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FINAL REPORT

STUDIES ON THE FLORA OF GLEN CANYON NATIONAL RECREATION AREA

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1. INTRODUCTION

Previous work on the flora of Glen Canyon N.R.A. (NRA) is summarized by Welsh et al. (1978), Welsh (1984), and Schultz et al. (1987). Despite considerable work in parts of the NRA, the flora remains relatively small (646 species) compared to other nearby parks such as Grand Canyon (1400 species; Phillips et al. 1987) or Capitol Reef (760 species; Heil 1992). This may in part result from the smaller elevational ranges and hence habitat diversity, but the lack of field work in many parts of the NRA probably also contributes to the small flora. Future collecting will certainly add to this list. For example, ca. 100 species found near Glen Canyon but not within park boundaries are included in the revised checklist (see below).

The revised checklist presented below was prepared primarily to address three main concerns. First, there is a need to have a list for use in filling in the gaps in the park's herbarium collection, as many species are known from the park but are not included in the collections. Second, several species new to Glen Canyon NRA were collected during the course of 1992 field work. Finally, the currently available list needed to be revised because of extensive duplication of names (the same species occurring under more than one name in the list).

New species to Glen Canyon NRA are reported first, then a revised checklist for the park, with information on herbarium collections, is presented. A brief summary of collections made during the 1992 field season follows. Finally, recommendations on future collecting in the park are made.

1. ADDITIONS TO THE FLORA OF GLEN CANYON NATIONAL RECREATION AREA

Interesting rare or new species are listed below alphabetically by genus (families in parentheses). Brief collection and habitat notes, and the significance of the findings, are also noted for each species. Expected species

are those that, based on their distribution and ecology, were to be expected from the park. The collection number is my own, rather than an N.P.S. accession number.

Acer glabrum Torr. (ACERACEAE). Rocky Mountain maple is the dominant understory species in the Douglas fir tree stand in Miller's Creek, at an elevation of 1760 m (Spence 1992a). This species is generally found above ca. 2100 m along streams in southern Utah.

Amelanchier cf. alnifolia Nutt. (ROSACEAE). Growing in the Douglas fir tree stand in upper Miller's Creek. The leaf length varies from ca. 2.0-3.0 cm, which is intermediate between A. alnifolia and A. utahensis. As pointed out by Welsh et al. (1987), these two species intergrade, and many collections are difficult to name. Based on the shaded montane habitat, the plants are tentatively placed in the high elevation A. alnifolia, which generally occurs at elevations above 2000 m in southern Utah (no collection).

Carex rossii F. Boott (CYPERACEAE). Found in the Douglas fir tree stand in upper Miller's Creek, where it is a common element under the tree canopy on the slopes above the stream. A sterile sedge which is probably this species was also found in the understory of the Ostrya woodland in Clearwater Canyon (see Spence 1992a). Elk sedge is an abundant component of drier open forests in the mountains, especially in Ponderosa and mixed conifer forests. The Clearwater Canyon site is at an unusually low elevation for this species (S5018).

Cheilanthes feei Moore (SINOPTERIDACEAE). Growing in shaded crevices of Entrada sandstone in middle Clearwater Canyon. An expected species (S5010).

Cystopteris fragilis (L.) Bernh. (ATHYRIACEAE). Growing in damp shaded crevices of Navajo Sandstone in a hanging garden at the end of the south fork of Cow Canyon. This species is generally found at high elevations, in moist woodlands

and along streams, in southern Utah. This is elevationally the lowest known location known for this species in southern Utah (S4977). It was also found in the tree stand in upper Miller's Creek.

Erigeron kachinensis Welsh & Moore (ASTERACEAE). On damp soil in an exposed seep in middle Clearwater Canyon, associated with Carex curatorum. This is a federal candidate C2 species which occurs in hanging gardens and seeps in the Cedar Mesa formation, principally around Natural Bridges National Monument. More details on this species can be found in Spence (1992b)(S5014).

Ferrocactus acanthodes (Lemaire) B. & R. (CACTACEAE). A common element of the hot deserts, this species is occasionally found on limestone near the edge of the gorge south of Lee's Ferry. (no collection).

Galium triflorum Michx. (RUBIACEAE). Growing on damp shaded soil near the spring in the north fork of Cow Canyon. This species is part of a relict patch of deciduous woodland described in Spence (1992a). This species is generally found in moist deciduous woodlands at high elevations in southern Utah, especially in aspen forests. The Cow Canyon site is unusually low for G. triflorum (S4975).

Juncus articulatus L. (JUNCACEAE). Occasional in riparian zones around Lake Powell as well as along the river below the dam. An expected species (S4982).

Lycopus americanus Barton (LAMIACEAE). Growing in a marsh site at -6.5 miles on the river. Neither Kearney and Peebles (1960), McDougall (1960), nor Phillips et al. 1987) report this species. It appears to be new to Arizona (S4979).

Potamogeton nodosus Poir. (POTAMOGETONACEAE). In a quiet pool near the mouth of Bowns Canyon. This species favors still or slowly moving water, as in pools. Although numerous beaver ponds exist in side canyons around Lake Powell, this is the first collection of this species. Few collections of this species have been made elsewhere in the region (S5019).

Rhus glabra L. (ANACARDIACEAE). Growing in a south facing, sunny site in the north fork of Cow Canyon, ca. 1 km up from the junction. This species was found growing in mixed deciduous woodland around a seep in an alcove. This is only the second report from Glen Canyon NRA. Welsh (1984) first reported it, also from a hanging garden. Rhus glabra is rare in Utah, and is probably a Tertiary relict (S4972).

Sambucus caerulea Raf. (CAPRIFOLIACEAE). Growing on damp shaded soil near the spring in the north fork of Cow Canyon. This species is part of a relict patch of deciduous woodland described in Spence (1992a). Blue elderberry is generally found at higher elevations in coniferous forest. The Cow Canyon loation is unusually low for this species (S4976).

