

**STATUS REPORT ON *IPOMOPSIS AGGREGATA* SSP. *WEBERI*  
(WEBER'S IPOMOPSIS) IN CARBON COUNTY, WYOMING**

Prepared for the Bureau of Land Management  
Wyoming State Office and Rawlins Field Office

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## ABSTRACT

*Ipomopsis aggregata* ssp. *weberi* was surveyed in Carbon County, Wyoming as a Wyoming Bureau of Land Management (BLM) sensitive species. Surveys were based on prior collection records, prior surveys and a potential distribution model. The only *Ipomopsis* found on BLM lands in the vicinity of the original records and elsewhere were mixed-color colonies of *I. a.* ssp. *attenuata* with a prevalence of white flowers. Many additional colonies of mixed-color colonies of *I. a.* ssp. *attenuata* were also found. It is concluded that *I. a.* ssp. *weberi* is not present or potential present on BLM lands. Information from this report has been used by Wyoming BLM to determine that *I. a.* ssp. *weberi* does not meet the sensitive species criteria.

The status of *I. a.* ssp. *weberi* on in the Wyoming flora is contingent on review of the first collection of *I. a.* ssp. *weberi* in the state. If the determination is verified, it would be the only known collection and may no longer be extant. It is appropriate to treat *I. a.* ssp. *weberi* as having an undetermined state status in Wyoming pending specimen review, which will take place as part of *Flora of North America* work.

## ACKNOWLEDGEMENTS

This report reflects the work of many botanists. The information in it draws heavily from the species conservation assessment prepared by Juanita Ladyman (2004). The astute observations, survey information and collections by Wendy Haas (Medicine Bow National Forest) are gratefully acknowledged. The specimen review and taxonomic commentary provided by Dieter Wilken (*Ipomopsis* author for the pending *Flora of North America* treatment; Santa Barbara Botanic Garden, California) are gratefully acknowledged. Joy Handley (Wyoming Natural Diversity Database; WYNDD) prepared digital orthophotograph imagery for use in the field with printed potential distribution model polygons and the public land boundaries superimposed. She also participated in a field visit and provided review of this report in draft form. The resources and facilities of the Rocky Mountain Herbarium were essential to all phases of the study. Frank Blomquist (Bureau of Land Management; BLM) coordinated this project, initiated lease holder contacts, and provided the support that made the project possible. This project was conducted as a challenge cost-share project between the BLM and WYNDD.

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## I. INTRODUCTION

*Ipomopsis aggregata* ssp. *weberi* (Weber's scarlet-gilia) is a regional endemic reported from the Park Range in northwestern Colorado and the Sierra Madre area in adjoining south-central Wyoming. The status of *I. a.* ssp. *weberi* was recently addressed throughout its range (Ladyman 2004). Needs for baseline survey of *I. a.* ssp. *weberi* and updated status information were identified in the assessment document, especially for Wyoming, based on three main considerations:

- Information on location and extent of the only two records of *I. a.* ssp. *weberi* in Wyoming were incomplete.
- A potential distribution model was developed for *I. a.* ssp. *weberi* (Fertig and Thurston 2003), which identified additional areas of potential habitat, but it had not been used in surveys. Digital orthophotographs also became readily available for use in aerial photointerpretation of habitat.
- Difficulties distinguishing between the subspecies *I. a.* ssp. *weberi* and *I. a.* ssp. *attenuata* have been reported in Wyoming, including questions of whether the two subspecies are sympatric or whether there is just one variety present that exhibits color variation.

The primary objectives of this study were to document location and extent of *Ipomopsis aggregata* ssp. *weberi*, clarify the basis of the reported color variation, and survey for it elsewhere in areas of south-central Carbon County, Wyoming identified as potential habitat.

