

Current Knowledge and Conservation Status of *Ivesia webberi* Gray (Rosaceae), the Webber ivesia, in Nevada.

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SUMMARY: *Ivesia webberi* was first discovered by J. G. Lemmon at what would be its type locality in Sierra Valley, Plumas County, California in 1872. Asa Gray described it as a new species in 1874. It is a perennial, tap-rooted low spreading herb to 2.5 dm across with silky haired grayish leaflets clustered at the tips of a dark red rachis and bright yellow ball-like heads of flowers. This distinctive species is not likely to be confused with other similar species. *Ivesia webberi* occurs very sporadically in Lassen, Plumas, and Sierra Counties, California and in Douglas and Washoe Counties, Nevada.

Until very recently, nearly all of its California occurrences and many of its Nevada occurrences were known only from historic herbarium collections. Field surveys sponsored in 1990 and 1991 by the Plumas, Tahoe, and Humboldt-Toiyabe National Forests succeeded in relocating the type population as well as documenting several new occurrences on the rim of Upper Long Valley on the California-Nevada border. Surveys conducted in 1997-1998 as part of this status report redocumented all of the known Nevada occurrences and substantiated other historic records but found no additional occurrences.

At the end of 1996, *Ivesia webberi* was known from 14 populations in Lassen, Plumas and Sierra Counties, California, and Douglas and Washoe Counties, Nevada. Four of the Nevada populations were within the vicinity of rapid urbanization in the Reno area. One of the California populations is in a valley which had been repeatedly proposed for a water storage reservoir. Because of these potential impacts and its rarity and continued vulnerability, *Ivesia webberi* was designated a category-2 candidate for federal listing on 21 February 1990. Responding to this concern, the U.S. Fish and Wildlife Service, Nevada Natural Heritage Program, the Plumas, Tahoe, and Humboldt-Toiyabe National Forests, and others sponsored and conducted extensive field surveys in 1990-1998 to verify and refine the historical reports, discover any additional populations, and document the biology, ecology, and conservation status of all populations. This report summarizes the results of all recent surveys, reviews all previous knowledge of the species, and recommends conservation and recovery actions.

The recent surveys compiled for this report document seven extant populations in Nevada and seven extant populations in California. Since the status surveys, one additional population has been documented in Washoe County, Nevada. These 15 occurrences are clustered in seven general locations. As documented, the global occurrences of *Ivesia webberi* total roughly 4,855,200 plants covering about 186 acres (75.5 ha) between 4480 and 5950 feet (1365-1815 meters) elevation. The Nevada populations total about 4,740,000 plants in an area of approximately 29.2 acres (11.9 ha) at elevations of 5,320 to 5,950 feet (1620-1815 meters). In Nevada, *Ivesia webberi* occurs on public lands managed by the Bureau of Land Management (0.9%) Humboldt-Toiyabe National Forest (69.8%), and on privately managed lands (29.3%).

Ivesia webberi is restricted to shallow, clayey soils with a rocky pavement-like surface. These soils are derived from andesitic rock. Occupied sites are restricted to mid-elevation flats, benches or terraces with no colluvial accumulation from upslope. Generally they occur on mountain slopes above large valleys. The habitat supports a sparse to moderately dense vegetation usually dominated or co-dominated by *Ivesia webberi* and low sagebrush or squirrel-tail grass in association with a wide variety of usually dwarfed, or cushion-like perennial herbs.

Recent surveys focusing on about 3,955 acres (1600 ha) of additional potential habitat in western Washoe County and in the Pine Nut Mountains of Douglas County, Nevada, have revealed no further populations of *Ivesia webberi*. Although there is still a lot of potential habitat in Nevada which remains unsurveyed, and despite a new population discovered in 2000, field observations indicate it unlikely that any significant new occurrences will be found. Globally, the western rim of Upper Long Valley, Sierra County, California, remains the last unsurveyed area with highly suitable habitat.

The mid-elevation bench or terrace location of many of the *Ivesia webberi* sites are particularly vulnerable to urban development. The sites are also attractive and convenient for access roads, off-road vehicle use, livestock supplementation and resultant trampling, and fire suppression activities. All eight of the Nevada occurrences of *Ivesia webberi* have moderate impacts from one or more of these. Urban development is the single-most significant threat to the private land occurrences of *Ivesia webberi*. At the time of the 1997-1998 field surveys, three of the eight known populations had been recently fenced by the landowner for the purposes of low density housing development. A fourth population occurs in southwest Reno just above recent urban development and is subject to impacts associated with the nearby high-density human habitation as well as by the potential for expanding development in the area. Only two populations are entirely on public lands and afforded any protection from private development. But both of these are immediately adjacent to private lands and off-road vehicular use and other human use impacts may compromise their viability as well. The California populations are primarily on public lands managed by the Humboldt-Toiyabe National Forest, tend to be a bit more remote, and do not appear to be quite as vulnerable as those in Nevada. Currently *Ivesia webberi* is managed as a "sensitive species" by the U.S. Forest Service and the Bureau of Land Management, but has no other legal status or protective designation.

Based on the best available scientific evidence, *Ivesia webberi* meets the definition of a candidate for listing as threatened under the Endangered Species Act. The inevitable extirpation of several populations near Bordertown and the ongoing impacts and threats to populations in the vicinity of Reno clearly indicate that this species is "likely to become endangered within the foreseeable future throughout a significant portion of its range." This report recommends that *Ivesia webberi* be proposed for candidacy and listing as Threatened under the Endangered Species Act. Additionally, this report recommends several conservation and recovery measures which, if successfully implemented, offer the best change to eliminate any future need to list *Ivesia webberi* as endangered. Primary among these are acquisition of the largest of the at-risk populations on private lands, long-term monitoring of all populations, development of cooperative management plans, and realignment of roads and trails which currently impact numerous populations.

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All information contained in this report was believed current and complete on the date it was printed. Please submit any and all additions, corrections, updates, comments, or suggestions, whatever their magnitude, to either of the addresses above.

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I. CLASSIFICATION AND SYSTEMATICS

Scientific Name: *Ivesia webberi* Gray (1874, p. 71).

Type Specimen: CALIFORNIA, Sierra County: Sierra Valley, 1873, *J.G. Lemmon s.n.*
Lectotype: GH (Rydberg 1908, p. 287). Isolectotype: K.

Synonym(s): *Potentilla webberi* Greene (1887, p. 105) and *Horkelia webberi* Rydberg (1898, p. 149).

Vernacular Name(s): Webber ivesia, Webber's ivesia.

Family: Rosaceae (rose family).

Major Groups:	Cronquist (1988)	Thorne (1992)
Class	Magnoliopsida (Dicotyledoneae)	Magnoliopsida (Angiospermae)
Subclass	Rosidae	Magnoliidae (Dicotyledoneae)
Superorder		Rosanae
Order	Rosales	Rosales

Review of Alternative Taxonomic Treatments: *Ivesia webberi* is not likely to be confused with any other species. In the original description, Gray describes it as "a neat and very distinct little species, most resembling *I. unguiculata* in the leaflets; but these are crowded on an inch or less of the rachis, and the villosity is less dense and silky; also the petals smaller and bright yellow." No subsequent work published on this species or *Ivesia* has challenged this. *Ivesia webberi* appears to be a distinct and well-defined species.

There is no single feature separating *Ivesia* from *Potentilla* or the related *Horkelia*. Some authors have variously combined the three genera. *Ivesia webberi* was originally described as an *Ivesia*, but was later included in *Potentilla* (Greene 1887) and *Horkelia* (Rydberg 1898). In 1938, Keck returned this taxon to the genus *Ivesia* where it has remained ever since. Prevailing taxonomic sentiment is to recognize that the three genera are heterogeneous and overlapping as currently defined (Ertter 1989). The foregoing does not in any way call into question the validity of *Ivesia webberi* as a distinct species, in whatever genus it may eventually be placed.

Biogeography and Phylogeny: The genus *Ivesia* Torr. & A. Gray consists of about 30 taxa restricted to the western United States and northern Baja California, Mexico. The genus apparently evolved from *Potentilla* L., a notoriously complex, diverse, and widespread genus. *Ivesia* was often included within the larger genus, but more recent treatments have recognized *Ivesia* and the related *Horkelia* as distinct genera. These three genera may have common ancestors, or some may have evolved from ancient members of the others.

