

Current Knowledge and Conservation Status of *Phacelia inconspicua* E. Greene (Hydrophyllaceae), the obscure scorpion plant, in Nevada

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SUMMARY: *Phacelia inconspicua* was first discovered by Edward L. Greene in 1894 in the Humboldt Mountains of Pershing County, Nevada, and was named by him as a new species the following year. It is an annual herb up to 15 tall with unlobed elliptic leaves and small coils of pale-bluish bell-shaped flowers up to 4 mm long. It is known only from two widely separated areas in northwestern Nevada and south-central Idaho. *Phacelia inconspicua* is considered to be a valid and distinct species easily separated from its relatives, and its taxonomic status has never been disputed.

As of 1993 *Phacelia inconspicua* was reported from four sites between 6600 and 8360 feet (2010-2550 meters) elevation in the Humboldt Mountains of Pershing County, Nevada, and from five sites between 5390 and 6200 feet (1640-1890 meters) elevation on the Snake River Plains of Blaine and Butte counties, Idaho. Active cyanide heap-leach mining operations reach within 2 miles (3 km) of the Nevada populations, with numerous other claims posted throughout the area. Because of its rarity, limited distribution, and potential vulnerability to mineral exploration and development and other impacts to its known habitat, the species was designated a category-2 candidate for federal listing on 28 November 1983, and was listed as critically endangered by the State of Nevada. Responding to this concern, field surveys were undertaken in central and eastern Nevada during late spring and summer of 1994 and 1995 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 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.

Field surveys discovered no new populations, and relocated three of the historical Nevada populations, documenting about 3700 plants scattered over about 18 acres (7.3 ha) of public land managed by the Winnemucca District of the Bureau of Land Management. The original, vaguely-described type locality could not be verified, and may correspond to one of the other known sites. As now documented, *Phacelia inconspicua* is known worldwide from eight sites totalling roughly 24,400 plants and covering about 53 acres (21.4 ha) of Bureau of Land Management (99%) and National Park Service (1%) lands between 5390 and 8360 feet (1640-2550 meters) elevation. The species was restricted to deep, organic-rich soils on steep to very steep, north- or northeast-facing concave slopes which receive enhanced ground water, surface runoff, and slope wash from persistent snow drifts upslope. The Nevada populations occur on soils derived from early Mesozoic limestones, but the Idaho populations occur on Quaternary and late Tertiary rhyolite or basalt. In both areas, the plant is restricted to small, otherwise nearly unvegetated terracettes scattered in stands of mountain sagebrush

(*Artemisia tridentata* var. *vaseyana*), where locally it can dominate the herbaceous understory. Limited data suggest that *Phacelia inconspicua* is an early- to mid-seral fire-adapted species.

Recent surveys focusing on about 10,000 acres (4000 ha) of additional potential habitat at 11 sites across northern Nevada have revealed no further populations of *Phacelia inconspicua*, but many more tens of thousands of acres of potential habitat scattered across the higher ranges of this region remain unsurveyed. Because of the remaining potential for undiscovered populations, their difficulty of detection, and the wide size fluctuations and disjunctions in the known populations, the true global population of the species is estimated to be between 1.5 and 6 times larger than that now documented. Despite the plant's broad regional distribution, the known populations consist of only a few thousand individuals scattered over a few acres. All may be vulnerable to declines from long-term suppression of natural fires. The three Nevada populations are closely grouped within an area of high mineral exploration and development potential, and most of the Idaho populations are vulnerable to impacts from exotic weed invasions or livestock trampling. The habitat of one Idaho population is reported to have been noticeably impacted by livestock activity, but none of the Nevada sites showed significant disturbance. *Phacelia inconspicua* may require periodic disturbance by fire to regenerate its populations, but does not appear to tolerate much soil disturbance, or to be capable of colonizing disturbed or undisturbed soil in other habitat types. It is currently managed as a "special status species" by the Bureau of Land Management, and two Idaho populations are currently managed primarily for resource protection. No other protective management exists for the Nevada populations.

Based on the best available scientific evidence, *Phacelia inconspicua* does not now meet the definition of a candidate for listing as threatened or endangered under the Endangered Species Act. Its long-term viability remains a concern without more complete protective management, however, and it could become a threatened or endangered species in the future if more than about 10% of its known distribution were lost. It therefore continues to meet criteria for sensitive species designations by the Bureau of Land Management and the State of Nevada. This report recommends several conservation and recovery measures which, if successfully implemented, offer the best chance to eliminate any future need to list *Phacelia inconspicua* as threatened or endangered. Primary among these are long-term monitoring, surveys of additional potential habitat, careful design and mitigation of any future ground disturbance in or near known sites, possible exclusion of fire-suppression activities from habitat based on further studies of its fire responses, and development of a conservation agreement and management plan for the species.

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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 the NNHP or USFWS at the addresses above.

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I. CLASSIFICATION AND SYSTEMATICS

Scientific Name: *Phacelia inconspicua* E. Greene (1895, p. 24).

Type Specimen: NEVADA, Pershing County: West Humboldt Mountains, 18 July 1894, *Greene s.n.* (holotype: ND-G, on 3 sheets; isotype: NY) (Tiehm 1996).

Synonym(s): No synonyms or synonymy are known to have been proposed for *Phacelia inconspicua*.

Vernacular Name(s): Obscure scorpion plant; inconspicuous phacelia; obscure phacelia.

Family: Hydrophyllaceae (waterleaf family).

Major Groups:	Cronquist 1988	Heywood 1978	Takhtajan 1986	Thorne 1992
Class	Magnoliopsida	Dicotyledoneae	Magnoliopsida	Angiospermae
Subclass	Asteridae	Asteridae	Lamiidae	Dicotyledoneae
Superorder			Lamianae	Solananae
Order	Solanales	Polemoniales	Boraginales	Solanales
Suborder				Boraginineae

Review of Alternative Taxonomic Treatments: Greene (1895) apparently recognized *Phacelia inconspicua* as a new species as soon as he had found it. He described it as "[a] curious and very distinct but homely ally of *P. humilis*, altogether insignificant and weedy-looking by contrast with it . . .". Neither my personal field experience nor subsequent published work on *Phacelia* has challenged this. *Phacelia inconspicua* appears to be a distinct and well-defined species.

Biogeography and Phylogeny: The genus *Phacelia* A. L. Jussieu consists of about 175 species in North and South America, most abundant and diverse in the western United States and adjacent northern Mexico (Cronquist 1984, Wilken *et al.* 1993). *Phacelia inconspicua*'s distribution creates an interesting connection between Holmgren's (1972) Central Great Basin and Ertter and Moseley's (1992) Lava plains unit of the Upper Snake River Plains.

No detailed studies of the origin and evolution of the genus *Phacelia*, much less of *Phacelia inconspicua*, are known to exist. Howell (1943, p. 11) pointed out *Phacelia inconspicua*'s morphologic intermediacy between *P. humilis* Torrey & A. Gray and *P. austromontana* J. T. Howell, and speculated that *P. inconspicua* ". . . may represent the modern and relictual form from which originated *P. austromontana* and its relatives." *Phacelia humilis* ranges from the Sweetwater and Wassuk ranges north along the east side of the Sierra-Cascade axis to the Warner Mountains, thence east to the Santa Rosa Mountains and north barely into Oregon, then disjunctly to central Washington (Cronquist 1984). Both *Phacelia*

inconspicua and *P. humilis* occur in the Humboldt Mountains. *Phacelia austromontana* has a more southern range through the mountains of southern California north to the White Mountains, with disjunct sites to the east in the Toquima Range in central Nevada and the Pine Valley Mountains of southwestern Utah (Cronquist 1984). *Phacelia austromontana*'s range does not overlap with that of *Phacelia inconspicua*.

II. TAXON HISTORY

- 1894: Type specimen collected by E. L. Greene, Imlay Canyon, Pershing County, Nevada on 18 July.
- 1895: Formally published and described by Greene (1895).
- 1967: Atwood discovered population on north side of Big Southern Butte, Butte County, Idaho on 1 July (Moseley 1989).
- 1978: Tiehm and Williams recollected near the type locality on 11 June (Cronquist 1984).
- 1980: Designated a category-1 candidate for federal listing by the U. S. D. I. Fish and Wildlife Service (1980).
- 1980: Packard and Grimes relocated the Big Southern Butte population (Moseley 1989).
- 1983: Designated a category-2 candidate by the U. S. D. I. Fish and Wildlife Service (1983).
- 1984: Included and recognized in *Intermountain Flora* by Cronquist (1984).
- 1987: Included and recognized in Kartesz's (1987) flora of Nevada.
- 1989: Moseley (1989) prepared a status report for the Idaho populations.
- 1989-1990: Atwood and Elzinga found four more Idaho populations (Moseley 1989, pers. comm. 1996).
- 1989: Tiehm (1989) surveyed Humboldt Range, documenting three populations.
- 1994-1995. Field surveys conducted for this report.
- 1996: Category-2 candidate status dropped from use by the U. S. D. I. Fish and Wildlife Service (1996).

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, 1 being the most vulnerable and 5 the most secure. *Phacelia inconspicua* was most recently ranked 1 in Nevada by the Nevada Natural Heritage Program (Morefield and Knight 1992), 1 in Idaho (Moseley and Groves 1992), and 2 globally. This is consistent with the results of this survey.

Federal: Until very recently *Phacelia inconspicua* 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). *Phacelia inconspicua* is on the sensitive species list of the

U. S. D. I. Bureau of Land Management (1996) in Nevada and Idaho (Moseley and Groves 1992). This report recommends no changes to these designations.

State: Nevada: *Phacelia inconspicua* is listed as critically endangered under Nevada Revised Statutes (NRS 527.270). Critically endangered taxa are those "*threatened with extinction*," whose "*existence is endangered*," and whose "*survival requires assistance because of over exploitation, disease or other factors or because its habitat is threatened with destruction, drastic modification or severe curtailment*" (NRS 527.270). It is also on the Northern Nevada Native Plant Society's (NNNPS) Endangered list (Morefield and Knight 1992). This report recommends that NNNPS move *Phacelia inconspicua* to its Watch List. Idaho: no legal status or formal protection.

IV. DESCRIPTION

Non-technical: An upright, taprooted **annual** herb up to 20 cm (8 in) tall; **hairs** clearly spreading throughout, not glandular, of two forms on the stems and among the flowers, consisting of numerous fine, short, loosely curled to spreading hairs and a smaller number of longer, stiffer, spreading hairs (those of the flower cups more numerous, longer, and stouter), the two forms more similar on the leaves; **overall color** grayish to greenish with small coils of pale bluish flowers. **Stems** rounded, freely branched from the base, leafy. **Leaves** many, unlobed; **stipules** none; **stalks** winged, well-developed on lower leaves, shorter or absent on upper leaves; **blades** narrowly oval, up to 3.5 cm long and 1 cm wide, green above and somewhat paler below, main nerves 3-5 from near base. **Flower groups** coiled at stem tips, shorter than the leaves, internal leaves none. **Flowers** (late May to early July) each with male and female parts, radially symmetric; **stalks** 1-3 mm long; **flower cup** of 5 narrow green lobes, 2-3 mm long in flower, becoming 5-6 mm long in fruit; **petals** 5, fused about half their length into a bell-shaped tube 3-4 mm long and about as wide, pale bluish, tips upright; **stamens** equal to or barely exceeding the corolla in length, hairless; **anthers** about 0.2 mm long; **style** hairy, 2-2.5 mm long, divided in two above middle; **ovary** and fruit shortly hairy, ovules 4. **Fruit** (June-August) an egg-shaped **pod** tapered to a short beak, 2-3 mm long, shortly hairy, partially divided into 2 chambers; **seeds** 2(-4), about 1.6-1.8 mm long, closely pitted [modified from Mozingo and Williams (1980) and Cronquist (1984)].

Technical: Erect taprooted **annual**, 0.5-2 dm tall; **pubescence** evidently spreading throughout, non-glandular, dimorphic on the stems and inflorescence with numerous fine, short, loosely curled to spreading hairs and fewer longer, stiffer, spreading hairs (those of the calyces more numerous, longer, and stouter), less dimorphic on the leaves; **overall color** grayish to greenish with small coils of pale bluish flowers. **Stems** terete, freely branched from the base, leafy. **Leaves** many, entire; **stipules** none; **petioles** winged, evident below, shorter to obsolete above; **blades** narrowly elliptic to lance-ovate, mostly 1-3.5 cm long, to about 1 cm wide, green above, paler below, trinerved from near the base, or penninerved with few, elongate, ascending primary lateral veins. **Inflorescence** of small terminal helicoid cymes exceeded by the leaves, ebracteate. **Flowers** (late May to early July) perfect, radial; **pedicels** 1-3 mm long; **calyx** 2-3 mm long at anthesis, elongating to 5-6 mm long in fruit, the segments 5, linear or nearly so, only slightly or not at all expanded distally; **corolla**

pale bluish, open-campanulate, 3-4 mm long and up to as long as wide, the lobes 5, up to about as long as the tube; **filaments** glabrous, about equaling or very slightly surpassing the corolla; **anthers** minute, ca 0.2 mm long; **style** pubescent, 2-2.5 mm long, cleft more than half way to the base; **ovary** and fruit short-hairy, ovules 4. **Fruit** (June-August) a capsule ca 2-3 mm long, evidently beaked, short-hairy, partly bilocular; **seeds** 2(-4), about 1.6-1.8 mm long, pitted-reticulate [modified from Mozingo and Williams (1980) and Cronquist (1984)].