Selaginella mutica D.C. Eaton (SELAGINELLACEAE). Found on the sides of a shaded Cedar Mesa sandstone boulder in Clearwater Canyon, in the Ostrya woodland (Spence 1992a). An expected species (S5025).

Viola species (VIOLACEAE). Growing on shaded wet organic soil in a seep on side of stream channel, south fork of Cow Canyon, ca. 1 km from junction. The population was sterile, but leaf characters and the lack of stolons suggest the species is probably the common Viola nephrophylla (bog violet). This species is generally found at high elevations (>2000 m) in southern Utah (S4978).

2. CHECKLIST OF THE PLANTS OF GLEN CANYON NATIONAL RECREATION AREA

Species with an asterisk (*) are introduced. Cultivated ornamentals are not included unless they have spread into the wild. The first number before each name is the number of specimens in the herbarium, the second the number of specimens from within Glen Canyon NRA. If the number is 0 followed by a slash and letter, this indicates the species has been reported from the park, but no specimen exists. The letters stand for A = Albee et al. (1988), P = Phillips et al.

(1987), S = Schultz et al. (1987), W = Welsh et al. (1978) and Welsh (1984). The sequence 1/0 indicates the species is common in Glen Canyon NRA (reported by all sources) and is represented in the herbarium, but the specimen itself is not from Glen Canyon NRA. A 0/+ indicates I have seen the species in the field, while a 1/+ means that I have collected it. If the species is in square brakets [], then it is likely to be found in Glen Canyon NRA and/or has been found very close to the park boundary, but is not yet known from the park. Nomenclature follows Welsh et al. (1987) except for the Liliaceae, which follows the Flora of North America project, and the ferns, which follow Weber (1987).

FERNS AND FERN ALLIES

ADIANTACEAE
2/2 Adiantum capillus-veneris L.

ATHYRIACEAE
1/+ Cystopteris fragilis (L.) Bernh.

EQUISETACEAE
1/1 Equisetum arvense L.
1/1 E. hyemale
0/A E. laevigatum A. Br.

SELAGINELLACEAE
1/+ Selaginella mutica D.C. Eaton

SINOPTERIDACEAE (Adiantaceae in Phillips et al. 1987)
1/+ Cheilanthes feei Moore]
0/A Notholaena limitanea Maxon
0/A Pellaea glabella Mett. ex Kuhn
0/W P. truncata Godding

GYMNOSPERMS

CUPRESSACEAE
2/1 Juniperus osteosperma (Torr.) Little

EPHEDRACEAE
0/W Ephedra nevadensis Wats.
1/1 E. torreyana Wats.
3/3 E. viridis Cov.

PINACEAE
1/0 Pinus edulis Engelm.

1/O P. ponderosa Lawson
1/+ Pseudotsuga menziesii (Mirbel) Franco

ANGIOSPERMS

ACERACEAE
1/+ Acer glabrum Torr.
2/2 A. negundo L.

AGAVACEAE
O/P Agave utahensis Engelm.
O/W Yucca angustissima Engelm. ex Trel.
1/O Y. baccata Torr.
2/1 Y. baileyi Woot. & Standl.
[Y. harrimaniae Trel.]
1/1 Y. toftiae Welsh
1/1 Y. utahensis McKelvey

AIZOACEAE
[*Mollugo cerviana (L.) Ser.]
[*M. verticillata]
[Sesuvium verrucosum Raf.]

ALLIACEAE
[Allium acuminatum Hook.]
1/1 A. macropetalum Rydb.
1/1 A. nevadense Wats.
1/1 A. textile Nels. & Macbr.
1/O Androstephium brevifolium Wats.

AMARANTHACEAE
1/1 Acanthochiton wrightii Torr.
1/1 Amaranthus blitoides Wats.
O/W A. retroflexus L.
2/1 Tidestromia lanuginosa(Nutt.) Standley

ANACARDIACEAE
4/1 Rhus aromatica Aiton
2/2 R. glabra L.
1/O Toxicodendron rydbergii (Small) Greene

APIACEAE
[Berula erecta (Huds.) Cov.]
O/A Cymopterus acaulis (Pursh) Raf.
O/W C. a. var. higginsii (Welsh) Goodrich
1/1 C. fendleri Gray
2/1 C. newberryi (Wats.) Jones
2/1 C. purpurascens (Gray) M.E. Jones
1/1 Lomatium foeniculaceum (Nutt.) C. & R.
2/2 L. parryi (Wats.) Macbr.

APOCYNACEAE

0/A Amsonia jonesii Woodson
0/P A. palmeri Gray
3/1 A. tomentosa Torr. & Frem.
1/1 Apocynum cannabinum L.
1/1 Cycladenia humilis Benth. var. jonesii (Eastw.) Welsh & Atwood

ASCLEPIADACEAE

2/1 Asclepias asperula (Decne.) Woodson
0/A A. cryptoceras Wats.
1/0 A. labriformis Jones
2/2 A. latifolia (Torr.) Raf.
1/1 A. macrosperma Eastw.
0/A A. speciosa Torr.
1/0 A. subverticillata (Gray) Vail
1/1 Sarcostemma cynanchoides Decne.

