

## ADDITIONS TO THE FLORA OF GRAND CANYON NATIONAL PARK - I

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### ABSTRACT

Recent floristic surveys of the Grand Canyon region in northern Arizona and curation of the Deaver Herbarium have resulted in 35 new species records for Grand Canyon National Park. These species represent 13 families and 31 genera. Ten records are new, non-natives species. One of these, *Lepidium latifolium*, is widespread in Utah but in Arizona it is currently known only from the Grand Canyon. It is listed as a noxious weed in a number of western states and can be expected to colonize portions of Lake Mead and eventually the Lower Colorado River region.

### INTRODUCTION

Over the past several years, renewed attention has been directed to various aspects of the vegetation of the Grand Canyon, particularly along the Colorado River corridor. With funding provided by the Bureau of Reclamation and the National Park Service, researchers employed by Grand Canyon National Park, Northern Arizona University, and the Hualapai tribe have established permanent study quadrats along the river corridor throughout Grand and Marble Canyons. These quadrats have been established as part of a long-term program to monitor vegetation that may be affected by the operation of Glen Canyon Dam. Recent collections have not been restricted to these plots and many have been made in areas outside their immediate vicinities as well as in random locations surveyed throughout the river corridor.

Identification of these new collections, as well as the curation of older collections housed at the Deaver Herbarium at Northern Arizona University (ASC) and the Museum of Northern Arizona (MNA), has led to the discovery of taxa for Grand Canyon National Park (GCNP) unknown to previous workers. The recovery

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of a list compiled by James Rominger concerning collections at ASC made in the late 1960's from near the rim of the Grand Canyon, possibly around old ranching or mining sites, also yielded a few new records.

Most of the botanical surveys completed to date (for summary see Phillips, et al. 1987, Johnson 1991 for summary) focused on well-known trails from rim to river or along the river corridor. Most of the collections noted here also represent populations that occur in well-visited sites and most were recorded within a few tens of meters above the river or along larger perennial or ephemeral tributaries. Because Grand Canyon National Park encompasses 485,000 hectares, has an elevational gradient of 2410 meters, and most of that area is relatively isolated and unvisited, these records should not be viewed as the final additions to a completely known flora. Many more new reports await discovery in the Park.

### MATERIALS AND METHODS

Most of the collections were made in conjunction with censuses of long term quadrats (LTQ's) or other botanical surveys along the Colorado River corridor and its tributaries in the Grand Canyon. Identifications were checked against standard descriptions in Cronquist et al. (1977, 1984, 1989), Gould (1973), Hickman (1993), McDougall (1973), and Welsh (1994). Specimens were also compared to material at ASC, ASU, MNA and MO. None of the taxa reported here were included in Phillips et al. (1987) as synonyms. Nomenclature follows that of Lehr (1978), Lehr and Pinkava (1980, 1982) or more recent treatments. Habit, locality including Colorado River mile (CRM) downstream from Lees Ferry, Arizona, side of river (looking downstream), habitat information, and time of flowering are listed for each new report when available. River miles follow those used in Stevens (1983); place names follow those in Stevens (1983) and Brian (1992). All specimens are currently housed at ASC, except *Calliandra humilis* and *Psoralidium junceum*, which represent unicates collected by National Park Service staff, and are housed at GCNP. Duplicates will be distributed to the following herbaria: ARIZ, ASU, and GCNP.

### RESULTS AND DISCUSSION

A total of 35 species in 13 families and 31 genera are reported as new to Grand Canyon National Park (Appendix 1). Of these species 25 are native, 10 are non-native. Twenty-five species are herbaceous dicots, nine are grasses and one is a rush. Six of the herbaceous dicots and four of the grasses are non-native. Thirteen of the 25 native species are perennials and 12 are annuals. The populations of perennials should persist and be easy to relocate but the reports of the annual species with rare exception (*Aster subulatus* Michx. is abundant) are based on few individuals and they may be extirpated at those localities. One new report, *Boehmeria cylindrica* (L.) Sw., represents the fourth extant population of the species in Arizona (see Landrum et al. 1992).