Field Characters: *Phacelia inconspicua* is only likely to be confused with three other species: *P. austromontana*, *P. humilis*, and *P. minutissima* L. F. Henderson. *Phacelia inconspicua* has flowers that are smaller than those of *P. humilis* (corolla lobes 3-4 vs. 4-7 mm long). *Phacelia austromontana* has a generally more southern distribution, is glandular, and usually has at least some leaves with 1-2 lobes (always entire in *Phacelia inconspicua*). *Phacelia minutissima* is also glandular, has leafy inflorescences longer than the subtending leaves, well-included stamens, and produces as many as a dozen seeds per capsule. In *P. inconspicua* all hairs are non-glandular, the inflorescences are ebracteate and exceeded by the subtending leaves, the stamens are shortly exserted, and the fruits produce only 2 or 4 seeds. Typical material may be separated from similar or co-occurring taxa by the following key (condensed from Cronquist 1984):

1. Ovules more or less numerous, always more than 4; seeds usually more or less numerous, very rarely only 4 or glandular hairs present . . . other *Phacelia* including *P. minutissima*
- 1' Ovules 4; seeds 1-4; glandular hairs present or absent 2
2. Seeds conspicuously excavated on one or usually both sides of the prominent ventral ridge (shallowly so in one species); plants annual to biennial; leaves strongly toothed to more often pinnately lobed or dissected other *Phacelia*
- 2' Seeds not or scarcely excavated; plants annual; leaves entire or nearly so 3
3. Flowers relatively showy, the corolla mostly 4-7 mm long and wide; filaments rather sparsely spreading-hairy near the middle; style 4-7 mm long; anthers 0.4-0.5 mm long *Phacelia humilis*
- 3' Flowers small and inconspicuous, the corolla up to about 5 mm long and wide; filaments glabrous; style 2-4 mm long; anthers ca 0.2-0.4 mm long 4
4. Herbage spreading-hairy, with many of the hairs in the inflorescence gland-tipped; usually some of the leaves with 1-2 coarse teeth or small lobes on one or both sides; mountains of southern California as far north as the White Mountains, and with outlying stations in the Pine Valley Mountains of sw Utah and the Toquima Range of Nye County, NV *Phacelia austromontana*
- 4' Herbage spreading-hairy, but not at all glandular; leaves all entire; Pershing Co., Nevada, and Butte and Blaine counties, Idaho *Phacelia inconspicua*

Photographs and Line Drawings: A line drawing by Jeanne R. Janish was published in Mozingo and Williams (1980), and one by Robin A. Jess was published in Cronquist (1984); both are reproduced in appendix 2, figures 1-2. Photographs by Jan Nachlinger of *Phacelia inconspicua* and its habitat appeared in Tiehm (1989). Photographs from the Idaho sites also appeared in Moseley (1989). Photographs made for this report are reproduced in appendix 2, figures 13-17, and are filed with the Nevada Natural Heritage Program.

V. SIGNIFICANCE OF TAXON

Natural: *Phacelia inconspicua*'s preference for relatively barren soil microsites and increased abundance after transient disturbances such as fires may give it a role in stabilizing soils after natural disturbances within its habitat. Its disjunct distribution provides an interesting link between the floras of central Nevada and central Idaho (Tiehm 1989).

Human: No studies of medicinal or other qualities of potential human benefit are yet known to have been performed on *Phacelia inconspicua*.

VI. GEOGRAPHIC DISTRIBUTION

Geographic Range: (appendix 1, table 1; appendix 2, figure 3). Globally, *Phacelia inconspicua* has been documented from eight sites in two widely separated areas in northwestern Nevada and south-central Idaho on lands managed by the Bureau of Land Management (99%) and the National Park Service (1%). The three Nevada sites occur in a small area of the northern Humboldt Range in Pershing County. It is fairly likely that further populations will eventually be discovered in the region between the Nevada and Idaho sites.

Precise Occurrences: Site numbers and descriptions are given in appendix 1, table 1, which cross-references each site to its related maps and figures. The table also shows 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.

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. Apparently *Phacelia inconspicua* occurs only on public lands in Nevada.

Historical site(s) rediscovered or recently known extant: (See appendix 1, table 1, sites 1-3; appendix 2, figures 4-5). I relocated all three populations of *Phacelia inconspicua* that Tiehm (1989) observed, and documented an estimated 3712 individuals covering 18.15 acres (7.3 ha) of Bureau of Land Management lands between 6600 and 8360 feet (2010-2550 meters) elevation.

New site(s) discovered: No previously unreported sites were documented.

Historical site(s) searched for but not rediscovered: (appendix 1, table 1, site A4; appendix 2, figure 6). The exact type locality ("... on the slopes of the West Humboldt Mountains") is vague. Greene's 1894 collection refers to Imlay, the name of a local railroad siding, a former town, and of a small creek that drains the north end of the Humboldt Range. All three known sites are within 1.5 miles (2.4 km) of the headwaters of Imlay Creek and are less than 7 miles (11 km) from the old

settlement. The major mines of the Humboldt Range were 20 or more years old when Greene visited the area (Lincoln 1923), so access to the higher country where *Phacelia inconspicua* grows would have been established: all three modern sites would have been within an easy day's ride from town. Any or all of the three modern sites could correspond to Greene's type locality. I was unable to find *Phacelia inconspicua* in the Imlay Creek watershed during 1994 field surveys.

Tiehm (personal communication, 18 June 1996) noted that "*Greene traveled by train and got off the train at what was then called Humboldt House and is now just an exit on I-80 called Humboldt. My guess is that he went up Humboldt Canyon to Humboldt City and collected above there. Other things he collected in 1894 were Eriogonum anemophilum and Penstemon radicosus.*" See also Tiehm (1996).

Other site(s) searched where no *Phacelia inconspicua* was found: Tiehm (1989) spent 20 field days in the Humboldt Range in 1988 and 1989 while engaged in a sensitive plant survey. During that survey he located and mapped all three currently known populations. For this report sites A1-A11 (appendix 2, figures 4-12), comprising about 10,096 acres (4085 ha) between 5600 and 9668 feet (1710-2947 meters) elevation, were surveyed without encountering *Phacelia inconspicua*. Moseley (1989) searched suitable habitat on 14 Idaho buttes in T4S-2N R27-31E without finding additional populations. A single plant was subsequently found at one of these (Split Top, site ID3) in 1990.

Historical site(s) known or suspected to be erroneous reports: No historical reports were determined to be erroneous.

Historical site(s) known or assumed extirpated: No extirpations of *Phacelia inconspicua* populations are known or suspected to have occurred. Several large open-pit mines throughout northern Nevada exist on or near historically appropriate habitat for the species, and their construction could have extirpated one or a few populations prior to knowledge of conservation concerns for the species.

Historical site(s) where present status unknown: It was possible to assess the status of all historical sites in Nevada for this report.

Potential site(s) meriting future field surveys: Many tens of thousands of acres of apparently suitable stands of *Artemisia tridentata vaseyana* flank most of the higher ranges of central and northern Nevada, but could not be surveyed within the scope of this report. I found the plant in only a tiny fraction of the apparently suitable habitat I surveyed. Given *Phacelia inconspicua*'s appropriate name, its fragmented local distribution, disjunct global distribution, and large variations in population size, it is quite likely that additional populations remain to be detected both in the Humboldt Range and in some of the higher ranges to the north and east. Surveys of all remaining potential habitat would probably increase the existing population estimates by about 1.5-6 times.

VII. HABITAT CHARACTERISTICS

Environment and Habitat Summary: (appendix 2, figures 13-17). In Nevada, *Phacelia inconspicua* appears restricted to relatively deep, undisturbed, organic-rich soils on fairly steep, concave, north- to northeast-facing slopes between 6600 and 8360 feet (2010-2550 meters) elevation where snow drifts persist well into spring. These sites provide seasonal soil saturation and somewhat enhance the soil moisture throughout the year. The habitat supports shrub fields dominated by big sagebrush (*Artemisia tridentata vaseyana*) in association with mountain spray (*Holodiscus microphyllus*), mountain snowberry (*Symphoricarpos rotundifolius*), and Great Basin wildrye (*Leymus cinereus*). *Phacelia inconspicua* is localized on otherwise barren terracettes in small clearings among the shrubs, where it can locally dominate the herbaceous understory. *Phacelia inconspicua* may be a fire-adapted species, thriving best in the early- to mid-seral conditions after its habitat burns. Moseley (1989) described similar habitat parameters for the Idaho populations, with somewhat different associated species.

Physical Characteristics:

Physiography: The Humboldt Mountains lie at the western edge of Holmgren's (1972) Central Great Basin section of the Great Basin Division of the *Intermountain Flora* region. This corresponds to Fenneman's (1931) Great Basin Section of the Basin and Range Province. The Central Great Basin Section is a high mountainous region characterized by sagebrush-dominated valley floors generally elevated above 5000 feet (1520 meters), and mountain ranges dominated by non-calcareous rock types (Holmgren 1972). 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 sub-tropical 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 Humboldt Mountains populations of *Phacelia inconspicua* presently experience a dry subhumid continental regional climate (Houghton, Sakamoto and Gifford 1975), with cool, dry summers and cold moist winters. Annual precipitation averages about 9-14 inches (230-355 mm), mostly as winter and early spring snow which may linger for weeks after falling. Temperatures average about 53-61°F (12-16°C) in July and 15-22°F (-9 to -6°C) in January. Conditions are slightly drier at the lower-elevation, more northerly Idaho sites, with warmer summers and colder winters. Annual precipitation averages about 9-11 inches (230-280 mm), and temperatures average about 63-67°F (17-19°C) in July and 12-16°F (-11 to -9°C) in January. All known populations occupy steep side-slopes on the coldest (northerly to northeasterly) aspects, in the lees of ridges where snow drifts persist. A snow drift covering the Humboldt Canyon west population (site 1, figures 4 and 14) was visible from Interstate 80, nearly 4 miles (6.4 km) away, well into June of 1994. No unusual temperature or precipitation anomalies occurred during surveys for this report.

Geomorphology, aspect, and slope: All three Nevada sites were on the leeward side of high ridges in areas of obviously persistent snowdrifts, on steep to very steep, concave-upward side slopes facing north to northeast. *Phacelia inconspicua* grew on relatively barren terracettes in scattered clearings. Moseley (1989) described similar settings for the Idaho populations.

Geology: All three Nevada populations grew in soils derived from limestone facies of the early- to middle-Triassic Prida Formation (Johnson 1977, Yoder-Williams 1979, and this survey). This is in marked contrast to the Idaho populations, which all occur on Tertiary and Quaternary rhyolite, basalt, and pyroclastic deposits on the Snake River Plains (Moseley 1989). This edaphic contrast underscores the importance of the snowdrift microsites in which *Phacelia inconspicua* thrives. Moseley (1989, p. 6) mistakenly reported that "the Nevada populations also occur on volcanic substrates."

Soils: Yoder-Williams (1979) described the Humboldt Canyon east population (site 2) as growing in "Pachic haploxerolls, frigid, silt loam phase; black moist; 4-6% o.c." This indicates an uncommonly deep, organically rich soil that shows the influence of shallow ground water, presumably supplied by the persistent snow drifts. Soil

moisture deficits do not limit plant growth before July. The soil is below freezing from late fall through mid spring (Soil Survey Staff 1983).

The East Part Pershing County soil survey (Zielinski 1994) encompassed the Humboldt Mountains. This survey mapped "soil associations", broad categories consisting of two or more geographically associated soils shown as a single map unit. This mapping convention was used because of the impracticality of mapping the intimately-intermingled component soils. Interpretation of the map unit legend and descriptions indicated *Phacelia inconspicua* preferred Argic Pachic and Calcic Pachic Cryoborolls. These also are cold, uncommonly deep soils with significant accumulation of organic material. Many of these soils also showed signs of seasonal saturation (Soil Survey Staff 1983). Studies reviewed by Fowler (1986) indicated that some annual plant species accomplish the vast majority of their production in microsites with high levels of organic matter in the soil.

Hydrology: Besides incident precipitation, *Phacelia inconspicua* sites receive enhanced snow melt and slope wash from above because of their geomorphic position. Persistent snowdrifts provide considerable soil moisture over a prolonged period during late winter and spring. Moseley (1989) described similar settings for the Idaho populations.