No detailed studies of the origin and evolution of the genus *Ivesia*, much less of *Ivesia webberi*, are known to exist. Within the genus, *Ivesia webberi* is usually placed with the morphologically similar species such as *I. shockleyi*, *I. muirii*, and *I. lycopodioides*. These high elevation species have distributions which include the range of *Ivesia webberi* but there is no overlap of occupied habitats. Until there are significant additional studies of the *Horkelia*, *Potentilla*, and *Ivesia*, perhaps resulting in numerous smaller genera of more homogeneous evolutionary groups, it is impossible to speculate on the ancient origins of *Ivesia webberi*.

II. TAXON HISTORY

Unless otherwise cited, reports and correspondence documenting the following chronology are on file with the Nevada Natural Heritage Program.

- 1872: Discovered and first collected at the eventual type locality in Sierra Valley, California by J.G. Lemmon.
- 1874: Formally described as a distinct species by A. Gray, who reported it in error from Indian Valley, California. Gray also mentions it being found near the residence of Dr. Webber, the owner of Webber Lake.
- 1886. Last historic collection from California (American Valley) by M. Austin in June.
- 1887: Recombined as *Potentilla webberi* by E. L. Greene.
- 1896: First collected in Nevada (hills 5 miles N of Reno) by F. H. Hillman on 16 May.
- 1898: Recombined as *Horkelia webberi* by P. A. Rydberg.
- 1908. Lectotype herbarium specimen designated by P. A. Rydberg.
- 1938. Treated as *Ivesia webberi* by D. D. Keck in his revision of the genera *Ivesia* and *Horkelia*. Keck further stated that no collection in the Gray Herbarium is labeled “Indian Valley” or “Dr. Webber”.
- 1962. Rediscovered in California (Sierra County, Dog Valley) by UNR students York, Bell, and Small on 7-9 May.
- 1988. Included on the California Native Plant Society’s List 1B (Smith and Berg 1988).
- 1990. Designated a category-2 candidate for listing under the Endangered Species Act on 21 February (U.S.D.I. Fish and Wildlife Service 1990).
- 1990. Field surveys conducted in Sierra, Indian, American, and Genessee Valleys, California, through a joint effort between The Nature Conservancy, the Tahoe National Forest, and the Plumas National Forest. A single population in Sierra Valley, the type locality, was relocated. No other populations found.
- 1991. Designated a sensitive species by the Humboldt-Toiyabe National Forest (Weixelman and Atwood 1991).
- 1991. Field surveys conducted on the Humboldt-Toiyabe National Forest through a joint effort between The Nature Conservancy and the Humboldt-Toiyabe National Forest. Five new populations found in Sierra County, California and Washoe County, Nevada. Several historic Nevada populations relocated, others searched for unsuccessfully.
- 1992. Included on the Northern Nevada Native Plant Society (NNNPS) watch list (Morefield and Knight 1992).
- 1996. Category-2 candidate designations eliminated for all species on 28 February by the U. S. D. I. Fish and Wildlife Service, all in Nevada converted to sensitive species designations by the U. S. D. I. Bureau of Land Management.

1997. Field surveys conducted in Nevada by the Nevada Natural Heritage Program (NNHP).
2000. The April 6 Nevada Rare Plant Workshop moved *Ivesia webberi* from the NNNPS watch list to the NNNPS threatened list and recommended the species for addition to the State of Nevada's critically endangered list (Morefield, personal communication).
2000. New population discovered by Humboldt-Toiyabe National Forest personnel in the vicinity of Black Springs, Washoe County, Nevada, on September 19.

III. PRESENT LEGAL OR OTHER FORMAL STATUS

International: Using a system established by The Nature Conservancy, the various state Natural Heritage Programs rank sensitive taxa at state, national, and global levels on a scale of 1 to 5, with 1 being the most vulnerable and 5 the most secure. *Ivesia webberi* was most recently ranked 2 by the Nevada Natural Heritage Program at all levels (Nevada Natural Heritage Program 2000). In April, 2000 the Nevada Rare Plant Workshop ranked the species 1 at the state level (Morefield, personal communication). The results of this report show 1 to be the appropriate rank in Nevada. Although several of the California occurrences are relatively secure, all *Ivesia webberi* occurrences are small and localized making them vulnerable to both human impacts and natural events. Given the foreseeable but unavoidable loss of several populations in the vicinity of Bordertown and impact to other populations in the vicinity of Reno, the vulnerability of this taxon should be elevated to 1 on the global scale.

Federal: Until recently *Ivesia webberi* was designated a category-2 candidate for listing as endangered or threatened under 16 U.S.C. 1531 *et seq.*, the Endangered Species Act as amended in 1988. Category-2 included taxa for which "*proposing to list as threatened or endangered is possibly appropriate, but for which sufficient data on biological vulnerability and threats are not currently available to support proposed rules*" (U. S. D. I. Fish and Wildlife Service 1993). Use of that category has been discontinued by the U. S. D. I. Fish and Wildlife Service (1996). *Ivesia webberi* remains a "species of concern" to the Fish and Wildlife Service, but this term has no formal status. *Ivesia webberi* is on the sensitive species lists of the U. S. D. A. Forest Service Regions 4 (Weixelman and Atwood 1991) and 5 (Hanson, personal communication) and the U. S. D. I. Bureau of Land Management (1996). This report recommends that *Ivesia webberi* be proposed for candidacy and listing as Threatened under the Endangered Species Act. This species warrants consideration as Threatened as it is "likely to become an endangered species within the foreseeable future throughout (all or) a significant portion of its range."

State: No formal status has been designated at the state level. In April 2000, the Nevada Rare Plant Workshop recommended *Ivesia webberi* for addition to the State of Nevada's critically endangered list (Morefield, personal communication). At the same meeting, *Ivesia webberi* was elevated to the Northern Nevada Native Plant Society's threatened list. The findings of this status survey fully support these status changes. *Ivesia webberi* is on the California Native Plant Society's 1B list (Skinner and Pavlik 1994). No change in the CNPS designation is recommended.

IV. DESCRIPTION

Non-technical: Perennial, taprooted, low spreading herb to 2.5 dm across, odorless, hairy throughout, sparsely so on the stems and more densely so on the leaflets; **root crown** generally simple, though branched in some individuals, thick, clothed in old leaf bases, leaf bases dark brown to black, persistent, hairy; **overall color** greenish-gray foliage with dark red stems and bright-yellow balls of flowers, the whole plant becoming reddish-tinged late in the season; **stems** 0.5-1.3 dm long, dark red, wiry, upright or more usually lying flat at the base and angling upward at the tip, softly hairy or smooth, with a pair of opposite leaves near the middle. **Leaves** 3-7 cm long, mostly clustered around the base of the stem, with 4-8 pairs of leaflets crowded at the tip, generally covered with silky, long grayish hairs; **leaf stalks** generally without leaflets on the lower half, dark red especially below the leaflets and sparsely hairy; **leaflets** 3-10 mm long, parted to or nearly to the base into 2-5 narrow segments. **Flower groups** 1 at each stem tip, dense, ball-shaped, about 15-50 mm across, with 5-15 flowers per group each on 1-8 mm stalks, outside hairy, sometimes with minute glands, the outer-most flower blooming first; **flowers** about 10 mm across; **flower cups** like a shallow bowl, 2.5-3.5 mm across, dark golden within; **bractlets** linear, about ½ the length of the sepals; **sepals** long-triangular, 2.6-4.1 mm long, gray-green on the outside and yellow-to-golden on the inside; **petals** much smaller than the sepals, narrow, 2-3 mm long, bright yellow; **stamens** 5, the anthers 1-1.6 mm long, filaments linear and 2-3 mm long, anthers and filaments both yellow; **pistils** 3-8; **seeds** few, 1.9-2.5 mm, smooth, light brown and mottled. **Chromosome number** unknown. Flowering mid-May through June [modified from Ertter (1993) and Holmgren (1997)].