## II. METHODS

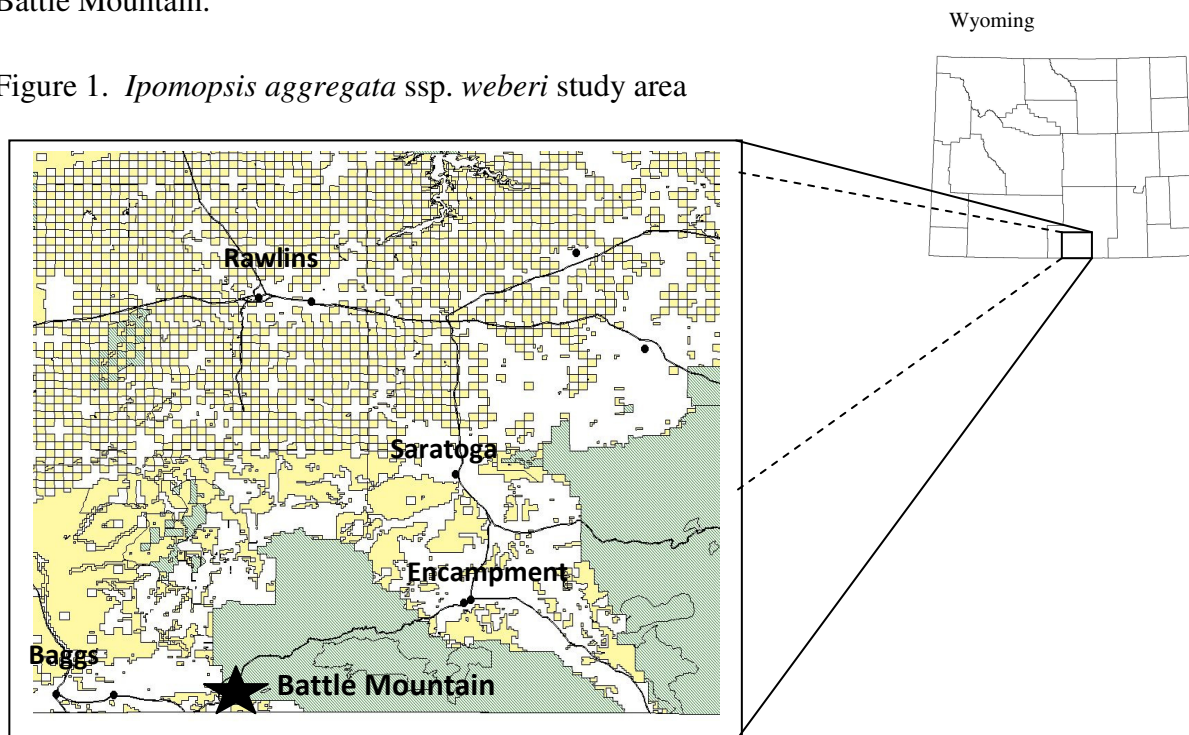
At the start of this project, information on the known distribution, habitat, and potential distribution model of *Ipomopsis aggregata* ssp. *weberi* was compiled and reviewed (Ladyman 2004, Fertig 1999, Fertig and Thurston 2003, Wyoming Natural Diversity Database records, Rocky Mountain Herbarium records). In preparation for fieldwork, there was review of known *I. a.* ssp. *weberi* distribution on file in the Wyoming Natural Diversity Database and of potential distribution polygons. These were overlain with public land layer and digital orthophotos in ArcMap (Appendix A).

Digital orthophotographs were printed out that contained known and potential *Ipomopsis aggregata* ssp. *weberi* distribution and public land boundaries, enlarged at a quarter-quad scale that corresponded closely to U.S.G.S. topographic maps (7.5'), for reference in the field. This also aided in looking for habitat signatures on public lands and determining public land access. It was not possible to identify a diagnostic "signature" of *I. a.* ssp. *weberi* habitat without having precise location information, but vegetation patterns in the general area of past collections were used to extrapolate across the landscape. In addition, a set of the U.S.G.S. topographic maps,

BLM land status maps, and geologic map (Love and Christiansen 1985) were also used to navigate and prioritize surveys. Coordination with the State Land Department was also sought for contacting the leaseholders of public land parcels.

The survey area was directed toward lands administered by the BLM Rawlins Field Office, but observations and new collections were made separately by Wendy Haas incidental to her work for Medicine Bow National Forest. All WYNDD surveys for *Ipomopsis aggregata* ssp. *weberi* were conducted on the west side of the Sierra Madre, while tandem Forest Service collections and surveys also were made on the west side of the Medicine Bow Mountains. The study area is in southern Carbon County, Wyoming (Figure 1), centered around the known occurrence at Battle Mountain.

Figure 1. *Ipomopsis aggregata* ssp. *weberi* study area



Battle Mountain lies in the southwest corner of the Sierra Madre, on Medicine Bow National Forest. It is located south and east of State Highway 70 between Baggs and Encampment.

Surveys of *Ipomopsis aggregata* ssp. *weberi* were conducted by the author on five days between 6-30 July when it was in flower. Fieldwork was planned to take estimates or censuses of plant numbers, mark field maps with approximate area boundaries, and record GPS coordinates for geo-referencing boundaries more accurately in later digitizing. Plans were also made to collect information on habitat, phenology, and plant associates were recorded on WYNDD survey forms for later entry into the centralized Biotics database. The state flora (Dorn 2001), the original monograph (Grant and Wilken 1986), and the Wyoming Rare Plant Guide (Fertig et al. 1994)

were used in making determinations, as well as a table of distinguishing characteristics based on the monograph, prepared by Ladyman (2004).