Of the ten non-native species, two are introduced from tropical America, six from Eurasia, and one each from the eastern Mediterranean and Africa. Most are well known in the Southwest (Whitson 1992). Four of the six non-native dicots are annuals and two are perennials. All four of the non-native grasses are perennials. Of these newly reported non-natives, *Lepidium latifolium* L. has the potential to become a serious threat and has already been declared noxious in a number of western states (Whitson 1992). It is widespread in Utah but known in Arizona only from the Grand Canyon (Ayers and Stevens, 1994). It should be expected to colonize portions of Lake Mead and eventually the Lower Colorado River region. *Lepidium latifolium* appears to be extremely fecund and can establish beneath existing canopies. It is a rapid colonizer and extremely difficult to control because of its deep rootstocks and ability to produce rhizomes as well as hundreds of seeds that are sticky when wet. Like two other invasive non-natives from the eastern Mediterranean, Tamarisk (*Tamarix chinensis* Lour.) and Camel Thorn (*Alhagi pseudalhagi* (M. Bieb.) Desv., *L. latifolium* appears to thrive in the Southwest. Every effort should be made to eradicate it from the Colorado river corridor before it becomes a permanent and dominant member of our flora.

The African Weeping Lovegrass, *Eragrostis curvula* (Schrader) Nees, appears to be rapidly colonizing sandy beaches and, as a C4 grass, may have a significant advantage in the moist, hot environment of the river corridor. Future flooding of the Paria River or possible high flows from Glen Canyon Dam may

spread this grass throughout the river corridor. Other "weedy" C4 grasses that are colonizing sandy beaches and developing wetlands include *Paspalum dilatatum* Poir. (reported here), *Sorghum halepense* (L.) Pers., *Cenchrus incertus* M. Curtis, and *Setaria glauca* (L.) Beauv.

Non-native weeds reported here and previously are often found in channel margins, sandbars, and developing wetland habitats (Stevens *et al.* in press). Sources include direct introductions (e.g., *Cynodon dactylon* (L.) Pers. at Lees Ferry and in Bright Angel and Havasu creeks), or hydrochorous dispersal from the larger tributaries (e.g., *Alhagi pseudalhagi* through the Little Colorado River drainage). Only in the case of *Tamarix chinensis* is there evidence of upstream, aeolian dispersal into small tributaries. Occasional post-dam flooding events have led to the system-wide colonization of some non-natives (e.g., Ravenna Grass, *Saccharum ravennae* (L.) Murray). Planned high flows, which are to be used for restoration of fluvial landforms (Stevens and Ayers 1993), may result in dispersal or localized extirpation of some non-native species. In addition, the National Park Service is attempting to manage the Colorado River corridor vegetation away from non-native species by selected removal of some species (e.g., *Saccharum ravennae*). If successful, this management strategy will reduce the threat of non-native species invasion into the many pristine tributaries and springs in this national park.

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## APPENDIX I

## Magnoliopsida (Dicots)

## Amaranthaceae

\**Amaranthus albus* L. **Tumble Pigweed** Annual herb; rare on upstream side of Kanab Creek mouth, CRM 143.5R; in rocky/sandy shoreline between 790-1150 m<sup>3</sup>/s stage elevation, 730 m (L. E. Stevens s.n.); June; native to tropical America.

## Apiaceae

\**Contioselinum scopulorum* (A. Gray) Coult. & Rose **Hemlock Parsley** Perennial herb; road to Swamp Point, near Kanabownits Spring, 2500 m (R. E. Collom 2320); July; naturalized from Eurasia.

## Asteraceae

\**Anthemis cotula* L. **Mayweed, Dog Fennel** Annual herb; Buggeln Ranch [South Rim, N of Grandview] (R. E. Collom 1078); July; cosmopolitan weed, naturalized from Eurasia.

*Aster subulatus* Michx. var. *ligulatus* Shinnery [A. *exilis* Elliott] Erect annual; common and widely distributed on silty banks and in marshes below 800 m<sup>3</sup>/s stage elevation, CRM 43-194, 485-975 m (L. E. Stevens s.n.); August-October.

*Senecio hartianus* A. Heller **Rhizomatous perennial herb**; Little Dutchman (R. E. Collom 2076); July.