Technical: Perennial, subscapose herb to 2.5 dm across; **caudex** generally simple, though branched in some individuals, thick, clothed in persistent leaf bases, leaf bases dark brown to black, strigose; **overall color** greenish-gray foliage with dark red stems and bright-yellow balls of flowers, often anthocyanic, the whole plant becoming reddish-tinged late in the season; **stems** 0.5-1.3 dm long, dark red, wiry, decumbent or ascending, villous to glabrate, unbranched, with a pair of opposite leaves near the middle (unique in *Ivesia*). **Leaves** 3-7 cm long, mostly clustered around the base of the stem, with 4-8 pairs of leaflets crowded at the tip; **rachis** generally without leaflets on the lower half, often dark red, especially below the leaflets, and sparingly villous to glabrous; **leaflets** 3-10 mm long, parted to or nearly to the base into 2-5 linear to lanceolate, acute segments; densely sericeous to canescent. **Inflorescence** a capitate or subcapitate cyme, 15-50 mm across, with 5-15 flowers, pedicels 1-8 mm, canescent to pilose and sometimes minutely glandular-puberulent; **flowers** 10 mm across; **hypanthium** cupulate, 2.5-3.5 mm across, 1.2-2.1 mm deep, dark golden within; **bractlets** linear, 1.2-2.6 mm long; **sepals** deltate-lanceolate, 2.6-4.1 mm long, acute, gray-green on the outside and yellow-to-golden on the inside; **petals** much smaller than the sepals, oblanceolate, 2-3 mm long, bright yellow; **stamens** 5, the anthers 1-1.6 mm long, filaments filiform and 2-3 mm long, anthers and filaments both yellow; **pistils** 3-8; **achenes** few, 1.9-2.5 mm, smooth, plump, light brown and mottled. **n** unknown. Flowering mid-May through June [modified from Ertter (1993) and Holmgren (1997)].

Field Characters: *Ivesia webberi* is a distinctive plant not readily confused with any other species. The combination of silky-haired gray-green leaflets clustered at the tip of a dark red rachis, a set of opposite leaves midway up the dark red peduncle, and yellow flowers with five

stamens separate this species from all others which may occur nearby. The following key is based on Keck, (1938), Ertter (1993) and Holmgren (1997) and distinguishes *Ivesia webberi* from co-occurring taxa in Nevada.

1. Plants annual or woody above ground *or* leaves not lobed *or* primary leaf lobes palmately arranged *or* inflorescence not a cyme *or* petals absent *or* mature fruit fleshy or soft or pubescent *or* style continuous with fruitother **Rosaceae**
- 1' Plants perennial herbs; primary leaf lobes pinnately arranged; inflorescence cymose; petals present; mature fruit dry, hard, glabrous, style jointed to fruit.
 2. Basal leaf lobes arranged in one plane or nearly so, not overlapping; stamens 20-40, filaments terete, separate**Potentilla**, some *Ivesia* species
 - 2' Basal leaf lobes arranged cylindrically, strongly overlapping *or* stamens <20 *or* filaments flattened, forming a tube.
 3. Hypanthium sides erect, bottom flat; filaments usually flattened and forming a tube; petals white to pinkish
 4. Stamens 20; primary leaf lobes 15-35 pairs**Horkeliella**
 - 4' Stamens 10; primary leaf lobes 2-15 pairs**Horkelia**
 - 3' Hypanthium sides spreading to erect, bottom curved to conic, not flat; filaments terete, thread-like not forming a tube; petals white to yellow most *Ivesia*
 5. Stamens 10-35other *Ivesia*
 - 5' Stamens 5
 6. Cymes generally open between individual flowers or clusters
 7. Flowering stems erect, 1.8-6.5 dm tall; herbage not aromatic; central and southern Nevada, southern Utah, and Arizona**Ivesia sabulosa**
 - 7' Flowering stems spreading to ascending, 0.2-1.7 dm long; herbage not aromatic
 8. Herbage glandular-puberulent and sparsely eglandular-hispid; petals oblanceolate, bright yellow**Ivesia shockleyi**
 - 8' Herbage densely eglandular-sericeous; petals oblanceolate to linear, white, cream, or pale yellow**Ivesia rhypara**
 - 6' Cymes capitate or subcapitate and caudex generally simple
 9. Cauline leaves 2, ± opposite; lateral leaflets 4-8 pairs, lobes linear to lanceolate, densely sericeous to canescent**Ivesia webberi**
 - 9' Cauline leaves generally 1 or alternate; lateral leaflets 10-25 pairs, hispid to glabrous**Ivesia gordonii**

Photographs and Line Drawings: A line drawing by Bobbi Angell was published in Cronquist *et al.* (1997, p. 115) and is reproduced in Appendix 2, Figure 1 of this report. Other line drawings have been published in Abrams (1944, p. 426). Photographs of *Ivesia webberi* and its habitat appeared in Weixelman and Atwood (1991, p. 49). Photographs made for this report are reproduced in Appendix 2, Figures 2-9, and are filed with the Nevada Natural Heritage Program.

V. SIGNIFICANCE OF TAXON

Natural: *Ivesia webberi* is one of several distinct, geographically restricted species in the closely related genera *Ivesia* and *Horkelia*. Its restriction to edaphically similar yet well isolated locations on mid-elevation benchlands of several valleys warrants further study in selection toward non-dispersal and possible introduction of the species into unoccupied habitat.

Human: No studies of medicinal or other qualities of potential human benefit are yet known to have been performed on *Ivesia webberi*. The plant is aesthetically pleasing and of potential horticultural interest for rock gardens. Many other species of *Ivesia* are already in the horticultural trade (Hickman 1993).

VI. GEOGRAPHIC DISTRIBUTION

Geographic Range: (refer to Appendix 1, Tables 1-3 and Table 6; Appendix 3, Maps 1-7) Globally, the precise number of historic populations of *Ivesia webberi* is open to speculation. Several California locations reported in the early literature have no corresponding herbarium specimens. A large number of California collections have little-to-no location information on the label. Many of the Nevada specimens were collected by students for a UNR undergraduate class in general botany. These may be prone to imprecise and possibly erroneous label information.

Currently *Ivesia webberi* is known from eight extant populations in Washoe and Douglas Counties, Nevada, and seven extant populations in Lassen, Plumas, and Sierra Counties, California. These populations, with few exceptions, are clustered on old mid-elevation benches or terraces surrounding moderately large valleys. This includes one population on the eastern rim of Sierra Valley in California, eight populations on terraces surrounding Upper Long Valley on the California-Nevada border, one population on the southern edge of Honey Lake Valley in California, and three populations on the western rim of the Reno-Sparks valley in Nevada. The populations in Dog Valley in California and at Dante Mine Road on the western side of the Pine Nut Mountains in Nevada appear to be the exceptions. One can only assume that these sites currently lend the same edaphic and climatic conditions as the typical terrace site.

At least two of the known populations in Nevada have had repeated collections from either the extant population or from now extirpated populations nearby. After several seasons of surveying for this species in northern California and northern Nevada, I have consolidated a considerable breadth of field observations into several generalities: 1) there is a great deal of apparently suitable habitat out there that does not support this species; 2) when found *Ivesia webberi* is usually very abundant and quite often the dominant or co-dominant species; and 3) with the exception of the southern rim of Upper Long Valley, populations tend to be very isolated. Additionally, I have surveyed in detail all available habitat surrounding the populations in question. For these reasons, I have chosen to take a conservative approach to the number of populations apparently documented by herbarium specimens. In particular, Sites 5 and 6 are represented by numerous herbarium collections with a wide variety of location descriptions and elevational ranges. Either there are a number of extirpated populations on the north and southwest edges of Reno, or the herbarium collections are from the known extant populations

and their labels contain various inaccuracies. Although both scenarios are possible, I personally consider the latter more likely.

Within Nevada the eight known extant populations occur within lands administered by the Humboldt-Toiyabe National Forest, Carson Ranger District (69.8%), the Bureau of Land Management, Carson City District (0.9%) and on private owned lands (29.3%). In California the seven known extant populations occur within lands administered by the Humboldt-Toiyabe National Forest, Carson Ranger District (84.9%), the Bureau of Land Management (0.5%), the State of California, Department of Fish and Game (0.1%), and on privately owned lands (14.5%).

Precise Occurrences: Site numbers and descriptions are given in Appendix 1, Tables 1-3. The tables cross-reference each site to its related maps and figures, as well as its most recent year observed and source(s) of documentation. The tables also show estimated areas and numbers of individuals for each site, along with elevations, apparent land management status, and types of impacts or threats. Nevada Natural Heritage Program element occurrence numbers have been updated to reflect incorporation of all sites documented in this report into the Nevada Natural Heritage Program database.

Some of the site information in Appendix 1 was compiled from other sources whose survey methods were not always exactly comparable to those used for this report. For all sites, numbers of individuals in small populations were estimated by direct counting, and the areas, elevation ranges, and land management information given in Tables 1-3 were derived from the final mapped population boundaries. Threats and impacts were assessed from all available information, including but not limited to visual inspection on the ground, and association with mapped disturbances. Most of the inconsistencies among surveys probably resulted from differences in mapping precision and techniques used to estimate numbers of individuals in large populations.