ASTERACEAE

2/2 Acamptopappus sphaerocephalus (Harv. & Gray) Gray
1/0 Agoseris glauca (Pursh) Raf.
1/1 Ambrosia acanthicarpa Hook.
0/A A. tomentosa Nutt.
2/1 Artemisia bigelovii Gray
2/2 A. campestris L.
1/0 A. carruthii Carruth
1/1 A. dracunculus L.
2/1 A. filifolia Torr.
0/A A. frigida Willd.
2/2 A. ludoviciana Nutt.
0/S A. nova A. Nels.
1/1 A. spinescens Wats.
1/1 A. tridentata Nutt.
1/1 Aster chilensis Nees.
2/2 A. glaucodes Blake
1/1 A. spinosus Benth.
1/1 Baccharis emoryi Gray
1/1 B. glutinosa Pers.
0/W B. salicina T. & G.
[Bahia dissecta (Gray) Britt.]
[B. neomexicana Gray]
[Brachyactis frondosa (Nutt.) Gray]
1/1 Brickellia atractyloides Gray
1/1 B. californica (T. & G.) Gray
2/0 Brickellia longifolia Wats.
2/1 B. microphylla (Nutt.) Gray
1/1 B. oblongifolia Wats.
[Calycoseris parryi Gray]
2/1 *Centaurea repens L.
1/1 Chaenactis macrantha D.C. Eat.
4/2 C. stevioides H. & A.
1/0 Chrysothamnus greenei (Gray) Greene
1/1 C. linifolius Greene

5/1 C. nauseosus (Pallas) Britt.
1/O C. parryi (Gray) Greene
1/S C. pulchellus (Gray) Greene
2/O C. viscidiflorus (Hook.) Nutt.
1/O Cirsium arizonicum (Gray) Petrak
1/1 C. calcareum (Jones) Woot. & Standl.
1/1 C. neomexicanum Gray
1/1 C. rydbergii Petrak
1/W C. undulatum (Nutt.) Spreng.
1/O C. wheeleri (Gray) Petrak
1/1 Conyza canadensis (L.) Cronq.
[Crepis occidentalis Nutt.]
1/1 Dicoria brandegei Gray
1/1 D. canescens Gray
1/1 Dyssodia acerosa DC.
2/2 D. pentachaeta (DC.) Robins.
2/1 Encelia frutescens Gray
1/1 Enceliopsis nudicaulis (Gray) A. Nels.
O/S Erigeron aphanactis (Gray) Greene
[E. argentatus Gray]
1/1 E. bellidiastrum Nutt.
1/1 E. divergens T. & G.
1/O E. eatonii Gray
1/O E. kachinensis Welsh & Moore
[E. pulcherrimus Heller]
2/1 E. pumilus Nutt.
3/2 E. utahensis Gray
2/2 Euthamia occidentalis Nutt.
O/P Franseria confertiflora (DC.) Rydb.
[Gaillardia parryi Greene]
2/2 G. pinnatifida Torr.
O/W G. spathulata Gray
1/1 Glyptopleura marginata D.C. Eat.
O/P Gnaphalium chilense Spreng.
1/O G. palustre Nutt.
1/1 G. wrightii Gray
O/W Grindelia aphanactis Rydb.
O/W G. fastigiata Greene
O/W *G. squarrosa (Pursh) Dunal
2/1 Gutierrezia microcephala (DC.) Gray
2/O G. sarothrae (Pursh) Britt. & Rusby
2/2 Haplopappus acaulis (Nutt.) Gray
O/P H. acredenius (Greene) Blake
3/2 H. armerioides (Nutt.) Gray
2/2 H. drummondii (T. & G.) Blake
1/O H. scopulorum (Jones) Blake
O/P H. spinulosus (Pursh) DC.
1/O Helianthella microcephala (Gray) Gray
O/W Helianthus annuus L.
1/1 H. anomalus Blake
1/1 H. petiolaris Nutt.
3/1 Heterotheca villosa (Nutt.) Shinners

3/1 Hymenopappus filifolius Hook.
6/2 Hymenoxys acaulis (Pursh) Parker
[H. bigelovii (Gray) Parker]
1/0 H. cooperi (Gray) Ckll.
2/1 H. richardsonii (Hook.) Cockerell
1/0 Iva axillaris Pursh
0/W Lactuca serriola L.
1/1 L. taractica (L.) C.A. Mey
1/0 Layia glandulosa (Hook.) H. & A.
3/2 Leucelene ericoides (Torr.) Greene
1/0 Lygodesmia grandiflora (Nutt.) T. & G.
1/1 Machaeranthera canescens (Pursh) Gray
2/1 M. grindelioides (Nutt.) Shinners
0/S M. leucanthemifolia Greene
1/0 M. linearis Greene
2/0 M. tanacetifolia (H.B.K.) Nees
3/3 Malacothrix glabrata (D.C. Eat.) Gray
2/2 M. sonchoides (Nutt.) T. & G.
1/1 M. torreyi Gray
2/1 Oxytenia aceroa Nutt.
[Pectis angustifolia Torr.]
1/0 P. papposa H. & G.
1/0 Perezia wrightii Gray
2/0 Petradoria pumula (Nutt.) Greene
0/W Perityle specuicola Welsh & Neese
2/0 Platyschkuhria integrifolia (Gray) Rydb.
2/2 Pluchea sericea (Nutt.) Cov.
1/0 Prenanthella exigua (Gray) Rydb.
1/0 Psathyrotes pilifera Gray
[Psilostrophe cooperi (Gray) Greene]
2/2 P. sparsiflora (Gray) A. Nels.
2/1 Senecio multilobatus T. & G.
4/1 S. spartioides T. & G.
1/+ Solidago canadensis L.
2/2 S. sparsiflora Gray
1/1 *Sonchus asper (L.) Hill
3/1 Stephanomeria exigua Nutt.
0/W S. parryi Gray
1/1 S. pauciflora (Torr.) A. Nels.
[S. spinosa (Nutt.) Tomb]
2/2 S. tenuifolia (Torr.) Hall
0/W Stylocline micropoides Gray
0/P *Taraxacum officinale Weber
2/1 Tetradymia canescens DC.
1/0 Thelesperma subnudum Gray
0/W Townsendia annua Beaman
2/2 T. incana Nutt.
2/1 Vanclevea stylosa (Eastw.) Greene
1/0 Verbesina encelioides (Cav.) Benth. & Hook.
0/A Viguiera longifolia (Robins. & Greenm.) Blake
0/W V. soliceps
1/0 Wyethia scabra Hook.

