

# Current Knowledge and Conservation Status of *Ivesia aperta* (J. T. Howell) Munz var. *aperta* (Rosaceae), the Sierra Valley ivesia, in Nevada.

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**SUMMARY:** *Ivesia aperta* was first collected in the 1870's by several botanists from the general area of Sierra Valley, California. In 1907 it was collected from the north slope of the Carson Range, Washoe County, Nevada. However, it was not until 1962 that J. T. Howell recognized this taxon as a distinct species and described it as *Potentilla aperta*. Between its earliest collections and its original description, *Ivesia aperta* was generally treated as a yellow-flowered color variation of *Ivesia sericoleuca* or sometimes *Ivesia pickeringii* (Jepson 1936, Keck 1938). Munz (1968) placed this taxon in the genus *Ivesia* where it has remained. In 1988 Ertter described *Ivesia aperta* var. *canina* from Dog Valley, Sierra County, California.

*Ivesia aperta* var. *aperta* is a perennial, taprooted upright herb to 4.0 dm tall with dense silky hairs throughout. The mostly basal leaves are clothed in crowded or imbricate pairs of leaflets. The somewhat leafy flowering stalk is an open-branched cyme of yellow flowers in compact heads. The hairs at the base of the stem are <2 mm long and ascending while the yellow flowers are <10 mm across. The latter attributes help to distinguish *Ivesia aperta* var. *aperta* from similar appearing species which occur nearby. *Ivesia aperta* var. *aperta* occurs in relatively large areas of Sierra Valley and Upper Long Valley, California, as well as other scattered localities in Washoe and Storey Counties, Nevada, and Lassen, Plumas, and Sierra Counties, California.

The California occurrence information presented in this report was obtained from the California Natural Diversity Database, various Tahoe and Plumas National Forest documents, and private survey reports. No additional California field work was conducted. Surveys performed as part of this status report were restricted to documenting Nevada occurrences. The survey relocated three of the five historic Nevada occurrences and documented one new population. The two populations not relocated are presumed extant due to the remoteness of their estimated locations. Since the surveys performed as part of this status report, one additional Nevada occurrence of *Ivesia aperta* var. *aperta* has been found.

The recent surveys compiled for this report document 15 population centers (metapopulations and other isolated occurrences) of *Ivesia aperta* var. *aperta*. The metapopulations and many of the scattered occurrences are located within California. In Nevada, four populations were surveyed as part of this project and an additional three are considered extant. As documented, the global population of *Ivesia aperta* var. *aperta* totals roughly 3,548,000 plants covering about 1930 acres (783 ha). The Nevada population of *Ivesia aperta* var. *aperta* totals 2,800,000 plants in seven populations covering 9.7 acres (3.9 ha). In Nevada the known populations occur on public lands managed by the Humboldt-Toiyabe National Forest (3.6%) and on privately managed lands (96.4%) at elevations of 6470 to 7300 feet (1970-2225 meters). *Ivesia aperta* var. *aperta* is restricted to mid- to high-elevation valleys, terraces, and slopes with volcanically derived soils which are saturated in the spring. The habitat supports a sparse to moderately dense vegetation type usually dominated or co-dominated by *Ivesia aperta* var. *aperta*. Recent surveys in Washoe and Storey Counties, Nevada have revealed that most potentially suitable habitat in the correct elevational range is too xeric for this species. Only the most suitable habitat was surveyed in detail and totaled approximately 714 acres (290 ha). One new population was discovered as a result of these surveys; this a small subpopulation of a nearby historic occurrence. Another small population was found in 2000 by forest service

personnel in a remote area. Although there is still a lot of potentially suitable habitat in northwestern Nevada which remains unsurveyed, field observations indicate it unlikely that any significant new occurrences will be found.

At the end of 1996, *Ivesia aperta* var. *aperta* was known from five populations in the Carson and Virginia Ranges, Nevada at between 6700 and 7300 feet (2040-2225 meters) elevation. Nine occurrences (metapopulations and isolated occurrences) were known in Sierra and Plumas Counties, California at 4870-6500 feet (1485-1980 meters) elevation. A large portion of the California occurrences are within areas subject to private development and agricultural conversion and many populations had already been impacted by road-building and livestock grazing. Because of these impacts and its rarity and continued vulnerability, *Ivesia aperta* var. *aperta* 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, Humboldt-Toiyabe, Tahoe, and Plumas National Forests, and California Department of Fish and Game sponsored and conducted extensive field surveys in 1991-1998 to verify and refine the historical reports, discover any additional populations, and document the biology, ecology, and conservation status of all populations. The recent surveys compiled for this report increase the known extent of *Ivesia aperta* var. *aperta* in Nevada by two populations (40%) and 0.2 acres (0.1 ha, 2%). This report summarizes the results of all recent surveys, reviews all previous knowledge of the species, and recommends conservation and recovery actions designed to prevent it from becoming a threatened or endangered species.

In Nevada, *Ivesia aperta* var. *aperta* occupies relatively high-elevation seeps or drainages. These tend to be remote and as such are not under immediate threat of urbanization or agricultural conversion. They are, however, usually adjacent to old dirt roads which are now used almost exclusively by recreational off-road vehicle enthusiasts. This and the fact that the populations are relatively small in area, make them particularly vulnerable to damage from existing roads and potential additional off-road travel. A single petrochemical spill could extirpate most or all of a population. Eventually these sites will also be threatened by direct and indirect impacts, including weed encroachment, resulting from a significantly increased human population in the Reno-Sparks basin.

In California, the majority of the *Ivesia aperta* var. *aperta* populations occur in and around Sierra Valley and over half are on privately managed lands. These populations are threatened by hydrologic changes caused by ongoing agricultural conversion of the valley, road maintenance, grazing, and potential urban or agricultural-residential development. The large metapopulations here are already showing patchiness resulting from habitat modification and fragmentation.