At the sites (4, 5, 6, and 7) surveyed for this report, population boundaries were mapped to the greatest precision possible in the field. Counts for large populations were estimated by taking the average density of plants observed along a belt transect through the population, and applying it to the entire mapped area of the population. Because they were extrapolated from relatively small, subjectively chosen density samples, these estimates were probably accurate only to within half an order of magnitude at best, and were intended mainly to reflect relative population sizes among those surveyed in this way.

Some of the other surveys compiled herein appeared to show less precisely mapped boundaries, with population sizes determined by direct visual estimation of total numbers of individuals. Such surveys probably overestimated surface area and underestimated individuals by significant amounts. In California, populations located within ¼ mile of each other were ultimately mapped by the California Department of Fish and Game Natural Diversity Database as a single continuous polygon which substantially overstates the area occupied. This appeared particularly true of the Sierra Valley, Plumas County, California and Dog Valley, Sierra County, California sites (Table 1), which collectively harbored 2.1% of the total reported individuals of the species on 77.9% of the total surface area. Because of these uncertainties, the percentages given above (and in the footnotes of Table 1) for each surface management status are averages of the

percentage based on surface area and the percent based population counts, and should be considered very rough estimates.

To the best of my knowledge, no privately managed sites were entered upon to obtain any of the new information documented by these surveys against the restrictions of the owners or managers. In some cases, private sites were small and easily viewed and documented from adjacent public lands or public access areas. In a couple of cases, sites were not surveyed due to lack of access, and the information in this report is then based solely on any previously existing information.

Historical site(s) rediscovered or recently known extant: (Appendix 1, Table 1)

Through the end of 1991, *Ivesia webberi* had been documented or reported from numerous locations in Washoe County and one location in Douglas County, Nevada. As discussed above, it occurs in eight extant populations (Sites 1-8) and I believe this to be the most likely total number of historic occurrences in Nevada. All but four of these were subsequently rediscovered and further documented during the course of this survey. Sites 1, 2, and 3 could not be accessed during surveys for this report, but can still be presumed extant though severely imperiled by private development. Site 8 was discovered in 2000 during a reconnaissance of the Seneca fire impacts. The Nevada populations are now estimated to comprise 4,740,000 individuals covering 29.2 acres (11.9 ha) of National Forest, BLM and private lands between 5320 and 5950 feet (1620-1815 meters) elevation.

New site(s) discovered: No previously unreported sites were documented during the course of this survey.

Historical site(s) searched for but not rediscovered: As discussed above, I have taken a conservative approach in determining the number of historic populations represented by the numerous herbarium collections of *Ivesia webberi* made from northern Nevada during the period of 1907 to the present. With the exception of the Pyramid Lake collection, which is discussed under possibly erroneous reports, all historic sites have been accounted for.

Other site(s) searched where not discovered: (Appendix 1, Table 3) In order to determine the total number of historic collections in the vicinity of Reno, in particular, all areas surrounding known populations were searched in detail. Additionally, in earlier surveys, Witham (1991) similarly searched extensive areas which appeared to match herbarium label location descriptions (i.e. terraces along Hunter Creek). During the 1997-1998 field season, unoccupied Sites U1-U6 in the vicinity of Sites 1-4, unoccupied Sites U7-U16 in the vicinity of Site 5, unoccupied Sites U17-U19 in the vicinity of Site 6, unoccupied Sites U20-U21 in the vicinity of Site 7, unoccupied Sites U22-U26 on the eastern slope of the Pine Nut Mountains, and unoccupied Sites U27-U28 in the Pah Rah Range were surveyed. These surveys comprise about 3,955 acres (1,600 ha) between 4860 and 6700 feet (1480-2040 meters) elevation. No additional populations were found.

Historical site(s) known or suspected to be erroneous reports: As mentioned earlier, a specimen collected by C. Fitz on 30 April 1959 from Pyramid Lake, desert area, very

sandy hillside, elevation 4000 ft is considered erroneous. Witham (1991) searched for potential habitat in the Pyramid Lake area and found none. Additionally, the described habitat of “desert area” and “very sandy hillside” is completely unlike any of the known populations of *Ivesia webberi* in California or Nevada. A search of the University of Nevada, Reno herbarium would most likely result in a number of collections made on 30 April 1959 by C. Fitz in an area ranging from Reno to Pyramid Lake. I suspect this specimen of *Ivesia webberi* actually came from Site 5 or Site 8 and was mislabeled.

Similarly, two California occurrences are suspected erroneous. In the original species description, Gray (1874) erroneously cites Indian Valley and first found near the residence of Dr. Webber, the owner of Webber Lake. Dr. Webber also owned property in Sierra Valley and it was from his ranch that the plant was collected (Lemmon 1908). Subsequent work by Keck (1938) states that no collections were found in Gray Herbarium labeled either Indian Valley or Dr. Webber. No suitable habitat has been found in the vicinity of Webber Lake (Witham, personal observation).

Historical site(s) known or assumed extirpated: Given the conservative approach taken in determining historical sites as discussed above, no Nevada sites are known or assumed extirpated. However, it is possible that there may have been additional populations to the north of Reno, in the Raleigh Heights–Black Springs area, and to the southwest of Reno, in the Hunter Lake Road area, which have recently become extirpated due to urban expansion in these areas.

In California, the American Valley site is presumed extirpated (Berridge 1990). No suitable habitat remains and the town of Quincy occupies most of the valley.

Historical site(s) where present status unknown: All of the Nevada historical sites have been accounted for in this or other recent surveys. The California historical sites have been similarly accounted for (Witham 1990, 1991) and the data reevaluated for this status survey.

Potential site(s) meriting future field surveys: (Appendix 1, Table 2). Potential Site P1 in the vicinity of Site 5 is the only area of potentially suitable habitat in that vicinity which could not be accessed during the 1997-1998 field season. The site comprises about 35 acres (14.2 ha) between about 4900 and 5000 feet (1495-1525 meters) elevation in Washoe County, Nevada. This site is north of Reno and within the distance and elevational range described in several historic herbarium collections.

There is a lot of potentially suitable habitat within the correct elevational range in northern Nevada. However, field surveys as described above and in other areas not documented in this report, such as western Sierra Valley, Plumas and Sierra Counties, California (Witham 1990), indicate that only a very small proportion of potentially suitable habitat is actually occupied. Usually, a site that looks suitable from a distance ends up being too xeric or lacks the shallow, clayey soils with a rocky surface pavement associated with this species. Additional Nevada surveys are unlikely to produce significant new findings.

VII. HABITAT CHARACTERISTICS

Environment and Habitat Summary: (Appendix 2, Figures 4-9) In the field, *Ivesia webberi* appears to be restricted to shallow soils derived from andesitic materials on mid-elevation benches and flats on all aspects between 4480 and 5950 feet (1365-1815 meters) elevation. The shallow, clayey soils are commonly very rocky on the surface and tend to retain moisture longer than the surrounding soils. This habitat supports a sparse vegetation usually dominated by *Ivesia webberi*, low sagebrush (*Artemisia arbuscula*) or squirrel-tail grass (*Elymus elymoides*) in association with dwarf everlasting (*Antennaria dimorpha*), Hooker's balsamroot (*Balsamorhiza hookeri*), Douglas's dwarf draba (*Cusickiella douglasii*), rayless daisy (*Erigeron bloomeri*), Douglas's buckwheat (*Eriogonum douglasii*), bitterroot (*Lewisia rediviva*), sagebrush violet (*Viola beckwithii*), and several other species (see Appendix 1 Table 4). The soils and plants combine in a showy rock garden-like display.

Physical Characteristics:

Physiography: The range of *Ivesia webberi* lies along the transition zone between the eastern edge of the northern Sierra Nevada and the northwestern edge of Holmgren's (1972) Reno Section of the Great Basin Division. The Reno Section is a strip of generally high mountain ranges adjacent immediately east of and parallel to the Sierra Nevada characterized by the "climatic influences of high mountains within and adjacent to the section, and the high, sagebrush covered valleys." The Great Basin Division consists of a series of mostly north-south oriented ranges and basins block-faulted from rocks that age progressively toward the northwest and that have been arched upward in the middle.

