

**REPORT ON THE CONSERVATION STATUS OF  
*CALOCHORTUS NITIDUS***

by

Michael Mancuso  
Conservation Data Center

February 1996

Idaho Department of Fish and Game  
Natural Resource Policy Bureau  
600 South Walnut, P.O. Box 25  
Boise, Idaho 83707  
Jerry M. Conley, Director

Status Survey Report prepared for  
Idaho Department of Parks and Recreation  
through Section 6 funding from  
U.S. Fish and Wildlife Service, Region 1

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*CALOCHORTUS NITIDUS***

**Taxon Name:** *Calochortus nitidus* Dougl.

**Common Names:** Broad-fruit mariposa lily

**Family:** Liliaceae

**States Where Taxon Occurs:** U.S.A.; Idaho, Washington

**Current Federal Status:** Category 1 Candidate

**Recommended Federal Status:** 3c

**Authors of Report:** Michael Mancuso

**Original Date of Report:** June 30, 1988

**Date of Most Recent Revision:** February 9, 1996

**Individual to Whom Further  
Information and Comments  
Should be Sent:**

Robert K. Moseley  
Conservation Data Center  
Idaho Dept. Fish and Game  
P.O. Box 25  
Boise, ID 83707

## ABSTRACT

*Calochortus nitidus* (broad-fruit mariposa lily) is a perennial forb with a single broad, flat basal leaf and showy flowers. Bulbs do not produce above ground tissue every year. This species is endemic to the Palouse Prairie of eastern Washington and adjacent Idaho, extending southward and eastward to confluent portions of west-central Idaho, an area approximately 100 miles long and wide. Extensive historic populations are assumed to have been destroyed during the rapid conversion of the prairie grasslands to crop agriculture, beginning more than a century ago. Remaining prairie sites are too steep or rocky to plow. Most extant populations occur along the grassy ridges, canyon rims and upper slopes, or openings in nearby dry conifer woodlands, peripheral to the prairie grasslands.

In Idaho, 16 occurrences are known to be extirpated due to habitat destruction or degradation. Ten occurrences have not been observed in recent years and are considered historical. It is thought that one occurrence may be based on an erroneous report. Of the 96 known extant occurrences in Idaho, 34 are comprised of less than 50 individuals and often persist in areas of fragmented and/or degraded habitat. Large, vigorous populations are concentrated in four areas - Craig Mountain, the Joseph Plain, the Cold Spring Mountains, and the upper Whitebird to Slate creek drainages south of Grangeville. Populations in these areas are located largely on public lands, except for the Joseph Plain. Four historical occurrences in Washington are known or assumed extirpated. A population was discovered in Asotin County in August 1995, and is the only known extant site in the state. *Calochortus nitidus* is not known from Oregon.

Most extant populations are located in areas open to livestock grazing. The cumulative direct and indirect effects of livestock grazing continues to threaten many populations, although most habitat depletion observed today is not of recent origin. Reduced reproductive success due to flower and fruit herbivory and trampling are examples of direct effects. Disturbance and the associated establishment of invasive weedy species is one example of the indirect effects. Road construction, rock quarrying, logging operations, and urban and rural developments have led to more localized habitat loss or depletion.

Despite these problems, I do not believe *Calochortus nitidus* warrants listing as a Threatened or Endangered Species at this time. I recommend its C1 status be changed to 3c or its equivalent. The rationale for this recommendation is based on several factors: (1) the persistence of many populations, including more than a dozen large and vigorous ones in areas of relatively intact native vegetation, (2) large populations with a high probability of long-term viability are found in four separate areas, (3) public lands dominate three of these areas and provide the opportunity for conservation measures among possible management options, and (4) several conservation measures have already been implemented for some populations. I agree with an earlier assessment that if public agencies act in a directed and timely manner, the long-term viability of *Calochortus nitidus* can be maintained.

I recommend the U.S. Fish and Wildlife Service prepare a rangewide Conservation Strategy for *Calochortus nitidus* that specifies conservation actions, responsible parties, and a timetable for their implementation. Several documents, such as the Species Management Guide for populations on the Nez Perce National Forest and Hells Canyon National Recreation Area, as well as an Action Plan for populations on the Clearwater National Forest and a Conservation Agreement for a population on BLM land, can form the framework for this recommended Conservation Strategy.

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## I. Species Information.

### 1. Classification and nomenclature.

#### A. Species.

##### 1. Scientific name.

a. **Binomial:** *Calochortus nitidus* Dougl.

b. **Full bibliographic citation:** Trans. Hort. Soc. Lond. 1828. 7:277, pl. 9A.

c. **Type specimen:** The original material collected by Douglas is located at K (Kew Herbarium) and BM (The Natural History Museum), both in England, United Kingdom.

2. **Pertinent synonym(s):** *Cyclobothra nitida* Kunth., *Calochortus pavonaceus* Fern. and *Calochortus douglasianus* Schult.

3. **Common name(s):** Broad-fruit mariposa; broad-fruit mariposa lily.

4. **Taxon codes:** PMLIL0D0Y0 (Association of Biodiversity Information and The Nature Conservancy).

5. **Size of genus:** Approximately 60 species of western North America, from Canada to Guatemala (Ownbey 1969).

#### B. Family classification.

1. **Family name:** Liliaceae.

2. **Pertinent family synonyms:** None.

3. **Common name(s) for family:** Lily.

C. **Major plant group:** Monocotyledonea (Class Liliopsida).

D. **History of knowledge of taxon:** This species was first collected by David Douglas in the early 19th century in what is now Washington state (Henderson 1900). Most early collections were from the Palouse region in areas that have subsequently been converted to cropland. *Calochortus nitidus* appeared in the Smithsonian Institute's original list of Threatened species in the United States (Ayensu and DeFilipps 1978). Based on regional herbarium records, *Calochortus nitidus* was known from 22 Idaho collections prior to 1980. Johnson (1977) was aware of 12 of these when he recommended maintaining *Calochortus nitidus* on the proposed federal Threatened list. At this time he commented that validated collection and field data were urgently needed. Four years later, with the availability of more collection, habitat and distribution data, Johnson (1981) recommended the status be changed to the federal Watch List. Johnson remarked that the western portion of the species range in Whitman County, Washington, was recently searched without success (Johnson

1981).

Between 1980 and 1989, *Calochortus nitidus* was discovered at over 40 new sites in Idaho. Most of these new occurrences were associated with field inventories conducted by Steve Caicco with the Idaho Natural Heritage Program (now the Idaho Conservation Data Center; Caicco 1987; 1988a; 1988b). When Caicco (1988a) compiled the original status report for *Calochortus nitidus* there were 38 extant and 12 extirpated occurrences for *Calochortus nitidus* in Idaho (Caicco 1988a). Also reported are 13 other occurrences of unknown status, either because they had not been observed in many years, had ambiguous or incomplete location information, or were suspected to be based on an erroneous report. The number of *Calochortus nitidus* occurrences in Idaho has approximately doubled since 1990, as a result of more intensive and systematic field surveys conducted by botanists associated with the Nez Perce and Clearwater national forests (NF), the Bureau of Land Management's (BLM) Cottonwood Resource Area, The Nature Conservancy at their Garden Creek Preserve on Craig Mountain, and the Idaho Conservation Data Center (CDC) at Craig Mountain (Mancuso and Moseley 1994) and Hells Canyon National Recreation Area (Mancuso and Moseley 1991).

In order to prepare a Habitat Management Plan for *Calochortus nitidus*, a life history and population dynamics study was initiated in 1988 (Caicco 1988c). A Species Management Guide was completed in 1992 (Caicco 1992). Additionally, an action plan was proposed for populations occurring on the Clearwater NF (Lorain 1991).

In Washington, *Calochortus nitidus* has been reported from Whitman and Garfield counties. In their status report for Washington, Kennison and Taylor (1979) reported that *Calochortus nitidus* had not been collected or seen in the state since 1965, and may be extirpated. A 1994 field inventory conducted by the Washington Natural Heritage Program in eastern Washington failed to relocate new or any of the state's four historical populations (Baxter and Gamon 1995). The first known extant population of *Calochortus nitidus* in Washington was discovered in Asotin County, in August 1995, by Scott Riley with the Umatilla NF. Further surveys by the Forest are scheduled for 1996. No populations have been reported for Oregon.

**E. Comments on current alternative taxonomic treatment(s):** *Calochortus* is segregated from Liliaceae in some treatments under the family name of Calochortaceae.

Many authors up to and including Ownbey (1940) have referred specimens of *Calochortus eurycarpus*, a related, but distinct species, to *C. nitidus*. This has caused a lot of confusion over the proper application of the name *C. nitidus*, although not about the delimitation of the two species. Examination of the type collection of *C. nitidus* material by Ownbey has clarified the proper application of this name (Ownbey 1969).

## **2. Present legal or other formal status.**

**A. International:** None.

**B. National.**

**1. Present designation of proposed legal protection or regulation:** *Calochortus nitidus* appears

in the 1980 and 1985 Notices of Review for candidate plants as a category 2 species (U.S. Fish and Wildlife Service 1980; 1985). In the 1990 and 1993 Notices of Review, it is a category 1 candidate (U.S. Fish and Wildlife Service 1990; 1993). A U.S. Department of Interior Memorandum dated November 20, 1995, updates the federal candidate species list (U.S. Fish and Wildlife Service 1995). Along with all other former C1 candidate plant species occurring in Idaho (except one), *Calochortus nitidus* has been moved to the "species of concern" list. The Notice of Review reporting these changes to the federal candidate list has not been published yet, although it was reportedly due by the end of 1995. *Calochortus nitidus* was party to the out-of-court settlement regarding the Lujan vs. Fund for Animals et al. lawsuit (U.S. Fish and Wildlife Service 1992). Among other requirements, this settlement directed the Service to decide on the listing disposition of all federal candidate species listed in the suit by September 30, 1996.

**2. Other current formal status recommendations:** *Calochortus nitidus* is a U.S. Forest Service Regions 1 and 6 Sensitive species (Conservation Data Center 1994; Brooks et al. 1991). The Association of Biodiversity Information (International Association of Natural Heritage Programs and Conservation Data Centers) ranks *Calochortus nitidus* G3. This rank includes taxa that are rare or uncommon, but not imperiled (Conservation Data Center 1994). The Idaho Native Plant Society maintains *Calochortus nitidus* on its list of current and recommended Federal Candidate Species, which includes all globally rare and threatened plant taxa in Idaho (Idaho Native Plant Society 1995).

**3. Review of past status:** In his original review for the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council, Fred Johnson (1977) recommended *Calochortus nitidus* be maintained on the proposed federal Threatened list. Johnson (1981) later revised his recommendation to instead place the species on the federal Watch list. The federal Watch List included those taxa in Idaho that were globally rare and could potentially become threatened, but had no apparent threats to their survival. It was also recommended as Endangered on the basis of its status in Washington (Kennison and Taylor 1979).

#### **C. Idaho.**

**1. Present designation or proposed legal protection or regulation:** None.

**2. Other current formal status recommendation:** The Conservation Data Center has assigned *Calochortus nitidus* a state rank of S3. This is the same as the global (G) rank (Conservation Data Center 1994).

**3. Review of past status:** None.

#### **D. Washington.**

**1. Present designated or proposed legal protection or regulation:** None.

**2. Other current formal status recommendation:** This species is considered possibly extinct or extirpated in Washington (Washington Natural Heritage Program 1994). Because a population of *Calochortus nitidus* was recently discovered in Asotin County, this designation will have to be changed when the *Washington Endangered, Threatened and Sensitive Vascular Plants of*

Washington booklet is next updated. No recommendation was made upon completion of the species' status in Washington (Baxter and Gamon 1995).

**3. Review of past status:** *Calochortus nitidus* was initially on the "Rare and Endangered Plant Species Task Force Working List" in 1977, compiled by Melinda Denton and Art Kruckeberg. It has been considered to be possibly extirpated by the Washington Natural Heritage Program since 1981 (Baxter and Gamon 1995).

### 3. Description.

**A. General non-technical description:** A perennial herb from a deep seated bulb. Stems are erect, 8-16 inches tall, and usually with a single reduced leaf about midway. There is a single broad, flat basal leaf approximately 1 inch wide. The one to four flowers per plant are large and showy. Petals are light to rich lavender and each one has a deep purple crescent above a triangular to crescent shaped gland. The fruit is an erect capsule, elliptic to nearly circular in outline, with three distinct wings (Caicco 1988a).

**B. Technical description:** Stem erect, 2-4 dm tall, usually with a single reduced cauline leaf about midway, simple, sub-umbellately 1- to 4-flowered; basal leaf flat, 1-3 dm long, 10-25 mm broad, tapering towards both ends, becoming involute, not exceeding the inflorescence; bracts two or more, narrowly lanceolate to linear, long-attenuate, 2-10 cm long, unequal; flowers erect, large and showy, purplish, with a deep purple crescent on each petal above the gland; sepals shorter than the petals, ovate to lanceolate, less ciliate laterally and sparingly invested above the gland with long flexuous hairs; gland more or less triangular-lunate, slightly depressed, bounded below with a narrow, deeply fringed membrane and covered with short, thick processes, both processes and membrane fringe densely beset with long papillae; anthers oblong, obtuse, 6-10 mm long, shorter than the filaments; ovary 3-winged, contracted to a short style and a persistent, trifid stigma; fruit elliptic to nearly orbicular, 3-winged, erect; seeds straw-colored. N=20 (Ownbey 1969).