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

Biologic Characteristics:

Community physiognomy: *Phacelia inconspicua* is a locally dominant component of the annual/herbaceous understory on otherwise nearly barren terracettes, between and beneath knee- to waist- high shrubs of the mountain sagebrush and mountain brush zones that characterize more mesic sites on the otherwise dry mid-elevation slopes of Great Basin mountain ranges. A few other annual herbs also may be present, but the terracettes are dried and barren by the time soil moisture reserves have been depleted. Moseley (1989) described similar situations for the Idaho populations.

Vegetation type: *Phacelia inconspicua* forms part of the herbaceous understory in pockets of mountain sagebrush (*Artemisia tridentata vaseyana*) associations with mountain spray (*Holodiscus microphyllus*), mountain snowberry (*Symphoricarpos rotundifolius*), and Great Basin wild rye (*Leymus cinereus*). These local shrub fields are maintained by a combination of concave slope profile, moisture input enhanced by persistent snowdrifts, and consequent deeper soil development. They are surrounded by the shorter, locally more common low sagebrush (*Artemisia arbuscula*) series (Sawyer and Keeler-Wolf 1995). Moseley (1989) reported undescribed mountain shrub communities occupying the Idaho sites, dominated by chokecherry (*Prunus virginiana*) and/or mountain snowberry with mountain sagebrush and other similar associates.

Associated plant species: (appendix 1, table 2) *Artemisia tridentata vaseyana*, *Holodiscus microphyllus*, *Lupinus argenteus heteranthus*, *Mertensia oblongifolia nevadensis*, and *Senecio integerrimus exaltatus* were observed at all of the Nevada sites. Of these, only *Artemisia tridentata vaseyana* has been reported from the Idaho sites. Otherwise, there is little additional overlap reported between the two areas, including only *Chrysothamnus viscidiflorus viscidiflorus*, *Symphoricarpos rotundifolius*, *Achnatherum lettermanii*, *Leymus cinereus*, *Poa secunda secunda*, *Pseudoroegneria spicata*, *Collomia linearis*, *Galium bifolium*, and *Microsteris gracilis*.

Other endangered, threatened, and sensitive species: At least six other sensitive plant and animal species are known from the Humboldt Range, and are listed in appendix 1, table 4. One of these is documented immediately adjacent to *Phacelia inconspicua* sites. None of these species was observed during surveys for this report.

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.

All known Nevada populations of *Phacelia inconspicua* occur entirely on BLM lands administered by the Winnemucca District, in the Prince Royal and Humboldt House grazing allotments. No domestic livestock were observed in the vicinity of the *Phacelia inconspicua* populations during field activities. The Prince Royal allotment is very small, permitting just 14 cows from June to September. Humboldt House is larger, currently permitting 120 cows from mid April to mid September. Competing applications have been received for the Humboldt House allotment, suggesting management changes may be forthcoming. Several dozen wild horses were gathered from the vicinity during 1994. Most animals were gathered around Rye Patch Reservoir, across Interstate 80 from the Humboldt Range (Redick 1995).

The Idaho populations occur on BLM lands administered by the Upper Snake River District, on National Park Service lands in Craters of the Moon National Monument, and possibly on some private land. Moseley (1989; personal communication, 27 September 1996) indicated that the Park Service population (Grassy Cone NNW, site ID5) is actively being protected and monitored. The Big Southern Butte population (site ID1) is within the Big Southern Butte National Natural Landmark, designated by the Park Service and voluntarily managed by BLM for protection of geologic and ecologic features, including removal of livestock grazing. The Pratt Butte population (site ID2) remained open to heavy cattle use, with significant impacts to nearby habitat, but the viability of *Phacelia inconspicua* there did not yet appear compromised (Moseley 1989).

VIII. BIOLOGY AND ECOLOGY

Population Summary: Based on the information gathered for this report, the total known global population of *Phacelia inconspicua* was estimated to be about 24,413 individuals, and to occupy about 53.15 acres (21.5 ha) of habitat divided among 8 sites in the Humboldt

Mountains of Pershing County, Nevada, and the Snake River Plains of Butte and Blaine counties, Idaho, between 5390 and 8360 feet (1640-2550 meters) elevation. The Nevada population was estimated to comprise about 3712 individuals on 18.15 acres (7.3 ha) of habitat divided among 3 sites between 6600 and 8360 feet (2010-2550 meters) elevation. Based on the probable extent of unsurveyed potential habitat, and the difficulty of detecting the plants, the true total population of *Phacelia inconspicua* is estimated to be 1.5-6 times greater than now documented. Reproducing populations appear to fluctuate widely from year to year in response to moisture levels and seral conditions (appendix 1, table 3).

Demography: Long-term monitoring has not been conducted for most *Phacelia inconspicua* populations, including any Nevada sites, 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.

As an annual, *Phacelia inconspicua* must complete its entire life cycle every growing season. Desert annuals are known for large year-to-year fluctuations in population size that reflect "good" vs. "bad" years. Many such species go virtually undetected for years or even decades, then explode when conditions are just right. Obviously these annuals must develop large seed populations that can remain dormant in the soil seed bank for many years.

From estimates of the total individuals within total occupied habitat (see population summary, above), an average density of 205 plants per acre (505/ha) at the Nevada sites, 590/acre (1460/ha) at the Idaho sites, and 459/acre (1135/ha) overall can be estimated. However, individual site estimates ranged from about 30/acre (75/ha; site 2) to about 3335/acre (8235/ha; site ID4; appendix 1, table 1). On local terracettes the actual density can greatly exceed even the highest average site values.

Phenology: From observations of the cotyledons, Moseley (1989) surmised that the seeds of *Phacelia inconspicua* germinate during the spring. In Nevada, plants were in full flower during field visits on 10-13 June 1994. Tiehm's collections from 11 June 1978 noted "good flower and mature fruit." His 14 July 1978 observations noted mature fruit, as did Yoder-Williams' 10 July 1979 collection. Moseley (1989) noted flowering in early to mid June, with seed ripe by mid July. Both the Santa Clara Canyon and the Humboldt Canyon west population spanned a considerable range in elevation. At both sites the plants at lowest elevations had mature capsules when the highest plants were just beginning to flower. Depending on elevation and annual timing of moisture and temperature changes, flowering probably begins sometime between late May and late June and continues sporadically into July. The fruit probably mature by 2-3 weeks after flowering, between early June and early August.

Genetics: No studies of the genetic structure in *Phacelia inconspicua* are known, but some speculative predictions are possible. If *Phacelia inconspicua* is predominantly self-pollinating, as its inconspicuous flower size and color would suggest, there is a high

likelihood that individuals within each population would be genetically very similar. Without outcrossing to generate new genetic combinations, each small and isolated population of *Phacelia inconspicua* would face a disproportionate challenge in adapting to changed environmental conditions, increasing its likelihood of extirpation in the long term if it cannot disperse quickly enough to a more favorable site. The relatively great distances between most *Phacelia inconspicua* populations probably have also resulted in accumulation of unique genetic variations at each site, rendering each important in maintaining the overall genetic diversity of the species.

Reproduction and Dispersal: No studies or observations of reproduction or dispersal are known for *Phacelia inconspicua*. Moseley (1989) speculated that *Phacelia inconspicua* was probably pollinated by flying insects. Most *Phacelia* species have the relatively large, showy flowers associated with insect-mediated outcrossing. But reduction in floral display, such as that seen in *Phacelia inconspicua*, is often associated with increased autogamy, or self-pollination.

Because it is an annual, *Phacelia inconspicua* can reproduce only by forming seeds. Moseley (1989) pointed out that *Phacelia inconspicua* has a relatively low seed output for an annual of 2 (rarely 4) seeds per flower. If, as suggested below under Response to Disturbance, *Phacelia inconspicua* is adapted to early-seral conditions after fire, low seed production is consistent with a strategy of maintaining low population levels during mid- to late-seral conditions, conserving resources while maintaining and slowly increasing a long-lived seed population in the soil, then germinating in mass and regenerating the seed population during the transient early-seral conditions after fire. This would also suggest that *Phacelia inconspicua* is especially vulnerable to both natural and human-caused impacts during mass germination events, when even moderate losses of individuals prior to seed set could cause permanent declines in the seed population at a site.

The seeds are probably dispersed primarily by gravity and water, and across relatively short distances. Seeds may also be transported for some distance by wind as the dried fruiting units or whole plants still containing seeds break off and are blown. Such distances are probably limited by the relatively tall vegetation and sheltered positions of the sites. The relatively large and easily gripped seeds could also be attractive to ground-dwelling insects such as ants. Because of the steepness of most *Phacelia inconspicua* sites, the rate of upslope dispersal is probably limited relative to other directions. This could seriously limit its ability to migrate upslope in response to rapid climatic warming and/or drying. Impacts from warming and drying during the current interglacial period could explain the species' limited and spotty distribution and its restriction to relatively mesic habitat patches.

Hybridization: *Phacelia inconspicua* has not been observed growing with any other species of *Phacelia*, and no hybridization with other species has been observed or suspected to occur. If *Phacelia inconspicua* is predominantly self-pollinating, its potential to form hybrids with other species would be even lower.

Pathology: No disease affecting *Phacelia inconspicua* 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 plants on an occasional basis without significant impacts. A band of sheep moving directly across a population during the reproductive season could inflict substantial herbivory damage. Any impacts from cattle use appear to result primarily from substrate disturbance rather than predation.

Competition: *Phacelia inconspicua* appears to be a poor competitor that depends on transient disturbances such as fire or soil creep to keep the surrounding shrub canopy open enough for the species to persist. Within its open microsites, however, it has been reported to dominate the herbaceous understory and become quite dense (Moseley 1989), apparently tolerating competition with itself as long as resources are sufficient. It must also respond to other habitat factors besides low competition, since it has never been found on open microsites in other habitat types. Although *Phacelia inconspicua* may decline in productivity under dense shrub canopies, it may also depend on at least the cyclic presence of large shrubs for their contribution of organic matter to the soil. Several studies reviewed by Fowler (1986) suggest that some annual species in arid and semiarid regions depend on the organic matter accumulated under shrubs for the vast majority of their productivity.

Response to Disturbance: Based on limited observations, *Phacelia inconspicua* appears to be an early- or mid-seral, fire-adapted species that undergoes population increases after its habitat burns. At the Humboldt Canyon west site, Yoder-Williams (1979) found about 1000 plants in 1978. The site burned in the early 1980s. Tiehm (1989) reported over 20,000 plants and noted that the plants were doing well in the burned area. By 1994 the canopy had closed almost completely, and I could find only about 400 plants.

Although Moseley (1989) reported that the Idaho sites appeared "successionally stable" (p. 8), he also noted that *Phacelia inconspicua* occurred on relatively unstable, barren microsites, and that fires have probably affected these sites in the past (p. 7). On the specimen label for his collection from site ID3, Atwood described *Phacelia inconspicua* as a locally "common understory species" in a sagebrush/mountain brush community within and above a burned aspen (*Populus tremuloides*) stand.

While *Phacelia inconspicua* may depend on soil creep or periodic fire to reduce herbaceous competition, it does not appear to tolerate intense disruption of the soil surface. Over a century of mineral exploration and extraction has created innumerable road cuts, tailings piles, and other disturbances around the three Nevada populations but no individuals were observed to have occupied these sites.

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. None of the Nevada sites yet appear to have been significantly impacted by any of the following threats.

Present or threatened destruction, modification, or curtailment of habitat or range:

Mineral exploration and development: The greatest potential threat to the Nevada populations of *Phacelia inconspicua* probably is mining. Mines have been active in the Humboldt Range since the 1860s (Lincoln 1923), producing silver, gold, lead, copper, sulfur and some mercury. Large cyanide heap leach mines are active within 2 miles (3 km) of the Humboldt Canyon west population. The entire north end of the Humboldt Range is bristling with mine claim witness posts, prospects, and other signs of mineral exploration, indicating a high potential for further mineral development to which the habitat of *Phacelia inconspicua* and other rare species will remain vulnerable for the indefinite future.

Animal grazing or trampling: Livestock and wildlife did not yet appear to have much impact on *Phacelia inconspicua*, but the potential for such impacts remains. All sites in Nevada are open to livestock grazing, which presently is the dominant land use within the species' range. The relatively dense and high vegetation of the sites makes them appealing to grazers relative to the surrounding vegetation. A band of sheep moving across a population could inflict substantial herbivory and trampling damage, particularly during the reproductive season. Two of the Idaho sites currently are closed to livestock use. Moseley (1989) noted very low covers of native bunch grasses at sites ID1 and ID2, suggesting heavy grazing use in the past. Site ID2 is still heavily used, with stock watering occurring within 100 feet (30 meters) of the population.

Fire and fire suppression activities: Because of the apparent adaptation of *Phacelia inconspicua* to mass germination in the early seral conditions following fire, long-term suppression of natural fires constitutes a potentially serious but as yet unquantified threat. Absence of natural fire for long periods leads to canopy closure and fuel buildup, and may slowly deplete populations of *Phacelia inconspicua* through low production of plants and seeds, loss of seed viability in the soil, and other sources of seed attrition. If too much fuel builds up, the fire that eventually results is likely to be unnaturally hot, with the potential to permanently alter the soil characteristics of a site, increase erosion, and sterilize the seed bank. Such scenarios could partially explain the current absence of *Phacelia inconspicua* from many apparently suitable sites around and between the known sites.