0/+ *Xanthium strumarium L.
[Xylorhiza confertiflora (Cronq.) T.J. Wats.]
1/1 X. glabriuscula Nutt.
1/0 X. tortifolia Greene
1/0 X. venusta (Jones) Heller

BERBERIDACEAE
0/S Mahonia fremontii (Torr.) Fedde
3/1 M. repens (Lindl.) G. Don

BETULACEAE
0/W Betula occidentalis Hook.
2/2 Ostrya knowltonii Cov.

BIGNONIACEAE
0/P Chilopsis linearis (Cav.) Sweet

BORAGINACEAE
1/1 Cryptantha abata Johnst.
1/0 C. confertifolia (Greene) Payson
4/2 C. cinerea (Greene) Cronq.
1/0 C. circumscissa (H. & A.) Johnst
2/1 C. crassisepala (T. & G.) Greene
1/0 C. fendleri (Gray) Greene
3/2 C. flava (A. Nels.) Payson
0/S C. flavoculata (A. Nels.) Payson
1/1 C. fulvocanescens (Wats.) Payson
1/1 C. gracilis Osterh.
1/0 C. humilis (Greene) Payson
1/0 C. inaequata Johnst.
1/0 C. micrantha (Torr.) Johnst.
0/W C. nevadensis Nels. & Kenn.
1/1 C. osterhoutii (Payson) Payson
2/1 C. pterocarya (Torr.) Greene
0/W C. recurvata Cov.
1/0 C. tenuis (Eastw.) Payson
0/W C. wetherillii (Eastw.) Payson
0/P C. utahensis (Gray) Green
0/W Eriastrum diffusum (Gray) Mason
2/1 Heliotropium convulvulaceum (Nutt.) Gray
[H. curassavicum L.]
2/1 *Lappula occidentalis (Wats.) Greene
2/1 Lithospermum incisum Lehm.
0/A Pectocarya heterocarpa (Johnst.) Johnst.
2/2 Tiquilia latior (Johnston) A. Richards

BRASSICACEAE
[Arabis holboelii Hornem.]
3/1 A. perennans Wats.
1/1 A. pulchra M.E. Jones
0/+ *Brassica sp.
0/W Capsella bursa-pastoris (L.) Medic.

2/1 Caulanthus crassicaulis (Torr.) Wats.
[*Chorispora tenella (Pallas) DC.]
2/1 Descurainia pinnata (Walt.) Britt.
2/1 *D. sophia (L.) Prantl
4/1 Dithyrea wislizenii Engelm.
2/1 Draba cuneifolia R. Graham
0/S *D. verna L.
4/1 Erysimum asperum (Nutt.) DC.
2/2 Hutchinsia procumbens (L.) Desv.
2/1 Lepidium densiflorum
0/W L. lasiocarpum Nutt.
3/2 L. montanum Nutt.
[*L. perfoliatum L.]
0/A Lesquerella ludoviciana (Nutt.) S. Wats.
1/1 L. rectipes Woot. & Standl.
[L. wardii Wats.]
1/0 *Malcolmia africana R. Br.
0/+ *Nasturtium officinale R. Br.
2/1 Physaria acutifolia Rydb.
1/0 P. chambersii Rollins
0/W P. newberryi Gray
2/1 Schoencrambe linifolia (Nutt.) Rydb.
2/1 *Sisymbrium altissimum L.
3/1 Stanleya pinnata (Pursh) Britt.
3/1 Streptanthella longirostris (Wats.) Rydb.
2/1 Streptanthus cordatus Nutt.
1/0 Thelypodiopsis divaricatus (Roll.) Welsh & Reveal
2/2 Thelypodium integrifolium (Nutt.) Endl.

CACTACEAE
[Coryphantha vivipara (Nutt.) Britt. & Rose]
0/P Echinocactus polycephalus Engelm. & Bigel.
2/0 Echinocereus engelmannii (Parry) Rumpler
0/W E. triglochidiatus Engelm.
0/+ Ferrocactus acanthodes (Lem.) Britt. & Rose
[Mammillaria tetrancistra Engelm.]
1/1 Opuntia basilaris Engelm. & Bigel.
0/P O. chlorotica Engelm. & Bigel.
1/1 O. erinacea Engelm.
2/2 O. phaeacantha Engelm.
1/0 O. polyacantha Haw.
[O. whipplei Engelm. & Bigel.]
0/+ Pediocactus bradyi L. Benson
1/1 Sclerocactus whipplei (Engelm.) Britt. & Rose

CALOCHORTACEAE
1/1 Calochortus aureus Wats.
2/1 C. flexuosus Wats.
2/1 C. nuttallii T. & G.

CAPPARACEAE
2/1 Cleome lutea Hook.

2/0 C. serrulata Pursh
1/0 Cleomella palmeriana Jones

CAMPANULACEAE
1/0 Lobelia cardinalis L.

CAPRIFOLIACEAE
1/+ Sambucus caerulea Raf.
1/1 Symphoricarpos longiflorus Gray

CARYOPHYLLACEAE
2/1 Arenaria fendleri Gray
0/S Paronychia sessiliflora Nutt.
0/A Silene antirrhina L.

CHENOPODIACEAE
2/1 Atriplex canescens (Pursh) Nutt.
1/1 A. confertifolia (T. & G.) Wats.
1/0 A. corrugata Wats.
0/A A. gardneri (Moq.) D. Dietr.
2/1 A. garrettii Rydb.
0/A A. graciliflora Jones
2/2 A. navajoensis C.A. Hansen
1/1 A. obovata Moq.
1/0 *A. rosea L.
2/1 A. saccaria Wats.
2/0 Ceratoides lanata (Pursh) Howell
[Chenopodium dessicatum A. Nels.]
[C. glaucum L.]
1/0 C. fremontii Wats.
1/1 C. leptophyllum (Moq.) Wats.
1/0 Corispermum villosum Rydb.
2/1 Cycloloma atriplicifolium (Spreng.) Coult.
2/1 Grayia spinosa (Hook.) Moq.
[*Halogeton glomeratus (Bieb.) C.A. Mey.]
1/0 Kochia americana Wats.
[*K. scoparia (L.) Schrad.]
[Monolepis nuttalliana (Schult.) Greene]
2/2 *Salsola australis R. Br.
0/S Salsola paulsenii Sennen & Pau
0/W Sarcobatus vermiculatus (Hook.) Torr.
1/0 Suaeda torreyana Wats.
2/1 Zuckia brandegei (Gray) Welsh & Stutz

COMMELINACEAE
2/0 Tradescantia occidentalis (Britt.) Smyth

CONVALLARIACEAE
2/2 Smilacina stellata (L.) Desf.