**C. Local field characters:** Diagnostic characteristics include the large, showy, lavender petals, each with a deep purple crescent above the gland, the erect, distinctly three-winged capsules that are elliptic to nearly circular in outline, and a single, broad, flat basal leaf that is blue-green in color.

**D. Similar looking species:** At least five other species of mariposa lily are known from the range of *Calochortus nitidus*. Within its range, it can be confused with *C. macrocarpus* var. *macrocarpus* (green-band mariposa lily), which also has lavender flowers. It can also be confused with the much less widespread and usually white-flowered, *C. macrocarpus* var. *maculosus*. The ovaries and fruits of both varieties of *C. macrocarpus* are linear and not winged, however. Additionally, they have sepals generally longer than the petals and a more narrow basal leaf. *C. eurycarpus* (big-pod mariposa lily) is another look alike, except this species has a circular rather than crescent-shaped purple blotch on its generally white-to light lavender-colored petals. Other *Calochortus* species within the range of *C. nitidus* have either non-lavender petals or nodding fruits.

**E. Identifying characteristics of material which is in interstate or international commerce or trade:** No interstate or international trade is known. See above section for differences with some of the related species.

**F. Photographs and/or line drawings:** A line drawing appears on page 776 in *Vascular Plants of the Pacific Northwest, Part I* (Hitchcock et al. 1969). Reproductions of this line drawing can be found in Caicco (1988a), U.S. Forest Service (n.d.), Mancuso and Moseley (1994) and Baxter and Gamon (1995). A line drawing and photograph are included in Brooks et al. (1991). Photographs (35 mm slides) of *Calochortus nitidus* and its habitat in Idaho are in the slide collection of the Idaho CDC. Several have been reproduced in Appendix 1. Photographs also exist in the files of the BLM, Upper Columbia - Salmon Clearwater Districts, Cottonwood Resource Area, and The Nature Conservancy.

#### 4. Significance.

**A. Natural:** *Calochortus nitidus* is the only tetraploid species within the genus occurring in the Pacific Northwest. Caicco (1992) noted herbivory by domestic livestock and the removal of whole plants by pocket gophers. He also noted leaf and seed predation by insects.

**B. Human:** The flowers of this species are beautiful and may have horticultural potential, although Ownbey (1969) points out that members of this genus are extremely difficult to propagate.

#### 5. Geographical distribution.

**A. Geographical range:** *Calochortus nitidus* is endemic to the Palouse Prairie of eastern Washington and adjacent Idaho. The Palouse Prairie includes the area in Idaho commonly referred to as the Camas Prairie. In Idaho, *Calochortus nitidus* extends eastward from the Palouse grasslands in widely scattered populations as far as the lower Lochsa River, and southward to the Joseph Plains and Cold Springs Mountains. Ownbey (1969) includes "the Seven Devils Mountains above Riggins" as the southern edge of the range of *Calochortus nitidus*. As pointed out by Caicco (1992), its southern and eastern limits correlate closely with the limits of the flood basalts of the Columbia River Group. The extant distribution of *Calochortus nitidus* encompasses an area approximately 100 miles wide and long. Figure 1 shows the approximate historical distribution of *Calochortus nitidus*. Figure 2 shows its distribution in Idaho. Additional maps showing the precise locations of occurrences in Idaho are on file at the Idaho Conservation Data Center in Boise. The Washington Natural Heritage Program in Olympia has more location data regarding populations in that state.

#### **B. Precise occurrences in Idaho.**

**1. Populations currently or recently known extant:** The CDC data base contains 123 occurrences of *Calochortus nitidus* in Idaho. One-hundred (81%) occurrences have been observed at least once since 1980, including 64 (52%) since 1990. A total of 96 (79%) occurrences are currently or recently known to be extant. Records for these occurrences known to be extant are in Appendix 2. Each occurrence record (formatted data base record) is identified by a three-digit code (i.e. 001, 002, etc.). Note that although there are 123

Figure 1.

Figure 2.

occurrence records for *Calochortus nitidus*, the three-digit codes range from 1 to 137. This discrepancy is due to the lumping of several occurrences following updated observation reports and associated attempts to maintain data management consistency. These records contain information on the county of occurrence, site name, narrative of its location, location information including legal description and latitude and longitude, date of initial discovery and most recent observation and pertinent USGS quadrangles.

**2. Populations known or assumed extirpated:** Sixteen occurrences (14%) are known or assumed extirpated based on field observations since 1985. This includes occurrences 002, 003, 006, 008, 009, 010, 012, 014, 024, 029 and 030 (also considered extirpated by Caicco 1988a), as well as five occurrences that upon last observation were noted to consist of only a few plants and probably soon to be extirpated - 005, 017, 021, 035 and 039. Occurrence records for extirpated sites are contained in Appendix 3. The Grave Point Lookout occurrence (058) was noted to consist of several hundred genets in 1987 (Caicco 1988a), but no plants were observed during cursory revisits by Caicco or Mancuso. Caicco (1992) suggests this population may be extirpated, but until this is substantiated by more intensive searches, I am considering this population extant.

**3. Historically known populations where current status not known:** Ten occurrences (8%) are considered historical in Idaho, with the implied expectation that they may still be extant. This includes occurrences 011, 013, 016, 018, 025, 026, 027, 028, 031 and 036. All but one of these occurrences have not been relocated since prior to 1970. One occurrence (036) was last observed in 1980, but Caicco (1988a) could not relocate it several years later. The ten historical occurrences include five considered historical and five based on ambiguous or incomplete location information by Caicco (1988a). CDC records for historical occurrences are in Appendix 4.

**4. Locations not yet investigated believed likely to support additional natural populations:** The range of *Calochortus nitidus* in Idaho has been delineated. Within this range, new populations or extensions of known populations will probably continue to be periodically found. The northern portion of Camp Howard Ridge and the Highrange Ridge complex in the Joseph Plain area are suspected to contain additional populations. An area that seems especially worthy of further field investigation is on the Oregon side of Hells Canyon, north from about Hat Point.

**5. Reports having ambiguous or incomplete locality information:** Several of the historical occurrences (011, 013, 016, 018 and 036) have vague location information. These were noted as occurrences having ambiguous or incomplete location information in the original status report for *Calochortus nitidus* in Idaho (Caicco 1988a). These occurrences are found in Appendix 4 with the historical populations.

**6. Locations known or suspected to be erroneous reports:** Caicco (1988a) considers the Keuterville gravel pit site (116), reported in 1980 by Mering Hurd, to be erroneous. He comments that although it is possible the report is correct, he was unable to find any *Calochortus* at the site. He did, however, find a population of *Allium tolmiei* var. *platyphyllum*, at the time also considered a conservation concern. This lead Caicco to believe the *Calochortus* report was based on an inadvertent transcription error. There has been no recent information to refute Caicco's assumption that the report is erroneous. The occurrence record for 116 appears in Appendix 5.

### C. Precise occurrences in Washington.

**1. Populations currently or recently known extant:** In August 1995, a population was discovered in Asotin County, on the Pomeroy Ranger District of the Umatilla NF. The legal description for this population is T09N R43E Sec. 15. The population is near the western edge of the Palouse Prairie. It occurs in deep soils on a north-facing slope within the *Festuca idahoensis*-*Agropyron spicatum* grassland zone (John Gamon, Washington Natural Heritage Program; pers. comm. 1996).

**2. Populations known or assumed extirpated:** Based on field work for their report concerning the status of *Calochortus nitidus* in Washington, Baxter and Gamon (1995) consider the three Whitman County and one Garfield County occurrences known from old collections to be extirpated. See their report for precise location and other information regarding these four occurrences.

**3. Historically known populations where current status not known:** Baxter and Gamon (1995) report none for Washington.

**4. Location not yet investigated believed likely to support additional natural populations:** The full extent of the population discovered in 1995, in Asotin County, or the possibility of additional populations in the area, are unknown. To clarify these points, further field surveys are scheduled for 1996 on the Pomeroy Ranger District, Umatilla NF (Karl Urban, Umatilla NF; pers. comm. 1996).

**5. Reports having ambiguous or incomplete locality information:** Baxter and Gamon (1995) report none for Washington.

**6. Locations known or suspected to be erroneous reports:** Baxter and Gamon (1995) report none for Washington.

**D. Biogeographical and phylogenetic history:** Ownbey (1940) notes that *Calochortus* differs considerably in its morphology and cytology from all other genera in the subfamily Lilioideae and tribe Tulipeae within the family Liliaceae. Its closest relationship may be with the genus *Tulipa*. *Calochortus* is a relatively large group and restricted to western North America, as far east as the Dakotas. Roughly 40 of the approximately 60 species have a California distribution. About half of these are considered rare, endangered, or extinct. Several others in the Pacific Northwest are also considered rare. Many species of *Calochortus* are considered rare because of their limited distribution, but may be locally abundant (Fiedler 1986).

### 6. General environment and habitat description.

**A. Concise statement of general environment:** *Calochortus nitidus* formerly occupied the grasslands of the Palouse Prairie region, but has generally been extirpated from historical sites on the deep loessal soils of the plateaus because of agricultural conversions. Remaining prairie sites are generally too steep or rocky to be plowed. This species was historically known from wet meadows within the Palouse grasslands, but no examples are known to remain. Most extant sites are grassy ridgecrests, canyon rims, and upper slopes or openings in dry conifer woodlands. These

habitats are associated with the Salmon, Snake, and Clearwater canyons and their tributaries. At most of these sites, soils are shallow and derived from volcanic substrates. Plants occur on flat to gentle or occasionally steep slopes, on all aspects, and mostly between 3500-5500 feet elevation.

## **B. Physical characteristics.**

### **1. Climate.**

**a. Koppen climate classification:** Type Db, as modified and simplified by Trewartha and Horn (1980); humid continental, cool summer.

**b. Regional macroclimate:** The climate of northern Idaho is influenced primarily by Pacific maritime air. This influence is modified by the Cascades and other intervening ranges, resulting in a climate with many continental characteristics as well. The following climatic summary is based on data from weather stations in Moscow (representing the Palouse area) and Grangeville (representing the Camas Prairie region) (Johnson 1978). The average annual temperature in Moscow is 47.3<sup>0</sup> F (8.5<sup>0</sup> C). July is the warmest month, with an average maximum temperature of 82.9<sup>0</sup> F (27.7<sup>0</sup> C) and minimum of 51.1<sup>0</sup> F (10.6<sup>0</sup> C). January is the coldest month, with an average maximum temperature of 34.1<sup>0</sup> F (1.2<sup>0</sup> C) and minimum of 21.8<sup>0</sup> F (-5.6<sup>0</sup> C). Precipitation patterns in the Palouse area are characterized by ample moisture during the winter and early spring, decreasing through late spring and with dry summers. Total annual precipitation averages 22.6 inches (573 mm), with about 40% falling between November through January and only about 10% from July through September. Climate for adjacent Washington is very similar and is summarized in Baxter and Gamon (1995).

The mean annual temperature in Grangeville is slightly cooler at 46.3<sup>0</sup> F (7.9<sup>0</sup> C). As in Moscow, July and January are the warmest and coldest months, respectively. Mean annual precipitation is almost identical with 22.7 inches (578 mm). The main difference between the precipitation patterns of the two areas is the proportional increase in late spring moisture from north to south. At Grangeville, about 22% of the annual precipitation falls during the November through January period, about the same as for March and April, and less than the 27% received during May and June. Summers are dry.

**c. Local microclimate:** No quantitative data are available. Grassland habitats are open with full sunlight, while in open woodland sites, plants receive less direct sunlight. *Calochortus nitidus* does not occur under a fully closed canopy.

### **2. Air and water quality requirements:** Unknown.

**3. Physiographic provinces:** Most extant and historical populations in Idaho are known from the Palouse Hills section and Tri-State Uplands section of the Columbia Intermontane province, with a few extending into the Northern Rocky Mountains province (Ross and Savage 1967). Using the classification of McNab and Avers (1994), *Calochortus nitidus* occurs within the Palouse Prairie section of the Columbia Plateau province and the Bitterroot Mountains section of the Northern Rocky Mountains physiographic province. In Washington, sites are all within the Columbia Basin Province of Franklin and Dyness (1973).

**4. Physiographic and topographic characteristics:** All extant plateau grassland occurrences are in places too steep or rocky for conversion to cropland. Sites in the Clearwater River Canyon are on steep south-facing canyon slopes and ridgecrests. Along the western edge of the plateau grasslands, such as Craig Mountain and northern Hells Canyon, populations are confined to ridgecrests and upper slope positions.