The survey started with efforts to relocate *Ipomopsis aggregata* ssp. *weberi* on the “west flank of Battle Mountain”, where it was originally collected in 1989 by Nancy Kastning (1923) as part of her floristic thesis covering the Park and Sierra Madre Ranges (Kastning 1990). The original collection had been made along a collecting route that traversed two sections. The precise collection location point along that route was not recorded, but an elevation of 7200-7800 was recorded. The lower end of this range is lower than the elevation of the two sections in question. The full elevation ranges of both sections were surveyed in 2009 but no species of *Ipomopsis* were found.

Next, surveys were conducted on state land in the vicinity of a later 1993 collection of *I. a.* ssp. *weberi* by Charmaine Refsdal Delmatier (102) and of a nearby survey on state land in 1994 conducted by Wendy Haas (Medicine Bow National Forest). Likewise, no species of *Ipomopsis* were found. These collections comprised the two-part Battle Mountain population record.

The other population record in the database was based on a 1994 observation near Divide Peak reported by Haas and Safranek. It was resurveyed and *Ipomopsis* specimen vouchers collected in 2009 by Haas.

The rest of WYNDD surveys focused on adjoining sections and townships where there was public land, including but not limited to areas identified in the potential distribution model (Fertig and Thurston 2003). Survey routes are reported in Appendix B.

### III. RESULTS - SPECIES INFORMATION

#### A. Classification

1. Scientific name: *Ipomopsis aggregata* (Pursh) Grant ssp. *weberi* Grant & Wilken
2. Synonyms: *Ipomopsis aggregata* (Pursh) Grant var. *weberi* (Grant & Wilken) Dorn

It is treated at the variety level by Dorn (2001) and referenced as such in the central database of Wyoming Natural Diversity Database (WYNDD). Dorn (2001) also treats the related taxon *I. a.* var. *tenuituba* at variety level, while Grant and Wilkens (1986) treat it at the species level. The Grant and Wilkens (1986) treatment is used throughout this report to be consistent with the monograph, the BLM sensitive species list, and the PLANTS database. The genus *Ipomopsis* was segregated from the closely-related genus *Gilia* by Grant (1956). Some western taxonomists continued to place *Ipomopsis aggregata* in the genus *Gilia*.

3. Common name: Weber's ipomopsis, Weber's scarlet-gilia. It is named after William Weber, famous Colorado botanist. Note: The genus *Ipomopsis* genus is also referred to as the scarlet-

gilia genus, which can be a source of confusion since some members of the genus are white-flowered.

4. Family: Polemoniaceae (Phlox family)

5. Size of genus: *Ipomopsis* is a New World genus of 27 species, concentrated in western North America (Mabberley 1997, Ladyman 2004). .

6. Phylogenetic relationships: A history of the genus *Ipomopsis* is presented by Grant and Wilken (1986). *Ipomopsis aggregata* is composed of six subspecies, said to differ strikingly in geographic and ecological distribution, morphological variation, and mode of pollination (Grant and Wilken 1986). They have been used as textbook examples of adaptive radiation for pollination by different pollen vectors. Three of the six subspecies are in Wyoming, in addition to *I. tenuituba*, a closely-related species reduced to variety by Dorn (2001). The *I. aggregata* subspecies and related species of Wyoming are referred to for purposes of this report as the “*I. aggregata* group.” Most member of this group are wide-ranging subspecies that contain regional and local races, hybrid populations in some cases, and polymorphic variations. As for *I. a. ssp. weberi*, it was referred to as a “semispecies” and narrow endemic within a territory occupied by the red-flowered *I. a. ssp. aggregata* and *I. a. ssp. attenuata* that could have been a former species swamped out by *I. a. ssp. aggregata* over much of its range (Grant and Wilken 1986). Further evaluation of phlogenetic relationships awaits genetic research.

#### B. Present legal or other formal status

##### 1. National legal status

a. Fish and Wildlife Service: *Ipomopsis aggregata ssp. weberi* has no federal status at the present time. It was formerly a Category 2 (C2) candidate for listing in 1993 under the Endangered Species Act (U.S. Fish and Wildlife Service 1993). The C2 list included species that might have warranted listing as Threatened or Endangered, but for which the Service lacked sufficient biological data to support a listing proposal. In February 1996, the Service revised its candidate policy and eliminated the C2 designation.

b. Bureau of Land Management: Formerly Sensitive (USDI BLM 2001, 2002) and removed from list in 2010 (USDI BLM 2010). Also Sensitive (USDA Forest Service Rocky Mountain Region 2009).

2. Global Heritage rank: G5T2. Globally the species is secure, but the variety is imperiled.

3. State Legal status: None.

4. State Heritage rank: SU. Undetermined status. The state status was ranked S1 prior to this study, meaning that it was critically imperiled. It has since been determined that all reports are false with the possible exception of the first specimen voucher in the state (*Kastning 1923 RM*).

