* var. *lutescens*, to be expected in desert shrub to pinyon-juniper communities in all GLCA NRA Cos. This species is to be expected in the park from crevices in desert shrub to pinyon-juniper woodland. Occurs in ARCH, CALA, CARE, GSENM.

Polygonaceae

+*Eriogonum brachypodum* Torr. & Gray - PARRY'S BUCKWHEAT

Previous voucher annotated to *E. deflexum*. In Utah known only from Washington County. In Arizona *E. brachypodum* is reported from a cinder cone at west base of Vulcans Throne, Grand Canyon NP.

Polygonum persicaria L. - SPOTTED LADYSTHUMB

No voucher for this species could be found. This species was reported by John Spence from Millard Canyon and is to be expected along lake margins. Occurs in GRCA, GSENM.

Portulacaceae

+*Claytonia perfoliata* Donn ex Willd. - MINER'S LETTUCE

[*Montia perfoliata* (Donn ex Willd.) T.J. Howell]; No voucher for this species could be found. Distributed in western counties in Utah, not including the Glen Canyon NRA region. Occurs in GRCA.

Ranunculaceae

+*Ranunculus acris* L. - TALL BUTTERCUP

No voucher for this species could be found. In Utah *R. acris* known only along the Sevier River above 1780 m (5,850 ft).

Rosaceae

Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer - SASKATOON SERVICEBERRY

Previous voucher JRS 5231 annotated to *A. utahensis*. It is possible that this species occurs in Glen Canyon NRA. Occurs in CALA, CARE, GSENM.

Holodiscus dumosus (Nutt. ex Hook.) Heller - ROCKSPIREA

atlas No voucher for this species could be found. This species is to be expected in the park from Glen Canyon NRA and has been reported from Millers Canyon. Occurs in BRYC, ARCH, NABR, CALA, GRCA, CARE, GSENM.

Potentilla biennis Greene - BIENNIAL CINQUEFOIL

No voucher for this species could be found. It is possible that this species occurs in moist soils in Garfield County and along the Colorado River. Occurring in CALA, GRCA.

Prunus virginiana L. - CHOKECHERRY

No voucher for this species could be found. This species was reported by S. Flowers in 1958, possibly all populations were inundated by Lake Powell as it has not been collected after the completion of Glen Canyon Dam and Lake Powell. Occurs in BRYC, NABR, CALA, GRCA, GSENM.

Rubiaceae

Galium trifidum L. - THREEPETAL BEDSTRAW

Previous voucher annotated to *G. proliferum*. It is possible that this species occurs in moist soils of Garfield, Kane, and San Juan Counties. Occurs in BRYC, GRCA, CARE, GSENM.

Salicaceae

Salix amygdaloides Anderss. - PEACHLEAF WILLOW

Previous voucher annotated to *S. gooddingii*. This species was reported by John Spence from Good-Hope Bay. Occurs in ARCH, CALA, CARE.

Scrophulariaceae

Linaria dalmatica (L.) P. Mill. - DALMATIAN TOADFLAX

No voucher for this species could be found. This species is was reported by Tina Ayers (Curator of Deaver Herbarium) from Lee's Ferry. Occurs in ARCH, GRCA, GSENM.

Mimulus floribundus Lindl. - MANYFLOWERED MONKEYFLOWER

No voucher for this species could be found. This species is to be expected in the park from seeps, springs, and hanging gardens of Coconino and Kane Counties. Occurs in GSENM.

Mimulus suksdorfii Gray - SUKSDORF'S MONKEYFLOWER

No voucher for this species could be found. This species is to be expected in the park from sagebrush and pinyon-juniper communities in Kane and San Juan Counties. Occurs in GRCA, GSENM.

Penstemon barbatus (Cav.) Roth - BEARDLIP PENSTEMON

No voucher for this species could be found. It is possible that this species occurs in Glen Canyon NRA above 1585 m (5,200 ft) in Garfield, Kane, and Wayne Counties. Occurs in ARCH, NABR, CALA, GRCA, CARE, GSENM.

+*Penstemon lentus* Pennell - HANDSOME BEARDTONGUE

No voucher for this species could be found. In Utah known only from the Abajo Mtns. and near Natural Bridges National Monument both in San Juan County. Occurs in NABR.

Penstemon moffatii Eastw. - MOFFATT'S BEARDTONGUE

atlas No voucher for this species could be found. It is possible that this species occurs in Glen Canyon NRA in clayey soils of Garfiled, San Juan, or Wayne Counties. Occurs in CARE.

Penstemon strictus Benth. - ROCKY MOUNTAIN PENSTEMON

No voucher for this species could be found. It is possible that this species occurs in Glen Canyon NRA above 1830 m (6,000 ft) in Garfield, San Juan, or Wayne Counties. Occurs in BRYC, NABR, CALA, CARE.

Penstemon thompsoniae (Gray) Rydb. - THOMPSON'S BEARDTONGUE

atlas No voucher for this species could be found. This species is to be expected in the park from pinyon-juniper woodlands on calcareous soils in Kane County. Currently there is a collection from East Clark Bench, Kane Co., UT. Occurs in GSENM.