**5. Edaphic factors:** As Caicco (1988a) notes, the historical record of *Calochortus nitidus* indicates it occurred in a wide variety of edaphic conditions, ranging from the deep loessal soils of the plateau grasslands to the lithosols characterizing many canyon ridgecrests sites. It was also found on lithosols exposed within the loess deposits and in moist bottomland areas. No extant sites are known representing Palouse Prairie or moist bottomland habitats in Idaho. The recently discovered Washington population occurs on a slope with deep soils.

**6. Dependence of this taxon on natural disturbance:** *Calochortus nitidus* does not appear to recolonize areas which have been highly disturbed. Fire was probably the primary natural disturbance in the plateau grasslands, but probably did not greatly alter the vegetation structure or composition (Daubenmire 1970). Fire is less of a factor in rocky, shallow soil habitats with a naturally open vegetation, such as along ridgecrests. These habitats do not carry fire well. This species has a deep seated bulb that would survive even very hot fires. Because it does not persist under a closed canopy, portions of a population occurring in open woodlands would be expected to contract if forest succession led to such conditions.

**7. Other unusual physical features:** Unknown.

### C. Biological characteristics.

**1. Vegetation physiognomy and community structure:** Native grasslands in which *Calochortus nitidus* occurs are dominated by perennial bunchgrasses. Trees or tall shrubs are rare. On deeper soils, *Festuca idahoensis* (Idaho fescue), *Agropyron spicatum* (bluebunch wheatgrass), and *Koeleria cristata* (prairie Junegrass) are the dominants. Other perennial forbs are common associates, including *Geum triflorum* (prairie smoke), *Potentilla gracilis* (slender cinquefoil), *Hieracium albertinum* (western hawkweed), and *Balsamorhiza sagittata* (arrowleaf balsamroot). Bluebunch wheatgrass and *Poa sandbergii* (Sandberg's bluegrass) dominate more xeric and lithosolic sites. Associated forbs may include *Lomatium* spp. (desert-parsley species), *Phlox viscida* (sticky phlox), and *Sedum* spp. (stonecrop species). At a few sites it occurs within *Artemisia rigida* (stiff sagebrush) or *Eriogonum douglasii* (Douglas's buckwheat) scabland communities. Near Cow Creek Saddle, at the most southern known location for the species, it occurs within a mosaic of stiff sagebrush and *A. tridentata* ssp. *vaseyana* (mountain big sagebrush).

Grasslands disturbed by livestock grazing have a decreased abundance of native bunchgrasses and an increase in invasive grasses and weedy forbs. The most common invasive grasses are the annual bromes (*Bromus* spp.). *Danthonia unispicata* (onespike oatgrass) can become abundant on dry or rocky sites, and *Poa pratensis* (Kentucky bluegrass) in more mesic habitats.

*Calochortus nitidus* also occurs in open conifer woodland habitats, usually along ridgetops. These are characterized by an open overstory of *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga*

*menziesii* (Douglas-fir). Bluebunch wheatgrass is usually the dominant understory graminoid. Patches of *Carex geyeri* (elk sedge), *Symphoricarpos albus* (common snowberry), and *Spiraea betulifolia* (white spiraea) may also be common. Natural openings in these forests are usually caused by shallow soils closely overlying bedrock (Caicco 1992). Taxonomy throughout this report follows Hitchcock and Cronquist (1973).

**2. Regional vegetation type:** Within Kuchler's (1964) classification, *Calochortus nitidus* habitats include fescue-wheatgrass (K-50), wheatgrass-bluegrass (K-51) or western ponderosa pine forest (K-11) types. Grasslands supporting *Calochortus nitidus* include the following habitat types: *Festuca idahoensis/Symphoricarpos albus*, *Agropyron spicatum-F. idahoensis*, and *Eriogonum douglasii/Poa sandbergii* (Daubenmire 1970); *F. idahoensis-Koeleria cristata*, *F. idahoensis-A. spicatum* (Tisdale 1986); and the *F. idahoensis-K. cristata* (ridgetops), *F. idahoensis-A. spicatum* (ridgetops), *P. sandbergii-Danthonia unispicata*, and *E. douglasii/P. sandbergii* plant associations of Johnson and Simon (1987). Woodlands include the *Pinus ponderosa/A. spicatum*, *P. ponderosa/S. albus*, and *Pseudotsuga menziesii/F. idahoensis* habitat types of Daubenmire and Daubenmire (1968) and Cooper et al. (1987). *Artemisia rigida* sites approach the 'high elevation' description outlined in Tisdale (1986).

**3. Frequently associated species:** These are listed above within the section describing vegetation physiognomy and community structure.

**4. Dominance and frequency:** *Calochortus nitidus* can be locally abundant, but is not a dominant species because of its overall scattered distribution and low cover. Its density is often variable, from small dense clusters to very widely separated and scattered individuals. The density of flowering plants can vary widely from year to year. In disturbed habitats, as the abundance of invasive species increases, the frequency and total number of *Calochortus nitidus* plants decreases. Highly disturbed areas generally support only a few individuals.

**5. Successional phenomena:** *Calochortus nitidus* occurs primarily in late seral and climax grassland communities. It can tolerate partial canopy closure as shown by its occurrence in open conifer woodlands. However, it has not been observed under a closed canopy.

**6. Dependence on dynamic biotic features:** Most *Calochortus nitidus* habitats are subject to periodic burning. Whether *Calochortus nitidus* is somehow dependent on periodic fire in any of these habitats is unknown.

**7. Other endangered species:** At a few locations in Idaho, two other federal candidate species, *Haplopappus liatriformis* and/or *Silene spaldingii*, also occur. *Trifolium plumosum* var. *amplifolium*, another regional endemic, also occurs with *Calochortus nitidus* in a few places. This former federal candidate is considered a BLM sensitive species in Idaho and a state sensitive species by the Idaho Native Plant Society (Conservation Data Center 1994). No federally listed endangered or threatened species occur in the vicinity of the historic Washington populations (Baxter and Gamon 1995), nor are any presently known from the recently discovered site in Asotin County.

## 7. Population biology.

**A. General summary:** *Calochortus nitidus* is known from 96 extant occurrences in Idaho, while 16 occurrences are considered extirpated. Ten occurrences have not been observed recently. The current status of these historical occurrences is not known, although the persistence of three sites in the Moscow region is probably not high. Additionally, there is one occurrence believed to be based on an erroneous report. In Latah County, containing the core of Palouse Prairie habitat in Idaho, five occurrences are extirpated and four are considered historical. Only one population is considered extant, and this is along a ridgecrest, not in prairie grassland habitat. Idaho occurrences range in size from less than 10 to over 10,000 genets. Based on records that provide estimated population numbers, Idaho occurrences are comprised of a total of approximately 142,000 genets. The aerial extent of occurrences varies from one square meter to about 250 acres, or even 10 miles, along Wapshilla Ridge at Craig Mountain. *Calochortus nitidus* is estimated to occupy a minimum of 1,240 acres. This conservative estimate does not include the hundreds of potential additional acres adjacent to occurrences not fully surveyed, or the extensive ten mile long Wapshilla Ridge occurrence at Craig Mountain

**B. Demography.**

**1. Known populations:** Populations are characterized by individual plants being widely scattered, clustered, or a combination of these patterns. The most common pattern is scattered individuals at low density. The number of above ground plants can vary widely from year to year. This may partly be connected to annual precipitation fluctuations. In highly degraded habitats, where invasive species dominate the vegetation, *Calochortus nitidus* is usually present only in low numbers. Most occurrences supporting robust populations are located in areas where the native bunchgrass communities are relatively intact, or where a shallow, rocky substrate precludes the development of a dense vegetation cover. Late seral communities have usually seen only light livestock use (Caicco 1992). Known populations with a high likelihood of long-term viability are concentrated along the periphery of the species' range, in the Craig Mountain, Joseph Plains, and Cold Springs Mountains areas, and along the ridge systems south of Grangeville, mainly in the Whitebird to Slate creek drainages. All of these areas except the Joseph Plains contain substantial amounts of public lands. Table 1 provides a summary of several population attributes, including first and last date observed, ownership, size, occurrence rank (explained in the "Demographic details" section below), and population data. Additional information for each occurrence is contained in Appendices 2, 3, 4 and 5.

In Washington, the number of plants and extent of the one known extant population are unknown.

**2. Demographic details:** Appendices 2, 3, 4 and 5 contain the occurrence records for extant, extirpated, historical, and probable erroneous reports, respectively. No population data are available for most extirpated and historical occurrences. Records for most extant populations contain all or some of several demographic attributes, such as (1) number of plants, (2) density, (3) evidence of reproduction, (4) estimated area occupied (size), and (5) evidence of **Table 1.** Summary of selected attributes for Idaho occurrences of *Calochortus nitidus*.

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres) | <sup>5</sup> Rank | <sup>6</sup> Population data |
|------------------|-------------------------|------------------------|------------------------|--------------|-------------------|------------------------------|
| 001              | 1939                    | 1993                   | pvt, IDFG, NPT         | 15           | A                 | ca. 2500 in 9 subpops.       |

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres) | <sup>5</sup> Rank | <sup>6</sup> Population data |
|------------------|-------------------------|------------------------|------------------------|--------------|-------------------|------------------------------|
| 002              | 1938                    | 1938                   | pvt                    | -            | X                 | -                            |
| 003              | 1939                    | 1939                   | pvt                    | -            | X                 | -                            |
| 004              | 1939                    | 1985                   | pvt                    | -            | D                 | 14                           |
| 005              | 1947                    | 1985                   | pvt                    | -            | X                 | 3; close to elimination      |
| 006              | 1940                    | 1940                   | pvt                    | -            | X                 | -                            |
| 007              | 1898                    | 1995                   | pvt, NPT               | 2            | B                 | ca 440 in 2 subpops.         |
| 008              | 1937                    | 1937                   | pvt                    | -            | X                 | -                            |
| 009              | 1938                    | 1938                   | pvt                    | -            | X                 | -                            |
| 010              | 1953                    | 1953                   | pvt                    | -            | X                 | -                            |
| 011              | 1932                    | 1932                   | pvt                    | -            | H                 | -                            |
| 012              | 1950                    | 1950                   | pvt                    | -            | X                 | -                            |
| 013              | 1947                    | 1947                   | pvt                    | -            | H                 | -                            |
| 014              | 1942                    | 1942                   | pvt                    | -            | X                 | -                            |
| 015              | 1977                    | 1992                   | pvt                    | 100+pot      | B                 | several 100                  |
| 016              | 1927                    | 1927                   | pvt                    | -            | H                 | -                            |
| 017              | 1994                    | 1994                   | pvt                    | -            | X                 | 2; close to elimination      |
| 018              | 1934                    | 1934                   | pvt                    | -            | H                 | -                            |
| 019              | 1981                    | 1986                   | IDL                    | -            | D                 | ca 100                       |
| 020              | 1981                    | 1991                   | WWNF                   | 100          | B                 | ca 1000                      |
| 021              | 1982                    | 1991                   | NPNF                   | -            | X                 | 1987=1, 1991=0               |
| 022              | 1985                    | 1985                   | pvt                    | -            | D                 | 7                            |
| 024              | 1946                    | 1946                   | pvt                    | -            | X                 | -                            |
| 025              | 1969                    | 1969                   | pvt                    | -            | H                 | -                            |
| 026              | 1956                    | 1956                   | pvt                    | -            | H                 | -                            |
| 027              | 1956                    | 1956                   | pvt                    | -            | H                 | -                            |
| 028              | 1957                    | 1957                   | pvt                    | -            | H                 | -                            |
| 029              | 1913                    | 1913                   | pvt                    | -            | X                 | -                            |

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres)       | <sup>5</sup> Rank | <sup>6</sup> Population data  |
|------------------|-------------------------|------------------------|------------------------|--------------------|-------------------|-------------------------------|
| 030              | 1946                    | 1946                   | pvt                    | -                  | X                 | -                             |
| 031              | 1951                    | 1951                   | pvt                    | -                  | H                 | -                             |
| 032              | 1965                    | 1991                   | WWNF                   | 250+               | A                 | ca 10,000                     |
| 033              | 1987                    | 1987                   | pvt                    | 5                  | D                 | 26                            |
| 034              | 1987                    | 1987                   | pvt                    | 1                  | D                 | 16                            |
| 035              | 1980                    | 1987                   | pvt                    | 1 <sup>2</sup> m   | X                 | 1; close to elimination       |
| 036              | 1980                    | 1980                   | pvt                    | 3 <sup>2</sup> m   | D                 | 30                            |
| 037              | 1987                    | 1987                   | pvt                    | 1                  | D                 | 8                             |
| 038              | 1957                    | 1987                   | pvt                    | 500 <sup>2</sup> m | C                 | 250                           |
| 039              | 1987                    | 1987                   | pvt                    | 1 <sup>2</sup> m   | X                 | 4; close to elimination       |
| 040              | 1987                    | 1987                   | pvt or NPT             | 1                  | C                 | ca 150                        |
| 041              | 1987                    | 1987                   | pvt                    | 1                  | C                 | ca 150                        |
| 048              | 1987                    | 1987                   | pvt                    | 1                  | D                 | 1-50                          |
| 049              | 1987                    | 1987                   | pvt                    | 2                  | D                 | ca 30                         |
| 050              | 1987                    | 1993                   | IDFG, NPT              | > 2                | B                 | 500-1000                      |
| 052              | 1900s                   | 1993                   | BLM, IDFG              | > 10               | A                 | 5-10,000                      |
| 053              | 1989                    | 1992                   | CNF                    | 0.5                | C                 | ca 140                        |
| 055              | 1980s                   | 1993                   | IDL,BLM,IDFG,T<br>NC   | ca 10<br>miles     | A                 | 7500+                         |
| 056              | 1987                    | 1987                   | NPNF,WWNF,pvt          | 20                 | A                 | several 1000                  |
| 057              | 1987                    | 1987                   | WWNF                   | 1                  | D                 | < 50                          |
| 058              | 1987                    | 1987                   | WWNF                   | 8                  | C                 | several 100                   |
| 059              | 1987                    | 1987                   | WWNF                   | 10                 | C                 | several 100                   |
| 060              | 1987                    | 1987                   | NPNF                   | 2                  | C                 | 100+                          |
| 061              | 1987                    | 1991                   | NPNF                   | 25?                | C                 | ? but probably many           |
| 062              | 1987                    | 1987                   | NPNF,WWNF,pvt          | 20                 | C                 | several 100                   |
| 063              | 1988                    | 1988                   | NPNF                   | -                  | C                 | 3 subpops. of low density     |
| 064              | 1988                    | 1988                   | NPNF                   | -                  | C                 | 1 high, 1 low density subpop. |