### C. Description

1. General non-technical description: Weber's scarlet gilia is a taprooted biennial herb with stems 15-60 cm tall. The leaves are pinnately divided into numerous, linear segments with loose, white-woolly pubescence. Flowers are typically white with petals fused into a long, slender, trumpet-like corolla tube 10-22 mm long and 1-2 mm wide with five lobes at the tip (Grant and Wilken 1986; Fertig et al. 1994).
2. Technical description: Plants 15-60 cm tall. Inflorescences congested, with closely spaced many-flowered lateral cymes. Flowers fragrant. Calyx lobes 3 mm long. Corolla white, the populations uniformly white-flowered or predominantly white with some pink-flowered individuals. Corolla short salverform, tube filiform, ca. 1 mm wide at base, 10-22 mm long, with narrow orifice 1-2 mm in diameter. Anthers including highest one usually at orifice or sometimes exerted (Grant and Wilken 1986).
3. Local field characters: Flower color has been used in characterizing the predominant, typical color of the varieties. However, flower color is not a reliable distinction and all *Ipomopsis aggregata* surveyed in 2009 were in mixed-color populations. Several spanned the full spectrum of colors from white to red and all intermediates, while other populations seemed to be mainly light or dark. Thus, notes were taken on the range of flower color, prevalent flower color, and in some cases, the number of plants in each flower color category.

There were also subtle color pattern variations between individual plants. Among some plants, the corolla tube color was darker on the outside than the inside of the corolla tube or on the corolla limb ("petals"). There was also reddish or pinkish mottling at the corolla throat and corolla limb found on many flowers of all colors, even on white flowers. These variations were present on all flowers of an individual so it appeared to be genetic. A photographic set that highlights the variation documented in 2009 surveys is presented in Appendix C.

There did not appear to be other flower traits that varied with flower color, such as corolla tube dimensions, proportions, or inflorescence branching. If flower color alone varied between individuals, then this is more likely to represent population variation than sympatry between discrete taxa.

4. Similar species: *Ipomopsis aggregata* ssp. *aggregata* and *I. a.* ssp. *attenuata* and *I. tenuituba* all have broader corolla tubes than *I. a.* ssp. *weberi* (Grant and Wilken 1986), which is described as filiform and no more than 1 mm diameter at the base when pressed. They collectively represent the *Ipomopsis aggregata* group in Wyoming. All other members of the group tend to have longer tubes than *I. a.* ssp. *weberi*; the latter is generally less than 15 mm. In addition, *I. a.* ssp. *aggregata* and *I. a.* ssp. *attenuata* have tubes that flare. Finally, the inflorescence of *I. a.* ssp. *weberi* is congested compared to the open or widely-spaced branching pattern of the other three taxa.



A table of distinguishing features among the *Ipomopsis aggregata* group (Table 1) is reprinted from Ladyman (2004). Reprinted below are two illustrations that have been used for reference. Figure 2 shows the typical *I. a. ssp. weberi* with a relatively short, filiform tube in a congested inflorescence. The Figure 3 illustration used to represent the species in Wyoming shows an *Ipomopsis* with a flaring corolla tube that is long relative to the calyces, and that has widely-spaced flower. The latter illustration more closely fits *I. a. ssp. attenuata* (Wilken personal communication 2010).

The flowers of *Ipomopsis aggregata ssp. weberi* are described as fragrant while those of *I. a. ssp. attenuata* are described as fragrant or odorless. However, the *Ipomopsis* plants found in 2009 surveys were described as having a skunky smell, a distinct though not necessarily fragrant odor. It was not certain whether the skunky smell came from the vegetative plant, but flower odor was not a reliable distinction in field surveys.

Figure 2. *Ipomopsis aggregata ssp. weberi* (from Spackman et al. 1997), by Ann Fenwick.

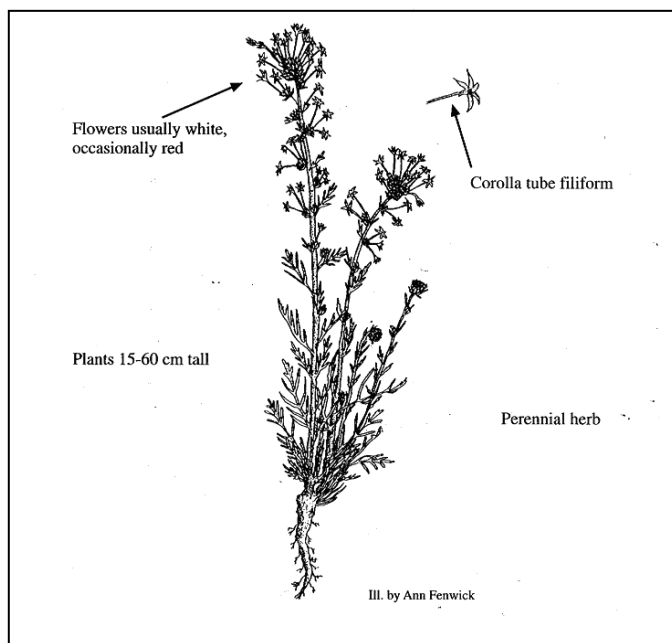
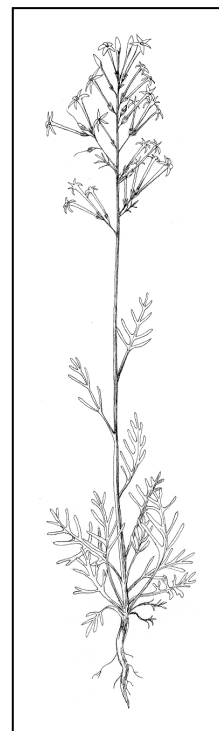