Based on the best available scientific evidence, *Ivesia aperta* var. *aperta* does not now meet the definition of a candidate for listing as threatened or endangered under the Endangered Species Act. However, unchecked loss of populations in the Sierra Valley vicinity of California could reduce long-term viability for this species. Generally, the Nevada populations are remote and are not critically imperiled by short-term impacts. But, loss of the southeastern most population in the Virginia Range could compromise the genetic diversity of this taxon. For these reasons, this report recommends several conservation and recovery measures which, if successfully implemented, offer the best chance to eliminate any future need to list *Ivesia aperta* var. *aperta* as threatened or 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. The Virginia Range population is currently included in a proposed land exchange that would bring it into BLM ownership if implemented.

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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 aperta* (J.T. Howell 1962, p. 239) Munz (1968, p. 111) var. *aperta*.

**Type Specimen:** CALIFORNIA, Beckwourth [as Beckwith], Sierra Valley, Plumas Co., 18 July 1907, A. A. Heller & P. B. Kennedy 8882. Holotype: CAS; Isotypes: BKL, F, GH, ISC, NY, PH, POM, RENO, UC, US.

**Synonym(s):** *Potentilla aperta* J.T. Howell (1962).

**Vernacular Name(s):** Sierra Valley ivesia.

**Family:** Rosaceae (rose family).

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

**Review of Alternative Taxonomic Treatments:** It was not until 1962 that J.T. Howell recognized that the yellow flowered *Ivesia* from the central Sierra Nevada constituted a valid species, which he described as *Potentilla aperta*. Prior to that, *Potentilla aperta* had been treated as only a color phase of *Potentilla sericoleuca* (sometimes treated as a synonym of *Potentilla pickeringii*, a species now known to be restricted to Siskiyou and Trinity Counties, California) by Jepson (1936) and Keck (1938). In 1968, Munz placed *Ivesia aperta* in the genus *Ivesia* where it has remained. In 1988, Ertter described populations of *Ivesia aperta* from Dog Valley, Sierra County, California as var. *canina*. This new variety which combines features of *Ivesia sericoleuca* and *Ivesia aperta* may very possibly be a stabilized hybrid between the two species (Ertter 1989).

There is no single feature separating *Ivesia* from *Potentilla*. Some authors have combined the two genera under *Potentilla*. Prevailing taxonomic sentiment is to recognize both genera, accepting that both are heterogeneous and overlapping as currently defined (Ertter 1989). The foregoing does not in any way call into question the validity of *Ivesia aperta* as a distinct species, in whatever genus it may eventually be placed. Field botanists observing *Ivesia aperta* find it quite distinct from *Ivesia sericoleuca* as noted by Howell (1962) in the original description. Additionally, *Ivesia aperta* var. *aperta* is readily distinguishable from the related *Ivesia aperta* var. *canina* by its smaller flowers (<1 cm in diameter) and shorter filaments (<2 mm) (Ertter 1993). No specimens intermediate between var. *aperta* and var. *canina* have been observed.

**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 aperta*, are known to exist. Within the genus, *Ivesia aperta* is usually placed with morphologically similar species such as *I. sericoleuca*, *I. pityocharis*, *I. kingii*, and *I. pickeringii*. These species all occur in vernal mesic habitats in the mountains and high valleys of the Sierra Nevada-Cascade axis, eastward into the Great Basin. Only in the case of *Ivesia sericoleuca* is there any overlap of distribution and occupied habitat (near Beckwourth, Sierra County, California). Until there are significant additional studies of *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 aperta*.

## II. TAXON HISTORY

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

- 1872: First known collection by H. N. Bolander and A. Kellogg (on label as Keller) in June from Sierra Valley, California.
- 1874: Several additional collections made by J. G. Lemmon during 1874-1875. All with imprecise location information.
- 1907. Type collection made from near Beckwourth (as Beckwith) in Sierra Valley, California, by A. A. Heller and P. B. Kennedy on 18 July.
- 1907. Species first collected in Nevada by P. B. Kennedy on the north flank of Mount Rose during a 20-25 June collecting trip.
- 1936. Treated as a yellow-flowered color phase of *Potentilla sericoleuca* (which was treated as a synonym of *Potentilla pickeringii*) by Jepson in *A Flora of California*. This decision was shared by Keck (1938).
- 1962. Formally described as a distinct species (*Potentilla aperta*) by J. T. Howell.
- 1968. Recombined as *Ivesia aperta* by P. A. Munz.
- 1984. Included on the California Native Plant Society's List 4 (Smith and York 1984).
- 1988. A new variety (var. *canina*) of *Ivesia aperta* is described from Dog Valley, California (Ertter 1988).
- 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).
- 1992. Interim management guide prepared by the Tahoe, Plumas, and Toiyabe National Forest (Van Zuur et al. 1992).
- 1995. Included on the updated sensitive vascular plants of Nevada list (Morefield 1995).

1996. Category-2 candidate designations eliminated for all species on 28 February by the U. S. D. I. Fish and Wildlife Service (1996), all in Nevada converted to sensitive species designations by the U. S. D. I. Bureau of Land Management (1996).
1997. Field surveys conducted in Nevada by the Nevada Natural Heritage Program (NNHP).
2000. Additional Nevada population located by Humboldt-Toiyabe National Forest personnel during a reconnaissance of the Arrowcreek fire. No population size or area was reported.

### 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 aperta* var. *aperta* was most recently ranked T2 by the Nevada Natural Heritage Program at the global level and S1 at the state level (Nevada Natural Heritage Program 2000). The results of this report show T2 to be the appropriate rank at the global level and, due to its extreme rarity in Nevada, S1 is the appropriate rank at the state level.

**Federal:** Until recently *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* remains a "species of concern" to the Fish and Wildlife Service, but this term has no formal status. *Ivesia aperta* var. *aperta* is on the sensitive species lists of the U. S. D. A. Forest Service Regions 4 and 5 (Van Zuuk *et al.* 1992) and the U. S. D. I. Bureau of Land Management (1996). This report recommends no changes to these designations.