Climate: Hidy and Klieforth (1990) aptly describe the climate of the Great Basin as ". . . one of the most extreme and variable climates on earth." This high variation occurs along horizontal and elevational gradients and at all time scales: hourly, daily, seasonally, annually, and over the tens of thousands of years of glacial cycles. The region's latitude, interior continental position, and high mountainous borders combine to create a generally arid climate. As in most arid regions, evapotranspiration greatly exceeds precipitation at all elevations, producing an average net loss of surface moisture (Hidy and Klieforth 1990). Most annual precipitation falls from about November through April in Pacific storm systems from the west. The Great Basin also lies within the influence of subtropical summer moisture, which originates in the Gulfs of Mexico and California and spreads over most of Arizona during July and August. This "monsoonal" influence produces a secondary peak of precipitation particularly toward the eastern and southern parts of the region, averaging about a quarter to half of the annual total, and capable of delivering a substantial majority of annual precipitation to limited areas in any given year. Both summer and winter precipitation are highly variable from year to year, ranging between about 25% and 250% of the long-term averages. Variability decreases somewhat toward the northeast and at higher elevations.

Temperature variations range up to 40-50°F (22-28°C) in daily changes, in average differences between warmest and coldest months, and in departures of extreme highs and

lows from seasonal averages (Hidy and Klieforth 1990, Holmgren 1972). This can result in differences up to 120-140°F (67-78°C) in the extremes experienced at any one site during a year. In general, temperature ranges at all the above scales tend to increase toward lower elevations and toward the northeast part of the region. Daily variations further tend to be greatest at the lowest humidities during the spring and fall seasons. The average daily temperature range throughout the year is about 25-30°F (14-17°C).

The western Great Basin is within the Sierra Nevada rain shadow, which is the dominant influence on local climate. The elevations where *Ivesia webberi* populations occur in Nevada experience warm dry summers and cold moist winters. Annual precipitation averages about 10-14 inches (250-350 mm) water equivalent, with about a quarter or less of that amount falling as snow which does not linger for more than a few days or weeks. Daily mean temperatures average about 67-71° F (19-22° C) in July and 31-34° F (-1 to 1° C) in January. No unusual temperature or precipitation anomalies occurred during surveys for this species.

Geomorphology, aspect, and slope: *Ivesia webberi* occurs on benches or terraces at mid-elevation on the side slopes of typical block-faulted mountain ranges in the Great Basin. Occupied benches, terraces or saddles are generally on the rim of large valleys which have no accumulation of colluvium from upslope. The population sites vary from slightly concave to slightly convex or sloped (0-10°) and occur on all aspects.

Geology: The soils at all sites surveyed for this report were observed to be derived from andesitic (or other volcanogenic clastic) rock types with a significant amount of both quartz and clay minerals.

Soils: Generally the soils on all sites were composed of a surface of weathered tan andesitic rock with fine clay or silt in the interstices overlaying a shallow, clayey subsoil. The clay shrinks and swells during cycles of wetting and drying and this behavior heaves rocks to the surface creating a rocky surface pavement. The high clay content of the soil, particularly the subsoil, may be responsible for excluding many competing species. Plants occupying these soils must have a deep, firm taproot (or caudex) to withstand the shrink-swell of the clay subsoil, or they must be shallowly rooted above the clay horizon and able to complete their reproductive cycle before the soil surface dries out.

Soil studies from populations of *Ivesia webberi* in Dog Valley, California (U.S.D.A. Forest Service, Humboldt-Toiyabe National Forest 1999) and near Raleigh Heights in Washoe County, Nevada (Zamudio, personal communication), found the plants to be growing in soils classified as Xerollic Haplargids. In Dog Valley the soils may border on an Ultic Agrixeroll, with a lower base saturation. These soils are well developed with an argillic horizon, characteristically shallow and clayey, and derived from andesitic rock (Soil Conservation Service 1983).

Hydrology: *Ivesia webberi* is not associated with free water, and is entirely dependent on incident precipitation and its retention in the soil. *Ivesia webberi* occurs on generally flat to concave or convex landforms such as benches or saddles with clayey, shallow soils

over bedrock. These sites and clayey soils may have a slightly higher water holding capacity than surrounding areas due to water perched above the bedrock. This is also the typical habitat of low sagebrush (*Artemisia arbuscula*), with which *Ivesia webberi* is often co-dominant, at low elevations (Sawyer and Keeler-Wolf 1995).

Air and water quality requirements: No specific requirements or unusual tolerances are known.

Biologic Characteristics:

Community physiognomy: *Ivesia webberi* usually co-dominates its habitat with other, mostly dwarfed perennial herbs, grasses, and shrubs, with very occasional larger, emergent species, within the mountain sagebrush zone that characterizes the low- to mid-elevation slopes of Great Basin mountain ranges.

Vegetation type: Because *Ivesia webberi* tends to dominate or co-dominate its sparsely vegetated habitat with other perennial herbs, grasses, and shrubs, it forms a unique plant association. On many of the sites, the vegetation type could be described as an *Artemisia arbuscula*-*Ivesia webberi* association (Sawyer and Keeler-Wolf 1995), or as an *Ivesia webberi*-perennial rock garden-type plant community. These are generally quite showy in the spring when all of the associate species are in bloom. On a few of the sites, perennial grasses such as *Elymus elymoides* and *Poa secunda* play an important or even co-dominant role. These sites are less showy due to the higher abundance of grasses. The latter vegetation type may be due to disturbance.

Associated plant species: (Appendix 1, Table 4) *Antennaria dimorpha* occurred at all sites where associates were documented. *Artemisia arbuscula*, *Balsamorhiza hookeri*, *Cusickiella douglasii*, *Erigeron bloomeri*, *Eriogonum douglasii*, *Lewisia rediviva*, and *Viola beckwithii* were the other most frequently noted associates.

Other endangered, threatened, and sensitive species: At least 13 other sensitive plant and animal species are known in and near the range of *Ivesia webberi*, and are listed in Appendix 1, Table 5. One of these is documented to occur within or adjacent to *Ivesia webberi* sites. One occurrence of *Eriogonum robustum* with several sub-populations was encountered and documented during surveys for this report (Appendix 1, Table 3).

Land Management: (Appendix 1, Table 1) For all sites, management status was determined based on the best maps and other information available, but generally was not further verified. Ownership status of associated minerals and water rights was not determined for any site, nor was the presence or absence of any easements or other encumbrances.

Humboldt-Toiyabe National Forest (HTNF), Carson Ranger District, U. S. Dept. of Agriculture: About 69.8% (average of percentage population size and percentage occupied area) of the Nevada *Ivesia webberi* population occurs on public lands managed by HTNF. These lands have been open to and used for extractive activities such as mineral exploration and livestock grazing. Some vehicular recreation and access is

associated with the Forest Service roads along which many populations occur (Appendix 2, Figure 8). Most of the grazing allotments on Peavine are now vacant or closed and a new HTNF policy makes use of unmarked two-tracks illegal. HTNF has designated *Ivesia webberi* a Sensitive Species, and has been very supportive in conducting or funding field surveys for this and other Sensitive Species in the region (Witham 1990, Witham 1991). HTNF does not currently have a management plan for *Ivesia webberi*.

Bureau of Land Management (BLM), Carson City District: About 0.9% of the Nevada *Ivesia webberi* population occurs on land managed by BLM in the Pine Nut Mountains. These lands have been open to and used for extractive activities such as mineral exploration and livestock grazing. BLM has designated *Ivesia webberi* a Sensitive Species, but does not currently have a management plan for it.

Private lands: About 29.3% of the Nevada *Ivesia webberi* population occurs on lands identified as privately managed. Land use and/or management plans and actions on these lands are not known to or likely to consider the presence of *Ivesia webberi* or its habitat. The relatively low terrace position of most populations makes them especially vulnerable to housing development, particularly Sites 1-3, 6 and 8. Site 7's close proximity to a major highway makes it vulnerable to off-road vehicle impacts and potential commercial development. All sites are probably subject to developments associated with livestock management.

California occurrences: Because survey methods for the *Ivesia webberi* occurrences in California may have overestimated occupied area and underestimated population size, land ownership and management status for these populations was not included in the discussions above. In California, about 84.9% of the *Ivesia webberi* population (based on the average of percent of area occupied and percent of total plants) occurs on public lands managed by the HTNF. Other public lands occurrences include 0.5% managed by the Bureau of Land Management, Susanville District and 0.1% managed by the California Resources Agency, Department of Fish and Game. The remaining 14.5% of *Ivesia webberi* populations occur on lands identified as privately managed. Most of the California occurrences are subject to grazing impacts and potential developments associated with livestock grazing.