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres) | <sup>5</sup> Rank | <sup>6</sup> Population data |
|------------------|-------------------------|------------------------|------------------------|--------------|-------------------|------------------------------|
| 065              | 1988                    | 1992                   | NPNF                   | -            | C                 | 6 low density subpops.       |
| 066              | 1988                    | 1988                   | NPNF                   | -            | B                 | 10 subpops.                  |
| 067              | 1988                    | 1989                   | NPNF, pvt              | 5            | C                 | 200+                         |
| 068              | 1988                    | 1989                   | NPNF                   | -            | C                 | locally common               |
| 069              | 1988                    | 1988                   | NPNF                   | -            | C                 | 6 low density subpops.       |
| 070              | 1988                    | 1988                   | NPNF                   | -            | C                 | 3 low density subpops.       |
| 071              | 1988                    | 1995                   | NPNF                   | -            | C                 | 11 low density sites; 85+    |
| 072              | 1988                    | 1995                   | NPNF                   | 1            | C                 | 100+ at 2 low density sites  |
| 073              | 1988                    | 1995                   | NPNF, pvt              | -            | B                 | 450+ at 5+ sites             |
| 074              | 1988                    | 1993                   | NPNF                   | 120          | A                 | 9-11,000                     |
| 075              | 1995                    | 1995                   | NPNF                   | 0.2          | C                 | ca 100                       |
| 076              | 1995                    | 1995                   | BLM                    | 1            | D                 | 41                           |
| 079              | 1989                    | 1989                   | pvt                    | -            | C                 | ca 70 in 3 subpops.          |
| 080              | 1896                    | 1988                   | pvt                    | -            | D                 | ca 50                        |
| 081              | 1989                    | 1989                   | pvt                    | 5            | C                 | 300-500                      |
| 082              | 1989                    | 1989                   | NPNF                   | 10           | B                 | 100-1000                     |
| 083              | 1989                    | 1989                   | NPNF                   | 5            | D                 | 10-50                        |
| 084              | 1989                    | 1989                   | NPNF, WWNF             | 70+          | A                 | ca 1000                      |
| 085              | ?                       | ?                      | pvt                    | -            | ?                 | -                            |
| 086              | 1990                    | 1990                   | NPNF                   | 2            | D                 | ca 50                        |
| 087              | 1990                    | 1995                   | NPNF                   | 10           | B                 | ca 500                       |
| 089              | 1990                    | 1990                   | NPNF                   | -            | B                 | 548                          |
| 090              | 1991                    | 1991                   | WWNF                   | 100+pot      | B                 | ca 1000                      |
| 091              | 1991                    | 1991                   | NPNF                   | 1-3          | C                 | 20+, but likely more         |
| 092              | 1991                    | 1991                   | WWNF                   | 1            | D                 | ca 20                        |
| 093              | 1991                    | 1991                   | IDL, pvt               | 100+pot      | A                 | several 1000                 |
| 094              | 1991                    | 1991                   | IDL, BLM, pvt          | 2+           | A                 | ca 2000                      |

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres)      | <sup>5</sup> Rank | <sup>6</sup> Population data |
|------------------|-------------------------|------------------------|------------------------|-------------------|-------------------|------------------------------|
| 095              | 1991                    | 1991                   | pvt                    | -                 | ?                 | -                            |
| 096              | 1991                    | 1992                   | pvt                    | 1                 | C                 | ca 100                       |
| 097              | 1991                    | 1991                   | pvt                    | <1                | D                 | 11                           |
| 100              | 1991                    | 1995                   | NPNF                   | 30                | A                 | ca 17,000                    |
| 101              | 1991                    | 1992                   | BLM, pvt               | 20+               | A                 | ca 2500                      |
| 102              | 1992                    | 1992                   | pvt                    | -                 | D                 | 3?                           |
| 103              | 1992                    | 1992                   | pvt                    | 2.5               | C                 | 75-80                        |
| 104              | 1992                    | 1992                   | pvt                    | -                 | D                 | 1?                           |
| 105              | 1992                    | 1992                   | BLM, pvt               | 100+pot           | C                 | 115                          |
| 106              | 1992                    | 1992                   | BLM, pvt               | 20                | B                 | 150, but many more likely    |
| 107              | 1992                    | 1992                   | BLM, pvt               | 50 <sup>2</sup> m | D                 | 15                           |
| 108              | 1992                    | 1992                   | pvt                    | 1                 | D                 | 10                           |
| 109              | 1992                    | 1992                   | BLM                    | 3                 | C                 | 250                          |
| 110              | 1992                    | 1992                   | BLM, pvt               | 3.5               | D                 | 45                           |
| 111              | 1992                    | 1992                   | IDL, BLM               | 2                 | C                 | ca 100                       |
| 112              | 1992                    | 1992                   | BLM, pvt               | 8-10              | C                 | ca 150                       |
| 113              | 1992                    | 1992                   | BLM, pvt               | 4                 | D                 | ca 35                        |
| 114              | 1992                    | 1992                   | BLM, pvt               | 24                | B                 | 700-835                      |
| 115              | 1992                    | 1992                   | pvt                    | 200+              | A                 | 1100-1200                    |
| 116              | 1980                    | 1980                   | pvt                    | -                 | D                 | -                            |
| 117              | 1992                    | 1992                   | CNF, pvt?              | -                 | D                 | 13                           |
| 118              | 1993                    | 1993                   | NPNF                   | 0.25              | C                 | ca 100                       |
| 119              | 1993                    | 1993                   | BLM                    | 0.1               | D                 | ca 20                        |
| 120              | 1993                    | 1993                   | BLM                    | 0.7               | B                 | 500-1000                     |
| 121              | 1993                    | 1993                   | BLM                    | 0.2               | D                 | ca 50                        |
| 122              | 1993                    | 1993                   | BLM, pvt               | 0.1               | D                 | 25                           |
| 123              | 1993                    | 1993                   | BLM                    | 0.1               | D                 | 20                           |

| <sup>1</sup> EOR | <sup>2</sup> First obs. | <sup>3</sup> Last obs. | <sup>4</sup> Ownership | Size (acres) | <sup>5</sup> Rank | <sup>6</sup> Population data |
|------------------|-------------------------|------------------------|------------------------|--------------|-------------------|------------------------------|
| 124              | 1993                    | 1993                   | BLM                    | 0.1          | C                 | 100                          |
| 125              | 1993                    | 1993                   | BLM                    | 0.1          | D                 | ca 30                        |
| 126              | 1993                    | 1993                   | IDL                    | 2            | C                 | 150                          |
| 127              | 1993                    | 1993                   | IDFG, pvt              | 5            | C                 | ca 200                       |
| 128              | 1993                    | 1993                   | IDL, pvt               | -            | C                 | ca 100                       |
| 129              | 1993                    | 1993                   | IDL, IDFG              | 10+          | A                 | > 5000                       |
| 130              | 1993                    | 1993                   | IDFG, BLM              | 5            | B                 | ca 750                       |
| 131              | 1993                    | 1993                   | pvt                    | 0.5          | C                 | 50+                          |
| 132              | 1993                    | 1993                   | IDFG,NPT,pvt           | -            | A                 | ca 5500                      |
| 133              | 1993                    | 1993                   | IDL,IDFG,BLM           | 15           | A                 | ca 2000                      |
| 134              | 1993                    | 1993                   | IDFG                   | 1            | B                 | 250-500                      |
| 135              | 1993                    | 1995                   | IDFG,BLM,pvt           | 30           | A                 | 25-30,000                    |
| 136              | 1993                    | 1995                   | IDL,IDFG,BLM           | 10+          | A                 | ca 10,500                    |
| 137              | 1974                    | 1974                   | pvt                    | -            | ?                 | -                            |

<sup>1</sup>The Element Occurrence Record number is the unique three-digit identifier code assigned by the Conservation Data Center for data management and reference purposes.

<sup>2</sup>The year the occurrence was first observed.

<sup>3</sup>The year the occurrence was last observed.

<sup>4</sup>BLM=BLM, Cottonwood Resource Area; CNF=Clearwater NF; IDFG=Idaho Dept. of Fish and Game (Craig Mountain Wildlife Management Area); IDL=Idaho Dept. of Lands; NPT=Nez Perce Indian Reservation; NPNF=Nez Perce NF; pvt=private land; WWNF=Wallowa-Whitman NF (Hells Canyon Natural Recreation Area).

<sup>5</sup>"A" (highest) to "D" (lowest) ranks for each occurrence based on occupied area, site quality, population numbers, threats, fragmentation and proximity to developed sites. Historical (last observed pre-1970 and status unknown) occurrences are designated by "H". Sites known or assumed extirpated are designated by "X".

<sup>6</sup>Number of genets comprising the occurrence, plus other pertinent comments.

expansion or contraction.

Each occurrence has been given a rank ("EORANK" field in the records in Appendices 2, 3, 4 and

5). The "A" (highest), "B", "C" and "D" (lowest) ranks for each occurrence are based primarily on occupied area, ecological quality of the site, and population numbers. Secondary considerations include population isolation and habitat fragmentation, imminent threats and proximity to developed areas (with the implied expectation that habitats will be degraded in the near-term). More specific criteria used to help standardize ranks for each *Calochortus nitidus* occurrence include the following: A rank - populations covering 2 or more acres, with 1000 or more genets, and with relatively intact native vegetation; B rank - populations with 500 -1000 genets and at least portions of the habitat are relatively intact, or larger populations in degraded areas; C rank - populations with 50 -500 genets, habitat conditions are often variable, with some portions often in poor ecological condition; D rank - populations with less than 50 genets, often isolated and fragmented and with degraded habitat conditions. In addition, occurrences known or assumed extirpated are ranked "X", and historical occurrences where the status remains uncertain are ranked "H".

For *Calochortus nitidus* in Idaho, 17 occurrences are ranked "A", 15 are ranked "B", 34 are ranked "C", 29 are ranked "D", 16 are ranked "X" and 9 are ranked "H". No data exists for three extant occurrences (085, 095 and 137), and were not ranked. A number of extant occurrences are based on only cursory survey work and may be more extensive than presently known. Table 1 provides the occurrence rank for each occurrence in Idaho.

For the 107 extant or historical Idaho occurrences, the estimated areas occupied are as follows: unknown - 32 (30%); 16 (15%) - less than one acre; 32 (30%) - between 1 and 5 acres; 6 (6%) - between 6 and 10 acres; 16 (15%) - between 11 and 99 acres; and 5 (4%) - 100 acres or more. Occurrences range in extent from one square meter to at least 250 acres. The Wapshilla Ridge occurrence (055) at Craig Mountain extends for about ten miles.

Demographic details for the one extant Washington population will probably be available after additional field work is conducted during the 1996 field season by Umatilla NF botanists.

### **C. Phenology.**

**1. Patterns:** Seedlings are barely distinguishable from a blade of grass when they emerge in June. By mid-July this basal leaf has generally withered and is present only as brittle thread lying on the ground. Older plants possess a larger basal leaf that lasts through the summer. Stems emerge from the ground in June and undergo rapid elongation in late June and early July. One to four floral buds per plant open during the first half of July and remain open for 7-10 days, at which time the petals drop off. Fruits mature during July and August, with dehiscence beginning in early August (Caicco 1992). *Calochortus nitidus* occurs from about 1500 feet to 6400 feet elevation. Because of this variability, plant phenology will be somewhat earlier at lower elevations and later at higher elevations.

**2. Relation to climate and microclimate:** Caicco (1988a) suggests that based on observations he made during 1985 -1987, plant phenology did not vary appreciably from year to year and is not affected by regional climatic variability. I have seen *Calochortus nitidus* flower one or two weeks sooner when the weather turned hot and dry early, compared to a cool, wet spring and early summer.