Invasion of exotic plant species: No exotic species were noted at the Nevada sites, but cheatgrass (*Bromus tectorum*) has been reported at sites in Idaho, and the potential exists at all sites for major cheatgrass invasions after fire. Such an invasion

could permanently alter the vegetation and fire frequency characteristics of a site, with unknown but potentially disastrous impacts to *Phacelia inconspicua*.

Off-road vehicle (ORV) use: Several pieces of the front end, drive line, and body of an abandoned vehicle litter the slopes below the Santa Clara Canyon population (site 3), indicating some past ORV activity. This appears to have been an isolated incident, however, and such activity appears rare and unlikely to be a source of significant impacts at any site.

Over-utilization for commercial, sporting, scientific, or educational purposes: The few scientific collections that have been taken to document populations (appendix 1, table 5) 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 impacts or threats have 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 *Phacelia inconspicua* 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. *Phacelia inconspicua* is protected by such a state law in Nevada. It also should be noted the Endangered Species Act and the various agency regulations implementing it are in direct conflict with provisions of the 1872 mining law, and are therefore of uncertain protective value when minerals-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 *Phacelia inconspicua*. Most of these species continue to be tracked and treated as sensitive by the Bureau of Land Management, the Forest Service, state natural heritage programs, and other agencies. The long term impact of this change, however, remains unknown but potentially 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. 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 *Phacelia inconspicua* is no longer a candidate for Federal listing, the Nevada State Office of BLM continues to track former candidates and state-listed species as special status species for planning purposes (U. S. D. I. Bureau of Land Management 1996; BLM Manual Section 6840.06E). No management plans specific to *Phacelia inconspicua* are known to exist, however, and the effectiveness of such plans would still depend upon adequate implementation and enforcement resources.

Phacelia inconspicua is listed as "critically endangered" under Nevada Revised Statutes (NRS) 527.270. Such listing provides 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, isolated populations with limited dispersal ability, *Phacelia inconspicua* may be vulnerable to natural events such as climatic shifts or unprecedented extremes of heat, cold, or drought, and to human-caused climate changes, particularly sudden climatic warming or drying. The natural climatic warming and drying of the present interglacial period may have contributed to the current highly-fragmented distribution of the species.

X. GENERAL ASSESSMENT AND RECOMMENDATIONS

General Assessment: Based on partial surveys conducted in several different years, the maximum global reproductive population of *Phacelia inconspicua* consists of about 24,413 individuals restricted to about 53.15 acres (21.5 ha) of public lands divided among 8 sites in the Humboldt Mountains of Pershing County, Nevada, and the Snake River Plains of Butte and Blaine counties, Idaho. In 1994 the reproductive Nevada population consisted of about 3712 individuals on 18.15 acres (7.3 ha) of BLM lands divided among 3 sites, all of which fit inside a circle only 3 miles (5 km) in diameter. *Phacelia inconspicua* is an annual, and the numbers of individuals germinating and flowering each year appear to fluctuate widely in response to moisture levels and seral conditions. Unless and until simultaneous monitoring can be conducted in both states, the proportions of the reproductive populations occurring in Idaho versus Nevada cannot accurately be estimated. *Phacelia inconspicua* is universally accepted by taxonomists as a valid and distinctive species. The species is restricted to relatively deep, undisturbed, organic-rich soils forming relatively barren terracettes on steep, concave, north- to northeast-facing slopes where snow drifts persist well into spring and provide extra soil moisture. It can locally dominate the

herbaceous understory in mesic pockets of mountain sagebrush and mountain shrub vegetation. *Phacelia inconspicua* may be adapted for mass-germination in early- to mid-seral post-fire conditions. Many thousand acres of potential habitat are believed to remain unsurveyed, and the true total population may be about 1.5-6 times larger than that now documented.

Because of its rarity, fragmented global range, small localized populations, and ongoing threats, *Phacelia inconspicua* remains vulnerable to human-caused extirpations in the short term which could, perhaps in combination with natural or human-caused climatic fluctuations, lead to extinction in the long term. All of the known populations, except for one of the smaller Idaho sites, are not yet visibly impacted, although historic suppression of natural fires may be contributing to long-term population declines. It therefore remains relatively easy to avoid extirpations or extinction through appropriate conservation management. Two of the Idaho sites are already under some level of protective management and are closed to livestock grazing. All remaining sites are open to livestock use, with the Idaho sites particularly vulnerable to impacts. Because of their lower elevation, the Idaho sites are also more vulnerable to habitat alteration by invasions of exotic weeds. The Nevada sites are surrounded by evidence of more than 130 years of mineral exploration and extraction, with several mines active in the vicinity and more proposed. No mining activity is yet known to be planned within the documented *Phacelia inconspicua* sites. Threats from all the above sources will exist indefinitely under present circumstances.

Status Recommendations: Until recently *Phacelia inconspicua* 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. With further surveys, appropriate long term monitoring, and cooperation in management of habitat disturbance and natural fires, human-caused extirpation or extinction can be avoided. Absent such management, the long-term possibility of extinction or major declines will remain, and federal listing could become justified if more than about 10% of the known population were lost to preventable causes.

Phacelia inconspicua is listed as "Critically Endangered" by the State of Nevada, and is considered a "Special Status Species" by the Bureau of Land Management in Nevada and Idaho. These designations afford a moderate level of protection under existing agency policies. The plant has not been found on Forest Service lands, but if it were it would be appropriate for sensitive species designation by that agency as well. In addition, *Phacelia inconspicua* is ranked 1 (critically imperiled) at the state levels, and 2 (imperiled) at the global level, by the Nevada Natural Heritage Program and the Idaho Conservation Data Center, and is considered Endangered by the Northern Nevada Native Plant Society (NNNPS). The only status change recommended is to move the species to the NNNPS Watch List.

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, the snowdrift accumulation areas in which they occur, the surrounding low sage areas from which the snow is blown, and all of the watershed area directly upgradient from each site. Critical habitat should not be formally designated in cases where it might subject *Phacelia inconspicua* 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 *Phacelia inconspicua*, 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 2) indicates that preventable declines in viability of the species are occurring, more aggressive conservation and recovery measures should be identified and pursued.

1. The Bureau of Land Management (BLM) and the National Park Service (NPS) should field-check all previously documented *Phacelia inconspicua* sites at least every 2 years, and at least annually where significant impacts have previously occurred or are reasonably foreseeable, to detect any new or intensified impacts, and should take immediate steps to eliminate and correct any such impacts. Field checks should include field tours for appropriate personnel to familiarize them with the plant and its habitat. If extirpations or new significant impacts become likely for more than 5% of the known populations, the survey efforts outlined in recommendations 2 and 3 below should be intensified until all potential habitat has been examined.
2. BLM, NPS, and when appropriate the Humboldt-Toiyabe National Forest and other responsible land management agencies, should conduct or require additional surveys, following recognized professional standards (Nelson 1994), for undocumented *Phacelia inconspicua* populations prior to implementation of projects within potential habitat of the species, and any new populations found should be thoroughly documented. Impacts to any populations found should be avoided or minimized during project implementation.
3. Whenever funding and personnel permit, surveys of the same nature as above should be continued during demonstrably favorable years across northern Nevada and southern Idaho, outside of the project evaluation process.
4. BLM, NPS, the U. S. Fish and Wildlife Service, and the Nevada Division of Forestry should jointly develop, implement, and adequately fund a long-term species management plan and conservation strategy for *Phacelia inconspicua*, to address at a

minimum all the other recommendations above and below. Participants should share implementation costs proportionately to their management responsibilities.

5. BLM and NPS should monitor any invasions of exotic weeds near known sites, and should control them if necessary and possible to avoid habitat destruction or alteration. BLM and NPS should aggressively manage and control invasions of exotic weeds within the range of *Phacelia inconspicua*, in cooperation with adjacent landholders and managers, to help reduce fire hazards to more natural levels.
6. The responses of *Phacelia inconspicua* populations to periodic fire and fire-suppression activities should be studied in greater detail, and fire-management of its range and habitat should be modified, possibly to exclude future fire-suppression activities, if necessary to ensure long-term health of the species.
7. At least until the fire responses of *Phacelia inconspicua* are better documented, BLM should prohibit all artificial post-fire reseeding or revegetation within *Phacelia inconspicua* sites and adjacent areas of potential habitat. Any other artificial revegetation actions in and near the range of *Phacelia inconspicua* should only use plant species native to the local area. BLM, NPS, and other agencies anticipating the need for artificial revegetation should plan in advance of reasonably foreseeable needs to ensure sufficient sources and/or supplies of 100% native-species seeds. In appropriate cases, other species documented not to persist under local conditions could be added at non-competitive levels for temporary stabilization until the native species can establish.
8. BLM should work with any future mineral exploration or development proponents to avoid destruction of *Phacelia inconspicua* sites by requiring use of lateral drilling, underground mining techniques, etc., to the maximum extent possible, and to ensure use of 100% native species in any revegetation activities (see above).
9. BLM should work with grazing permittees to ensure that only dispersed grazing activity occurs in and near known populations. Placement of salt blocks, watering sources, or other range supplements likely to concentrate animals in small areas, should be prohibited within 0.25 mile of any known population as part of permit requirements.
10. The Nevada Division of Forestry should act to minimize any future impacts to known sites through contact and coordination with land owners and managers, through its permitting process, through acquisition and management of conservation easements, or if necessary through law enforcement actions.
11. Studies of pollinator populations, and their effectiveness in the reproductive success of *Phacelia inconspicua*, should be encouraged and supported. If found to play a significant role, pollinators should be monitored at least every 2-3 years to detect any downward trends that could contribute to reproductive failure in *Phacelia inconspicua*, and the cause(s) and possible remedies of any such declines should be assessed.

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Kern Mountains, Nevada (1988)

Wendover, Nevada (1985)

Winnemucca, Nevada (1986)

BLM 1:500,000 scale Topographic Series, Surface Management Status:

Nevada (State of) (1990)

Field Research: Recent field surveys contributing information to this report were conducted from 10 June to 11 August 1994 and 17 May to 9 August 1995 by Robert F. Holland.

Specimens: All specimens known to document *Phacelia inconspicua* sites are listed by site in appendix 1, table 5. The list was compiled from Moseley (1989, personal communication 1996), Tiehm (1989), and all other available published and unpublished sources, but is not necessarily complete. Although new collections from previously documented sites are discouraged, and by law require a permit in Nevada, the Nevada Natural Heritage Program welcomes further additions or corrections to this table as they become known.

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TABLE 1. Sites searched for *Phacelia inconspicua* in Nevada, and known Idaho sites.

Site	EO	Fig.	Site location; map quadrangle County; land survey location	Est. Acres	Elevation range (ft)	Est. Plants	Threats **	Manage- ment*
HISTORICAL SITES IN NEVADA WHERE <i>PHACELIA INCONSPICUA</i> WAS REDISCOVERED								
1	001	4,13 14	Humboldt Canyon west; Star Peak 1:24,000 Pershing; T31N R34E S7	1.15	6600-7700	400	fm	w
2	002	4 15	Humboldt Canyon east; Star Peak 1:24,000 Pershing; T31N R34E S8	5	7400-7850	150	fm	w
3	004	5,16 17	Santa Clara Canyon; Star Peak 1:24,000 Pershing; T31N R34E S15	12	7800-8360	3162	fm	w
3	3	= = =	TOTAL NEVADA POPULATION = = =	18.15	6600-8360	3712	fm	w
HISTORICAL SITES IN IDAHO WHERE <i>PHACELIA INCONSPICUA</i> IS PRESUMED EXTANT								
ID1	001		Big Southern Butte; Big Southern Butte 1:24,000 Butte; T1N R29E S14/23/24	32	5520-5980	> 10000	fx	s
ID2	002		Pratt Butte; Pratt Butte 1:24,000 Butte; T1S R27E S22 N of SE	< 0.5	5390-5400	500	fg*x	s
ID3	004		Split Top; Split Top 1:24,000 Blaine; T3S R29E S18 SE	< 0.1	5440	1	fgx	s
ID4	005		North Sunset Cone; Inferno Cone 1:24,000 Butte; T2N R24E S23	> 3	5780	> 10000	fgx	p?s
ID5	006		Grassy Cone NNW; Inferno Cone 1:24,000 Butte; T2N R24E S27/34	< 1	6100-6200	200	fx	k
5	5	= = =	TOTAL IDAHO POPULATION = = =	35	5390-6200	> 20701	fgx	kp?s
8	8	= = =	TOTAL GLOBAL POPULATION = = =	53.15	5390-8360	> 24413	fgmx	kp?sw
AREAS SEARCHED SURROUNDING NEVADA <i>PHACELIA INCONSPICUA</i> SITES								
A1		4	Area surrounding Site 1	203	5600-8389			w
A2		4	Area surrounding Site 2	257	7300-9668			w
A3		5	Area surrounding Site 3	275	6200-8400			w
HISTORIC SITE SOUGHT BUT NOT RELOCATED								
A4	003	6	Imlay Canyon; Eugene Mts. 1:100,000 Pershing; T31N R34E S4,5,8,9	1350	6600-9262			w
ADDITIONAL AREAS SEARCHED WHERE <i>PHACELIA INCONSPICUA</i> WAS NOT FOUND								
A5		6	Prince Royal Canyon; Eugene Mts. 1:100,000 Pershing; T31N R34E S3/4/9/10/16	1100	5800-9090			w
A6		7	Auld Lang Syne Pk. N; Winnemucca 1:100,000 Pershing; T33N R37E S6/7	370	5740-7216			w
A7		8	Clear Creek; Winnemucca 1:100,000 Humboldt; T34N R39E S5/6/7/8	1435	7050-9020			pw
A8		9	Pole Canyon; Winnemucca 1:100,000 Humboldt; T35N R39E S29/30/31/32	1425	8800-9090			pw
A9		10	Battle Mountain; Winnemucca 1:100,000 Humboldt/Lander; T32N R43E	1050	6500-8550			bw
A10		11	Spruce Mountain Ridge; Wendover 1:100,000 Elko; T31N R63E S1-4/9-12	2216	7380-8460			e
A11		12	Becky Peak; Kern Mountains 1:100,000 White Pine; T24N R65E S2/11	415	7872-9180			y
11	0	= = =	TOTAL UNOCCUPIED NV SITES = = =	10096	5600-9668			bepwy
14	3	= = =	TOTAL NV SITES SEARCHED = = =	10114	5600-9668			bepwy

EO = Element occurrence number in the Nevada Natural Heritage Program or the Idaho Conservation Data Center databases. Fig. = figure(s) in appendix 2.