**State:** No formal status has been designated at the state level. *Ivesia aperta* var. *aperta* is on the Northern Nevada Native Plant Society's threatened list (Nevada Natural Heritage Program 2000). No change in this designation is recommended. *Ivesia aperta* var. *aperta* 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, tufted, generally erect herb to 4 dm tall, odorless, densely white silky-haired throughout; **root crown** generally simple, though branched in some individuals, thick, clothed in old leaf bases; **overall color** greenish-gray to whitish foliage with an open-branched arrangement of dense clusters of yellow flowers; **stems** 1.5-4.5 dm long, densely white silky-haired, hairs at base <2 mm long and ascending, stems upright or occasionally lying flat at the base and angling upward at the tip, usually with 3-8 alternate leaves. **Basal leaves** 10-20 cm long, with 20-35 crowded pairs of leaflets, generally covered with silky whitish hairs; **leaf stalks** generally without leaflets on the lower third, hairy; **leaflets** 4.5-13 mm long, deeply divided into ≤5 narrow segments. **Flower groups** open branched arrangement of compact, ball-shaped, clusters of flowers about 10-20 mm across, with 5-20 flowers per group

each on 0.5-2 mm stalks (except the lowest), outside hairy, the outer-most flower blooming first; **flowers** <10 mm across; **flower cups** like a shallow cone or cup, wider than deep, 1.4-3.4 mm deep, golden-yellow within; **bractlets** lance-shaped, about ½ the length of the sepals; **sepals** lance shaped, 2.5-5.2 mm long, gray-green on the outside and pale yellow on the inside; **petals** much smaller than the sepals, narrow, 2-3 mm long, yellow; **stamens** 20 in 3 series, the anthers 0.3-0.5 mm long, filaments linear and 1-1.5 mm long, anthers and filaments both yellow; **pistils** 2-7, styles 2.5 mm; **seeds** 2.2-2.5 mm, smooth, brown. **Chromosome number** 14 (Howell 1962). Flowering June through August [modified from Holmgren (1997) and Ertter (1993)].

**Technical: Perennial**, erect herb to 4.0 dm tall, densely white-sericeous throughout, eglandular; **caudex** generally simple, though branched in some individuals, clothed in persistent leaf bases; **overall color** greenish-gray to whitish foliage with open-branched cymes of yellow flowers in compact glomerules; **stems** decumbent to erect. 2-4 dm tall, white-sericeous, unbranched, with 3-8 alternate leaves; hairs at base of stem <2 mm long and ascending. **Basal leaves** 10-20 cm long, with 20-35 crowded or imbricate pairs of leaflets; **rachis** generally without leaflets on the lower third, sericeous; **leaflets** 4.5-13 mm long, deeply divided into ≤5 oblanceolate, acute to rounded (rarely pinnatifid) segments; densely sericeous. **Inflorescence** an open-branched cyme of flowers in compact glomerules, heads 10-20 mm across, with 5-20 flowers, pedicles <3 mm (except the lowest) and straight, sericeous; **flowers** <10 mm across; **hypanthium** turbinate to cupulate, depth less than width, 1.6-3.4 mm deep, golden-yellow within; **bractlets** lanceolate, 1.2-2.5 mm long, acute; **sepals** lanceolate to narrowly lanceolate, 2.5-5.2 mm long, acuminate, gray-green on the outside and yellowish on the inside; **petals** much smaller than the sepals, obovate to oblanceolate, 2-3 mm long, rounded to truncate apically, cuneate, clawed, yellow; **stamens** 20, in 3 series, the anthers 0.3-0.5 mm long, filaments filiform and 1-1.5 mm long, anthers and filaments both yellow; **pistils** 2-7, styles 2-3 mm long and glandular-thickened near the base; **achenes** 2.2-2.5 mm, smooth and brown. **n** = 14 (Howell 1962). Flowering June through August [modified from Holmgren (1997) and Ertter (1993)].

**Field Characters:** Although quite distinctive, *Ivesia aperta* var. *aperta* can be confused with several similar taxa which occur nearby. This is particularly true of non-flowering plants. However, the combination of silky-haired gray-green leaflets, ascending <2 mm hairs at the base of the stem, and the open cyme of yellow flowers in compact glomerules separate this species from all others which may occur nearby. The following key is based on Munz (1968), Ertter (1989, 1993) and Cronquist *et al.* (1997) and distinguishes *Ivesia aperta* var. *aperta* from co-occurring taxa in Nevada and northeastern California.

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 fruit ..... other **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 5 ..... other *Ivesia*
  - 5' Stamens 20
    6. Branches of cyme terminating in solitary flowers or small clusters of few flowers; pedicels usually >5 mm long; basal leaves often stipulate, often with >35 pairs of leaflets; petals white to pink
      7. Hypanthium flat at anthesis, yellow inside; pistils 8-20 mm; leaflets 16-22 pairs; Pine Nut Mountains, Douglas Co., Nevada ..... *Ivesia pityocharis*
      - 7' Hypanthium cupulate, ca. half as deep as wide, pale yellow to pink inside; pistils 2-6; leaflets to 50 pairs
        8. Stems and leaves grayish with abundant spreading hairs to 4 mm long, some inconspicuous glandular hairs present; petals oblanceolate; serpentinitic clays, California ..... *Ivesia pickeringii*
        - 8' Stems and leaves glabrous or with appressed hairs <1 mm long, non-glandular; petals obovate; alkali flats and meadows (*Ivesia kingii*)
          - 9 Leaflets crowded but individually distinguishable, variously pubescent; caudex simple or few branched; common in Great Basin ..... *Ivesia kingii* var. *kingii*
          - 9' Leaflets tightly overlapping, resembling a rat's tail, silvery pubescent; caudex becoming well branched; Ash Meadows, Nye Co., Nevada ..... *Ivesia kingii* var. *eremica*
  - 6' Branches of cyme terminating in glomerules of many flowers; pedicels (except lowermost) ca. 3 mm; basal leaves estipulate, with less than 35 pairs of pairs of leaflets
    10. Petals white; hypanthium depth greater than or equal to width; hairs at base of stem 2-4 mm long, spreading; northeast California *Ivesia sericoleuca*
    - 10' Petals yellow; hypanthium depth less than width; hairs at base of stem <2 mm long, ascending (*Ivesia aperta*)
      11. Petals 4-7 mm long, narrowly to broadly obovate; flowers more than 1 cm in diameter; filaments 2-4 mm long; stems decumbent-ascending; Dog Valley, Sierra Co., California ..... *Ivesia aperta* var. *canina*
      - 11' Petals 2-3 mm long, oblanceolate; flowers <1 cm in diameter; filaments <2 mm long; stems ascending-erect; northeast California and northwest Nevada ..... *Ivesia aperta* var. *aperta*

**Photographs and Line Drawings:** A line drawing by Bobbi Angell was published in Cronquist *et al.* (1997, p. 109) and is reproduced in Appendix 2, Figure 1 of this report. Other line drawings have been published in Hickman (1993, p. 963). Photographs made for this report are reproduced in Appendix 2, Figures 2-7, and are filed with the Nevada Natural Heritage Program.