## D. Reproductive ecology.

**1. Type of reproduction:** *Calochortus nitidus* lacks the basal bulblets found in some related species (Ownbey 1969), and therefore probably reproduces only by seed.

### 2. Pollination.

**a. Mechanisms:** Apparently based on his life history studies of *Calochortus nitidus*, Caicco (1992) suggests that wind is a primary pollination vector, although insects may also be effective. The suggestion that wind is so important is contrary to many other species with showy flowers, where insects or some other biotic vectors are the main pollinators. Preliminary pollination investigations suggest some mechanism operating to prevent self-fertilization (Caicco 1992).

**b. Specific known pollinators:** Unknown, although Caicco (1992) comments that small insects may be effective pollinators. I have observed small flying and crawling insects in the flowers.

**c. Other suspected pollinators:** Unknown. However, Fiedler (1987) remarks that flowers of *Calochortus albus*, a common Californian species, are pollinated primarily by Hymenoptera or Coleoptera, or both.

**d. Vulnerability of pollinators:** Unknown.

### 3. Seed dispersal.

**a. General mechanisms:** There are no apparent morphological adaptations for specialized capsule or seed dispersal. Seeds may be wind dispersed, but as Caicco (1988) points out, data are lacking.

**b. Specific agents:** Unknown, although gravity and perhaps wind may play a role.

**c. Vulnerability of dispersal agents and mechanisms:** Unknown.

**d. Dispersal patterns:** Unknown.

### 4. Seed biology.

**a. Amount and variation of seed production:** Thirty capsules sampled during the summer of 1988 produced an average of 55 seeds/capsule, with actual seed counts ranging between 20 and 149 (Caicco 1992).

**b. Seed viability and longevity:** Unknown for *Calochortus nitidus*. Fiedler (1987) found the four Californian species of *Calochortus* she was studying to have a "transient", or annually renewed seed bank.

**c. Dormancy requirements:** Unknown.

**d. Germination requirements:** Unknown.

**e. Percent germination:** Unknown.

**5. Seedling ecology:** Factors affecting seedling establishment are unknown. The number of seedlings at a given site varies widely from year to year. Herbivory and trampling by livestock may negatively affect seedling establishment (Caicco 1992). *Calochortus nitidus* does not seem to recolonize depleted habitats, and it is possible this is related to seedling ecology.

**6. Survival and nature of mortality of plants:** Unknown. Assessment of survival is difficult because bulbs may or may not produce above ground tissue every year. During his life history studies of *Calochortus nitidus*, Caicco (1992) notes that numerous genets present in 1988, where absent in 1989, then reappeared in 1991.

**7. Overall assessment of reproductive success:** Several years of life history and population data have been collected from permanent plots located in the Cold Springs Mountains, east of Lucile, Idaho (Caicco 1988c; 1989; 1992). Populations of *Calochortus nitidus* can fluctuate widely from year to year, as can the degree of reproductive success. There appears to be no direct correlation between the total number of plants, the number of reproductive plants, and the number of fruits produced in a given year (Caicco 1992). *Calochortus nitidus* appears to have a relatively low rate of reproductive success in areas open to livestock grazing. The highest percentage of fruit set in grazed populations was about 10% along transects sampled by Caicco (1989).

## **8. Population ecology of the taxon.**

**A. General summary:** Vigorous populations of *Calochortus nitidus* are largely confined to areas where the native vegetation is in good ecological condition. In depleted habitats dominated by invasive weedy species, *Calochortus nitidus* is usually present only in low numbers. Most extant populations occur along open grassland ridgecrests and nearby upper slopes or openings within dry forests. A few are known from open woodlands, but plants do not occur under a closed canopy. Most populations are characterized by scattered individuals at low density or scattered, higher density clumps. The number of reproductive plants can vary widely from year to year. Many sites are apparently capable of producing large numbers of reproductive individuals in good years, but successful fruit production may nevertheless remain low. Herbivory of flower buds, flowers, and immature fruits are primary factors affecting successful reproduction. Removal of whole plants by pocket gophers can be a locally important factor affecting population size. Limited insect damage has been observed, but appears to be of minor consequence. Most extant populations have been disturbed to some degree by livestock grazing, including indirect effects such as habitat degradation. Other disturbances include road construction, rock quarrying or occasionally timber harvest (Caicco 1989;1992).

**B. Positive and neutral interactions:** None known.

**C. Negative interactions.**

**1. Herbivores, predators, pests, parasites and diseases:** Studies by Caicco (1988c; 1989; 1992) document that herbivory can have a major affect on population dynamics. Herbivory of

flower buds, flowers, and fruits are primary factors limiting successful reproduction. This herbivory is most serious in areas open to summer livestock grazing. Native ungulates are also responsible for some herbivory. Short-term effects of reduced reproduction may be negligible, but the long-term effects are unknown. Based on several years of field observations, Caicco (1989) suggests that continual heavy grazing by cattle can reduce *Calochortus nitidus* populations to very low levels, and in some cases, result in local extirpation. Removal of whole plants by pocket gophers has been observed, but is of local consequence. Limited insect damage has also been observed.

## **2. Competition.**

**a. Intraspecific:** Unknown.

**b. Interspecific:** *Calochortus nitidus* is typically absent or found only in low numbers in depleted habitats dominated by invasive annual grasses and other weedy species. Caicco (1992) suggests these weedy species may have a competitive advantage. *Calochortus nitidus* can tolerate a partial, but not complete canopy coverage.

**3. Toxic and allelopathic interactions with other organisms:** None known.

## **D. Hybridization.**

**1. Naturally occurring:** No naturally occurring hybridization has been observed. At least two congeners occur sympatric or in close proximity to *Calochortus nitidus* populations, *C. elegans* and *C. macrocarpus* var. *maculosus*.

**2. Artificially induced:** Unknown.

**3. Potential in cultivation:** Ownbey (1969) remarks that cultivation within the genus is difficult, that most species propagate freely only from seed, and then take three-five years of exacting care to produce a flowering plant. It is unknown if recent advances in plant propagation techniques have the potential to make cultivation easier.

**E. Other factors of population ecology:** None known.

## **9. Current land ownership and management responsibility:**

**A. General nature of ownership:** Extant populations of *Calochortus nitidus* in Idaho occur on private, The Nature Conservancy (TNC), Nez Perce NF, Clearwater NF, Wallowa-Whitman NF, BLM, Idaho Department of Lands (IDL), Idaho Department of Fish and Game (IDFG) and Nez Perce tribal lands. Many populations occur on a complex mix of two or more of these ownerships. Twenty occurrences are located wholly or partly within four special management areas: Hells Canyon National Recreation Area (NRA), Craig Mountain Wildlife Management Area (WMA), Garden Creek Preserve, and Captain John Creek Research Natural Area (RNA). Additionally, one extant occurrence is located within the Middle Fork Clearwater Recreation River corridor. The single extant population known for Washington is located on the Pomeroy Ranger District, Umatilla NF. The range of the species in Washington is primarily privately owned.

**B. Specific landowners:** The ownership of the extant or historical occurrences are listed in Appendices 2 and 4, respectively. Ownership of extirpated and possibly erroneous occurrences are listed in Appendices 3 and 5, respectively. Land ownership for all occurrences is also provided within Table 1 (page 14). A summary of land ownership for the 107 extant or historical (underlined) occurrences is provided below.

There are 76 (71%) occurrences located on land under single ownership:

Private lands: 36 (34%): 004, 011, 013, 015, 016, 018, 022, 025-028, 031, 033, 034, 036, 037, 038, 040, 041, 048, 049, 079-081, 085, 095-097, 102-104, 108, 115, 116, 131, 137  
Nez Perce NF: 21 (20%): 060, 061, 063-066, 068-072, 074, 075, 083, 083, 086, 087, 089, 091, 100, 118  
Wallowa-Whitman NF: 7 (6%): 020, 032, 057, 058, 059, 090, 092  
Clearwater NF: 1 (<1%): 053  
BLM - 8 (7%): 076, 109, 119, 120, 121, 123, 124, 125  
IDL - 2 (2%): 019, 126  
IDFG: 1 (<1%): 134

There are 31 (29%) occurrences under a mix of ownerships. Twenty-two of these involve private lands. This means that 58 (54%) of the known extant or historical occurrences are located at least partially on private land.

Private and BLM: 101, 105, 106, 107, 110, 112, 113, 114, 122  
Private, BLM and IDL: 094  
Private, BLM and IDFG: 135  
Private and Nez Perce NF: 067, 073  
Private and Clearwater NF: 117  
Private, Nez Perce NF and Wallowa-Whitman NF: 056, 062  
Private and IDFG: 127  
Private, IDFG and Nez Perce Tribe: 001, 132  
Private and Nez Perce Tribe: 007  
Private and IDL: 093, 128  
BLM and IDFG: 052, 130  
BLM, IDFG and IDL: 133, 136  
BLM and IDL: 111  
BLM, IDFG, IDL and TNC: 055  
Nez Perce NF and Wallowa Whitman NF: 084  
IDFG and Nez Perce Tribe: 050  
IDFG and IDL: 129

Land ownership of the sixteen extirpated Idaho occurrences are listed below.

Private: 002, 003, 005, 006, 008, 009, 010, 012, 014, 017, 024, 029, 030, 035, 039  
Nez Perce NF: 021

The one Idaho occurrence believed to be based on an erroneous report (116) is in an area dominated by private land. All four of the extirpated Washington occurrences were located on

private land.

**C. Management responsibility:** Management responsibility is the same as ownership of the occurrence. Occurrences noted for the Wallowa-Whitman NF are located within the Hells Canyon NRA. This special management area is managed by the Wallowa-Whitman NF, although it is within the boundaries of the Nez Perce NF.

**D. Easements, conservation restrictions, etc.:** The Canyon Creek population (053) on the Clearwater NF occurs within the Lochsa Recreation River corridor. This designation provides protection from certain activities such as logging. The Suttler Creek population (137) is located within the Middle Fork Clearwater River Recreation River corridor. A Conservation Agreement between the U.S. Fish and Wildlife Service, BLM, and a private landowner is in place for the Cove Creek population (101), southeast of Grangeville (U.S. Fish and Wildlife Service 1991). This population is periodically monitored by the BLM, and the private landowner also has several cooperative responsibilities.

Twenty other occurrences are located wholly or partly within four areas offering conservation-oriented management: Hells Canyon NRA, managed by the Wallowa-Whitman NF; Craig Mountain WMA, managed by IDFG; Garden Creek Preserve, managed by TNC; and Captain John Creek RNA, managed by the BLM. The latter three areas are located in the Craig Mountain area, south of Lewiston. Note that occurrences 055, 135 and 136 are in more than one management area.

Hells Canyon NRA: 020, 032, 057, 058, 059, 090, 092

Hells Canyon NRA in part: 056, 062, 084

Craig Mountain WMA: 134

Craig Mountain WMA in part: 001, 050, 052, 055, 127, 129, 130, 132, 133, 135, 136

Garden Creek Preserve in part: 055

Captain John Creek RNA in part: 135, 136

The one extant Washington population on the Umatilla NF is located in an area managed as a Wildlife Conservation Management Area. This designation means the area receives relatively low livestock use (Karl Urban, Umatilla NF; pers. comm. 1996).

## 10. Management practices and experience.

### A. Habitat management.

#### 1. Review of past management and land-use experiences.

**a. This taxon:** Within the past century, the former Palouse Prairie grassland habitats of *Calochortus nitidus* have undergone nearly total agricultural conversion, mainly for the dryland farming of grains and legumes. Areas not plowed are largely used for pasturing livestock or have been lost to urban and rural development and roads. Cropland conversion and other changes to the Palouse Prairie have basically eliminated *Calochortus nitidus* from the northern and western quarters of its former distribution. Except for some small scattered populations, the east-central portion of its range in the Camas Prairie area has also been effectively lost. With few exceptions, grasslands throughout the rest of the range of *Calochortus nitidus* are

used by domestic livestock at least part of the year. Timber harvest activities continue to be a common land-use in forested portions of the species' distribution.

**b. Related taxa:** Unknown.

**c. Other ecologically similar taxa:** Other ecologically similar regional endemics such as *Aster jessicae*, *Haplopappus liatrifolius*, *Silene spaldingii*, and *Trifolium plumosum* var. *amplifolium* have also suffered drastic contraction of their former distributions due to habitat loss. All but the latter species are restricted to deep, loamy soil grassland sites and are among the most serious conservation concerns in Idaho.

**2. Performance under changed conditions:** Research has shown that reproductive success declines with livestock grazing (Caicco 1988c; 1989; 1992). *Calochortus nitidus* abundance is reduced in depleted habitats dominated by annual grasses and other weedy species, compared to areas supporting intact native vegetation. Populations and habitat destroyed by crop agriculture and urbanization must be considered permanently lost.