* **Land Management:** b: U. S. D. I. Bureau of Land Management (BLM), Battle Mountain District; e: BLM Elko District; k: U. S. D. I. National Park Service, Craters of the Moon National Monument; p: Private/municipal/county; s: BLM Upper Snake River District; w: BLM Winnemucca District; y: BLM Ely District.

** **Threats:** f: fire suppression; g: animal grazing/trampling; m: mineral exploration/development; x: invasive exotics and control measures; *: significant near-term impacts present or anticipated.

TABLE 2. Plant species observed or reported at *Phacelia inconspicua* sites, indicated with + where present. Nomenclature follows the *Jepson Manual* (Hickman 1993) or *Intermountain Flora* (Barneby 1989; Cronquist 1994; Cronquist *et al.* 1972, 1977, 1984). Site numbers are from Table 1.

Taxon***	Site Number:	1	2	3	ID1-2
Average Elevation (ft):		7150	7625	8080	5685
TREES (NONE)					
SHRUBS					
<i>Artemisia tridentata vaseyana</i>		+	+	+	+
<i>Chrysothamnus viscidiflorus</i>		+			+
<i>Holodiscus microphyllus</i>		+	+	+	
<i>Prunus virginiana</i>					+
<i>Purshia tridentata tridentata</i>					+
<i>Ribes velutinum</i>				+	
<i>Symphoricarpos rotundifolius</i>		+			+
SUCCULENTS (NONE)					
GRAMINOIDS					
<i>Achnatherum lettermanii</i>			+	+	+
<i>Bromus tectorum</i> ***					+
<i>Leymus cinereus</i>		+		+	+
<i>Poa secunda</i>		+		+	+
<i>Pseudoroegneria spicatum</i>			+		+
NON-GRAMINOID PERENNIAL FORBS					
<i>Allium acuminatum</i>					+
<i>Astragalus cibarius</i>					+
<i>Balsamorhiza sagittata</i>		+		+	
<i>Calochortus nuttallii</i>					+
<i>Chaenactis douglasii douglasii</i>					+
<i>Crepis acuminata</i>					+
<i>Hydrophyllum occidentale</i>		+		+	
<i>Lithospermum ruderales</i>					+
<i>Lomatium triternatum</i>					+
<i>Lupinus argenteus heteranthus</i>		+	+	+	
<i>Lupinus polyphyllus</i>					+
<i>Mertensia oblongifolia nevadensis</i>		+	+	+	
<i>Perideridia bolanderi</i>			+		
<i>Senecio integerrimus exaltatus</i>		+	+	+	
NON-GRAMINOID ANNUALS					
<i>Collomia linearis</i>			+		+
<i>Cryptantha fendleri</i>					+
<i>Galium bifolium</i>		+			+
<i>Gayophytum ramosissimum</i>					+
<i>Gilia tenerrima</i>		+	+		
<i>Lappula redowskii</i>					+
<i>Mentzelia albicaulis</i>					+
<i>Microsteris gracilis</i>			+	+	+
<i>Orthocarpus sp.</i>					+
<i>Phacelia inconspicua</i>		+	+	+	+
<i>Polygonum sp.</i>					+

*** indicates non-indigenous species.

TABLE 3. Available estimates of *Phacelia inconspicua* population sizes in Nevada. Site numbers are from Table 1.

Year	Site 1: Humboldt Canyon west	Site 2: Humboldt Canyon east	Site 3: Santa Clara Canyon
1978	1000 in 800 square foot area (Tiehm)		
1979		>100 (Yoder-Williams)	
1989	>20,000, somewhat depauperate (Tiehm)	50 (Tiehm)	1000+ (Tiehm)
1994	400 (this survey)	150 (this survey)	3162 (this survey)

TABLE 4. Status of other endangered, threatened, and sensitive species reported in and near the geographic range of *Phacelia inconspicua* in Nevada.

TAXON NAME		AGENCY STATUS					NV HERITAGE PROGRAM RANKS	
Scientific	Vernacular	Federal			NV	NN NPS	Global	State
		FWS	BLM	FS				
ANIMALS								
<i>Myotis volans</i> *	long-legged myotis	<2	S				5	3
PLANTS								
<i>Astragalus porrectus</i>	Lahontan milkvetch	<3				D	2-3	2-3
<i>Cymopterus goodrichii</i>	Goodrich biscuitroot	<2	S	S		W	1	1
<i>Eriogonum anemophilum</i>	windloving buckwheat	<2	S			W	2-3	2-3
<i>Silene scaposa lobata</i>	lobed catchfly	<3				D	4	3
<i>Smelowskia holmgrenii</i> *	Holmgren smelowskia	<3				D	2	2

* documented on or near *Phacelia inconspicua* sites.

FWS (Endangered Species Act administered by U. S. D. I. Fish and Wildlife Service): <: most recent past status, no current status; 2: former category-2 candidate; 3C: former category 3C.

BLM, FS (U. S. D. I. Bureau of Land Management, U. S. D. A. Forest Service): S: Sensitive.

NNNPS (Northern Nevada Native Plant Society): D: delisted; W: watch list.

NV Heritage Program Ranks: Global: worldwide; State: within Nevada; 1: critically imperiled; 2: imperiled; 3: vulnerable; 4: apparently secure; 5: demonstrably secure.

TABLE 5. Specimens documenting known and reported *Phacelia inconspicua* sites.

Site Number and Name	Collector and Number	Date	Repository*
NEVADA			
1. Humboldt Canyon west	Tiehm and Williams 4345	11 June 1978	CAS, NY, RENO, UC, UTC
2. Humboldt Canyon east	Yoder-Williams 1221	10 July 1979	Unknown
3. "West Humboldt Mts." or "Imlay,"	Greene s.n.	18 July 1894	ND-G, NY
4. Santa Clara Canyon	Holland 3065	13 June 1994	NSMC
IDAHO			
ID1. Big Southern Butte	Atwood 969 Atwood 1071 Grimes & Packard 1627 Moseley 1392 Bernatas 89-33	unknown 1 July 1967 1980 unknown unknown	BRY, NY BRY, NY CIC, NY ID ID
ID3. Split Top	Elzinga 4146	15 June 1990	BLM-Salmon
ID4. North Sunset Cone	Atwood 13620	16 June 1989	NSMC
ID5. Grassy Cone NNW	Elzinga s.n.	1993	Park Service

* Abbreviations from Holmgren *et al.* (1990). See Table 1 for site descriptions.

Figure 1. Line drawing of *Phacelia inconspicua* from Mozingo and Williams (1980).

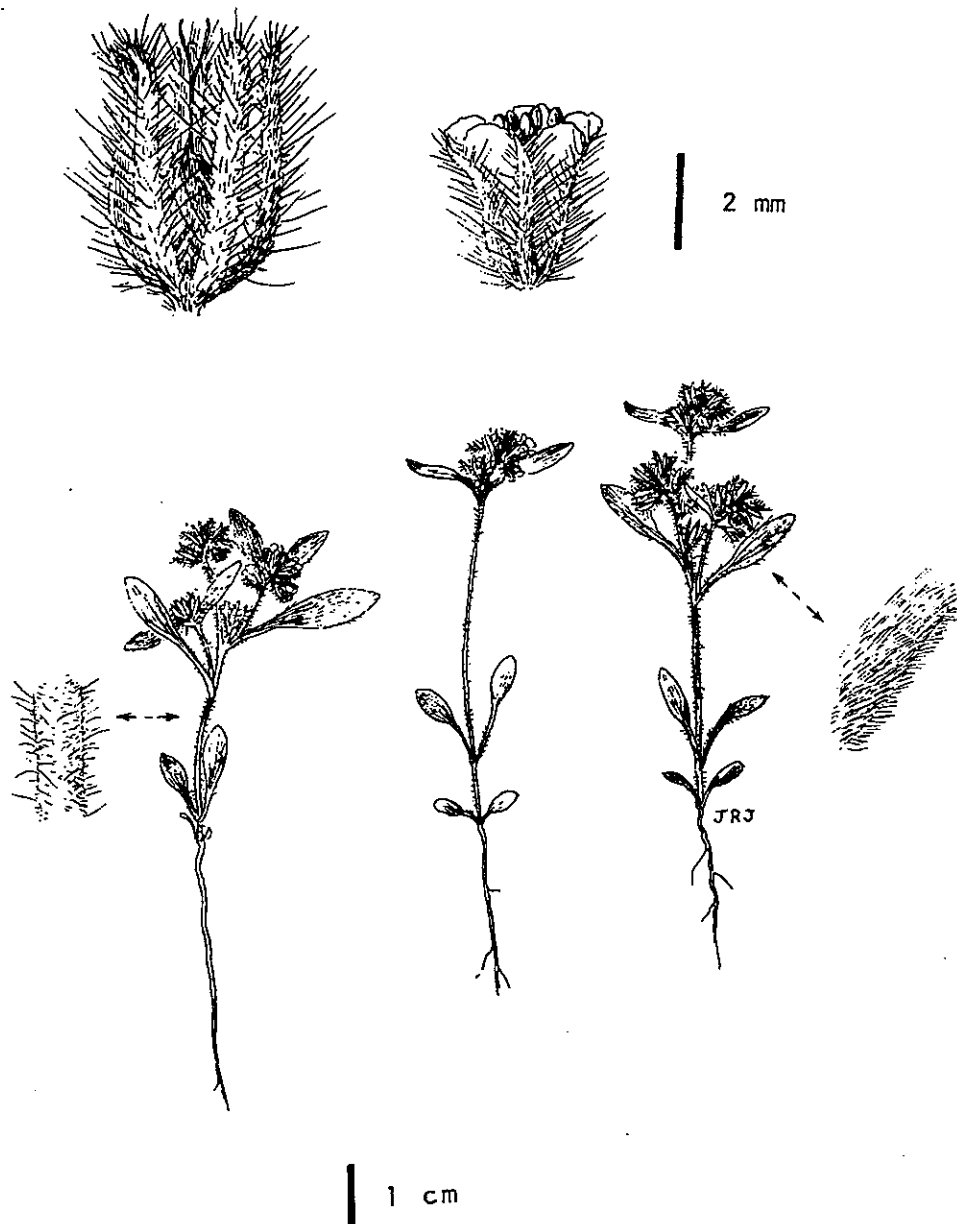


Figure 2. Line drawing of *Phacelia inconspicua* from Cronquist (1984).

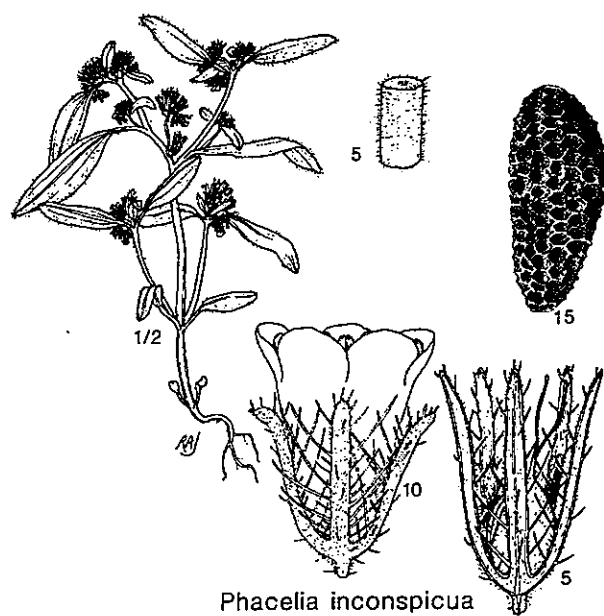


Figure 3. Global distribution of *Phacelia inconspicua*. Base map from Raisz (1957); distribution data from Nevada and Idaho Natural Heritage Programs. Gray circles indicate known population centers.