## V. SIGNIFICANCE OF TAXON

**Natural:** *Ivesia aperta* var. *aperta* is one of several distinct, geographically restricted species in the closely related genera *Potentilla*, *Ivesia* and *Horkelia*, and therefore represents an important tool for studying the apparently recent and rapid evolution of new outcrossing species.

**Human:** No studies of medicinal or other qualities of potential human benefit are yet known to have been performed on *Ivesia aperta* var. *aperta*. 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 populations of *Ivesia aperta* var. *aperta* is open to interpretation. In California, 78.6% of the records for this species are from three distinct areas: near Beckwourth in the northwest end of Sierra Valley, Plumas County; southeastern Sierra Valley and Antelope Valley, Plumas and Sierra Counties; and Balls Ranch in the southwest end of Upper Long Valley, Sierra County. When plotted on 1:24,000 scale topographic maps, many of the individually recorded occurrences appear distinct though some are rather large and amorphous. However, when plotted on a 1:100,000 scale map, the boundaries of these individual occurrences become less apparent and these three areas appear to form interconnected super population centers or metapopulations. Current patchiness within these metapopulations is most likely the result of recent human alterations of the landscape and hydrology.

In California, in addition to the three metapopulations, there are six isolated populations in small valleys or watersheds along the western slope of the Diamond Mountains which occur along the Plumas-Lassen County line. Last Chance Valley, now the location of the Frenchman Lake reservoir, is the largest of these valleys. The several recorded California Natural Diversity Database occurrences of 1-3 individual plants are not herein treated as populations although they are listed in Appendix 1. In California, the known populations occur within lands administered by the Plumas-Tahoe National Forests, the Bureau of Land Management, the State of California, Department of Fish and Game, but the majority are on privately owned lands in Sierra Valley.

In Nevada, *Ivesia aperta* var. *aperta* is known from seven locations in Washoe and Storey Counties. One redocumented population is on the northwest flank of Peavine Mountain. Another redocumented population and one new population are located in the western Carson Range in the watershed north of Thomas Creek. The southeastern most population of *Ivesia aperta* var. *aperta* is located in the Virginia Range of Storey County and was also redocumented during this survey. Two historic collections, one from the Hunter Creek area in the northern Carson Range and the other from the foothills of Mount Rose west of Washoe, were not resurveyed, but may be presumed extant due to the remoteness of their estimated locations. One additional population documented in 2000 is located along Evans Creek on the eastern flank of the Carson Range. Within Nevada the seven known populations occur within lands administered by the Humboldt-Toiyabe National Forest, Carson Ranger District (3.6%) and on private owned lands (96.4%).

**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 (1, 2, 3, and 4) 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 and data 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-Antelope Valley metapopulation, California (Table 1), which collectively harbored 16.4% of the total reported individuals of the species on 49.1% 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 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 one case, potential 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 1986 *Ivesia aperta* var. *aperta* had been documented from four locations in Washoe County and one location in Storey County, Nevada. Three of these historic sites were subsequently rediscovered and further documented during the course

of this survey. Sites 5 and 6 were not found during surveys for this report, but can still be presumed extant since their estimated locations are rather remote. Site 7 was discovered since the surveys were completed for this status report. The Nevada populations are now estimated to comprise 2,800,000 individuals covering 9.3 acres (3.8 ha) of Humboldt-Toiyabe National Forest and private lands between 6470 and 7300 feet (2970-2225 meters) elevation.

**New site(s) discovered:** One new population of *Ivesia aperta* var. *aperta* was discovered during the course of this survey. It was located approximately 0.5 mile north of the population in the watershed north of Thomas Creek which had previously been documented by Tiehm and Nachlinger (see Table 6). This new population is estimated to comprise 700 individuals covering 0.08 acres (0.03 ha) of Humboldt-Toiyabe National Forest lands at 6700-6720 feet (2045 m) elevation.

**Historical site(s) searched for but not rediscovered:** As discussed above, two of the historical sites were not relocated during this survey. One, Site 5, was searched for, but not found. Access to the area in which Site 6 is estimated to occur was not possible during the survey. Therefore, the precise locations from which the 1907 Dinsmore Camp and 1918 west of Washoe collections (Appendix 1, Table 6) were made remain unknown. However, the general areas from which they were collected are rather remote and unlikely to be subject to more than grazing or off-road vehicle impacts.

**Other site(s) searched where not discovered:** (Appendix 1, Table 3; Appendix 3 Maps 2-5) All areas surrounding known populations and in their general vicinity were searched to the extent possible. Table 3 and Maps 2-5 show only those areas searched which contained possibly suitable habitat. Additional sites searched in which no vernal mesic habitats were found included extensive areas surrounding and between the unoccupied habitat depicted in Maps 2-5. During the 1997-1998 field season, unoccupied Sites U1-U3 in the vicinity of Site 1, unoccupied Sites U4 in the vicinity of Sites 2-3, unoccupied Sites U5-U7 in the vicinity of Site 4, and unoccupied Sites U8-U9 in the vicinity of Site 5 were surveyed. These surveys comprise about 714 acres (190 ha) between 6360 and 7600 feet (1940-2315 meters) elevation.

**Historical site(s) known or suspected to be erroneous reports:** No Nevada historical sites are suspected to be erroneous reports. The two historical sites which were not relocated during the course of this survey have only imprecise location information. The general areas are known to contain scattered patches of potentially suitable habitat but the exact locations are still unknown.