**3. Current management policies and actions:** The majority of populations receive no special management and occur in areas open to at least some level of livestock grazing. Populations at Craig Mountain located within the TNC's Garden Creek Preserve, the BLM's Captain John Creek RNA, and the Craig Mountain WMA managed by IDFG are afforded protection from livestock grazing and human developments. However, trespass cattle grazing continues to occur at all three places. The BLM has established a *Calochortus nitidus* monitoring plot within a portion of the Wapshilla Ridge occurrence (055) at Craig Mountain. The IDFG has a vegetation monitoring plot adjacent to the BLM station that also contains *Calochortus nitidus*. A Conservation Agreement between the U.S. Fish and Wildlife Service, BLM, and a private landowner is in place for the Cove Creek population (101), southeast of Grangeville (U.S. Fish and Wildlife Service 1991). This population is periodically monitored by the BLM and the private landowner also has several cooperative responsibilities. The Canyon Creek population (053) on the Clearwater NF occurs within the Lochsa Recreation River corridor, but receives no special management action. Monitoring plots are located within several populations (020, 060, 064, 082, 084 and 100) on the Nez Perce NF and Hells Canyon NRA.

**4. Future land use:** All present private land uses are likely to continue. The extensive series of populations on BLM, IDFG and TNC lands at Craig Mountain should remain secure from any detrimental land use changes.

## **B. Cultivation.**

**1. Controlled propagation techniques:** Ownbey (1969) remarks that cultivation within the genus is difficult. Baxter and Gamon (1995) report that an individual in Moscow is propagating *Calochortus nitidus* from seed, along with several other congeners. These vary in age from seedlings to five-year old flowering plants.

**2. Ease of transplanting:** According to Ownbey (1969), no species of *Calochortus* has been successfully established in cultivation using wild-collected bulbs.

**3. Pertinent horticultural knowledge:** See above.

**4. Status and location of presently cultivated material:** An individual in Moscow, Idaho, has several species of *Calochortus*, including *C. nitidus*, in cultivation on his property (Baxter and Gamon 1995). No other cultivated plants are known.

## **11. Evidence of threats to survival.**

### **A. Present or threatened destruction, modification, or curtailment of habitat or range.**

**1. Past threats:** The historical range of *Calochortus nitidus* has greatly contracted, primarily due to its former grassland habitats in the Palouse Prairie region being converted to cropland. A century of livestock grazing has led to habitat degradation in much of the area that was not tillable. Dominance by invasive annual grasses and other weedy species characterize this habitat degradation. More localized habitat loss or degradation has also been caused by urban and rural community development, road construction, rock quarrying, and logging operations.

**2. Existing threats:** The cumulative direct and indirect effects of livestock grazing continue to threaten many populations, although most habitat depletion is not of recent origin. Reduced reproductive success due to flower and fruit herbivory and trampling of plants are examples of direct effects. Disturbance and the associated establishment of invasive weedy species is one example of the indirect effects. The rapid spread and seriousness of several weeds such as yellow starthistle (*Centaurea solstitialis*), spotted knapweed (*Centaurea maculosa*), sulfur cinquefoil (*Potentilla recta*) and common crupina (*Crupina vulgaris*) make habitat depletion a formidable ongoing threat. Timber harvest has increased in the past few years along the Joseph Plains, an area supporting several extensive *Calochortus nitidus* populations associated with forest openings. Timber harvest continues on the Nez Perce NF in areas also supporting extensive *Calochortus nitidus* populations. Impacts from logging operations are mainly associated with ground-disturbing activities such as road construction and decking. A few populations are known to be threatened by herbicide spraying or powerline route maintenance.

**3. Potential threats:** Potential threats are a continuation of those already reviewed above. In addition, small, isolated populations in the Grangeville, Orofino, and Kamiah areas may be more susceptible to local extirpation due to genetic bottlenecks and destructive stochastic events (Shaffer 1987). Fragmented populations in other portions of the species' range potentially face the same problems. The effects of forest successional canopy closure threatens a few populations as well.

### **B. Overutilization for commercial, sporting, scientific, or educational use.**

**1. Past threats:** Fiedler (1986) suggests overcollection for the horticultural trade may have contributed to the rarity of many *Calochortus* species in California. It is not known if *Calochortus nitidus* bulbs were ever collected for horticultural purposes.

**2. Existing threats:** Minimal to no existing threats known.

**3. Potential threats:** If propagation techniques improve for species like *Calochortus nitidus*, then horticultural collecting may pose a threat, at least at selected populations and especially as

gardening and landscaping with native plants increases.

### **C. Disease, predation, or grazing.**

**1. Past threats:** No diseases are known. Minor insect predation has been observed, but does not appear to be a conservation concern. Predation by pocket gophers can locally impact *Calochortus nitidus* populations (Caicco 1992). Past threats posed by livestock grazing have been discussed in previous sections and include both direct and indirect effects.

**2. Existing threats:** See past threats.

**3. Potential threats:** See past threats.

### **D. Inadequacy of existing regulatory mechanisms.**

**1. Past threats:** No evidence.

**2. Existing threats:** More than half of all extant *Calochortus nitidus* occurrences in Idaho occur fully or partly on private land and several others on State land. There are, however, no regulatory mechanisms in place to provide conservation options for populations on either private or State lands. There have been trespass cattle problems at populations in the Craig Mountain area. This problem is often hard to resolve, in part, due to inadequate regulatory options. Altering livestock grazing plans for plant conservation purposes on public lands, or in some cases even enforcing plans designed for such purposes, can be a difficult and contentious process.

**3. Potential threats:** Same as existing threats. There are also no existing state regulations for the protection of rare plants in Washington. This may limit potential conservation efforts if extant populations are discovered on private or State land in the future.

### **E. Other natural or manmade factors.**

**1. Past threats:** None known.

**2. Existing threats:** The small size of many populations, in terms of both size and numbers, poses a threat due to deleterious genetic and environmental events. The continued fragmentation and isolation of populations resulting mainly from habitat degradation compounds the threat to their survival.

**3. Potential threats:** See existing threats.

## **II. Assessment and Recommendations.**

**12. General assessment of vigor, trends, and status:** In Idaho, 16 occurrences are known to be extirpated due to habitat loss or degradation. These extirpations have taken place mainly in the Palouse Prairie area. An unknown number of other populations were destroyed when most of the species' core prairie grassland habitats were converted to crop agriculture, beginning over a century ago. Most remaining populations are located along the periphery of the former prairie grasslands. Of the 96 known

extant occurrences for *Calochortus nitidus*, 34 (35%) are comprised of less than 50 documented individuals, and often persisting in areas of fragmented and/or degraded habitat. These small, isolated populations are especially vulnerable to deleterious environmental and genetic events, and the long-term viability for at least some of these sites is doubtful. Seventeen (18%) occurrences are known to support more than 1000 genets. These larger populations are concentrated in four areas: Craig Mountain, the Joseph Plains, the Cold Spring Mountains, and the upper Whitebird to Slate creek drainages south of Grangeville. Populations in these areas are located largely on public lands, except for the Joseph Plains. The status of nine occurrences are unknown, as they have not been revisited in recent years. Several of these historical populations are located in the Palouse area, and the likelihood of their persistence is questionable.

Four historical populations in Washington are known or assumed extirpated (Baxter and Gamon 1995). Washington, as in Idaho, has seen nearly all of its former Palouse grassland habitat converted to agriculture. A population was discovered in Asotin County in August 1995, and is the only known extant site in the state.

### **13. Recommendations for listing or status change, and/or conservation actions.**

**A. Recommendations to the U.S. Fish and Wildlife Service:** Extensive historic populations of *Calochortus nitidus* were destroyed during the rapid conversion of the Palouse Prairie grasslands to crop agriculture during the latter part of the nineteenth century. A more gradual attrition of the species is related to subsequent habitat fragmentation and degradation, largely caused by early livestock grazing operations in the region. Despite these problems, I do not believe *Calochortus nitidus* warrants listing as a Threatened or Endangered Species at this time. This is the same conclusion reached by Caicco (1992) in the Species Management Guide he prepared for *Calochortus nitidus*. I recommend its C1 status be changed to 3c. The rationale for this recommendation is based on several factors: (1) the persistence of many populations, including more than a dozen large and vigorous ones in areas of relatively intact native vegetation, (2) large populations with a high probability of long-term viability are found in four separate areas, (3) public lands dominate three of these areas and provide the opportunity for conservation measures among possible management options, and (4) several conservation measures have already been implemented for some populations.

I agree with Caicco's (1992) assessment that if public agencies act in a timely and efficient manner, viable populations of *Calochortus nitidus* can be maintained, and in some places perhaps even enhanced. Implicit in this assessment is that *Calochortus nitidus* requires special and directed management to ensure its long-term conservation. My recommended status change is partly based on the premise that conservation measures now in place will continue and other identified conservation actions will also be implemented. In the future, if either of these premises proves to be false, then the recommendation should receive serious reevaluation.

When Caicco (1988a) compiled the first comprehensive status report for *Calochortus nitidus* in 1988, he recommended that a Habitat Management Plan be developed for the species. He also recommended *Calochortus nitidus* for federal C1 status. Since that time, a Species Management Guide pertaining to populations on the Nez Perce NF and Hells Canyon NRA has been written (Caicco 1992). This thorough analysis, with the objective of maintaining existing population levels, outlines specific conservation actions for populations located on the Salmon River (referred to as Slate Creek in the report) and Clearwater Ranger Districts of the Nez Perce NF, and the Idaho

portion of the Hells Canyon NRA. Also, a proposed Action Plan for *Calochortus nitidus* for the Clearwater NF has been prepared (Lorain 1991) and recommends several specific actions.

Based on new and updated information collected since 1988, Caicco's (1988a) recommendation that *Calochortus nitidus* be added to the federal C1 category no longer seems valid. However, his recommendation that a comprehensive Habitat Management Plan be developed remains applicable. Therefore, I recommend the U.S. Fish and Wildlife Service complete a rangewide Conservation Strategy for *Calochortus nitidus*. This strategy should specify conservation actions, responsible parties, and a timetable for their implementation. The Conservation Strategy should incorporate the reports and recommendations of Caicco (1992) and Lorain (1991). Several of these recommendations have already been initiated by the two forests. The Conservation Strategy should also incorporate the existing Conservation Agreement between the U.S. Fish and Wildlife Society, BLM, and a private landowner for the Cove Creek (101) occurrence. The Conservation Strategy should include the participation of the following agencies - Clearwater NF, Nez Perce NF, Wallowa-Whitman NF, Umatilla NF, BLM - Cottonwood Resource Area and IDFG. Inclusion of the Nez Perce tribal council and IDL should also be encouraged. In developing the Conservation Strategy, the identification of core populations based on size and ecological condition attributes will be important. However, the Strategy should not dismiss the importance of all extant populations for maintaining acceptable metapopulation structure and dynamics.

## **B. Recommendations to other U.S. Federal Agencies.**

### **1. U.S. Forest Service:**

**a. Nez Perce National Forest:** Although presently judged not to meet the requirements for federal listing under the Endangered Species Act, *Calochortus nitidus* is nonetheless a rare element and should remain a sensitive species for the Nez Perce NF. The long-term conservation of *Calochortus nitidus* is in large part contingent on its conservation on the Forest. This is highlighted by the fact that 31 (24%) of all known extant occurrences, including 9 of the 32 "A" and "B" ranked occurrences are located wholly or in part, on Forest land. I recommend the conservation of *Calochortus nitidus* be a resource objective for the Forest, and as such, its conservation should be incorporated into management strategies and objectives at the area or project level. Specific management recommendations for the Salmon River and Clearwater ranger districts have already been outlined in the Species Management Guide for *Calochortus nitidus* (Caicco 1992). These recommendations should be expanded to include the several new occurrences and extensions to previously known occurrences that have been discovered since the Guide was written in 1992. Recommended actions in the Guide not yet accomplished should continue to be pursued. I recommend all populations of *Calochortus nitidus* on the Forest be periodically revisited and population, habitat, and threat information updated. Newly identified threats should be dealt with as soon as possible. Ideally, sites should be revisited during "good" flowering years, typically following wet springs. Copies of the updated occurrence information should be forwarded to the CDC office in Boise. An additional recommendation is that areas supporting populations of *Calochortus nitidus* be a high priority for noxious weed surveys and control. Knapweeds, sulphur cinquefoil and perhaps other invasive weeds are serious threats to the open, grassland habitats supporting *Calochortus nitidus*. It is important control methods not be harmful to *Calochortus nitidus* plants. The Forest should be included in the rangewide Conservation Strategy I recommend be developed

for *Calochortus nitidus*.

**b. Clearwater National Forest:** Although presently judged not to meet the requirements for federal listing under the Endangered Species Act, *Calochortus nitidus* is nonetheless a rare element and should remain a sensitive species for the Clearwater NF. Two important populations are known from the Forest. The Canyon Creek population (053) near Lowell is located about 13 miles east of the nearest population and appears to represent the eastern extent of the species' distribution. The Hog Creek occurrence (117) near Deary is the only known extant population in Latah County. All others are extirpated or are considered historical because they have not been seen in the past 25 years or more. It represents the northernmost population known, being approximately 20 miles north of the next nearest population around Ahsahka. Although neither population is known to be very extensive they may still serve important evolutionary and conservation purposes (Lesica and Allendorf 1992).