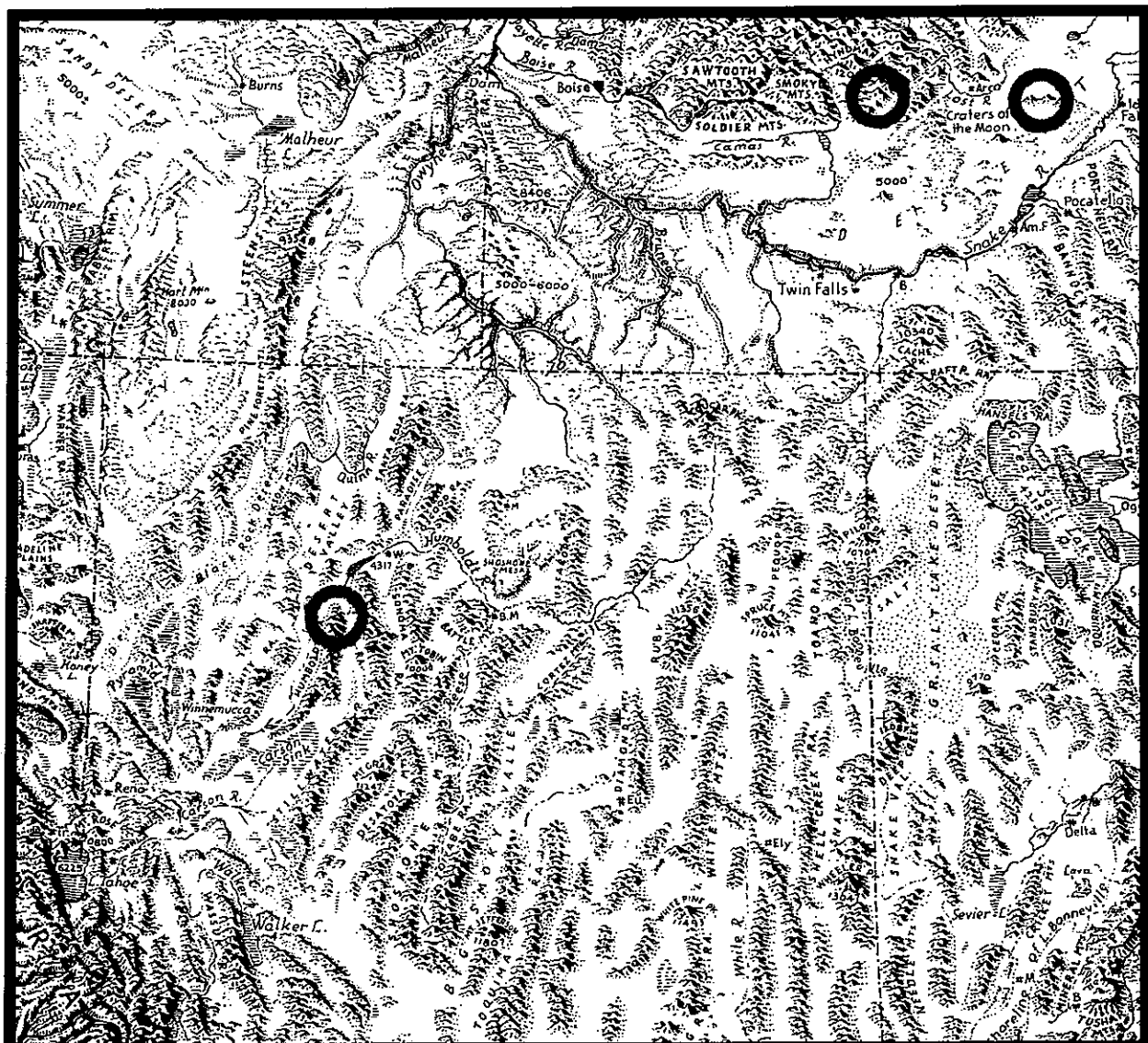


Figure 4. Known sites of *Phacelia inconspicua* in Nevada. Portion of Star Peak 1:24,000 scale quadrangle showing location of sites 1 and 2 where the plant was located, and of areas A1 and A2, where the plant was sought but not found. Site numbers correspond to those in Table 1.

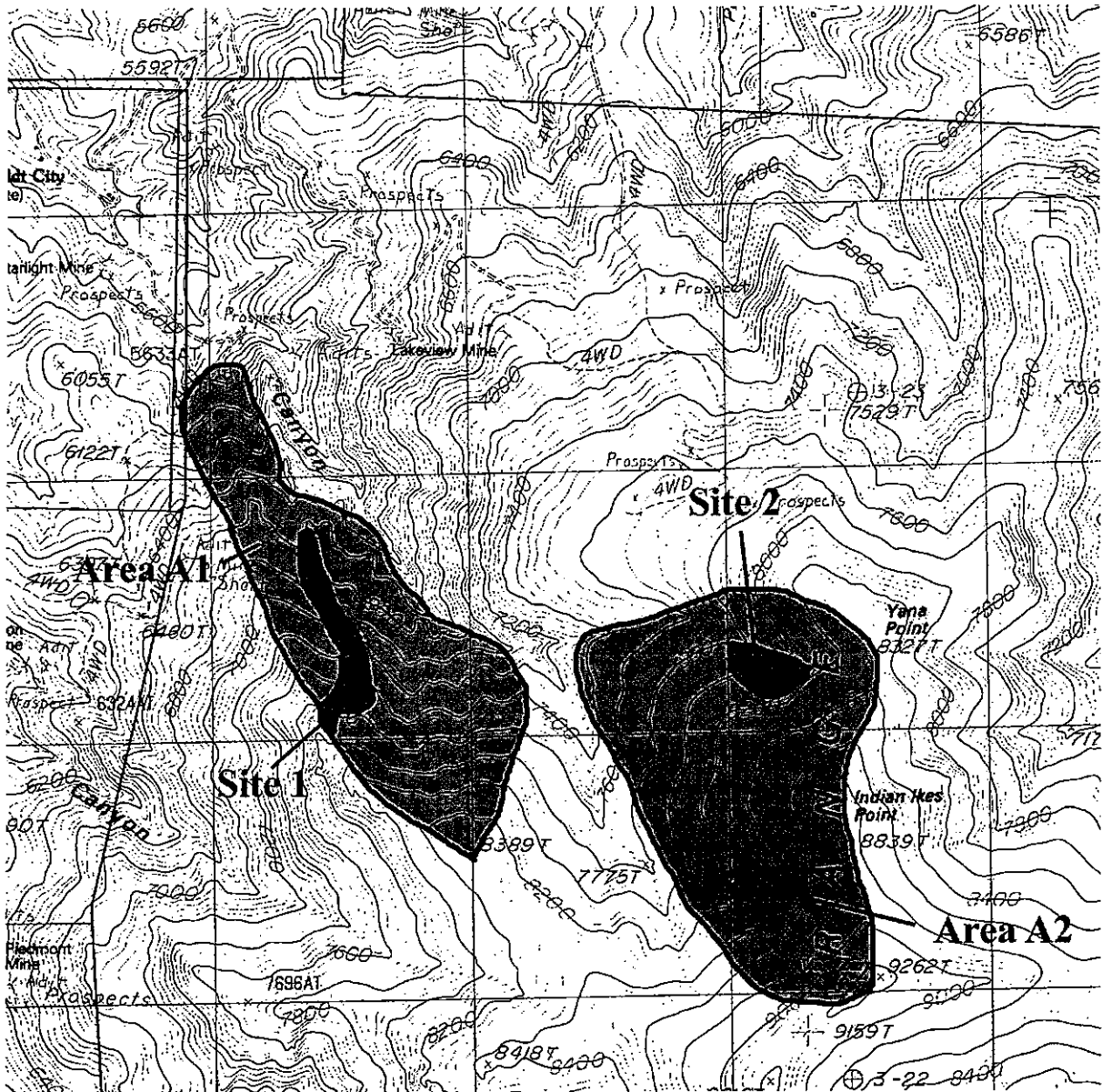


Figure 5. Known sites of *Phacelia inconspicua* in Nevada. Portion of Star Peak 1:24,000 scale quadrangle showing location of site 3 where the plant was located, and of Area 3, where the plant was sought but not found. Site numbers correspond to those in Table 1.

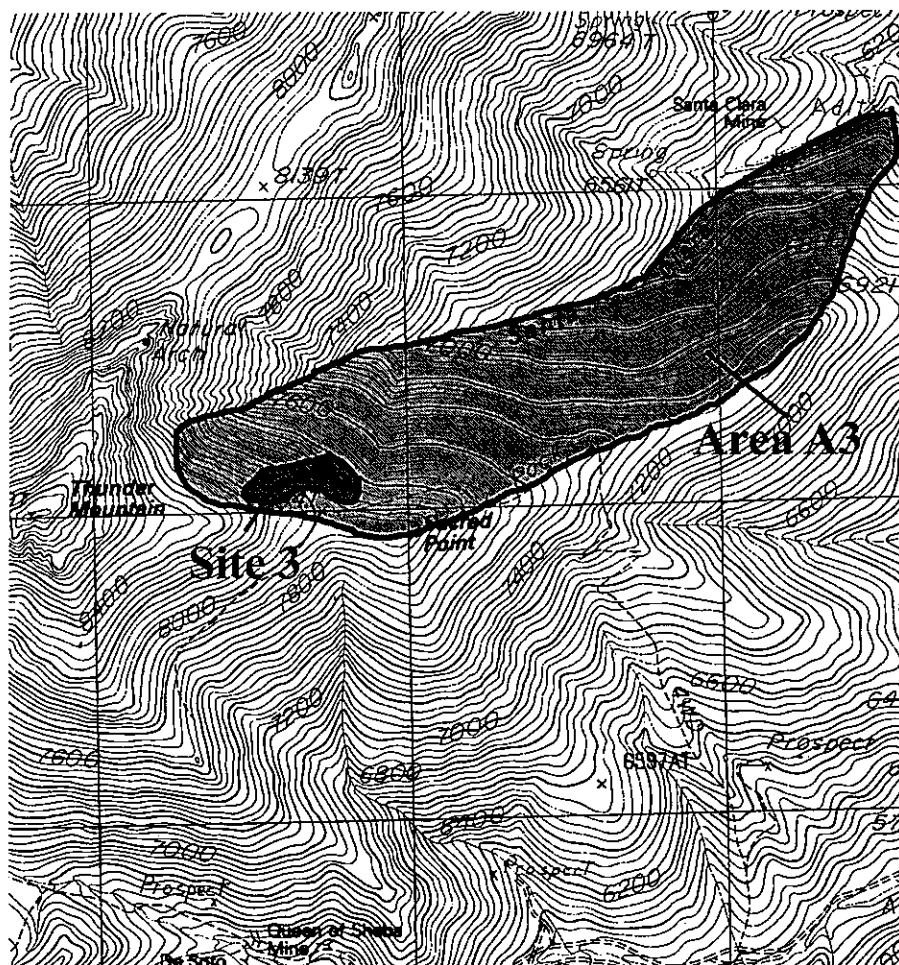


Figure 6. Portion of the Eugene Mountains 1:100,000 quadrangle showing areas A4 and A5, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1