Solanaceae

Lycium torreyi Gray - TORREY WOLFBERRY

atlas No voucher for this species could be found. This species is to be expected in the park from desert shrub communities in Garfield and Wayne Counties. Occurs in CALA, GRCA.

Nicotiana attenuata Torr. ex S. Wats. - COYOTE TOBACCO

No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in NABR, GRCA, CARE, GSENM.

Solanum rostratum Dunal - BUFFALOBUR NIGHTSHADE
No voucher for this species could be found. This species is to be expected in the park from disturbed sites in Coconino, Garfiled, Kane, and San Juan Counties. Occurs in CALA, GRCA.

MAGNOLIOPHYTA: LILIOPSIDA

Agavaceae

Yucca baccata Torr. - BANANA YUCCA
atlas No voucher for this species could be found. This species was reported by John Spence from Warm Creek Bay. Occurs in NABR, CALA, GRCA, GSENM.

+*Yucca elata* (Engelm.) Engelm.var. *utahensis* (McKelvey) Reveal - UTAH YUCCA
[*Yucca utahensis* McKelvey]; Previous voucher annotated to *Y. angustissima* var. *toftiae* based on flower size. In Utah this species is known only from Washington County. Occurs in GRCA.

Cyperaceae

Carex nebrascensis Dewey - NEBRASKA SEDGE
No voucher for this species could be found. This species was reported by John Spence from East End Spring on Navajo Point. Occurs in BRYC, ARCH, CALA, GRCA, CARE, GSENM.

+*Carex vesicaria* L. - BLISTER SEDGE
No voucher for this species could be found. Known in Utah but not from the Glen Canyon NRA region. Occurs in GSENM.

+*Cyperus acuminatus* Torr. & Hook. ex Torr. - TAPERTIP FLATSEDGE
No voucher for this species could be found. In Utah known only from Millard County.

Cyperus erythrorhizos Muhl. - REDROOT FLATSEDGE
No voucher for this species could be found. This species is to be expected in the park from riparian areas of Glen Canyon NRA in Coconino, Garfield, Kane, and San Juan Counties. Occurs in ARCH, GRCA.

Schoenoplectus americanus (Pers.) Volk. ex Schinz & R. Keller - CHAIRMAKER'S BULRUSH
[*Scirpus americanus* Pers.]; No voucher for this species could be found. This species is to be expected in the park from riparian areas in Wayne County. Occurs in ARCH, CALA, GRCA, GSENM.

Schoenoplectus pungens (Vahl) Palla - COMMON THREESQUARE
[*Scirpus pungens* Vahl]; No voucher for this species could be found. This species is to be expected in the park from riparian areas. Occurs in BRYC, CALA, GRCA, CARE, GSENM.

+*Scirpus pallidus* (Britt.) Fern. - CLOAKED BULRUSH
Previous voucher annotated to *S. maritimus*. In Utah known only from Uintah and Utah Counties.

Iridaceae

Sisyrinchium demissum Greene - STIFF BLUE-EYED GRASS

No voucher for this species could be found. This species was reported by John Spence from East End Spring on Navajo Point. Occurs in BRYC, GRCA, CARE, GSENM.

Lemnaceae

Lemna minuta Kunth - LEAST DUCKWEED

No voucher for this species could be found. This species is to be expected in the park from ponds, lakes, and sluggish streams. Occurs in GRCA.

Liliaceae

+*Zigadenus elegans* Pursh - MOUNTAIN DEATHCAMAS

Previous voucher annotated to *Z. paniculatus*. In Utah this species is known only from elevations above 1980 m (6,500 ft). Occurs in BRYCE, ARCH, NABR, CALA, GRCA, CARE.

Poaceae

Bothriochloa laguroides (DC.) Herter - SILVER BEARDGRASS

No voucher for this species could be found. This species is to be expected in the park from Glen Canyon NRA from disturbed sites and along roadsides in Kane Co. Occurs in CALA, GRCA.

**Bromus catharticus* Vahl - RESCUEGRASS

No voucher for this species could be found. This species is to be expected in the park from Glen Canyon NRA from disturbed sites in Garfield, Kane, and Wayne Cos. Occurs in GRCA, CARE.

Cenchrus longispinus (Hack.) Fern. - MAT SANDBUR

No voucher for this species could be found. This species is to be expected in the park from disturbed sites. Occurs in ARCH, CARE, GSENM.

**Poa annua* L. - ANNUAL BLUEGRASS

No voucher for this species could be found. This species is to be expected in the park from Glen Canyon NRA from disturbed sites in Garfield County. Occurs in GRCA.

Appendix C

Plants extirpated from Glen Canyon NRA after the completion of Glen Canyon Dam

The following list is of vascular plant species that were collected prior to the completion of the Glen Canyon Dam (before 1964) and have not been documented since. A plus sign (+) preceeding the species name indicates voucher specimens that were not inspected to assure correct identification. See Appendix D for park acronyms.