Figure 3. *Ipomopsis aggregata ssp. weberi* (from Fertig et al. 1994), by Walter Fertig.

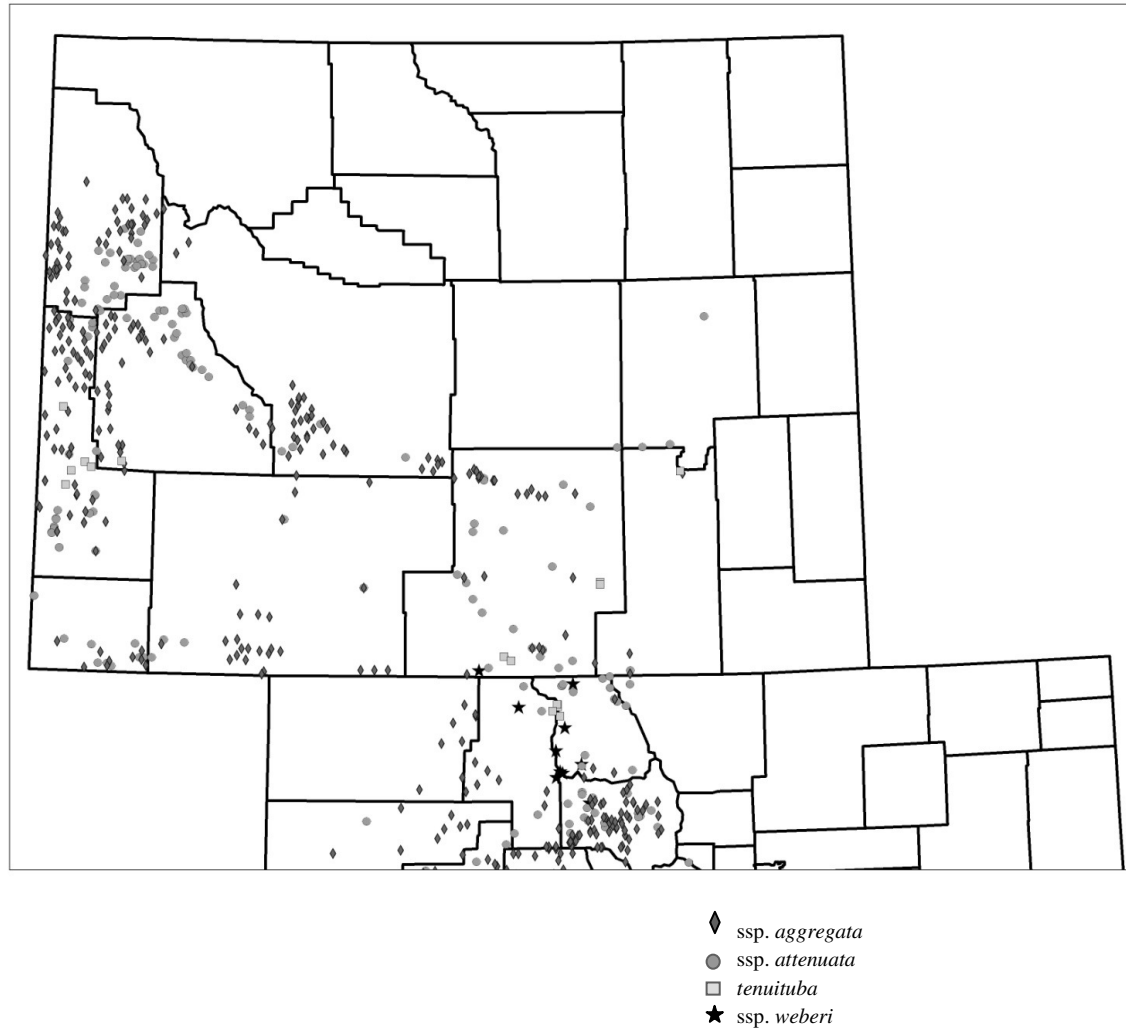


The Rocky Mountain Herbarium on-line database (2009) provides the most complete distribution for Wyoming members of the of *Ipomopsis aggregata* group, all of which are present in south-central Carbon County, Wyoming (Figure 4). The map of herbarium accessions shows the widespread distribution of *I. a. ssp. aggregata* and *I. a. ssp. attenuata* in the state, in contrast with the localized distributions of *I. tenuituba* and putative *I. a. ssp. weberi*.