The Hog Creek population was discovered during a cursory survey by Mike Hayes in 1992. He stated it was probably more extensive. I recommend additional survey work to better delineate this occurrence and to search for new populations on the Palouse Ranger District. Both the Hog Creek and the Canyon Creek occurrences should be considered for monitoring. I recommend all populations of *Calochortus nitidus* on the Forest be periodically revisited and population, habitat and threat information updated. Newly identified threats should be dealt with as soon as possible. Ideally, sites should be revisited during "good" flowering years, typically following wet springs. Copies of the updated occurrence information should be forwarded to the CDC office in Boise. Areas near *Calochortus nitidus* populations should receive high priority for noxious weed surveys and control. It is important control methods not be harmful to *Calochortus nitidus* plants. The Forest should be party to the rangewide Conservation Strategy recommended above. These recommendations are similar to those originally proposed in the Action Plan for *Calochortus nitidus* on the Clearwater NF in 1991 (Lorain 1991).

**c. Wallowa-Whitman NF:** The Wallowa-Whitman NF administers the segment of Hells Canyon NRA located in Idaho. The Cold Springs Mountain portion of the NRA supports some of the highest quality populations of *Calochortus nitidus* known. The Cold Springs Mountains are one of four remaining areas supporting populations of *Calochortus nitidus* with good long-term conservation prospects. Among the ten occurrences within the NRA are three "A" ranked (032, 056 and 084) and two "B" ranked (020, 090) populations. The Cow Creek Saddle occurrence (020) represents the southernmost known extent for the species. Although presently judged not to meet the requirements for federal listing under the Endangered Species Act, *Calochortus nitidus* is nonetheless a rare element, and I recommend it be added to the sensitive species for the Wallowa-Whitman NF. I recommend the Forest conduct field inventories for *Calochortus nitidus* in Oregon, targeting the area from near Hat Point, north to the Forest boundary, between about 2500 to 6000 feet elevation. I recommend all populations of *Calochortus nitidus* within the NRA be periodically revisited and population, habitat, and threat information updated. Newly identified threats should be dealt with as soon as possible. Ideally, sites should be revisited during "good" flowering years, typically following wet springs. Copies of the updated occurrence information should be forwarded to the CDC office in Boise.

Presently, the NRA is in the process of revising its Comprehensive Management Plan. The draft Environmental Impact Statement (EIS) for the Management Plan is due for release in February 1996, and the final EIS is anticipated around September 1996. Recommendations for the NRA outlined in the *Calochortus nitidus* Species Management Guide (Caicco 1992) should be incorporated into the Management Plan. This includes a continuation of population monitoring studies established within the NRA. An additional recommendation is that areas supporting populations of *Calochortus nitidus* be a high priority for noxious weed surveys and control. It is important control methods not be harmful to *Calochortus nitidus* plants. The Forest should be included in the rangewide Conservation Strategy I recommend be developed for *Calochortus nitidus*. The recommended actions outlined in the Species Management Guide can form the basis of the Forest's responsibilities within the Conservation Strategy framework.

**d. Umatilla National Forest:** The only known extant population of *Calochortus nitidus* in Washington was discovered in August 1995, on the Umatilla NF, Pomeroy Ranger District. This is the westernmost population known and is disjunct by about 25 miles from the nearest Idaho populations. Although presently judged not to meet the requirements for federal listing under the Endangered Species Act, *Calochortus nitidus* is nonetheless a rare element, and it should remain on the sensitive species list for the Umatilla NF. I recommend additional field surveys be conducted for *Calochortus nitidus* on the Forest. These are scheduled for the 1996 summer field season (Karl Urban, Umatilla NF, pers. comm. 1996).

**2. Bureau of Land Management:** Although presently judged not to meet the requirements for federal listing under the Endangered Species Act, *Calochortus nitidus* is nonetheless a rare element, and I recommend it be added to the BLM sensitive species list for Idaho. If in the future, populations are discovered on BLM land in Oregon or Washington, it should be considered for the sensitive species lists in these states. Twenty-five (26%) extant *Calochortus nitidus* occurrences in Idaho are at least partly on BLM land. This include eight "A" or "B" ranked occurrences. Several of these are at Craig Mountain, and the long-term conservation of *Calochortus nitidus* in this area will require continued BLM coordination and cooperation with several entities, especially the IDFG.

The Cove Creek (101) population of *Calochortus nitidus* is presently protected by a Conservation Agreement between the U.S. Fish and Wildlife Service, BLM, and private landowner. I recommend this Agreement be renewed. It is also recommended that the BLM cooperate with the U.S. Fish and Wildlife Service in developing a rangewide Conservation Strategy to maintain and/or enhance existing populations on land they administer. Actions agreed upon should be incorporated into the appropriate BLM management planning documents when these are due for revision.

The BLM, Cottonwood Resource Area should continue sensitive plant clearance work in project areas known or suspected to support *Calochortus nitidus* populations. Two areas south of Joseph, Idaho, that are a mix of BLM and private lands, contain a large amount of potential *Calochortus nitidus* habitat and deserve further field investigation. These are the Camp Howard Ridge complex from Saddle Horse Ridge, south for approximately four miles to the Camp Howard triangulation point area, and the nearby Higrange Ridge complex. The Rattlesnake Ridge area several miles west of Boles also contains potential *Calochortus nitidus* habitat. This area is also largely a mix of BLM and private land. Good populations in these areas would substantially improve the long-

term prospects of *Calochortus nitidus* in the Joseph Plains area. I recommend all populations of *Calochortus nitidus* within the Cottonwood Resource Area be periodically revisited and population, habitat, and threat information updated. Newly identified threats should be dealt with as soon as possible. Ideally, sites should be revisited during "good" flowering years, typically following wet springs. Copies of the updated occurrence information should be forwarded to the CDC office in Boise. Scattered BLM parcels in Wallowa County, Oregon, contain potential *Calochortus nitidus* habitat administered by the Vale District Office. In adjacent Asotin County, Washington, a small amount of potential *Calochortus nitidus* habitat may occur on land administered by the Spokane District Office. I recommend field surveys be conducted for *Calochortus nitidus* on BLM land in both states as soon as feasible. Finally, areas supporting populations of *Calochortus nitidus* should be a high priority for noxious weed surveys and control. It is important control methods not be harmful to *Calochortus nitidus* plants.

### **C. Other status recommendations.**

**1. Counties and local areas:** No recommendations.

#### **2. State - Idaho:**

**a. Idaho Department of Fish and Game:** Management recommendations for populations of *Calochortus nitidus* occurring on IDFG land at Craig Mountain are contained in Mancuso and Moseley (1994). These include:

1. IDFG should consult the species' distribution maps prepared for the Craig Mountain WMA to help avoid possible conflicts with management activities.

2. Plants occur alongside or in close proximity to roads in several places. Road maintenance and related activities should be conducted to avoid destroying plants. This may entail coordination with county roadcrews.

3. Portions of populations near roads are potentially subject to inadvertent poisoning from herbicide sprays. Spray applicators should know how to identify this species and avoid spraying it.

4. Grasslands a few miles west of the main Zaza road, in the vicinity of the Fish and Game access road to the Madden Corrals parking area, are in excellent ecological condition and support robust *Calochortus nitidus* populations. The access road should be regularly (annually) surveyed for noxious weeds. If found, they should be controlled as soon as possible. Presently, the noxious weed problem along this road is minimal compared to many others at Craig Mountain.

5. *Calochortus nitidus* is found in natural grassy openings along the crest of Craig Mountain. These openings are often surrounded by forests. It should not be difficult to avoid disturbing *Calochortus nitidus* sites during any timber harvest operations. Because not every grassy opening has been surveyed for this species, those that may be impacted by logging activities should be checked first.

6. At least one of the IDFG vegetation monitoring stations (94MM008) contains *Calochortus nitidus*. This site should be incorporated into any rangewide monitoring plan developed for the species. This site is adjacent to a BLM monitoring plot.

**b. Idaho Department of Lands:** Ten occurrences of *Calochortus nitidus* occur at least partly on IDL lands. This includes three "A" rank sites, two (093, 094) of which are on the Joseph Plains and largely shared with private landowners. The other is located in the Hoover Point area at Craig Mountain and shared with IDFG. These high quality populations are important for the long-term conservation of the species. To the fullest extent possible, IDL should work with the U.S. Fish and Wildlife Service to develop conservation measures assuring the long-term persistence of populations they manage, especially the three mentioned above. I recommend that *Calochortus nitidus* populations and adjacent areas be a high priority for noxious weed surveys and control. It is important control methods not be harmful to *Calochortus nitidus* plants.

**c. Conservation Data Center:** The Idaho CDC has ranking responsibility for *Calochortus nitidus* in the Association of Biodiversity Information. The CDC will keep the global (G) and state (S) ranks as G3 and S3.

**d. Idaho Native Plant Society:** I recommend the Idaho Native Plant Society transfer *Calochortus nitidus* from their list of globally rare and threatened federal candidates to the sensitive category. The sensitive list is for taxa with small populations or localized distribution within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats.

### **3. Other Nations:**

**a. Nez Perce Indian Reservation:** Four occurrences of *Calochortus nitidus* are partly located on land owned by the Nez Perce nation. The South of Orofino occurrence (007) is the largest known population remaining in the Orofino portion of the species' range. This "B" rank population apparently extends onto adjacent private land. The other three occurrences are located in the Craig Mountain area and include two "A" rank (001, 132) and one "B" rank (050) populations. Land ownership of these populations is shared with IDFG at all sites and with private landowners at two (001, 132). To the fullest extent possible, the U.S. Fish and Wildlife Service should work with the Nez Perce nation to include these four populations in preparing the Conservation Strategy for *Calochortus nitidus*.

**4. International:** No recommendations.

## **14. Recommended critical habitat:**

**A. Concise statement of recommended critical habitat.** At this time, no specific critical habitat is recommended. However, identification of protected habitat should be considered as part of an overall Conservation Strategy for *Calochortus nitidus*. These areas should be distributed

throughout the range of *Calochortus nitidus* as much as possible, including Craig Mountain, Cold Springs Mountains, the Joseph Plains and the ridges south of Grangeville. Caicco (1988) listed several areas as possible critical habitat in the 1988 status report. In Idaho, public lands owned/managed by the Nez Perce NF, Clearwater NF, Wallowa-Whitman NF, BLM and IDFG are probably the best candidates for critical habitat designation. The one known extant population in Washington is also located on public land, in this case the Umatilla NF.

**B. Legal Description of boundaries:** No specific areas recommended.

**C. Latitude and longitude:** No specific areas recommended.

**D. Publicity/sensitivity of critical habitat area:** No specific areas recommended.

## 15. Conservation/recovery recommendations.

### A. General conservation recommendations.

**1. Recommendations regarding present or anticipated activities:** Additional field surveys recommended for *Calochortus nitidus* are outlined in the Recommendations section above. In addition I recommend populations of *Calochortus nitidus* on the various National Forest and BLM lands be periodically revisited and population, habitat, and threat information updated. Newly identified threats should be dealt with as soon as possible. The Forest Service and BLM should continue sensitive plant clearance work in project areas known or suspected to support *Calochortus nitidus* populations. *Calochortus nitidus* sites on public and state lands are recommended to be a high priority for noxious weed surveys and control. Caicco (1992) lists a series of recommended actions for the Nez Perce NF and Hells Canyon NRA that should continue to be pursued and implemented. Finally, I recommend the U.S. Fish and Wildlife Service take the lead in developing a rangewide Conservation Strategy for this species.

**2. Areas recommended for protection:** I recommend areas throughout the range of *Calochortus nitidus* be selected for conservation management. Caicco (1988a) recommended several populations in the Cold Springs Mountain, extending north from Cow Creek Plateau to the Grave Point area. I recommend this be extended further north and include the Big Canyon Saddle (084) occurrence. Several occurrences located on BLM and IDL (e.g., 093, 094 and 121-125) land are good candidates for protection in the Joseph Plains area. Most of these occurrences are based on cursory survey work and may be more extensive than presently known. Populations in the Craig Mountain area (e.g., 001, 052, 055, 129, 132, 133, 135 and 136) are already afforded various levels of protection due to the conservation-oriented management of the Craig Mountain WMA, the South Fork Captain John RNA and TNC's Garden Creek Preserve. There are a series of large populations in forest openings along the ridge systems west of the Gospel Hump Wilderness. Most of these are on the Nez Perce NF (e.g., 066, 073, 074, 082, 087, 089 and 100). Three are *Calochortus nitidus* monitoring sites (066, 082 and 100) and perhaps the most logical sites for special conservation management. The Cove Creek occurrence (101) is already covered by a Conservation Agreement between the U.S. Fish and Wildlife Service, BLM, and a private landowner. The two known populations on the Clearwater NF are located at the northern (117) and eastern (053) limits of the species' distribution and worthy of special management consideration. The largest remaining population known in the Orofino area (007) is located on Nez Perce Tribe

and private land. The feasibility of protecting this population deserves investigation.