**Historical site(s) known or assumed extirpated:** No Nevada sites are known or assumed extirpated.

In California, evidence suggests that several populations or portions of populations may be extirpated. In particular, Little Last Chance Valley, now the site of Frenchman Lake reservoir, contains a couple of scattered occurrences on the lake margin, but probably once supported a much more extensive population. Similarly, the Sierra-Antelope

Valleys and Beckwourth metapopulations have probably become fragmented due to habitat conversion including hydrological alterations, road construction, housing developments, agricultural conversion, and perhaps overgrazing.

**Historical site(s) where present status unknown:** As discussed above, Sites 5 and 6 were not redocumented during the course of this field survey. Their location information is imprecise, and although Site 5 was searched for, it was not found. Both of these sites are considered extant at this time primarily due to the remoteness of their estimated locations. Both are probably located near old dirt roads which have eroded and become virtually impassible to all but the most rugged four wheel drive vehicle. A third site for which current status is unknown was discovered in 2000 along the eastern flank of the Carson Range at Evans Creek. This occurrence is presumed extant, but no population size or area data are available.

**Potential site(s) meriting future field surveys:** (Appendix 1, Table 2). Potential Site P1 in the vicinity of Site 5, potential Sites P2-P5 in the vicinity of Site 6, and potential Site P6 in the vicinity of Site 7 are areas of identified potentially suitable habitat which could not be accessed during the 1997-1998 field season. The sites comprise about 212 acres (86 ha) between about 6420 and 7050 feet (1960-2150 meters) elevation in Washoe County, Nevada. These sites are on the north and the east slopes of the Carson Range and may be the locations of the two historic herbarium collections which were not redocumented during this survey.

There is a lot of potentially suitable habitat within the correct elevational range in northern Nevada (U.S.D.A. Forest Service, Humboldt-Toiyabe National Forest 1999). However, field surveys as described above, indicate that only a very small proportion of potentially suitable habitat is actually occupied. Usually, a site that looks suitable from a distance often ends up being too xeric for this species. Additional Nevada surveys are unlikely to produce significant new findings.

## VII. HABITAT CHARACTERISTICS

**Environment and Habitat Summary:** (Appendix 2, Figures 4-7) In the field, *Ivesia aperta* var. *aperta* appears to be restricted to shallow, slowly draining soils derived from volcanic rock or volcanic alluvium on mid- to high-elevation benches and flats on all aspects between 4,870 and 7,300 feet (1485-2225 meters) elevation. This species tends to be associated with vernal saturated sites (e.g. meadows, washes, intermittent drainages, vernal flats and seep areas). Dittes (unpublished data, cited in Yandell 1994) contends that the dry-down rate in the spring and the depth of the local perched water table may be crucial elements in the distribution of *Ivesia aperta* var. *aperta*. The surface soils are typically very rocky, to somewhat sandy, with shallow and clayey subsoils that tend to retain moisture longer than the surrounding soils. This habitat supports a generally sparse vegetation usually dominated by *Ivesia aperta* var. *aperta* and often containing other hydrophytic species such as Lemmon's onion (*Allium lemmonii*) and silver everlasting (*Antennaria luzuloides*). Although sagebrush (*Artemisia tridentata*) occurs on most

of the sites, it generally describes the edge of the population and seldom occurs within. See Appendix 1, Table 4 for other species observed within *Ivesia aperta* var. *aperta* populations.

### **Physical Characteristics:**

**Physiography:** The range of *Ivesia aperta* var. *aperta* lies along the transition zone between the eastern edge of the northern Sierra Nevada and the in the northwestern part 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, including the California valleys where *Ivesia aperta* var. *aperta* occurs, is within the Sierra Nevada rain shadow, which is the dominant influence on local climate. The elevations where *Ivesia aperta* var. *aperta* populations occur in Nevada experience warm dry summers and cold moist winters. Annual precipitation averages

about 14-27 inches (350-690 mm) water equivalent, with about half or more falling as snow which may remain on the ground for several weeks or months. Daily mean temperatures average about 61-66°F (16-19°C) in July and 28-32°F (-2 to 0°C) in January. No unusual temperature or precipitation anomalies occurred during surveys for this species.

**Geomorphology, aspect, and slope:** *Ivesia aperta* var. *aperta* occurs in vernal saturated habitats (e.g. meadows, washes, intermittent drainages, vernal flats, and seep areas) in mid-elevation valleys in California. The easternmost populations in Nevada occur at a higher elevation and tend to be associated with seeps. Occupied areas follow the western slope of the Diamond Mountains, both the western and the eastern slopes of the Bald Mountain Range, the north and eastern slopes of the Carson Range, and the summit of the Virginia Range. 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. Yandell (1994) observes that all known California and Nevada occurrences are associated with rocks of volcanic origin and when occurrences fall on alluvial soils (such as some Sierra Valley occurrences) that the alluvium is derived from volcanic rocks.

**Soils:** No detailed soil analysis is known from any of the Nevada *Ivesia aperta* var. *aperta* sites. All observed sites occur on shallow, clayey soils derived from volcanic, generally andesitic, substrates. At many sites, the soils have a relatively rocky surface “pavement” due to clay expansion and contraction pushing the rocks to the surface. Beneath the shallow surface horizon, the clay content increases and these subsoils exhibit shrink-swell behavior. 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 to withstand the shrink-swell of the clay zone or they must be shallowly rooted above the clay horizon and able to complete their reproductive cycle before the soil surface dries out.

In California, a study of the Dog Valley populations of *Ivesia aperta* var. *canina* showed a correlation with the shallow clayey soils of the Aldi and Borolls series (U.S.D.A. Forest Service, Humboldt-Toiyabe National Forest 1999). This HTNF report further suggests that suitable habitat for *Ivesia aperta* in Washoe County, Nevada might be found in meadows or on flatter slopes with Apmat, Duckhill Variant, Fraval, Jumbo or Tanob soil series. These soils occur extensively on western flanks of Peavine Mountain and the north and east slopes of the Carson Range (Soil Conservation Service 1983).