Table 1. Characteristics of *Ipomopsis aggregata* ssp. *aggregata*, *I. a.* ssp. *attenuata*, *I. a.* ssp. *weberi* and *I. tenuituba* (Reprinted from Ladyman 2004)

<i>Ipomopsis</i> species and subspecies	Inflorescence	Fragrance	Color	Corolla	Tube	Anthers	Pollination
<i>I. aggregata</i> ssp. <i>aggregata</i>	Open	Odorless	Scarlet (rarely salmon)	Long salverform with flaring tube	>1.5 mm wide at base, (15) 18-22 (23) mm long, 3-7 mm diam. orifice	Well exerted	Ornithophilous
<i>I. aggregata</i> ssp. <i>attenuata</i>	Widely spaced	Fragrant or odorless	Pink to scarlet	Subsalverform with flaring tube	1 mm wide at base, 18-22 mm long, 2-3 mm diam. orifice, filiform.	Level with orifice or exerted	Ornithophilous
<i>I. aggregata</i> ssp. <i>weberi</i>	Congested	Fragrant	White (few pink ones in a population)	Short salverform with non-flaring tube	1 mm wide at base, 10-22 mm long, 1-2 mm diam. Orifice, filiform.	Level with orifice or exerted	Unknown
<i>I. tenuituba</i> (syn. <i>I. a.</i> var. <i>tenuituba</i> )	Very open	Fragrant	White, violet, pink	Long salverform with non-flaring tube	19-45 mm long, 2-3 mm diam. Orifice, not filiform.	Below, or level with orifice	Sphingophilous

Figure 4. Distribution of the *Ipomopsis aggregata* group in Wyoming and adjoining Colorado  
(From Rocky Mountain Herbarium online database 2010; covering the four taxa in Table 1 on the previous page.)



#### D. Geographical distribution

1. Range: *Ipomopsis aggregata* ssp. *weberi* is reported as a regional endemic of the Park Range in north-central Colorado and the Sierra Madre in Carbon County (Ladyman 2004). When it was first described, it was also reported from northern Idaho but this was based on a specimen that was later shown to be a small-flowered, white-pigmented population of *I. a.* ssp. *aggregata* (Wilken personal communication to Ladyman 2004). It was not recognized in Wyoming until collected in 1989 (*Kastning 1923 RM*) from the “west flank of Battle Mountain”, and reported in Kastning (1990). It was not initially recognized as separate from *I. a.* ssp. *attenuata* in Dorn (1992), but was accepted in the most current state flora (Dorn 2001).

In 1993, an *Ipomopsis* collection was made within two miles of the original Kastning collection by Charmaine (Refsdal) Delmatier (*Refsdal 102 RM*) and identified as *I. a.* ssp. *weberi*. It was added to the RM database and to the database of Wyoming Natural Diversity Database, but only recently mounted. In 1994, an *Ipomopsis* survey was conducted near the 1993 collection (Haas, Von Ahlefeldt, and Safranek). Also in 1994, an *Ipomopsis* survey was made in the Divide Peak area (Haas and Safranek) over 18 miles (29 km) from the other records and putative *I. a.* ssp. *weberi* were found though not collected.

Surveys conducted in 2009 sought to relocate all of the above collection sites and survey sites for *Ipomopsis aggregata* ssp. *weberi*, and to expand known distribution. However, no *Ipomopsis aggregata* ssp. *weberi* colonies were relocated and nearly all of the *Ipomopsis* collections in the area were provisionally determined to be *I. a.* ssp. *attenuata*. After the field season, they were sent to Dieter Wilken who verified the determinations. In February, 2010, photographs of the two putative *I. a.* ssp. *weberi* specimens from Wyoming (*Kastning 1923 RM*, *Refsdal 102 RM*) were sent to Dieter Wilken. He indicated that the flared tube and relatively long corolla tube relative to calyx of the Refsdal specimen more closely fit *I. a.* ssp. *attenuata*. He also suggested that the Kastning specimen looks like *I. a.* ssp. *attenuata* or introgression with *I. tenuituba*. Reviews of photographed specimens are not definitive. The specimens were reviewed by the author to be confident that the Refsdal specimen is not *I. a.* ssp. *weberi* but the Kastning specimen is plausible and should be included in specimen reviews for taxonomic treatment. Thus, the presence of this taxon in Wyoming remains to be confirmed, hinging on review and verification or annotation of the Battle Mountain specimen (*Kastning 1923 RM*)

2. Extant sites: None known. There are three general explanations why *Ipomopsis aggregata* ssp. *weberi* could not be found at Battle Mountain if the original specimen was correctly determined. The original habitat may have been destroyed, it may have changed since 1989, or else suitable habitat was missed in 2009. However, there were no apparent habitat losses in the two sections, apart from the narrow band of habitat loss caused by blading the section-line as maintenance access. There were no signs of fire though there could be changes to the shrub

community succession. The likelihood that it was simply missed seems slim in light of many new locations of *Ipomopsis aggregata* ssp. *attenuata* found in the vicinity.