**3. Habitat management recommendations:** Further loss and degradation of *Calochortus nitidus* habitat needs to be minimized. Towards this end, areas supporting populations of *Calochortus nitidus* should be a high priority for noxious weed surveys and control. The Species Management Guide for *Calochortus nitidus* (Caicco 1992) outlines several recommendations related to livestock grazing management. I recommend these continue to be pursued and implemented.

**4. Publicity sensitivity:** Modifications to livestock grazing programs for purposes related to the conservation of *Calochortus nitidus* can be expected to generate some public debate.

**5. Other recommendations:** None.

**B. Monitoring activities and further studies recommended:** To help gather information needed to prepare a Species Management Guide, Caicco (1988c; 1989; 1992) initiated a life history and population dynamics study for *Calochortus nitidus*. This included establishing plots at the Cow Creek Plateau (020) and Grave Point Lookout (060) populations on the Nez Perce NF in 1988. Similar studies have been conducted for several species of *Calochortus* in California (Fiedler 1985; 1986; 1987) and were used to help in the design for Idaho. A monitoring protocol based on less intensive methods than those used for the life history study was established on the Nez Perce NF in 1991, near Cabin Creek (064, 082). Caicco (1992) recommended additional transects be installed along the ridges between Banner Ridge and Dairy Mountain. In 1993, the Nez Perce NF met this recommendation when it established permanent monitoring plots at the Delmage Ridge (100) occurrence. One other monitoring station was constructed in 1993, at Big Canyon Saddle (084), within the Hells Canyon NRA. Caicco (1992) also suggested instituting a less rigorous assessment for populations he identified to be at a high risk of extirpation on the Forest. This would involve revisiting as many sites as possible each summer and appraising their status.

The Cove Creek (101) population is monitored by the BLM as part of a Conservation Agreement for this site. The BLM also has a permanent *Calochortus nitidus* monitoring station at Craig Mountain (055). This is adjacent to an IDFG vegetation monitoring plot that also contains *Calochortus nitidus*.

I recommend all of the above sites be resampled on a regular basis. I also recommend the Clearwater NF begin to monitor the Canyon Creek (053) and Hog Creek (117) populations. The BLM should consider monitoring one or more populations in the Joseph Plains area. Pending the results of additional field surveys in 1996, the Umatilla NF may also need to initiate a monitoring program. Monitoring will clearly be an integral component of any conservation strategy design for *Calochortus nitidus*.

The Conservation Data Center is in the process of building a data base to keep track of all rare plant monitoring conducted in Idaho. All of the National Forests and BLM offices around the state have been recently contacted regarding this project. Pertinent *Calochortus nitidus* monitoring information should be sent to the CDC to help with this effort.

## **16. Interested parties:**

Bob Moseley  
Conservation Data Center  
Idaho Fish and Game  
600 S. Walnut St.  
P.O. Box 25  
Boise, ID 83707

Robert Parenti  
Boise Field Office  
U.S. Fish and Wildlife Service  
4696 Overland Road  
Boise, ID 83705

John Gamon  
Washington Natural Heritage Program  
Department of Natural Resources  
P.O. Box 47016  
Olympia, WA 98504

District Ranger  
Nez Perce National Forest  
Clearwater Ranger District  
Route 2, Box 475  
Grangeville, ID 83530

District Ranger  
Nez Perce National Forest  
Salmon River Ranger District  
HC 01, Box 70  
White Bird, ID 83554

Leonard Lake  
Nez Perce National Forest  
Route 2, Box 475  
Grangeville, ID 83530

District Ranger  
Clearwater National Forest  
Palouse Ranger District  
Route 2, Box 4  
Potlatch, ID 83855

Mike Hays  
Clearwater National Forest  
Palouse Ranger District  
Route 2, Box 4  
Potlatch, ID 83855

District Ranger  
Clearwater National Forest  
Lochsa Ranger District  
Route 1, Box 398  
Kooskia, ID 83539

Wallowa-Whitman National Forest  
Hells Canyon NRA  
Route 1, Box 270A  
Enterprise, OR 97828

Paula Brooks  
Wallowa-Whitman National Forest  
P.O. Box 907  
Baker City, OR 97814

District Ranger  
Umatilla National Forest  
Pomeroy Ranger District  
Pomeroy, WA 99347

Karl Urban  
Umatilla National Forest  
2517 S.W. Hailey Ave.  
Pendleton, OR 97801

State Director - Idaho  
Bureau of Land Management  
3380 Americana Terrace  
Boise, ID 83706

Roger Rosentreter  
Bureau of Land Management  
3380 Americana Terrace  
Boise, ID 83706

District Manager  
Bureau of Land Management  
Upper Columbia - Salmon Clearwater Districts  
1808 North 3rd Street  
Coeur d'Alene, ID 83814

Craig Johnson  
Bureau of Land Management  
Upper Columbia - Salmon Clearwater Districts

Cottonwood Resource Area  
Route 3, Box 181  
Cottonwood, ID 83522

Nez Perce Tribe  
P.O. Box 365  
Lapwai, ID 83540

Director  
Idaho Department of Lands  
P.O. Box 83720  
Boise, ID 83720

Area Supervisor  
Idaho Department of Lands - Clearwater Area  
10230 Highway 12  
Orofino, ID 83544

Bill Rybarczyk  
Idaho Department of Fish and Game  
1540 Warner Ave.  
Lewiston, ID 83501

Hells Canyon Preservation Council  
P.O. Box 908  
Joseph, OR 97846

The Nature Conservancy  
Idaho Field Office  
P.O. Box 165  
Sun Valley, ID 83353

Janice Hill  
The Nature Conservancy  
2990 State Highway 3  
Deary, ID 83823

Idaho Native Plant Society  
P.O. Box 9451  
Boise, ID 83707

Steve Caicco  
U.S. Fish and Wildlife Service - Ecological Services  
2800 Cottage Way  
Rm. E 1803  
Sacramento, CA 95825

Doug Henderson  
University of Idaho Herbarium  
Department of Biological Sciences  
University of Idaho  
Moscow, ID 83843

Jim Smith  
Snake River Plain Herbarium  
Boise State University  
Department of Biology  
Boise, ID 83725

### III. Information Sources.

#### 17. Sources of information.

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## 2. Other pertinent publications.

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Bingham, R.T. 1987. Plants of the Seven Devils Mountains of Idaho - an annotated checklist. Gen. Tech. Rep. INT-219. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 146 p.

### b. Popular: None.

**B. Herbaria consulted:** At least four major herbarium searches have been conducted for Idaho's rare plants over the years, including *Calochortus nitidus*, most recently in 1989 (Moseley 1989). Specimens of *Calochortus nitidus* are known to be deposited at the following herbaria: Cottonwood BLM, ID, IDS, Lochsa R.D., MRC, OSC, Slate Creek R.D., SW, WS, WTU, UC. These standardized acronyms follow Holmgren et al. (1990) for national and regional herbaria and Moseley (1989) for local Idaho herbaria. For specific collection information relating to each occurrence, refer to the "Specimen" field in the occurrence records (Appendix 2, 3, 4 and 5). During a recent, brief visit to OSC, I looked at specimens of putative *Calochortus nitidus* in the appropriately labelled folder. All appear to be misidentified. They all look to be *C. eurycarpus*.

**C. Fieldwork:** Systematic field inventories in Idaho have been conducted by Steve Caicco for the Nez Perce NF (Caicco 1987), Clearwater NF (Caicco 1988b), and in support of the 1988 status report (Caicco 1988a). Caicco also searched for *Calochortus nitidus* along the Clearwater Canyon in 1985, and around White Bird Hill in 1986 (Caicco 1988a). Rare plant searches have been conducted by various botanist associated with TNC's Garden Creek Preserve at Craig Mountain, beginning in the late 1980s. During the 1990s, many occurrences have been discovered by Nez Perce NF and BLM, Cottonwood Resource Area, botanists conducting rare plant surveys and project clearance work. New populations were discovered and information on several others updated in the Idaho portion of Hells Canyon NRA and surrounding lands by Conservation Data Center botanists (Mancuso and Moseley 1991). In 1993, several new populations were discovered and information on other known sites updated during rare plant surveys associated with the IDFG's natural resource inventory project at Craig Mountain (Mancuso and Moseley 1994).

Fieldwork in eastern Washington was conducted in support of the recently completed status report for Washington (Baxter and Gamon 1995). Scott Riley discovered the only known extant population of *Calochortus nitidus* in Washington while conducting rare plant surveys for the Umatilla NF in 1995.

### D. Knowledgeable individuals:

Bob Moseley  
Conservation Data Center  
Idaho Dept. of Fish and Game  
600 S. Walnut St.  
P.O. Box 25

Boise, ID 83707

Michael Mancuso  
Conservation Data Center  
Idaho Dept. of Fish and Game  
600 S. Walnut St.  
P.O. Box 25  
Boise, ID 83707

Juanita Lichthardt  
Conservation Data Center  
404 Lewis Street  
Moscow, ID 83843

Doug Henderson  
University of Idaho Herbarium  
Department of Biological Sciences  
University of Idaho  
Moscow, ID 83843

Leonard Lake  
Nez Perce National Forest  
Route 2, Box 475  
Grangeville, ID 83530

Mike Hays  
Clearwater National Forest  
Palouse Ranger District  
Route 2, Box 4  
Potlatch, ID 83855

Craig Johnson  
Bureau of Land Management  
Upper Columbia - Salmon Clearwater Districts  
Cottonwood Resource Area  
Route 3, Box 181  
Cottonwood, ID 83522

Steve Caicco  
U.S. Fish and Wildlife Service - Ecological Services  
2800 Cottage Way  
Rm. E 1803  
Sacramento, CA 95825

Chris Ebrahimi  
2844 Fredrick  
Medford, OR 97504

Karen Gray  
P.O. Box 1075  
Orofino, ID 83544

Janice Hill  
2990 State Highway 3  
Deary, ID 83823

Loring Jones  
1546 Borah Ave.  
Moscow, ID 83843

Scott Riley  
c/o Umatilla NF  
2517 S.W. Hailey Ave.  
Pendelton, OR 97801

Angela Sondenna  
Dept. of Biological Sciences  
University of Idaho  
Moscow, ID 83843

Sarah Walker  
P.O. Box 69  
Peck, ID 83545

Several other names are listed in Caicco (1988a).

**E. Other information sources:** None known.

**18. Summary of material on file:** Color slides, field forms, maps, and most published and unpublished references pertaining to *Calochortus nitidus* are on file at the Idaho CDC office in Boise, Idaho. Many of the references cited, field notes, and additional information concerning the extirpated and extant populations of *Calochortus nitidus* in Washington state are on file at the Washington Natural Heritage Program office in Olympia.

#### **IV. Authorship.**

##### **19. Initial authorship:**

Michael Mancuso  
Conservation Data Center  
Idaho Dept. of Fish and Game  
600 S. Walnut St., P.O. Box 25  
Boise, ID 83707

**20. Maintenance of status report:** The Idaho CDC and the Washington Natural Heritage Programs

will maintain current information for their respective states. The Idaho CDC will update the status report for Idaho as needed. Should *Calochortus nitidus* be listed as a threatened or endangered species by the U.S. Fish and Wildlife Service, the Boise Field Office of the Service should maintain the primary file on information, encourage others to provide new information, and distribute new findings to the interested parties (see Section II.16.).

#### **V. New information.**

**21. Record of revisions:** This report updates information contained in the status report for *Calochortus nitidus* completed in 1988 (Caicco 1988a).

## Appendix 1

Slides of the habit and habitat of *Calochortus nitidus*.

Slide 1. Close-up of flower and the three-winged fruit.

Slide 2. Close-up of plant; note the solitary erect basal leaf.

Slide 3. *Calochortus nitidus* habitat in the Whitebird Hill area.

Slide 4. Canyon rim habitat along Wapshilla Ridge, Craig Mountain.

## Appendix 2

### Conservation Data Center records for extant occurrences of *Calochortus nitidus* in Idaho.

Note: Each extant population has an occurrence rank (EORANK) between A and D. These ranks are defined below.

**A-Ranked populations** - consist of a large number of plants in high quality habitat. Populations cover two or more acres and support 1000 or more genets. The relatively intact vegetation is dominated by native species. Invasive annual grasses or other weeds species may be present, but at low density. These populations are often in areas with limited access or water, or are rocky and provide minimal forage, and therefore are not subject to intensive livestock grazing.

**B-Ranked populations** - consists of 500 -1000 genets. At least portions of the habitat are relatively intact. Also applies to some larger populations with more than 1000 genets, but where the habitat has been degraded and is dominated by weedy species.

**C-Ranked populations** - consists of 50 - 500 genets. Habitat conditions are variable, but in most cases, portions are degraded and dominated by weedy species.

**D-Ranked populations** - consists of less than 50 genets. Populations are often isolated or fragmented and with degraded habitat conditions. The long-term viability of many of these sites is doubtful.

### Appendix 3

Conservation Data Center records for  
extirpated occurrences of *Calochortus nitidus* in Idaho.

### Appendix 4

Conservation Data Center records for  
historical occurrences of *Calochortus nitidus* in Idaho.

### Appendix 5

Conservation Data Center records for occurrences of  
*Calochortus nitidus* in Idaho believed to be based on erroneous reports.