VIII. BIOLOGY AND ECOLOGY

Population Summary: Based on the information gathered for this report, the total known global population of *Ivesia webberi* is estimated to be 4,855,200 individuals, and to occupy 186 acres (75.5 ha) of habitat divided among 15 populations in about seven scattered locations in Sierra, Dog, and Honey Lake Valleys, Lassen, Plumas, and Sierra Counties, California, Upper Long Valley in on the California-Nevada Border, both north and southwest of Reno, Washoe County, Nevada, and the western slope of the Pine Nut Mountains, Douglas County, Nevada. Extant populations occur between 4480 and 5950 feet (1365-1815 meters) elevation. The total Nevada population of *Ivesia webberi* is estimated to be 4,740,000 individuals, and to occupy 29.2 acres (11.9 ha) between 5320 and 5950 feet (1620-1815 meters) elevation. Observations on existing populations indicate that additional surveys are unlikely to produce significant new populations

in Nevada. The western edge of Upper Long Valley in California remains the only highly suitable habitat which has not been surveyed. However, since this is primarily private property, it is not likely to be surveyed in the near future and potential populations are vulnerable to private development activities.

Demography: Long-term monitoring has not been conducted for *Ivesia webberi* populations to determine demographic trends. Absence of the species from numerous apparently suitable sites provides circumstantial evidence that the species may have undergone population declines at least during prehistoric times, and/or that it may have limited ability to disperse and to establish new populations in unoccupied habitat.

The thickness of the caudex of each individual probably increases each year according to the resources available for new production and its ability to process those resources, providing a rough measure by which age classes could be separated within a population. However, determining age in this manner would be highly destructive to the continued existence of this species. There is no known way to accurately age an individual plant, or to compare age class distributions between populations. However, in very general terms, all populations observed during this survey appeared to consist of both large, well-established plants with numerous flowering stems and smaller plants represented by only a few leaves and no flowering stems. Many of the smaller plants within each population appeared to be water stressed (crisped and drying early in the season) and juvenile plant mortality is probably rather high. *Ivesia webberi* appears to have moderate recruitment within established populations, but no colonization of nearby unoccupied areas was detected.

From estimates of the total individuals within total occupied habitat (see population summary, above), an average global density of 27,016 plants per acre (66,734/ha) can be extrapolated. However, individual site population estimates performed on the Nevada occurrences ranged from about 625 plants per acre (1544/ha; Site 1) to about 341,075 plants per acre (842,506/ha; Site 5; Appendix 1, Table 1). The average plant density for the Nevada sites in which density was measured (Sites 4-7) was 3.17 plants per square foot (138,085/acre or 341,091/ha). California population estimates were as low as 50 plants per acre (124/ha, Site CA1) and as high as 10,000 plants per acre (24,700/ha, Site CA5) which are considerably lower than those measured from Nevada populations during this field survey. The lower densities reported for the California occurrences are likely the result of underestimated population sizes and overestimated population areas. No quantitative density sampling has been conducted in any of the California populations (Witham 1990, 1991).

Phenology: New leaves and flowering stems appear to emerge as soon as the soil temperatures are sufficiently high in the early spring. Populations in full flower have been observed during the last week of May, and some flowers have been seen opening throughout the month of June. Depending on annual timing of precipitation and temperature changes, flowering probably begins sometime between the beginning of May and early June and continues sporadically to the middle of July, especially on protected sites such as Dog Valley, California. The fruit probably mature by about a month after flowering, between mid-June and the end of July.

Genetics: No studies of the genetic structure in *Ivesia webberi* are known. Most *Ivesia* species appear to reproduce from seed produced by insect-mediated pollen exchange between flowers of the same or different plants. The seven general areas in which the 15 known populations occur are isolated enough from one another to preclude pollen transport, and each area has likely developed its own unique genetic makeup as a result. If major disturbances or other impacts to *Ivesia webberi* habitat become a critical threat to global population viability in the future, the genetic structure of the species and its populations should be studied in order to guide the most effective possible conservation strategies.

Reproduction and Dispersal: No studies of reproduction or dispersal are known for *Ivesia webberi*. As discussed above under genetics, insect-mediated out-crossing is the most likely reproductive mode in *Ivesia webberi*. Seed dispersal for this species is probably low to none. The seeds are relatively large and probably become lodged in the crevices in the rocky pavement-like soils very soon after being shed by the parent plant. This would partially explain the lack of apparent colonization of nearby seemingly suitable but unoccupied areas. No asexual, or vegetative, reproduction is apparent in this species.

Hybridization: *Ivesia webberi* grows in very close proximity with *Ivesia aperta* var. *canina* and *Ivesia aperta* var. *aperta* in Dog Valley, Sierra County, California. No apparent hybridization occurs here and none is suspected to occur elsewhere.

Pathology: No disease affecting *Ivesia webberi* has been observed or reported.

Predation: No evidence of significant herbivory or other predation has been observed. Rabbits and other native fauna probably graze the leaves and flowering stems on an occasional basis without significant impacts. A band of sheep moving directly across a population could cause significant predation impacts. Impacts from cattle use appear to result primarily from trampling and substrate disturbance rather than predation.

Competition: At all sites *Ivesia webberi* was found only in relatively open plant associations where competition for light and moisture with other species was low. It was absent from adjacent, otherwise appropriate habitat where deeper soils and taller, denser vegetation had developed. The species does appear to compete very well with itself, occurring in locally high densities up to about 7.83 per square foot (84.3 per square meter), but this does not necessarily foretell its ability to compete with other species in the same habitat. The unique soils and hydrology of the *Ivesia webberi* sites help to exclude many competitors. The shrink-swell of the clayey subsoils favor perennials with a strong taproot and shallow-rooted, early maturing annuals. The clayey soils and early spring saturation tend to exclude typical Great Basin species.

Response to Disturbance: Generally, *Ivesia webberi* is a dominant or co-dominant component of a well developed, climax dwarf perennial herb and shrub community. At several sites, *Ivesia webberi* has been observed to colonize and reproduce on mildly disturbed areas such as unimproved vehicle routes (tire tracks). At others, the species appears to be excluded from more moderately disturbed areas such as those in which chain removal of shrubby vegetation has occurred. This is especially true where the soils have been disturbed sufficiently to support aggressive non-native annual grasses.

Although *Ivesia webberi* appears to be at least partially adapted to disturbance, it would be a mistake to suggest that the species is not threatened by habitat disturbance. Most rare plant species are rare because they are adapted to and depend upon rare habitat types. Many of these habitat types impose harsh growing conditions that exclude most other plant species, thus creating relatively low-competition conditions for the few remaining species that are able to adapt. Disturbance also creates a temporary low-competition situation of which rare species, already adapted to such conditions, frequently are able to take short-term, opportunistic advantage. Almost always, though, this is observed only if the disturbance occurs within or immediately adjacent to a source population occupying the rare soil or other habitat type that the species requires for long-term survival, and only when the disturbance is temporary and has begun to stabilize. Almost never has a rare plant species been observed to continue spreading onto disturbances farther outside its rare habitat type, or to persist where disturbance is severe and continuous. If rare species had the biologic and ecologic characteristics of invasive weeds, they would not now be rare. No plant population can withstand severe, uninterrupted disturbance of its habitat, and rare plants are no exception.

Thus, while *Ivesia webberi* may be seen colonizing mildly disturbed sites, all my observations indicate that its long-term survival depends upon the continued availability of undisturbed mid-elevation benches or saddles with shallow, clayey soils with a rocky surface pavement. *Ivesia webberi* has never been observed spreading off of such sites along disturbance corridors, and permanent loss of plants is evident where disturbance has been continuous and severe, such as on well-used road beds bisecting the habitat.

Other Interactions: No other interactions have been noted.

IX. EVIDENCE OF THREATS TO SURVIVAL

Causes of impacts and threats observed or reported for the known sites are summarized in Appendix 1, Table 1.

Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range:

Mineral exploration and development: No evidence of mineral exploration occurs within the immediate vicinity of any population with the exception of Site 7 on the Dante Mine Road. The *Ivesia webberi* population and its immediate surroundings were not impacted by the nearby mining activities. Mineral exploration is not considered a significant threat at this time.

Animal grazing or trampling: Most known Nevada *Ivesia webberi* sites appear open to livestock grazing, which presently is the dominant land use within its range. The relatively sparse and low vegetation of most sites makes them relatively unappealing for grazing, but a band of sheep moving across a population could inflict substantial herbivory damage. The palatability of *Ivesia webberi* to livestock has not been determined. The terrace or saddle location of many populations make them appealing for livestock to congregate and for operators to place salt licks, fences, and other range modifications likely to concentrate trampling activities.