A fourth explanation for failure to find the species in the sections where *Ipomopsis aggregata* ssp. *weberi* was originally collected is that the location information was not recorded correctly on the collection label. The 1989 collectors would likely have had to cross Section 5 to reach Sections 4 and 9, and the fact that the lower elevation range of collecting was recorded at 7200 foot indicates that collecting may have been conducted on adjoining sections. This explanation is valid only if the taxonomic determination of the Kastning specimen as *I. a.* ssp. *weberi* is invalid or if hybridization with *I. a.* ssp. *attenuata* swamped the taxon in intervening decades.

*Ipomopsis aggregata* was found in two main areas of adjoining Section 5, including sagebrush habitats. However, only six plants were found within sagebrush habitats on a ridge in Section 5 and 451 plants were found along the highway or directly above the road in contiguous native shrubland. There could even be a combination of explanations for survey results above if, for example, the original collection was actually made in Section 5 where there could have been successional shifts of woody encroachment of sagebrush steppe. In any case, specimen review by the expert in the genus is warranted and recommended as a first step in determining whether Wyoming has any extant sites.

3. Historical sites: None known.

4. Unverified/Undocumented reports: None. The previously-identified report of *I. a.* ssp. *weberi* near Divide Peak on Medicine Bow NF was surveyed and specimens collected in 2009 by Wendy Haas.

5. Sites where present status not known: The predictive distribution model for *Ipomopsis aggregata* ssp. *weberi* produced by Fertig and Thurston (2003) was based on the 1993 collection and 1994 observation as the only records that were mapped in detail. As mentioned above, both were based on misidentifications. Thus, the distribution model could not be expected to have predictive value in identifying suitable sites if all of the positive data used to generate the model was invalid.

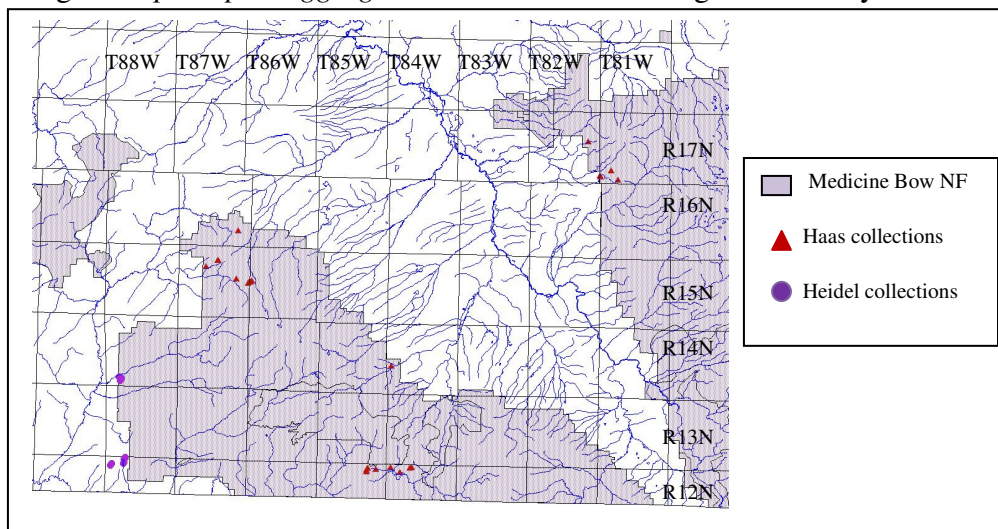
6. Areas surveyed but species not located: Surveys for *Ipomopsis aggregata* ssp. *weberi* were conducted by the author in over 12 areas concentrated around Battle Mountain, and by Wendy Haas at 15 or more sites; WYNDD survey sites are represented in Appendix B. Of these, 20 were found to have *Ipomopsis* present (Figure 4). Collections were made, flower characteristics noted and photographs taken. Nearly all *Ipomopsis* collected in 2009 have been determined to represent *I. a.* ssp. *attenuata* (Wilken personal communication 2010).

#### E. Habitat

1. Associated vegetation: The original collection of *Ipomopsis aggregata* ssp. *weberi* in Wyoming described the habitat as “sagebrush slopes.” Sagebrush is widespread in the two sections noted on the original collection label, though not dominating the vegetation except in

small patches at lower elevation benches. The collection area supports shrubland dominated by chokecherry (*Prunus virginiana*) prevails and shrubland dominated by mountain mahogany (*Cercocarpus ledifolius*) is on steep, exposed slopes.