*Senecio mohavensis* A. Gray **Winter annual**; locally common in sand along floor of steep, open drainage at CRM 238.3L, 400 m (A. M. Phillips, III 93-62); April; apparently a range extension from the lower Colorado River Valley.

*Verbesina encelioides* (Cav.) Benth. & Hook. var. *exauriculata* Robinson & Greenman. **Crownbeard**. Erect annual herb; Navajo Falls, Havasu Canyon (C. F. Deaver 1480); July-October.

*Zinnia grandiflora* Nutt. **Prairie Zinnia** Perennial herb; locally common in lower Supai Group in sand on S side of Cardenas Butte along Tanner Trail, 1740 m (L. E. Stevens s.n.); September.

## Brassicaceae

\**Hutchinsia procumbens* (L.) Desv. **Winter annual**; locally common in sand along floor of steep, open drainage at CRM 238.3L, 400 m (A. M. Phillips, III 93-60); April; naturalized from Europe.

\**Lepidium latifolium* L. **Clonal perennial herb**; common in moist sand on beaches in return channels and along rocky shorelines, 500-1100 m<sup>3</sup>/s stage elevation, CRM 24.5-194, 470-890 m (L. E. Stevens s.n.); May-July; reported as a new state record by Ayers and Stevens (1994); invasive weed from the eastern Mediterranean region.

## Chenopodiaceae

*Chenopodium berlandieri* Moq. var. *zschackei* (Murr) Murr **Annual herb**; Cape Royal, near Indian Ruins, 2400 m (R. E. Collom s.n.); July; annotated by H.A. Wahl, 1965.

*Chenopodium glaucum* L. ssp. *salinum* (Standl.) Aellen **Annual herb**; in moist fine sand adjacent to river, at upstream end of a reattachment bar, CRM 55.5, 850 m (L. E. Stevens s.n.); September.

\* denotes non-native species; nomenclature follows Lehr (1978), Lehr and Pinkava (1980, 1982) or Hickman (1993); month refers to flowering period.

\**Kochia scoparia* (L.) Schrad. **Summer Cypress** Annual herb; rare in return current channel marsh at the upstream end of sand bar, CRM 194L, 485 m (L. E. Stevens s.n.); August; naturalized from Eurasia.

#### Euphorbiaceae

*Croton texensis* (Klotzsch) Muell. Arg. in DC. **Dove Weed** Annual herb; in coarse sand, CRM 122-123L at 990-1275 m<sup>3</sup>/s stage elevation, 640 m (L. E. Stevens s.n.); September-October.

*Reverchonia arenaria* A. Gray Erect annual herb; rare in a channel margin sand bar at 790 m<sup>3</sup>/s stage elevation near CRM 142R, 580 m (L. E. Stevens s.n.); June; only staminate plants found.

#### Fabaceae

*Astragalus episcopus* S. Watson Perennial herb; rare in sand among boulders on beach at mouth of Bridge Canyon, CRM 235L, 375 m (A. M. Phillips, III 93-31); April.

*Astragalus preussii* A. Gray var. *preussii*. **Desert Milkvetch** Robust perennial; one mile below Lee's Ferry, 1150 m (E. Hall 3-67); March.

*Calliandra humilis* Benth. Perennial herb; Long Jim Canyon, SE slope on sandstone outcrop, T30N, R3E, south-central S 4 (T. Taylor s.n.); May.

*Lupinus arizonicus* S. Watson. Winter annual; uncommon on gravelly stream and talus deposits along floor of Separation Canyon about 100 m from river, CRM 239.5R, 365 m (A. M. Phillips, III 92-73); April.

*Psoralidium junceum* (Eastw.) Rydb. (*Psoralea juncea* Eastw.). Rhizomatous perennial herb; in sand at 710 m<sup>3</sup>/s stage elevation, below Bedrock Rapids, CRM 131.2R, 600 m (N. Brian s.n.); May.

#### Gentianaceae

*Gentiana affinis* Griseb. Perennial herb; Buck Springs Ranger Station, 2250 m (R. E. Collom 632); September.