Road development and maintenance: Most of the *Ivesia webberi* populations occur on or near dirt roads which occur throughout the hills and mountains of western Nevada. These probably represent the most severe threat to populations which occur on the public land managed by the Humboldt-Toiyabe National Forest, Carson Ranger District. The access created by these roads encourages further off-road access through populations, and off-road vehicle tracks have been observed in many sites, creating potentially significant and long-term impacts to populations. To date, none of these impacts appear to have compromised population viability at any site, but maintenance or expansion of the roads, or heavy off-road vehicle use, could compromise viability in the future without careful planning and protection, and cooperation by land users. Off-road vehicle impacts are also a possible threat to Site 7 along Highway 395 in Douglas County since the population occurs within a short distance of the highway and is unfenced.

Fire and fire suppression activities: Flat terraces and saddles make convenient sites for staging and conducting fire suppression activities that can potentially destroy individual plants and the habitat of *Ivesia webberi*. The roads cutting through many of the populations may have originated during such activities. Given the significant increases in nearby human populations, fire suppression activities required to protect human habitations could be a very real threat to some of the populations.

Private development: Private development is the most significant threat to *Ivesia webberi* populations on private lands. Since the HTNF sponsored surveys conducted in 1991, three sites (Sites 1-3) have been fenced and new road grading has occurred in the area. It was not possible to inspect two of these sites during the 1997-1998 field season and remote observations of the third indicated significant nearby disturbance (Appendix 2, Figure 4). These three populations are highly imperiled at this time and will probably become extirpated in the very near future. Site 6 (Appendix 2, Figure 8) may also be severely threatened by the rapid urban expansion in this part of Reno. When HTNF surveys were conducted in this area in 1991, development did not occur above McCarran Road. Now there are houses and shopping centers up to the Mt. Rose Substation. The terrace occupied by *Ivesia webberi* is the next logical area in which to develop "homes with a view". The recently discovered Site 8 south of Seneca Road and Black Springs is also topographically just above and adjacent to an area experiencing rapid urban development. Private development may also indirectly impact Site 5 on HTNF lands due to a substantial increase in recreational use of the area by nearby residents.

Invasion of exotic plant species: Only minor covers of exotic plant species such as cheatgrass (*Bromus tectorum*) have been able to invade and establish within intact, undisturbed *Ivesia webberi* habitat. Cheatgrass is unlikely to become dominant in undisturbed habitat and probably poses no threat to *Ivesia webberi*. However, in areas where range improvement or other disturbances have occurred on the edge of populations, medusa-head (*Teaniatherum caput-medusae*) is becoming established (Site 6; Appendix 2, Figure 8). Further disturbance to these areas, particularly soil disturbance, could result in the irreversible displacement of *Ivesia webberi* by medusa-head.

Over-utilization for Commercial, Recreational, Scientific, or Educational Purposes: The few scientific collections that have been taken to document populations (Appendix 1, Table 6) are neither known nor likely to have had significant impacts on any population of the species. No other uses of the species for such purposes are known.

Disease or Predation: Other than the livestock activity discussed above, no significant disease or herbivore damage has been noted at any of the sites.

Inadequacy of Existing Regulatory Mechanisms: No enforceable protective designations, conservation agreements, or approved management plans are known to exist for *Ivesia webberi* or its habitat. Unless it is listed as endangered or threatened (50 CFR 17.61, 17.71) and occurs within federal jurisdiction, a plant has no formal protection under the federal Endangered Species Act (ESA), except for regulatory determinations by some federal land management agencies (Forest Service, BLM) that candidate and other sensitive species will be managed in order to avoid the need for listing. No federal protection currently extends to plants under non-federal jurisdiction unless they are listed as endangered and removing, cutting, digging up, damaging, or destroying them would be "*in knowing violation of any law or regulation of any state or . . . of a state criminal trespass law*" [ESA Sect. 9(a)2(B)], and that law extended to non-federal jurisdictions. It should also be noted that the Endangered Species Act and the various agency regulations implementing it are in direct conflict with provisions of the mining law of 1872 (30 U.S.C. 21 *et seq.*), and are therefore of uncertain protective value when mineral-related projects are involved.

The recent elimination of category-2 candidate status and tracking by the U. S. D. I. Fish and Wildlife Service (1996) removed a source of centralized and coordinated oversight for hundreds of species still considered potentially vulnerable, including *Ivesia webberi*. Most of these species continue to be tracked and treated as sensitive by the Forest Service, the Bureau of Land Management, state natural heritage programs, and other agencies. The long term impact of this change, however, remains unknown but may be detrimental as agency policies and procedures go their separate ways, and budgets and priorities change. This could accelerate the need to list some former category-2 candidates as threatened or endangered.

U. S. D. A. regulation 9500-4 directs the Forest Service to manage "*habitats for all existing native and desired nonnative plants, fish, and wildlife species in order to maintain at least viable populations of such species,*" and to avoid actions "*which may cause a species to become threatened or endangered.*" Forest Service objectives further state that viable populations of all species must be maintained "*in habitats distributed throughout their geographic range on National Forest System lands*" (Forest Service Manual [FSM] 2670.22). *Ivesia webberi* is on the sensitive species list of the Humboldt-Toiyabe National Forest. Current Forest Service policy on species designated sensitive is to "*review programs and activities, through a biological evaluation, to determine their potential effect on sensitive species*" as part of the NEPA process, to "*avoid or minimize impacts*" from such activities or, if impacts cannot be avoided, to "*analyze the significance*" of those impacts for the species as a whole. Any decision to allow impacts "*must not result in loss of species viability or create significant trends toward Federal listing*" (FSM 2670.32). Department regulation 9500-4 has the force of law at least until changed;

specific provisions of written Forest Service policy implementing that regulation are of uncertain legal standing in specific cases.

U. S. D. I. Bureau of Land Management policy provides that the agency "*shall carry out management, consistent with the principles of multiple use, for the conservation of candidate species and their habitats and shall ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as Threatened or Endangered.*" If a candidate species occurs entirely on federal lands, BLM policy further requires that it be included as a priority species in land use plans, and that range-wide or site-specific management plans be prepared "*that identify specific habitat and population management objectives designed for recovery, as well as the management strategies necessary to meet those objectives*" (BLM Manual Section 6840). Although *Ivesia webberi* is no longer a candidate for Federal listing, both the Nevada and California state offices of BLM continue to track former candidates as sensitive species for planning purposes (U. S. D. I. Bureau of Land Management 1996). No management plans specific to *Ivesia webberi* are known to exist, however, and the effectiveness of such plans would still depend upon adequate implementation and enforcement resources.

Ivesia webberi is not listed as "critically endangered" under Nevada Revised Statutes (NRS) 527.270. Such listing would provide that ". . . no member of its kind may be removed or destroyed at any time by any means except under special permit issued by the state forester firewarden" on any lands in Nevada. The adequacy of this law, however, depends on informed and cooperative land managers, or on some form of deterrent enforcement, for either of which the current law does not provide. It also depends on the state forester firewarden's discretion in issuing or withholding permits, and in placing protective conditions on permits that are issued. Nevada law does not mandate the continued survival of any plant species which it declares to be in danger of extinction.

Other Natural or Man-made Factors: Because of its very small and localized populations, and its apparent adaptation to unusual edaphic conditions, *Ivesia webberi* may be vulnerable to natural events such as climatic shifts or unprecedented climatic extremes. Its absence from numerous natural sites apparently containing suitable habitat suggests a couple of possibilities: 1) the species already has endured population losses, and/or 2) the species has such specific environmental requirements that selection has favored atelochory (selection for non-dispersal). [Should this be the case, the species may respond favorably to experimental releases.] To the extent that *Ivesia webberi* may depend upon insect pollinators for successful reproduction, any natural or man-made factors affecting the viability of pollinating insects would also affect the viability of *Ivesia webberi*.

X. GENERAL ASSESSMENT AND RECOMMENDATIONS

General Assessment: As now known, the global population of *Ivesia webberi* consists of about 4,855,200 individuals restricted to about 186 acres (75.5 ha) of public and private lands divided among 15 populations occupying about seven scattered areas in Washoe and Douglas Counties, Nevada and Sierra, Plumas, and Lassen Counties, California. The total Nevada population of *Ivesia webberi* is estimated to be 4,740,000 individuals, and to occupy 29.2 acres (11.9 ha) between 5320 and 5950 feet (1620-1815 meters) elevation. *Ivesia webberi* is a fully distinct

species, and its validity as such has never been questioned. The species is restricted to mid-elevation terraces or benches characterized by shallow, clayey soils with a rocky surface pavement weathered from andesite or a similar volcanic substrate and underlain by bedrock or other indurated layer. *Ivesia webberi* is often the dominant or co-dominant of the uncommon plant community it occupies and grows in association with perennial herbs and dwarf shrubs. Most of the seemingly suitable surveyed habitat was unoccupied and most populations are well isolated from other populations. Only the western rim of Upper Long Valley in California shows much promise of producing significant additional populations.