**Hydrology:** *Ivesia aperta* var. *aperta* occurs in areas where the soil is saturated with water in the spring (Dittes, unpublished data, cited in Yandell 1994). In California, this habitat can be associated with vernal flats in montane valleys as well as with drainages and seeps. In Nevada, *Ivesia aperta* var. *aperta* invariably occurs on the edges of seeps or in intermittent channels which carry spring runoff. The soils and basin-like

configurations of these sites have a significantly higher water holding capacity than surrounding areas.

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

### **Biologic Characteristics:**

**Community physiognomy:** *Ivesia aperta* var. *aperta* usually co-dominates its habitat with other perennial herbs, grasses, and shrubs, within the mountain sagebrush zone that characterizes the mid- to high-elevation slopes of Great Basin mountain ranges.

**Vegetation type:** Because *Ivesia aperta* var. *aperta* tends to dominate or co-dominate its sparsely vegetated habitat with other perennial herbs, grasses, and shrubs, it forms a unique plant association. On a couple of the sites, the vegetation type could be described as an *Artemisia tridentata*-*Ivesia aperta* association (Sawyer and Keeler-Wolf 1995), or as an *Ivesia aperta*-vernal seep plant community. These can be relatively showy in the spring when all of the associate species are in bloom.

**Associated plant species:** (Appendix 1, Table 4) *Antennaria luzuloides* and *Poa secunda* occurred on 75% of the sites where associates were documented. *Allium lemmonii*, *Artemisia tridentata*, *Bromus tectorum* (an exotic species), *Elymus elymoides*, and *Poa bulbosa* were the other most frequently noted associates. The highest elevation site in the Virginia Range, Storey County, was co-dominated by *Carex douglasii*.

**Other endangered, threatened, and sensitive species:** At least 21 other sensitive plant and animal species are known in and near the Nevada range of *Ivesia aperta* var. *aperta*, and are listed in Appendix 1, Table 5. None of these have been documented to co-occur with *Ivesia aperta* var. *aperta* in Nevada.

**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 3.6% (based on percentage of total population size) of the Nevada *Ivesia aperta* var. *aperta* population occurs on public lands managed by HTNF. Historically, these lands were open to and used for activities such as livestock grazing and recreation. Most of grazing allotments in the Carson Range are now vacant or closed. Former impacts due to recreational vehicles may also be reduced due to a new HTNF policy making use of unmarked two-tracks illegal. HTNF has designated *Ivesia aperta* var. *aperta* a Sensitive Species, has prepared an interim management guide (Van Zuuk *et al.* 1992), and has been very supportive in conducting or funding field surveys for this and other Sensitive Species in the region (Witham 1991).

**Private lands:** About 96.4% of the Nevada *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* or its habitat. The high elevation and generally remote areas occupied by *Ivesia aperta* var. *aperta* on private land make them relatively secure from development in the near future. Current threats to privately owned habitat include off-road vehicle impacts, grazing, and potential weed encroachment.

In a recent development, the Virginia Range population of *Ivesia aperta* var. *aperta* is included in a proposed land exchange that, if implemented, would bring it under BLM management along with all the surrounding "checkerboard" ownership pattern. A decision notice (Conrad 2000) was been issued, and the 45-day comment period ended in early July 2000. This land swap is under protest (Morefield, personal communication).

**California occurrences:** Because survey methods for the *Ivesia aperta* var. *aperta* 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 35.9% of the *Ivesia aperta* var. *aperta* population (based on the average of percent of area occupied) occurs on public lands managed by the Plumas and Tahoe National Forests. Other public lands occurrences include 11.4% managed by the California Resources Agency, Department of Fish and Game, Region II, and a trace amount which occurs on lands managed by the Bureau of Land Management, Susanville District. The publicly managed populations are potentially subject to timber harvest and grazing allotment impacts. The remaining 52.7% of *Ivesia aperta* var. *aperta* populations occur on lands identified as privately managed. All of the California *Ivesia aperta* var. *aperta* occurrences on private lands are subject to grazing, potential housing development, and agricultural conversion impacts.

## VIII. BIOLOGY AND ECOLOGY

**Population Summary:** Based on the information gathered for this report, the total known global population of *Ivesia aperta* var. *aperta* is estimated to be 3,548,000 individuals, and to occupy 1930 acres (783 ha) of habitat divided among 48 recorded occurrences which translate to 15 scattered populations centers in Sierra, Plumas, and Lassen Counties, California, and Washoe and Storey Counties, Nevada. The Nevada population of *Ivesia aperta* var. *aperta* is estimated to be 2,800,700 individuals, and to occupy 9.7 acres (3.9 ha) of habitat divided among 7 populations in 6 scattered locations between 6470 and 7300 feet (1970-2225 meters) elevation. The populations are generally restricted to valleys or slopes associated with several typical basin and range mountain ranges. Populations occur on the west side of the Diamond Mountains, both slopes of the Bald Mountain Range, the north and east slopes of the Carson Range, and the summit of the Virginia Range. Extant populations occur between 4870 and 7300 feet (1485-2225 meters) elevation. Observations on existing populations indicate that additional surveys are unlikely to produce significant new populations in Nevada. Two historical populations in Nevada were not relocated during the course of this survey, but are expected to be extant due to the remoteness of their estimated locations.

**Demography:** Long-term monitoring has not been conducted for *Ivesia aperta* var. *aperta* populations to determine demographic trends. In California, a number of small populations have been reported just downstream from larger sites. Dittes (unpublished data, cited in Yandell 1994) has evidence suggesting that *Ivesia aperta* var. *aperta* may be water dispersed and that disturbed roadsides and ditches may be “safe-sites with appropriate hydrology” downstream from established natural occurrences.