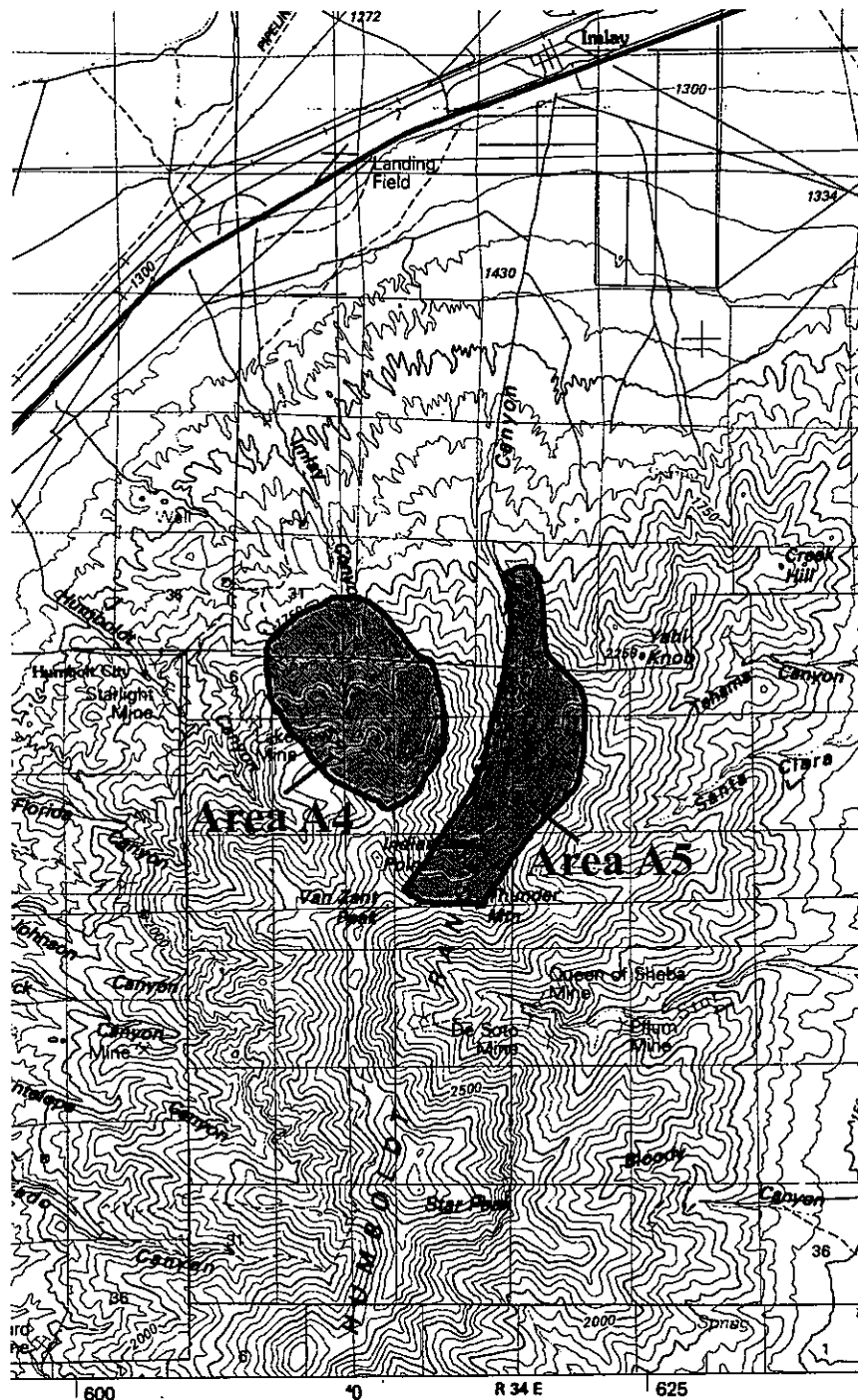


Figure 7. Portion of the Winnemucca 1:100,000 quadrangle showing area A6, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

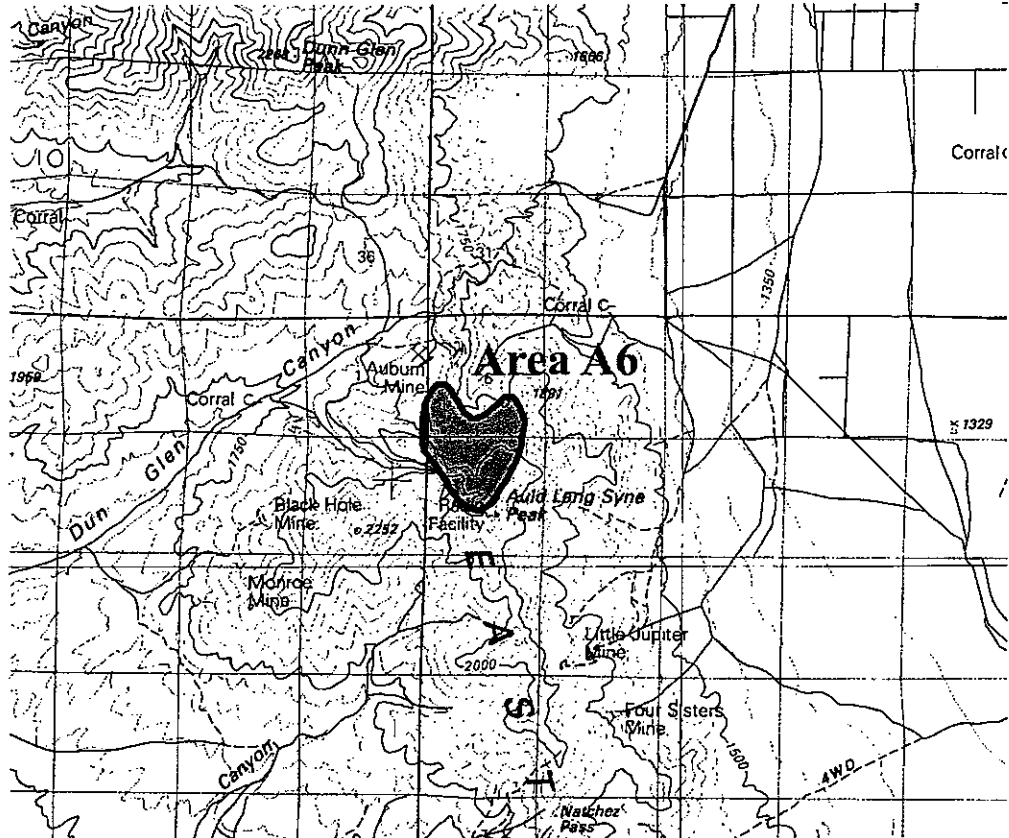


Figure 8. Portion of the Winnemucca 1:100,000 quadrangle showing area A7, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

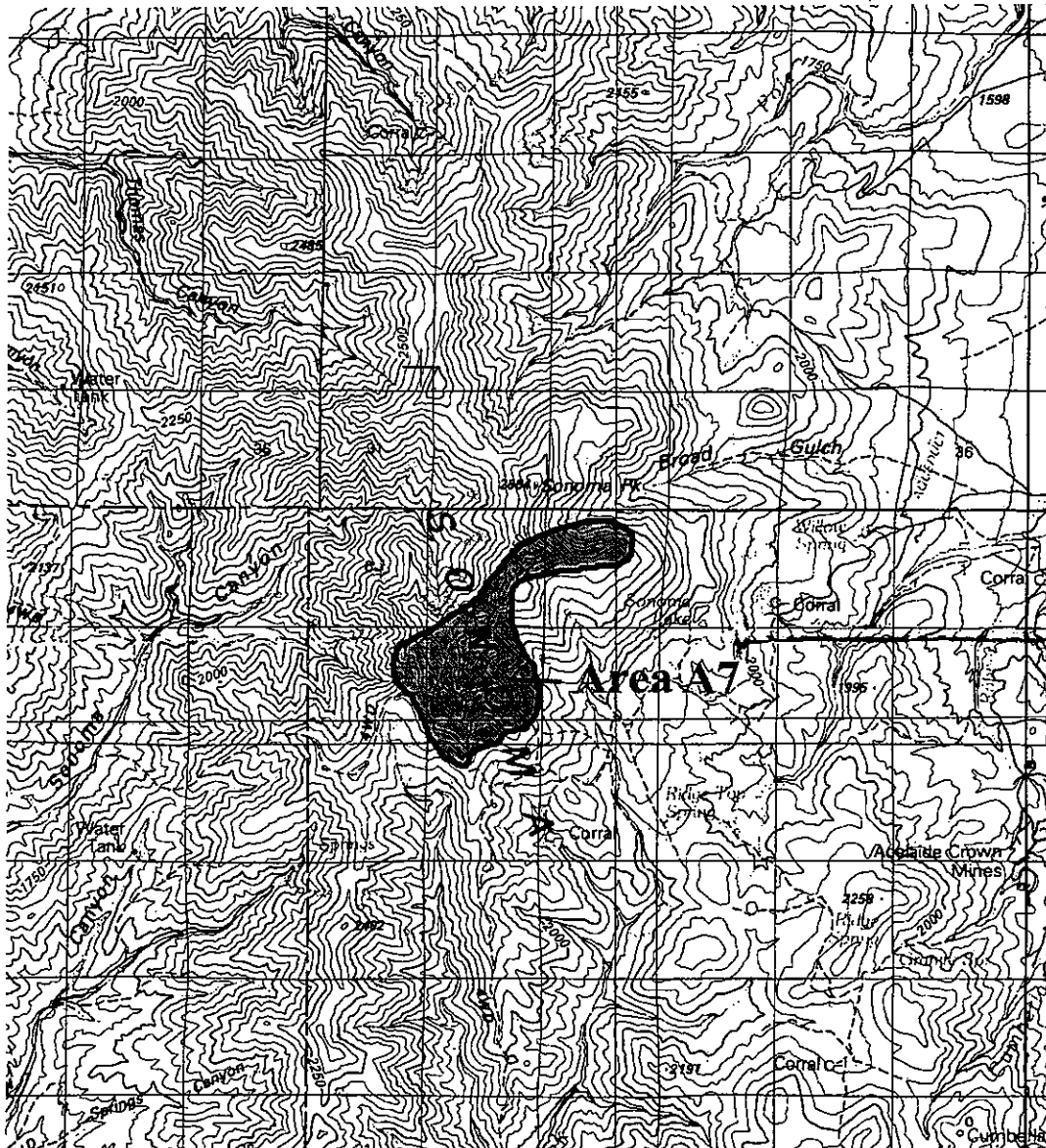


Figure 9. Portion of the Winnemucca 1:100,000 quadrangle showing area A8, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

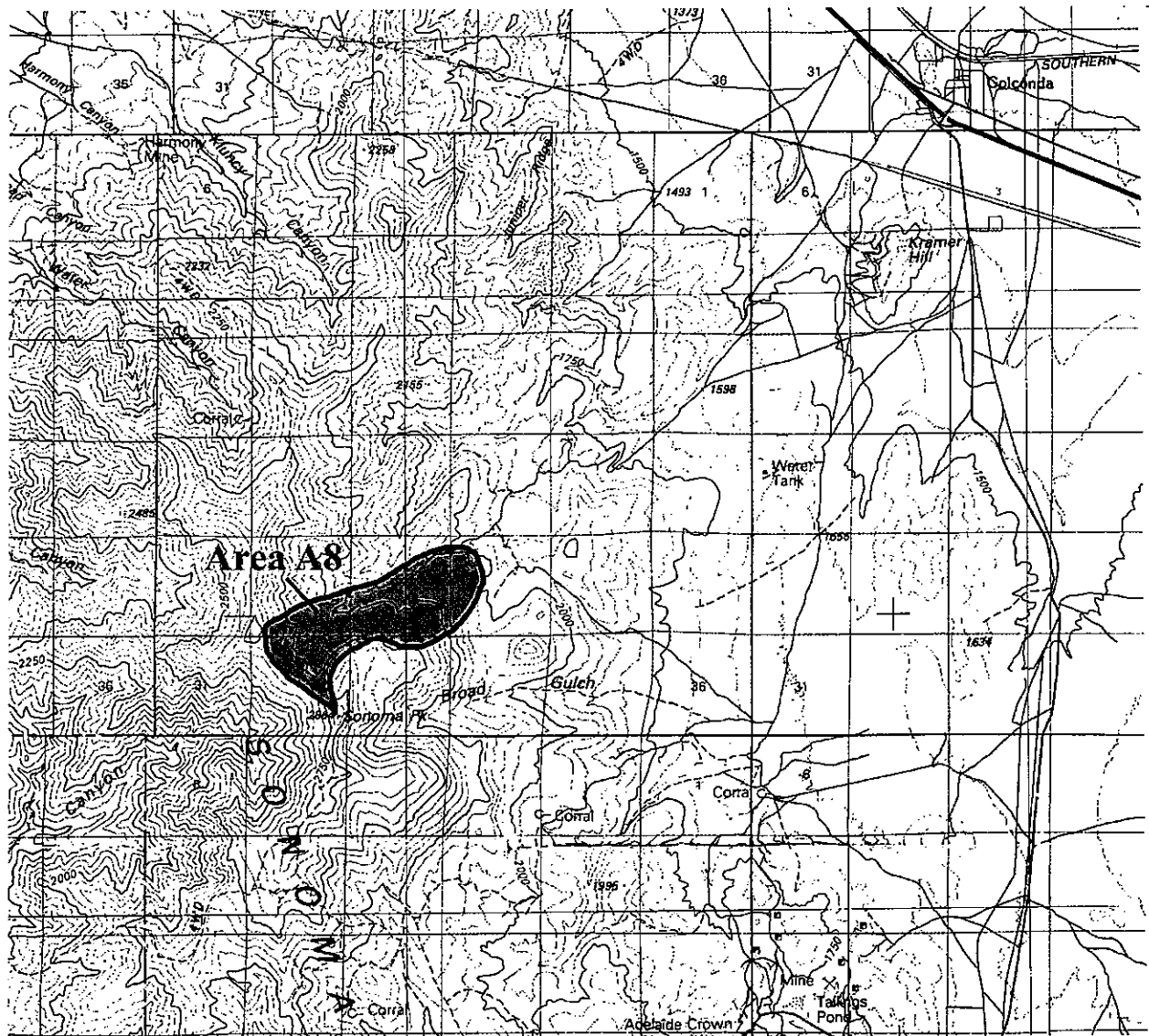


Figure 10. Portion of the Winnemucca 1:100,000 quadrangle showing areas A9, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