#### Polygonaceae

*Polygonum lapathifolium* L. **Willow Smartweed** Annual herb; uncommon along shoreline, marshes, and wet sand below 800 m<sup>3</sup>/s stage elevation at mouth of Kanab Creek (CRM 143R) to CRM 254R, 370-570 m (A. M. Phillips, III 92-05; L. E. Stevens s.n.); August-October.

#### Scrophulariaceae

*Penstemon palmeri* A. Gray subsp. *eglandulosus* Keck Erect perennial herb; beyond Miner's cabins, Havasu Canyon (C. F. Deaver 2069); May; annotated by F. S. Crosswhite, 1969.

*Penstemon subulatus* M. E. Jones Erect perennial herb; Bright Angel Trail, 1070 m (E. Kolle s.n.); April; possibly first collection from Coconino Co.

#### Urticaceae

*Boehmeria cylindrica* (L.) Sw. **Bog-hemp** Rhizomatous perennial herb; riverside seep at ca 990 m<sup>3</sup>/s stage elevation, dominated by *Mimulus cardinalis*, CRM 37.4R, 870 m (L. E. Stevens s.n.); August-September; apparently fourth extant locality in Arizona (see Landrum *et al.* 1992).

#### Liliopsida (monocots)

#### Juncaceae

*Juncus xiphioides* E. Mey. Perennial herb from creeping rhizome; mouth of Deer Creek, CRM 136R, 595 m (L. E. Stevens s.n.); June.

**Poaceae**

- \**Agropyron desertorum* (Fisch.) Schult. **Desert Crested Wheatgrass** Tufted perennial; alluvial sand/cobble in new high water zone, mouth of ephemeral drainage in Buckfarm Canyon, CRM 41R, 850 m (M. Yard 830627-1); June; native to eastern Europe.
- Andropogon gerardi* Vitman. var. *paucipilus* (Nash) Fernald **Sand Bluestem** Tufted perennial; silty fine sand in return current channel at waters edge (710 m<sup>3</sup>/s stage elevation), CRM 194L and 254.6R, 400-490 m (L. E. Stevens s.n.); July-September.
- Chloris virgata* Sw. **Feather Fingergrass** Annual; moist sand in riparian channel margin and marshes, Lees Ferry Ramp to CRM 51.5L, 149.5R, 194L, 470-850 m (L. E. Stevens s.n.; M. Yard 831017-1B); September-October.
- Diplachne uninervia* (C. Presl) Parodi **Mexican Sprangletop** (*Leptochloa uninervia* (C. Presl) Hitchc. & Chase). Tufted annual; silty terraces at CRM 136.6R, Parashaunt Canyon (CRM 198.5R) and sandy beaches 254R-266.5R, 365-590 m (L. E. Stevens s.n.; M. Yard 831005-1A); July-October.
- \**Eragrostis curvula* (Schrad.) Nees **Weeping Lovegrass** Tufted perennial; cobble bar below Lees Ferry at CRM 0.4R to CRM 43.1L, 870-1150 m (L. E. Stevens s.n.); May-June; naturalized from Africa.
- Eriochloa lemmoni* Vasey and Scribn. var. *lemmoni* **Small Southwestern Cupgrass** Annual; alluvial sand at old high water line, 0.4 km above mouth of Bright Angel Creek, CRM 87.8, 740 m (M. Yard 840909-1); September.
- Muhlenbergia racemosa* (Michx.) Britton, Sterns, Poggenb. **Green Muhly** Perennial from long scaly rhizomes; sandy soil at new high water zone, mouth of Crystal Creek, CRM 98.1, 710 m (M. Yard 830910-2B); September.
- \**Paspalum dilatatum* Poir. **Dallis Grass** Perennial from short rhizomes; rare in silty fine soil of return current channel marsh at 700 m<sup>3</sup>/s stage elevation, CRM 194L, 470 m (L. E. Stevens s.n.); October; native to South America
- \**Puccinellia distans* (L.) Parl. **European Alkali Grass** Perennial; in silty fine soil of return current channel marsh at 700 m<sup>3</sup>/s stage elevation, CRM 194L, 470 m (L. E. Stevens s.n.); September; native to Eurasia.