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. *Ivesia aperta* var. *aperta* appears to have moderate recruitment within the established Nevada 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 1837 plants per acre (4528/ha) can be extrapolated. However, individual site population estimates performed on the Nevada occurrences ranged from about 166,667 plants per acre (410,510/ha; Site 3) to about 500,000 plants per acre (1,231,530/ha; Site 4; Appendix 1, Table 1). The average plant density for the Nevada sites in which density was measured (Sites 1, 2, and 4) was 10.5 plants per square foot (457,380/acre or 1,126,550/ha). California population estimates were as low as 2.5 plants per acre (6.1/ha, Site C36) and as high as 10,375 plants per acre (25,555/ha, Site C05) which are considerably lower than those measured from Nevada populations during this field survey. As stated earlier, this is probably at least partially attributable to over-mapping of population areas and underestimating population numbers. However, during a survey of the Department of Fish and Game parcels in Sierra Valley, Witham (1993) reported a maximum density of 2.1 plants per square foot over the nine plots sampled which seems to support somewhat lower densities for California populations.

**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 mid-June, and some flowers have been seen opening throughout the month of August, particularly at higher elevations. The fruit probably mature by about a month after flowering, between mid-July and the end of September.

**Genetics:** No studies of the genetic structure in *Ivesia aperta* var. *aperta* 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 15 population centers (metapopulations and isolated occurrences) 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 aperta* var. *aperta* habitat become a critical threat to 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 aperta* var. *aperta*, though Dittes (unpublished data, cited in Yandell 1994) is investigating propagule dispersal, germination, and seedling recruitment. As discussed above under genetics, insect-mediated out-crossing is the most likely reproductive mode in *Ivesia aperta* var. *aperta*. A limited amount of seed dispersal for this species may be by water (Yandell 1994). The relatively large seeds probably become lodged in the crevices in the rocky soils very soon after being shed by the parent plant unless entire stems are carried downstream by spring runoff. No asexual, or vegetative, reproduction is apparent in this species.

**Hybridization:** *Ivesia aperta* var. *aperta* grows in very close proximity with *Ivesia sericoleuca* in several locations, particularly near Beckwourth in Sierra Valley, California. No apparent hybridization has been observed here or in other locations where the species overlap. On the other hand, *Ivesia aperta* var. *canina* from Dog Valley, Sierra County, California, has characteristics of both species and may very possibly represent a stable hybrid between these two species (Ertter 1989). No hybridization with other *Ivesia* species has been observed nor is likely to occur.

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

**Predation:** Some level of herbivory was observed at all sites. Rabbits and other native fauna probably graze the leaves and flowering stems on an occasional basis without significant impacts. In Nevada, cattle grazing impacts appear to be minimal. In California, grazing impacts, particularly in areas of permanent pasture or in forest openings, may be a significant threat to this species. Plumas National Forest data suggest that isolated populations may experience 60-80% consumption of flowering stems by cattle. Several exclosures have been recently installed by the Plumas National Forest to study the possible benefits of release from grazing pressure (Scott 1995). Periodically, grasshoppers may have a significant impact on *Ivesia aperta* var. *aperta* seed production by eating the entire plant before seed set (Scott, personal communication).

**Competition:** At all sites, *Ivesia aperta* var. *aperta* 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 13.8 per square foot (148.5 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 aperta* var. *aperta* sites help to exclude many competitors. The shrink-swell of the clayey subsoils favor perennials with a strong taproot (or caudex) and shallow-rooted, early maturing annuals. Because the soils are also saturated in the early spring, most typical Great Basin plant species are excluded.

**Response to Disturbance:** Generally, *Ivesia aperta* var. *aperta* is a dominant or co-dominant component of a well developed climax community. However, at several sites, *Ivesia aperta* var. *aperta* has been observed to colonize areas along highway and road right-of-ways, ditches, and interconnected low-lying spots. Both Scott (1995) and Dittes (unpublished data, cited in Yandell 1994) suggest that *Ivesia aperta* var. *aperta* grows in these locations because they have both the necessary hydrology and provide refuges from livestock grazing. Some populations or individual

plants appear to respond well to certain types of disturbance as long as the necessary spring soil saturation is maintained.

Although *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* may be seen colonizing mildly disturbed sites, all my observations indicate that its long-term survival depends upon the continued availability of undisturbed mid- to high-elevation vernal saturated areas in soils derived from andesite or similar volcanic material with clayey subsoils. *Ivesia aperta* var. *aperta* 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 or lands converted to intensive agriculture.

**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 Nevada population of *Ivesia aperta* var. *aperta*. Mineral exploration is not considered a significant threat at this time.

**Animal grazing or trampling:** Most Nevada *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* to livestock has not been determined.

**Road development and maintenance:** Most of the *Ivesia aperta* var. *aperta* 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 and the privately owned lands of the Virginia Range and eastern Peavine Mountain. The access created by these roads encourages further off-road travel through populations, and off-road vehicle tracks have been observed in many sites, creating potentially significant and long-term impacts to populations. To date, road development does not 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.

**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 of the habitat of *Ivesia aperta* var. *aperta*. The roads cutting through many of the populations may have originated during such activities. While most *Ivesia aperta* var. *aperta* sites are in relatively fireproof sites, the invasion of cheatgrass and medusahead (*Taeniatherum caput-medusae*) into areas following a fire can be problematic.

**Private development:** Private development is not an immediate threat to *Ivesia aperta* var. *aperta* populations in Nevada. Site 1 is on private lands on the eastern slope of Peavine Mountain. Some new development is occurring downslope, but the population is not threatened at this time. Site 4 occurs on private lands at the head of Cedar Hill Canyon in the Virginia Range. Although considerable development is occurring nearby, the population is sufficiently remote to remain unaffected for some time. Recently, the Virginia Range population of *Ivesia aperta* was included in a proposed land exchange that, if implemented, would bring it under BLM management (Conrad 2000).

**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 aperta* var. *aperta* habitat. Cheatgrass is unlikely to become dominant in undisturbed habitat and probably poses no threat to *Ivesia aperta* var. *aperta*. The sites occupied by *Ivesia aperta* var. *aperta* may be wet enough for tall whitetop (*Lepidium latifolium*) which is spreading rapidly in western Nevada. This perennial, highly invasive species may pose a threat to *Ivesia aperta* var. *aperta* habitat in the near future. Closing off vehicular access to the sites might help to prevent colonization by tall whitetop.