Ivesia webberi is known from eight occurrences in Nevada. Because these populations are small and isolated, they are individually and collectively vulnerable to both human impacts and natural events. All known Nevada populations of *Ivesia webberi* are currently subject to some level of ongoing human impact and many are threatened by more severe future impacts. Existing impacts, such as off-road vehicle use, affect all eight of the populations in Nevada. Three small populations (Sites 1-3) on private property near Bordertown are within an area being developed into low density housing. Even if they are not immediately destroyed, the long-term viability of these populations is severely compromised and their extirpation is inevitable. Another site (Site 6) on private property southwest of Reno is very close to new high density housing developments. This site is vulnerable to impacts associated with adjacent human habitation as well as the potential to be developed in the near future. The recently discovered site (Site 8) near Black Springs is also in an area experiencing rapid urban development and is partially located on private property. The southern-most site (Site 7) is also on private property and is vulnerable to vehicular damage as well as the potential for commercial development along Highway 395. Only two sites (Sites 4-5) are on public land and afforded any degree of protection from development pressures. However, these sites continue to be subject to potential impacts from grazing, off-road vehicles, and a significant increase in human use of their habitat. People in the nearby housing developments will use this area for a variety of “activities” and the severity of this impact is as yet unknown.

The California populations of *Ivesia webberi* are primarily on public lands managed by the Humboldt-Toiyabe National Forest, tend to be a bit more remote, and do not appear to be as vulnerable as those in Nevada. However, the information and data review conducted as part of this status survey indicates that one historic population is most likely extirpated and two other historic records are probably erroneous. The seven extant populations in California are also isolated and very localized making them extremely vulnerable to both human impacts and natural events. Two populations on private property were discovered during preconstruction surveys along a proposed transmission tower route. The type locality in Sierra Valley is also on private property and is threatened by off-road vehicle use and invasion of non-native species. One of the California HTNF occurrences of *Ivesia webberi* is immediately adjacent to newly fenced private property and another is located in a small valley which has been repeatedly proposed for a drinking water storage reservoir.

This status survey failed to locate previously unknown populations, reduced the number of historically known populations through a combination of survey work and conservative interpretation of herbarium specimen collections, and documented previously unknown severe and imminent threats to several Nevada populations. Collectively these results show that *Ivesia*

webberi may become endangered in the vicinity of Bordertown and Reno. Since these populations represent a substantial portion of the species' range, *Ivesia webberi* meets the definition of Threatened under the Endangered Species Act and is recommended for candidacy and listing as such.

Status Recommendations: Until recently *Ivesia webberi* was classified as a category-2 candidate for listing by the U. S. D. I. Fish and Wildlife Service (1993). That category was eliminated on 28 February 1996 (U. S. D. I. Fish and Wildlife Service 1996). Based on the best available scientific evidence, *Ivesia webberi* currently meets the definition of a candidate for listing as threatened under the Endangered Species Act. Due to the severity of existing, ongoing, and threatened impacts to this species in northeastern Nevada, particularly in the area around Reno and Bordertown, it is likely to become an endangered species within the foreseeable future throughout a significant portion of its range. This report recommends that *Ivesia webberi* be proposed for candidacy and listing as Threatened under the Endangered Species Act.

The species is designated a Sensitive Species by the U. S. Forest Service and the Bureau of Land Management, is ranked 2 (imperiled) at the global level and 1 (critically imperiled) at the state level by the Nevada Natural Heritage Program, and is on the Threatened list of the Northern Nevada Native Plant Society (NNNPS). At a recent Nevada Rare Plant Workshop, *Ivesia webberi* was recommended for addition to the State of Nevada's critically endangered list. The findings of this status survey fully support these designations except that I recommend that the vulnerability ranking of this taxon at the global scale be changed to 1 (critically imperiled).

Critical Habitat Recommendations: If critical habitat were ever designated through the provisions of the Endangered Species Act or any other law or regulation, it should include all populations then known, along with any additional benches or terraces contiguous with those populations within, and 500 feet above and below, the known elevation limits of the species. It should include a 250-foot (75-meter) horizontal buffer zone on each side of the populations and of the contiguous terraces. Critical habitat should not be formally designated in cases where it might subject *Ivesia webberi* to increased threats to its survival, would interfere with habitat management, or would subject managers of the habitat to problems of trespass by curiosity seekers.

Conservation and Recovery Recommendations: The following recommendations, roughly in descending order of priority, are offered as the best opportunities to maintain the long-term viability of *Ivesia webberi*, to avoid any future need to list it as endangered, and to reduce the overall long-term management costs for the species. They generally do not take into account limited agency resources or other conservation priorities, which may preclude implementation of some recommendations. If monitoring (outlined in recommendation 2) indicates that preventable declines in viability of the species are occurring, more aggressive conservation and recovery measures should be identified and pursued.

1. Acquire, through fee title or conservation easement, all known sites on private property. It may not be possible to act swiftly enough to acquire Sites 1-3. Sites 6-8, however, are not now so critically imperiled that acquisition is precluded. Site 6 is rather large and occurs on the edge of Reno developments and adjacent to HTNF managed lands and should be

acquired. Site 7 is the southern-most for this species and must be acquired to maintain the full genetic spectrum of this species. Site 8 occurs partially on HTNF lands and the remainder might be acquired through land exchange.

2. All sites now known should be monitored yearly in the field for impacts and population trends. Existing impacts, including those from exotic weed infestations, should be reversed where possible.
3. The Humboldt-Toiyabe National Forest (HTNF) and Bureau of Land Management (BLM) should conduct or require additional surveys, following recognized professional standards (Nelson 1994), for undocumented *Ivesia webberi* populations prior to implementation of projects within potential habitat of the species, and any new populations found should be thoroughly documented. Impacts to new populations should be avoided or minimized during project implementation. Whenever funding and personnel permit, similar surveys should be continued outside of the project evaluation process as well.
4. HTNF and BLM should develop, implement, and adequately fund a long-term species management plan and conservation strategy for *Ivesia webberi*, to address at a minimum all the other recommendations above and below.
5. All public lands now known to contain *Ivesia webberi* should be designated as Areas of Critical Environmental Concern, withdrawn from mineral entry, and managed for low impact uses. Livestock use should be limited to low-intensities or eliminated completely depending upon the results of exclosure studies within *Ivesia webberi* sites. Vehicular access must be restricted to previously established roads and must be prevented entirely during vulnerable wet-soil periods. Fire suppression, if any, should be limited so as to avoid ground disturbance within habitat.
6. Roads and trails currently passing through *Ivesia webberi* habitat should be closed or rerouted around the habitat where possible. Minimally, vehicular access should be restricted to existing roads and prevented entirely during vulnerable wet-soil periods. Lands adjacent to urban development should be fenced or posted to minimize pedestrian impacts. Consider providing interpretative information in these areas to foster public awareness.
7. The reproductive strategy of *Ivesia webberi* should be determined, along with its effects on genetic diversity within and among populations. The nature and role of insect pollinators in the reproductive success of *Ivesia webberi* should be further assessed, and the status of any pollinators monitored for changes that might affect the viability of *Ivesia webberi*.
8. If monitoring (as specified in 2) begins to indicate an overall downward trend for the species population or habitat, all human-caused impacts should be eliminated, and the species should, if necessary to prevent extinction, be listed as Endangered under the Endangered Species Act.
9. Further research into the taxonomy, systematics, and genetics of *Ivesia webberi* and closely related taxa should be supported to the maximum extent possible.

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Field Research: Recent field surveys contributing information to this report were conducted from 2 June to 25 June 1997 and 2 June to 2 July 1998 by Carol W. Witham.

Specimens: All specimens known to document *Ivesia webberi* sites are listed by site in Appendix 1, Table 6. The list was compiled from all available published and unpublished sources, but is not necessarily complete. Although new collections from previously documented sites are discouraged, the Nevada Natural Heritage Program welcomes further additions or corrections to this table as they become known.

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