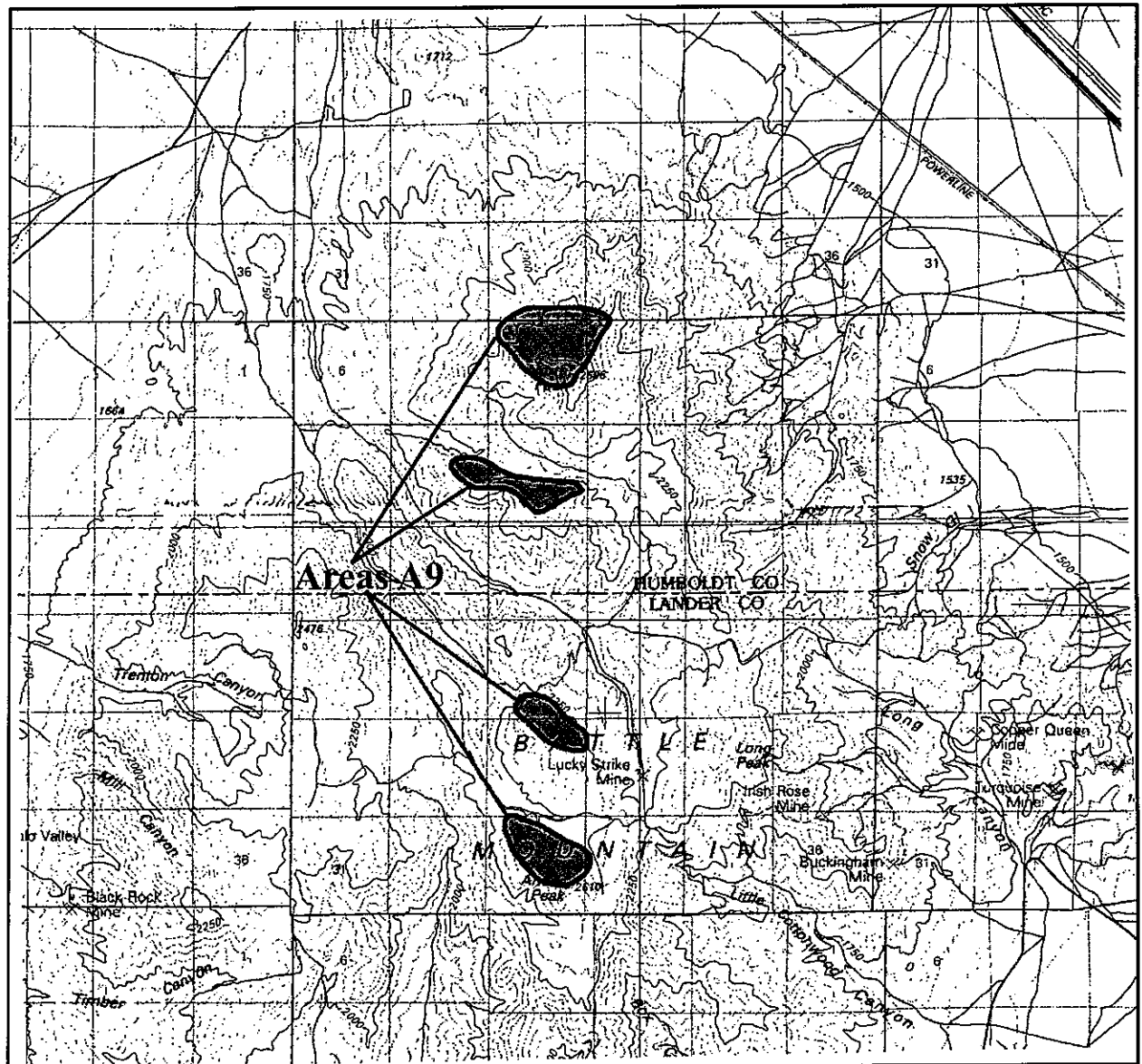


Figure 11. Portion of the Wendover 1:100,000 quadrangle showing area A10, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

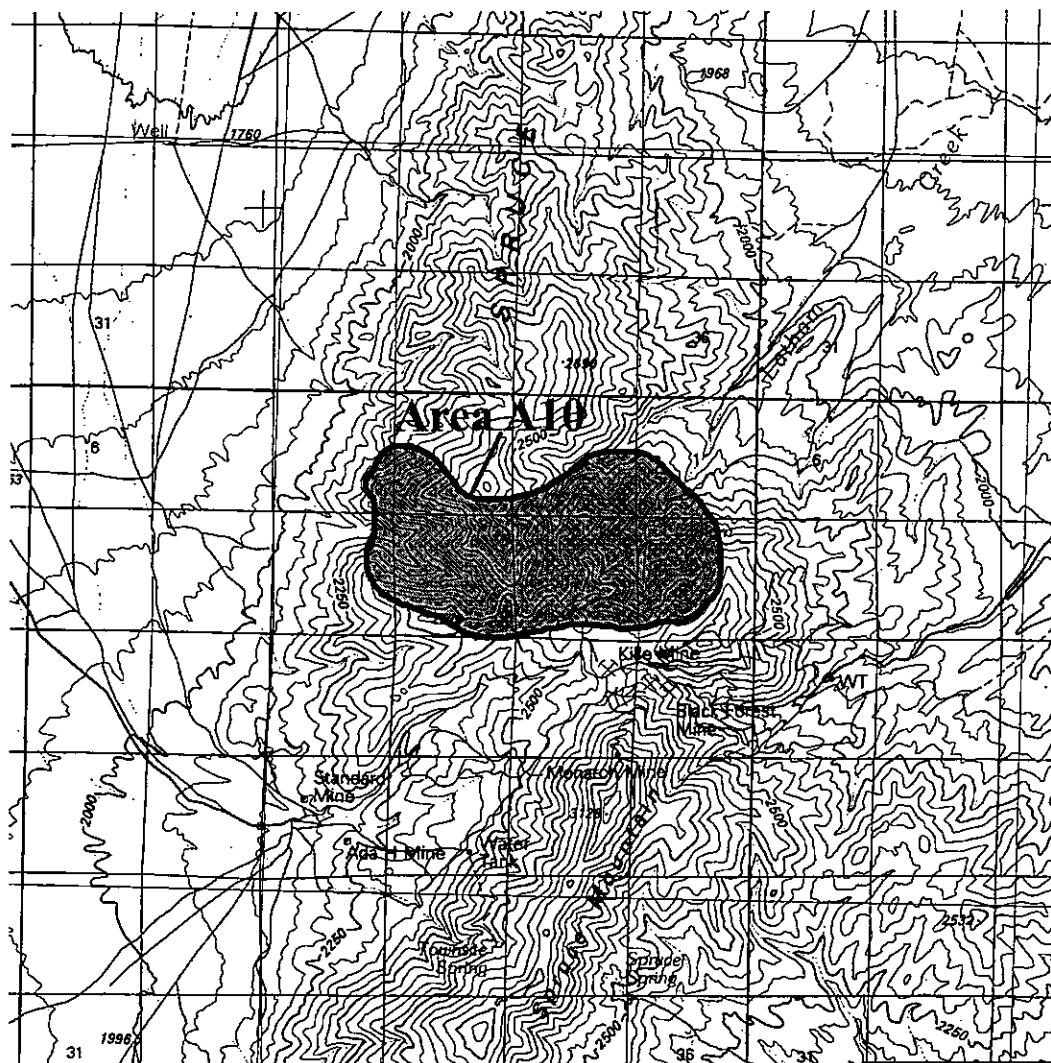


Figure 12. Portion of the Kern Mountains 1:100,000 quadrangle showing area A11, where *Phacelia inconspicua* was sought but not found. Site numbers correspond to those in Table 1.

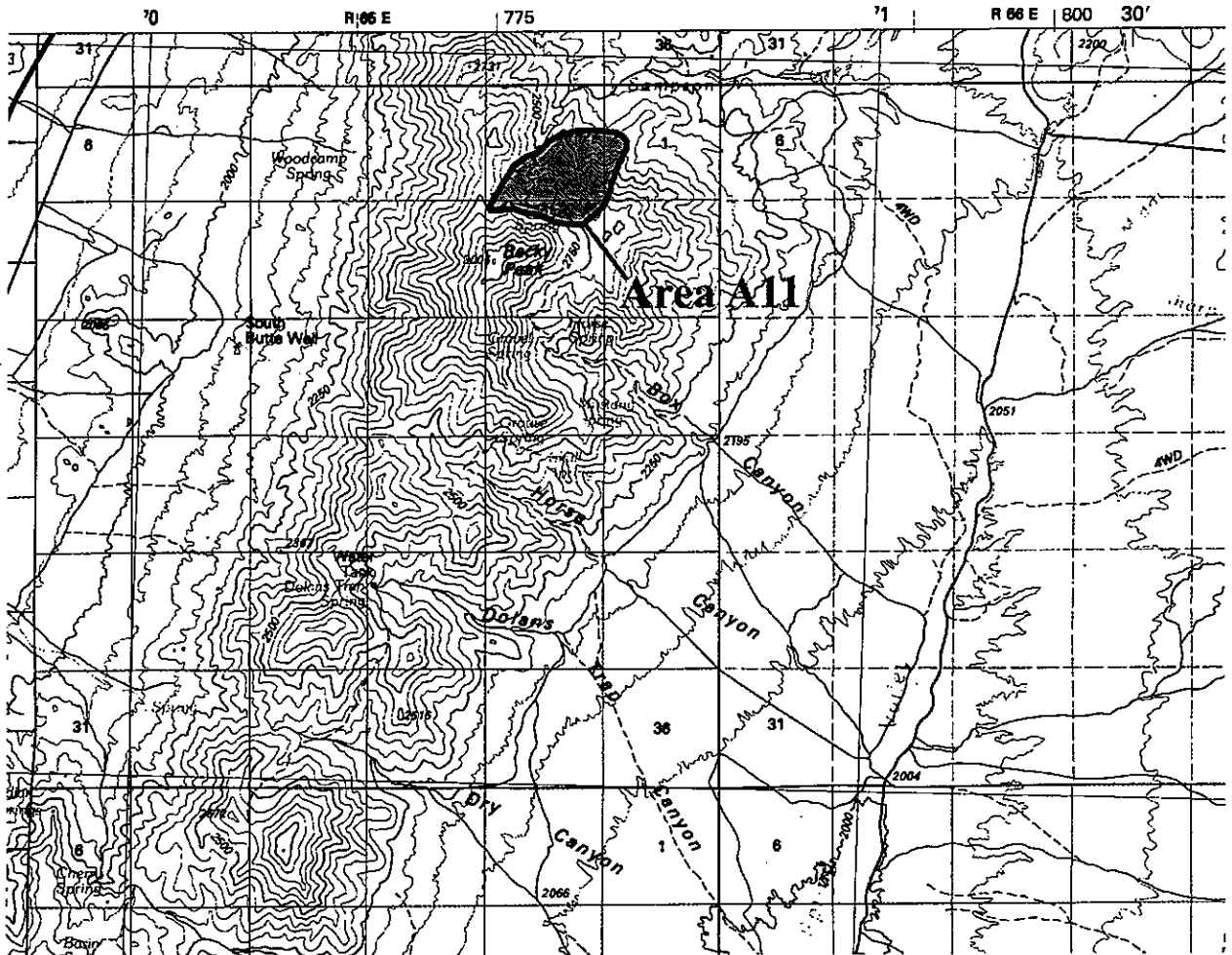




Figure 13. Habit of *Phacelia inconspicua* at the Humboldt Canyon west site (site 1). The small, erect plants are rooted in otherwise unvegetated terracettes (R. F. Holland photo).



Figure 14. Habitat of *Phacelia inconspicua* at the Humboldt Canyon west site (site 1). The site has recovered well from burning and has a high standing crop of forbs and grasses that may have shaded out the *Phacelia inconspicua*. (R. F. Holland photo).



Figure 15. Habitat of *Phacelia inconspicua* at the Humboldt Canyon east site (site 2). Plants were restricted to the lighter-green cover type of the foreground, where showy herbs grew beneath *Artemisia tridentata vaseyana*. The lower, darker cover type in the distance held no *Phacelia inconspicua* (R. F. Holland photo).



Figure 16. Habitat of *Phacelia inconspicua* at the Santa Clara Canyon site (site 3). The *Artemisia tridentata vaseyana*- and *Leymus cinereus*-dominated cover type exploited by *Phacelia inconspicua* is darker and taller than the surrounding *Artemisia arbuscula*-dominated scrub (R. F. Holland photo).



Figure 17. Habitat of *Phacelia inconspicua* at the Santa Clara Canyon site (site 3). About 20 plants are scattered over the otherwise unvegetated terracette surrounding the piece of wood. Such clearings are scattered loosely through the shrub field shown in the previous figure (R. F. Holland photo).