CONVULVULACEAE
1/1 *Convolvulus arvensis L.

[Cressa truxillensis H.B.K.]
O/W Evolvulus nuttallianus Schultes

CORNACEAE
[Cornus sericea L.]

CROSSOSOMATACEAE
[Forsellesia spinescens (Gray) Greene]

CUCURBITACEAE
[Cucurbita foetidissima H.B.K.]

CUSCUTACEAE
O/W Cuscuta cephalanthii Engelm.
1/O C. indecora Choisy
[C. pentagona Engelm.]

CYPERACEAE
1/1 Carex aurea Nutt.
1/1 C. curatorum Stacey
1/1 C. hystricina Muhl. ex Willd.
1/1 C. lanuginosa Michx.
1/1 C. occidentalis Bailey
1/1 C. parryana Dewey
1/+ C. rossii F. Boott
O/W C. vesicaria L.
1/1 Cladium californicum (Wats.) O'Neill
O/W Cyperus acuminatus Torr.
O/+ C. erythrorhizos Muhl.
[C. schweinitzii Torr.]
2/2 Eleocharis palustris (L.) R. & S.
O/A E. rostellata (Torr.) Torr.
1/1 Fimbristylis spadicea (L.) Vahl
2/1 Scirpus americanus Pers.
1/O S. acutus Bigel.
O/+ S. maritimus (L.) Pallas
1/1 S. pungens Vahl
1/1 S. validus Vahl

ELAEAGNACEAE
O/+ *Elaeagnus angustifolia L.
1/O Sheperdia argentea (Pursh) Nutt.
2/1 S. rotundifolia Parry

EUPHORBIACEAE
1/O Croton texensis (Klotzsch) Muell.-Arg.
[Euphorbia albomarginata T. & G.]
1/O Euphorbia brachycera Engelm.
2/1 E. fendleri T. & G.
2/2 E. glyptosperma Engelm.
[E. micromera Boiss.]
[E. nephradenia Barneby]

2/1 E. parryi Engelm.
0/P Euphorbia sp. novae (Lee's Ferry)
1/0 Reverchonia arenaria Gray

FABACEAE
2/1 Astragalus amphioxys Gray
[A. bisulcatus (Hook.) Gray]
[A. bryantii Barneby]
1/1 A. calycosus Torr.
2/1 A. ceramicus Sheld.
1/1 A. cottomii Welsh
2/1 A. desperatus Jones
0/W A. eastwoodae Jones
[A. episcopus Wats.]
[A. flavus Nutt.]
1/0 A. fucatus Barneby
1/1 A. kentrophyta Gray
5/1 A. lentiginosus Dougl.
0/W A. lonchocarpus Torr.
2/1 A. malacoides Barneby
2/1 A. moencoppensis M.E. Jones
2/1 A. mollissimus Torr.
1/1 A. monumentalis Barneby
1/1 A. musiniensis Jones
0/W A. newberryi Gray
1/1 A. nidularius Barneby
2/2 A. nuttallianus Nutt.
0/W A. oophorus Wats.
0/W A. pardalinus Rydb.
[A. pattersonii Brand.]
[A. piscator Barneby & Welsh]
2/1 A. praelongus Sheld.
2/1 A. preussii Gray
2/1 A. sabulonum Gray
1/0 A. sesquiflorus Wats.
0/S A. wingatanus Wats.
[A. woodruffii Jones]
2/1 A. zionis Jones
3/1 Cercis occidentalis Gray
3/2 Dalea flavescens (Wats.) Welsh
[D. lanata Spreng.]
3/1 D. oligophylla (Torr.) Shinners
0/P Glycyrrhiza lepidota Pursh
2/1 Hedysarum boreale Nutt.
2/0 Lathyrus brachycalyx Rydb.
0/S Lupinus argenteus Pursh
2/1 L. pusillus Pursh
[*Medicago lupulina L.]
0/P *M. sativa L.
1/1 *Melilotus alba Medic.
1/1 *M. officinalis (L.) Pallas
[Oxytropis lambertii Pursh]

0/W Parryella filifolia T. & G.
1/0 Pediomelum megalanthum (Woot. & Standl.) Rydb.
1/0 Peteria thompsonae Wats.
[Psoralea aromatica Pays.]
2/1 Psoralidium junceum (Eastw.) Rydb.
3/1 P. lanceolatum (Pursh) Rydb.
0/P Psorothamnus arborescens (Torr.) Barneby
2/2 P. fremontii (Torr.) Barneby
1/0 P. thompsonae (Vail) Welsh & Atwood
1/0 Sophora stenophylla Gray

FAGACEAE
2/1 Quercus gambelii Nutt.
1/0 Q. harvardii
1/W Q. turbinella Greene

GENTIANACEAE
1/1 Centaurium calycosum (Buckl.) Fern.
1/1 C. exaltatum (Griseb.) Wight
0/W Frasera albomarginata Wats.
1/1 F. paniculata Torr.

GERANIACEAE
1/1 *Erodium cicutarium (L.) L'Her.
0/P E. texanum Gray

GROSSULARIACEAE
0/W Ribes leptanthum Gray

HYDRANGEACEAE
[Fendlera rupicola Gray]

HYDROPHYLLACEAE
0/P Eucrypta micrantha (Torr.) Heller
[Nama densum Lemmon]
1/1 N. hispidum Gray
0/W N. retrorsum J.T. Howell
4/2 Phacelia crenulata Torr.
1/0 P. demissa Gray
1/0 P. heterophylla Pursh
0/W P. howelliana Atwood
4/1 P. ivesiana Torr.
0/W P. integrifolia Torr.
0/W P. mamillariensis Atwood
[P. pulchella Gray]
1/0 P. rafaelensis Atwood
0/P P. rotundifolia Wats.