Asteraceae

+*Erigeron argentatus* Gray
This species was collected by Flowers and Lindsey (s.n.) in 1959 and is known from the following surrounding parks NABR, CALA, and GSENM.

+*Isocoma pluriflora* (Torr. & Gray) Greene
This species was collected by Clover (4342) in 1938 at Lee's Ferry. This species in not known in Utah, but is known from Grand Canyon NP. In Grand Canyon NP I. pluriflora is reported from the North Rim and various Inner Gourge locations, though collections are thought to maybe be I. acradenia (Phillips et. al 1987).

+*Symphyotrichum ciliatum* (Ledeb.) Nesom – Rayless alkali aster
Collected by Flowers (s.n.) in 1959, also known from the following parks: ARCH, CARE, and GSENM.

Cactaceae

+*Mammillaria tetrancistra* Engelm.
It is likely that the voucher specimen for this species collected by Clover (2400) in 1938 from the mouth of Forbidding Canyon is misidentified. First, Benson's (1982) distribution map of M. tetrancistra does not include the GLCA NRA area. Secondly Benson annotated Clover's southwest cactus collections in 1968 and therefore would have been aware of this collection, had it been correctly identified (Tony Reznicek, pers. comm. 2005).

+*Pediocactus simpsonii* (Engelm.) Britt & Rose
It is possible that the voucher specimen for this species collected by Flowers (s.n.) in 1959 is misidentified. Benson's (1982) distribution map for this species doesn't include GLCA NRA, although P. simpsonii is present in the following parks BRYC, GRCA, and CARE.

Chenopodiaceae

+*Atriplex prostrata* Bouch. ex DC.
Collected by Flowers (s.n.) in 1959, in UT known from riparian habitats in San Juan and Wayne Cos.

Convolvulaceae

+*Cressa truxillensis* Kunth
Collected by Flowers (s.n.) 1959; in UT known from saline or alkaline habitats in Garfield Co.

Cyperaceae

Eleocharis parishii Britt.
Gaines' (864) collection was annotated to E. palustris. Also collected by Flowers and Lindsey (s.n.) in 1959 and is known to occur in GRCA on the North Rim and from the Inner Gorge.

Juncaginaceae

+*Triglochin maritimum* L.
Collected by Flowers (s.n.) in 1959, presently known from seeps and marshes in Garfield and San Juan Cos. Also known from the following surrounding parks: BRYC, ARCH, CARE, and GSENM.

Poaceae

+*Chloris virgata* Sw.
Collected by Flowers (s.n.) in 1959, presently known in disturbed riparian sites and from GRCA and GSENM.

+*Puccinellia nuttalliana* (J. A. Schultes) Hitch.
Collected by Flowers (s.n.) in 1959, presently known from moist sites in UT and from BRYC, CALA, CARE, and GSENM.

Polygonaceae

+*Eriogonum subreniforme* S. Wats.
Collected by Flowers (s.n.) in 1959, presently known from clayey soils in Garfield and Kane Cos, as well as from BRYC, CARE, and GSENM.

+*Rumex venosus* Pursh
Collected by Flowers (s.n.) in 1959, presently known from sand soils in Kane Co, as well as ARCH, CALA, and GSENM.

Ranunculaceae

Ranunculus sceleratus L.
Collected by Gaines (892) in 1938 from Mystery Canyon, also known from GRCA, CARE, and GSENM.

Rosaceae

+*Prunus virginiana* L.
Collected by Flowers (s.n.) in 1959, also known from NABR, CALA, and GRCA.

Scrophulariaceae

Cordylanthus parviflorus (Ferris) Wiggins
Gaines' (835) collection was annonatated to C. wrightii. Cordylanthus parviflorus was also collected by Flowers (s.n.) in 1959 and is presently known from desert shrub communities in Southeastern Utah as well as BRYC, CALA, GRCA, and GSENM.

Solanaceae

+*Physalis hederifolia* Gray
Collected by Clover (2151) in 1938 near the mouth of Dark Canyon. Presently known from Cottonwood communities in Southeastern Utah and from GRCA and GSENM.

Appendix D

Names and acronyms of Southern Colorado Plateau Network parks

Park Name	Acronym
Aztec Ruins National Monument	AZRU
Bandelier National Monument	BAND
Canyon De Chelly National Monument	CACH
Chaco Culture National Historic Park	CHCU
El Malpais National Monument	ELMA
El Morro National Monument	ELMO
Glen Canyon National Recreation Area	GLCA
Grand Canyon National Park	GRCA
Hubbell Trading Post National Historic Site	HUTR
Navajo National Monument	NAVA
Petroglyph National Monument	PETR
Salinas Pueblo Missions National Monument	SAPU
Sunset Crater Volcano National Monument	SUCR
Wupatki National Monument	WUPA
Yucca House National Monument	YUHO

Appendix E

Sensitive species

Glen Canyon National Recreation Area considers information about this federally-listed endangered species to be sensitive, and therefore, it has been removed from this report.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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