**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 aperta* var. *aperta* 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 aperta* var. *aperta*. 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 aperta* var. *aperta* is on the sensitive species list of the Plumas, Tahoe, and Humboldt-Toiyabe National Forests. 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. The Tahoe, Plumas, and Humboldt-Toiyabe National Forests have a joint interim management plan for *Ivesia aperta* (Van Zuuk *et al.* 1992).

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 aperta* var. *aperta* 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 aperta* var. *aperta* are known to exist, however, and the effectiveness of such plans would still depend upon adequate implementation and enforcement resources.

*Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* may be vulnerable to natural events such as climatic shifts or unprecedented climatic extremes. Its patchy distribution in certain natural sites such as within the Sierra-Antelope Valley metapopulation, suggests that this species has already lost populations or portions of populations due to human caused alterations to its habitat. To the extent that *Ivesia aperta* var. *aperta* may depend upon insect pollinators for successful reproduction, any natural or man-made factors affecting the viability of such insects would also affect the viability of *Ivesia aperta* var. *aperta*.

## X. GENERAL ASSESSMENT AND RECOMMENDATIONS

**General Assessment:** As now known, the global population of *Ivesia aperta* var. *aperta* consists of about 3,348,900 individuals restricted to about 1930 acres (783 ha) of public and private lands divided among 15 population centers in Washoe and Storey Counties, Nevada and Sierra, Plumas, and Lassen Counties, California. The Nevada population of *Ivesia aperta* var. *aperta* is estimated to be 2,800,700 individuals, and to occupy 9.7 acres (3.9 ha) of habitat divided among 7 populations in 6 scattered locations between 6470 and 7300 feet (1970-2225 meters) elevation. *Ivesia aperta* is a fully distinct species, and its validity as such has never been questioned. Variety *aperta* is similarly distinct and fully recognized by all western floras. The taxon is generally restricted to mid- to high-elevation valleys or slopes and occurs only in areas in which volcanic derived soils are saturated in the spring. *Ivesia aperta* var. *aperta* is often the dominant or co-dominant of the uncommon plant community it occupies and grows in association with perennial herbs, grasses and occasional shrubs. Most of the seemingly suitable habitat inspected during this survey was actually too xeric to support this species.

*Ivesia aperta* var. *aperta* is known from seven occurrences in Nevada. Because these populations are small and isolated, they are individually and collectively vulnerable to both natural and human caused events. The habitat of this taxon in Nevada is sufficiently remote to preclude immediate threat from urban development. However, the sites continue to be subject to impacts from grazing, off-road vehicles, and potential weed encroachment. Loss of native pollinators or unprecedented climatic extremes could potentially extirpate one or more of these populations. Increased human use of *Ivesia aperta* var. *aperta* habitat is also anticipated in the future as urban development moves closer to populations.

**Status Recommendations:** Until recently *Ivesia aperta* var. *aperta* 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, the species does not now meet the definition of a candidate for listing as threatened or endangered under the Endangered Species Act. *Ivesia aperta* var. *aperta* is not in danger of extinction (nor likely to become in danger of extinction in the foreseeable future) throughout or in a significant portion of its range. However, acquisition of key populations, long term monitoring, and cooperative management will be required to prevent possible extirpations in Nevada and ongoing habitat degradation in California. Absent such cooperative management, the long-term possibility of extinction or major declines will remain. Federal or state listing would become justified if more than about 10-20% of the known populations were lost to preventable causes.

The species is also designated a Sensitive Species by the U. S. Forest Service and the Bureau of Land Management, is ranked T2 (imperiled) at the global level and S1 (critically imperiled) at the state levels by the Nevada Natural Heritage Program. Although this survey found one additional population of *Ivesia aperta* var. *aperta*, the total number of, and areas occupied by, populations in Nevada remain small. No changes in status are recommended.

**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 mesic areas 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 areas. Critical habitat should not be formally designated in cases where it might subject *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta*, to avoid any future need to list it as threatened or 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 3) 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, significant *Ivesia aperta* var. *aperta* sites on private property. In particular, Site 4 is the southeastern most for this species and must be acquired to maintain the full genetic spectrum of this species. (In a recent development, the area in which the Site 4 population of *Ivesia aperta* var. *aperta* occurs has been proposed for a land exchange that, if implemented, would bring it under BLM management.) Large continuous areas of plants within the Sierra-Antelope Valley metapopulation, the Beckwourth metapopulation and the Balls Range metapopulation should be protected through acquired conservation easements with the current landowners.
2. Conduct additional surveys to determine the exact locations from which the 1907 Dinsmore Camp and the 1918 west of Washoe, Nevada, herbaria specimens were gathered. Survey for the Evans Creek population discovered in 2000. Include information gathered from these additional surveys, particularly on land ownership status and current and potential threats, in formulating ongoing conservation strategies for *Ivesia aperta* var. *aperta*.
3. Known sites 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. Cooperative management strategies must be developed which balance the needs for species conservation with the needs of private landowners.
4. The Plumas, Tahoe, and Humboldt-Toiyabe National Forest (HTNF), the California Department of Fish and Game, and the Bureau of Land Management (BLM) should conduct or require additional surveys, following recognized professional standards (Nelson 1994), for undocumented *Ivesia aperta* var. *aperta* 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.
5. All Nevada public lands now known to contain *Ivesia aperta* var. *aperta* should be designated as Areas of Critical Environmental Concern, withdrawn from mineral entry, and managed for low impact uses. On all public lands, livestock use should be limited to low-intensities or eliminated completely depending upon the results of exclosure studies within *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* habitat should be rerouted around the habitat where possible. Minimally, vehicular access should be restricted to existing roads. Remote populations might benefit from complete closure of 4-wheel drive access roads.
7. The reproductive strategy of *Ivesia aperta* var. *aperta* 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 aperta* var. *aperta* should be further assessed, and the status of any such pollinators monitored for any changes that might affect the viability of *Ivesia aperta* var. *aperta*.

8. If monitoring (as specified in 3) 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 Threatened or Endangered under the Endangered Species Act.
9. Further research into the taxonomy, systematics, and genetics of *Ivesia aperta* var. *aperta* 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 aperta* 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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