JUNCACEAE
3/1 Juncus arcticus Willd.
1/+ J. articulatus L.
1/1 J. bufonius L.

2/2 J. ensifolius Wikstr.
[J. longistylis Torr.]
1/1 J. nodosus L.
1/1 J. tenuis Willd.
1/1 J. torreyi Cov.

JUNCAGINACEAE
[Triglochin concinna Davy]

LAMIACEAE
0/W Hedeoma drummondii Benth.
1/+ Lycopus americanus Barton
0/S *Marrubium vulgare L.
1/+ Mentha arvensis L.
2/0 Poliomintha incana (Torr.) Gray
1/0 Salvia dorrii (Kell.) Abrams

LEMNACEAE
0/P Lemna minuta H.B.K.

LILIACEAE (see ALLIACEAE, CALOCHORTACEAE, CONVALLARIACEAE, and MELANTHIACEAE)
1/1 Eremocrinum albomarginatum (Jones) Jones

LINACEAE
2/1 Linum aristatum Engelm.
1/0 L. perenne L.
1/1 L. subteres (Trel.) Winkler

LOASACEAE
3/2 Mentzelia albicaulis Hook.
0/A M. cronquistii Thompson & Prigge
2/1 M. multiflora (Nutt.) Gray
[M. obscura Thompson & Roberts]
2/2 M. pterosperma Eastw.

MALVACEAE
0/P Sphaeralcea ambigua Gray
2/1 S. coccinea (Pursh) Rydb.
2/1 S. grossulariifolia (H. & A.) Rydb.
0/W S. leptophylla (Gray) Rydb.
1/1 S. parvifolia A. Nels.
2/1 S. rusbyi Gray

MELANTHIACEAE
1/1 Zigadenus elegans Pursh
0/S Z. paniculatus (Nutt.) Wats.
1/0 Z. vaginatus (Rydb.) Macbr.

NYCTANGINACEAE
4/0 Abronia fragrans Hook.
0/W A. nana Wats.
2/1 Allionia incarnata L.

0/W Mirabilis alipes (Wats.) Pilz
2/1 M. multiflora (Torr.) Gray
2/1 Oxybaphus linearis (Pursh) Robins.
1/1 Tripterocalyx carneus (Greene) Galloway
1/W T. micranthus (Torr.) Hook.

OLEACEAE
1/+ Forestiera pubescens Nutt.
0/W Fraxinus anomala Torr.

ONAGRACEAE
1/1 Calylophus lavandulifolius (T. & G.) Raven
0/W Camissonia atwoodii Cronq.
1/1 C. boothii (Dougl.) Raven
1/W C. eastwoodiae (Munz) Raven
2/2 C. multijuga (Wats.) Raven
[C. parvula (Nutt.) Raven]
[C. scapoidea (T. & G.) Raven]
0/W C. walkeri (A. Nels.) Raven
2/1 Epilobium ciliatum Raf.
1/W Oenothera albicaulis Pursh]
2/2 O. caespitosa Nutt.
2/2 O. coronopifolia T. & G.
0/P O. cavernae Munz
[O. elata H.B.K.]
2/1 O. longissima Rydb.
1/1 O. pallida Lindl.

ORCHIDACEAE
1/1 Epipactus gigantea Dougl. ex Hook.
1/+ Habenaria zothecina Higgins & Welsh

OROBANCHACEAE
1/1 Orobanche fasciculata Nutt.
[O. ludoviciana Nutt.]

PAPAVERACEAE
2/1 Argemone corymbosa Greene
[A. munita Dur. & Helg.]
0/+ *Eschscholzia californica Cham.

PLANTAGINACEAE
0/P *Plantago lanceolata L.
2/1 *Plantago major L.
1/1 P. patagonica Jacq.
[P. purshii Roem. & Schult.]

POACEAE
0/W *Agropyrum cristatum (L.) Gaertn.
1/1 Agrostis stolonifera L.
1/1 Andropogon gerardii Vitman
1/1 A. glomeratus (Walt.) B.S.P.

1/0 Aristida arizonica Vasey
2/0 A. purpureus Nutt.
2/1 Bothriochloa barbinodis (Lag.) Herter
0/W B. laguroides (DC.) Herter
2/0 Bouteloua aristidoides (H.B.K.) Griseb.
2/1 B. barbata Lag.
2/1 B. curtipendula (Michx.) Torr.
1/0 B. eriopoda Torr.
2/0 B. gracilis (H.B.K.) Lag. ex Steud.
0/W *Bromus catharticus Vahl
0/P *B. diandrus Roth
0/P *B. japonicus Murray
2/1 *B. rubens L.
2/1 *B. tectorum L.
2/1 Calamagrostis scopulorum Jones
1/+ Cenchrus longispinnus (Hack.) Fern.
1/+ Cynodon dactylon (L.) Pers.
1/1 *Dactylis glomerata L.
2/1 Distichlis spicata (L.) Greene
1/1 Echinochloa crus-galli (L.) Beauv.
2/1 Elymus canadensis L.
1/1 E. elongatus (Host) Runem.
3/2 E. elymoides (Raf.) Swezey
1/1 E. salinus Jones
1/0 E. smithii (Rydb.) Gould
1/0 E. trachycaulis (Link) Gould ex Shinners
0/W E. triticoides Buckl.
[Enneapogon desvauxii Beauv.]
[Eragrostis pectinacea (Michx.) Nees]
1/1 Erioneuron pilosum (Buckl.) Nash
1/1 E. pulchellum (H.B.K.) Tateoka
2/1 Hilaria jamesii (Torr.) Benth.
[Hordeum jubatum L.]
0/W Imperata brevifolia Vasey
[Koeleria macrantha (Ledeb.) Schultes]
1/1 Lycurus phleoides H.B.K.
[Leptochloa fascicularis (Lam.) Gray]
1/0 Muhlenbergia andina (Nutt.) Hitchc.
2/0 M. asperifolia (Nees & Mey.) Parodi
1/1 M. pauciflora Buckl.
0/W M. porteri Scribn. ex Beal
2/1 M. pungens Thurb.
2/2 M. thurberi Rydb.
2/1 Munroa squarrosa (Nutt.) Torr.
[Oryzopsis micrantha (T. & R.) Thurb.]
2/1 Panicum acuminatum Swartz
2/0 P. capillare L.
1/1 P. obtusum H.B.K.
0/+ P. oligosanthes Schultes
2/2 P. virgatum L.
2/1 *Phleum pratense L.
2/2 Phragmites australis (Cav.) Trin. ex Steudel

0/P *Poa annua L.
0/P P. bigelovii Vasey & Scribn.
2/1 P. fendleriana
0/W P. secunda Presl.
2/2 *Polypogon monspeliensis (L.) Desf.
1/1 *Polypogon semiverticillatus (Forsskal) Hylander
[Puccinellia distans (L.) Parl.]
0/P *Saccharum ravennae (L.) Murray
1/1 *Schismus barbatus (L.) Thell.
1/0 Schizachrium scoparium (Michx.) Nash
[*Secale cereale L.]
1/1 Spartina gracilis Trin.
1/0 Sphenopholis obtusata (Michx.) Scribn.
1/+ Sorghastrum nutans (L.) Nash
[*Sorghum halapense (L.) Pers.]
0/S Sporobolus airoides (Torr.) Torr.
1/0 S. contractus A.S. Hitchc.
3/2 S. cryptandrus (Torr.) Gray
3/2 S. flexuosus (Thurb.) Rydb.
0/+ S. giganteus Nash
0/W Stipa arida Jones
3/1 S. comata Trin. & Rupr.
1/1 S. coronata Thurber
2/1 S. hymenoides R. & S.
1/1 S. neomexicana (Thurb.) Scribn.
1/1 S. speciosa Trin. & Rupr.
0/P Tridens muticus (Torr.) Nash
0/S Vulpia octoflora Walt.

POLEMONIACEAE
1/0 Eriastrum diffusum (Gray) Mason
0/P E. eremicum (Jeps.) Mason
2/0 Gilia aggregata (Pursh) Spreng.
2/0 G. congesta Hook.
2/1 G. gunnisonii T. & G.
1/1 G. hutchinsifolia Rydb.
1/1 G. inconspicua (Smith) Sweet
2/1 G. latifolia Wats.
3/1 G. leptomeria Gray
1/0 G. longiflora (Torr.) G. Don
1/0 G. polycladon Torr.
1/1 G. roseata Rydb.
2/1 G. subnuda Torr.
0/W Langloisia setosissima (T. & G.) Greene
1/1 Leptodactylon pungens (Torr.) Nutt.
1/1 L. watsonii (Gray) Rydb.
0/S Phlox austromontana Cov.
0/S P. hoodii Richards
[P. longifolia Nutt.]

POLYGALACEAE
2/2 Polygola acanthoclada Gray

1/S P. subspinosa Wats.

POLYGONACEAE
1/1 Chorizanthe brevicornu Torr.
2/1 Eriogonum alatum Torr.
1/1 E.bicolor Jones
2/0 E. cernuum Nutt.
5/1 E. corymbosum Benth.
1/1 E. deflexum Torr.
2/1 E. flexum Jones
[E. hookeri Wats.]
2/1 E. inflatum Torr. & Frem.
[E. insigne Wats.]
1/0 E. leptocladon T. & G.
2/1 E. leptophyllum (Torr.) Woot. & Standl.
2/1 E. microthecum Nutt.
0/A E. palmerianum Reveal
[E. salsuginosum (Nutt.) Hook.]
1/0 E. scabrellum Reveal
2/1 E. shockleyi Wats.
2/0 E. umbellatum Torr.
2/1 E. wetherillii Eastw.
0/A Polygonum aviculare L.
0/A *P. lapathifolium L.
1/+ *P. persicaria L.
1/0 Rumex hymenosepalus Torr.

PORTULACACEAE
1/1 *Portulaca oleracea L.
2/1 P. parvula Gray
1/1 Talinum brevifolium Torr.
[T. parviflorum Nutt.]

POTAMOGETONACEAE
1/+ Potamogeton nodosus Poir.
1/1 P. pusillus L.
[P. foliosus Raf.]

PRIMULACEAE
2/1 Primula specuicola Rydb.

RANUNCULACEAE
0/W Anemone tuberosa Rydb.
2/1 Aquilegia micrantha Eastw.
2/2 Clematis ligusticifolia Nutt.
1/1 Delphinium andersonii Gray
[D. nuttallianum Pritz.]
0/+ Ranunculus cymbalaria Pursh

RHAMNACEAE
1/1 Ceanothus greggii Gray
2/1 Rhamnus betulifolia Greene

ROSACEAE

0/+ Amelanchier alnifolia Nutt.
3/2 A. utahensis Koehne
2/1 Cercocarpus intricatus Wats.
0/W C. montanus Raf.
1/0 Coleogyne ramosissima Torr.
3/1 Fallugia paradoxa (D. Don) Endl.
0/S Holodiscus dumosus (Nutt.) Heller
1/1 Petrophytum caespitosum (Nutt.) Rydb.
0/W Prunus virginiana L.
3/1 Purshia mexicana (D. Don) Welsh
0/W P. tridentata (Pursh) Dc.
2/0 Rosa woodsii Lindl.
2/2 Rubus neomexicanus Gray

RUBIACEAE

1/W Galium bifolium Wats.
1/1 G. multiflorum Kell.
1/1 G. trifidum L.
1/+ G. triflorum Michx.

RUTACEAE

1/1 Thamnosma montana Torr. & Frem.

SALICACEAE

4/1 Populus fremontii Wats.
1/1 Salix amygdaloides Anderss.
2/1 S. exigua Nutt.
1/+ S. goodingii Ball
[S. laevigata]
1/1 S. lutea Nutt.

SANTALACEAE

1/0 Commandra umbellata (L.) Nutt.

SCROPHULARIACEAE

2/1 Castilleja chromosa A. Nels.
2/1 C. linariifolia Benth.
1/1 C. scabrida Eastw.
3/1 Cordylanthus wrightii Gray
2/1 Mimulus eastwoodiae Rydb.
1/1 M. floribundus Lindl.
0/W M. glabratus H.B.K.
1/0 M. guttatus DC.
2/1 Pedicularis centranthera Gray
1/1 Penstemon ambiguus Torr.
0/W P. angustifolius Pursh
0/S P. barbatus (Cav.) Roth.
3/1 P. comarrhenus Gray
1/0 P. cyanocaulis Payson
2/1 P. eatonii Gray
1/0 P. lentus Pennell

1/1 P. palmeri Gray
2/0 P. rostriflorus Kellogg
1/0 P. strictus Benth.
1/1 P. utahensis Eastw.
1/+ *Veronica anagallis-aquatica L.

SOLANACEAE
2/1 Datura meteloides Dunal
1/1 D. wrightii Regel
2/1 Lycium andersonii Gray
0/W L. torreyi Gray
2/0 Nicotiana attenuata Torr.
1/1 N. trigonophylla Dunal
[Solanum elaeagnifolium Cav.]
0/+ *Solanum rostratum Dunal
0/W S. triflorum Nutt.

TAMARICACEAE
3/1 *Tamarix ramosissima Ledeb.

TYPHACEAE
2/2 Typha domingensis Pers.
1/A T. latifolia L.

ULMACEAE
2/1 Celtis reticulata Torr.

URTICACEAE
1/1 Parietaria pennsylvanica Willd.

VERBENACEAE
[Phyla cuneifolia (Torr.) Greene]
1/1 Verbena bracteata Lag. & Rodr.

VIOLACEAE
1/+ Viola sp.

VISCACEAE
[Arceuthobium divaricatum Engelm.]
1/0 Phorodendron juniperinum Gray

VITACEAE
1/1 Parthenocissus vitacea (Knerr) Hitchc.

ZANNICHELLIACEAE
0/P Zannichellia palustris L.

ZYGOPHYLLACEAE
1/0 *Tribulus terrestris L.

This list totals 646 species known from Glen Canyon NRA. Introduced species

account for 45 (6%). Of the total, 281 species (43%) are either not yet represented in the herbarium (154 species, 23%), or are represented by specimens from outside Glen Canyon N.R.A. (127 species, 20%). Most importantly, several listed or candidate T&E species are not represented in the herbarium, including Camissonia atwoodii, Cymopterus acaulis var. higginsii, and Pediocactus bradyi among others.

Three species are excluded from the flora. These are listed below with the reasons for rejecting them.

Adiantum pedatum L. Reported in Woodbury (1958), this is a misidentification. The species is found along the Wasatch Front in Utah, Zion National Park, and the upper Escalante River. It may eventually be found in Glen Canyon NRA.

Eriogonum brachypodum T. & G. A Mojave desert species found in creosote vegetation, this is unlikely to be found in Glen Canyon N.R.A. No specimen exists.

Juniperus monosperma (Engelm.) Sarg. This species is reported in Woodbury (1958), but is a misidentification. The species is known from a single locality in San Juan county in Utah.

3. SUMMARY OF 1992 FLORA COLLECTIONS

During the 1992 field season (April-September) ca. 150 numbers were collected. Most of these consist of duplicates, and the number of herbarium sheets will be ca. 250. These have been processed and shipped to the Deaver Herbarium, Northern Arizona University. Dr. Tina Ayers of the herbarium has agreed to confirm identifications, and properly label and mount the specimens on herbarium sheets for placement in the park herbarium. Duplicates will be retained at the Deaver Herbarium.

4. FUTURE WORK

Some areas of Glen Canyon NRA are either poorly known, or have high potential for harboring additional species. Additional collecting in the following areas would be particularly fruitful (time of best collecting).

Clay Hills (spring): a rich annual flora exists at the site (based on the herbarium and Welsh 1984), and future collecting will probably locate additional species.

Muley Point (spring-summer): the presence of the rare desert mountain lover, *Ceanothus greggii*, at this site suggests the possible presence of other interesting species.

Purple Hills (spring): as pointed out by Welsh (1984) and Heil (1992), this area remains poorly known. A wide diversity of substrates occurs in the area.

Kaiparowits Plateau (summer): the highest elevations in Glen Canyon NRA. occur here, and the end of the plateau around Navajo Point remains poorly collected because of difficulty of access.

Western boundary (Nipple Bench to Paria River; spring): recently two listed T&E species, *Asclepias welshii* and *Iris pariensis*, have been reported from areas near the western boundary of Glen Canyon NRA. The clay badlands and dune areas along the western boundary may produce many additional species new to the park.

Lee's Ferry area (early spring-summer): the rich hot desert flora which extends up to Lee's Ferry has the potential to produce additional species, especially in annuals.

Introduced species are not well collected, and future collecting in the Wahweap, Lee's Ferry, and Bullfrog areas will probably add many adventives to the flora. I have seen several adventives not reported from Glen Canyon NRA during cursory searches around Wahweap.

During field work in 1991 and 1992, bryophytes were collected (ca. 30

numbers) from two habitats in Glen Canyon NRA, hanging gardens and the Douglas fir tree stand in upper Miller' Creek. Bryophytes remain poorly known in southern Utah (Spence 1988), and the potential for species new to the region is high (cf. Spence 1991). Eventually it would be useful to produce a list of the bryophytes of the park. Lichens are less well known, and because of technical difficulties in identification, will probably remain poorly known for the forseeable future.

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