Figure 4. *Ipomopsis aggregata* collection sites among 2009 survey sites



In general, Colorado populations of *Ipomopsis aggregata* ssp. *weberi* often occur with big sagebrush (*Artemisia tridentata*) as found on coarse rocky or gravelly slopes. Almost all of the surrounding settings for the taxon in Colorado appear to represent openings within spruce/fir forest (Ladyman 2004), rather than in open shrubland or steppe landscapes as found at the Kastning collection area. Demographic monitoring of four Colorado populations of *I. a.* ssp. *weberi* determined that populations which were stable were those that had less than 50% vegetation cover, suggesting that reduced competition and availability of open sites promote successful reproduction, establishment, and long-term population stability (Wilken 1996).

2. Frequently associated species: No additional information.

3. Topography: No additional information.

4. Soil relationships: No additional information.

5. Regional climate: No additional information.

6. Local microclimate: No additional information.

F. Population biology and demography

1. Phenology: The original collection of *Ipomopsis aggregata* ssp. *weberi* in Wyoming was made on 22 June at or approaching peak flowering. Many flowers were in bud for the two plants on the specimen sheet, and there were no remnant pistils or withered flowers apparent. The other reported collections and observations in Wyoming were made between 10 June and 8 July when flowering plants were found. In Colorado, it is said to flower between early-July to mid-September (Ladyman 2004).

2. Population size and condition: The collection label information that accompanied the Kastning specimen (1923) of *Ipomopsis aggregata* ssp. *weberi* noted that there were “at least several thousand” plants. This makes the failure to find any *Ipomopsis* in the same sections 20 years later all the more puzzling.

The only *Ipomopsis* colonies of plants found in the Battle Mountain area were in Section 5. There, a total of 523 plants were counted including 350 plants in the NE ¼ extending over 30 m upslope into native habitat, 167 plants in the SE ¼ including an abandoned segment of road (but not expanding upslope), and 6 plants found in an isolated ridge opening above but not continuous with the latter. In all cases, white-flowered plants outnumbered pink-flowered plants which outnumbered red-flowered plants (Table 2). The tally did not include vegetative plants. It was the second largest *Ipomopsis* colony found in 2009, though having far fewer plants than “several thousand.”

Table 2. *Ipomopsis aggregata* ssp. *attenuata* numbers at Battle Mountain

Location/Flower color	White	Pink	Red/reddish	Total
Sec. 5 NE ¼ roadside	207	60	44	311
Sec. 5 Above NE ¼ roadside	19	13	7	39
Sec. 5 SE ¼ roadside	118	37	12	167
Total	344	110	63	517

#### G. Reproductive biology

1. Type of reproduction: *Ipomopsis aggregata* ssp. *weberi* is a monocarpic, short-lived perennial that reproduces by seed and lives 2-5+ years before flowering (Wilken 1996). There are no reports of vegetative reproduction.

2. Pollination biology: The flowers in the genus are likely to require cross-pollination based on pollination studies with other members of the group. In general, red-flowered members of the genus are considered to be hummingbird-pollinated, and *Ipomopsis tenuituba* as a white-flowered member with long corolla tube is considered to be moth-pollinated. The likely pollinators of *I. a.* ssp. *weberi* were thought to be some combination of small moths, bees, flies

and bee flies (Wilken person. commun. to Ladyman 2004). Bees were observed visiting *I. a. ssp. attenuata* and a swallowtail butterfly was photographed on it by W. Haas.

3. Seed dispersal and biology: There are no known seed dispersal mechanisms for *Ipomopsis aggregata ssp. weberi*. Most seedlings are recruited in late spring shortly after snow melt (Wilken 1996). Demographic research suggests that it does have a seed bank in which seeds can persist for more than a year, but that the seed bank longevity is limited (Wilken 1996). Highest mortalities occurred among seedlings during the first year as a result of summer drought (Wilken 1996). These combination of conditions suggest that population viability could be vulnerable to prolonged drought conditions.

#### H. Population ecology

1. General summary: *Ipomopsis aggregata ssp. weberi* appears to be an early-succession species or, in any case, restricted to low-competition settings in open or semi-open settings.

2. Competition: Wilken (1996) inferred that the establishment and long-term stability of *Ipomopsis aggregata ssp. weberi* populations appear related to reduced competition and continued availability of forest openings. In the course of 2009 surveys for *I. a. ssp. weberi*, a 1996 prescribed burn site south of the South Fork of Cedar Creek was revisited by Wendy Haas who noted about 1000 plants. This is the largest population of *Ipomopsis aggregata* noted during 2009 surveys, though they were verified as *I. a. ssp. aggregata*. The habitat had many of the same species present on Battle Mountain landscape, though much more open. Photographs of the prescribed burn setting with high *Ipomopsis* numbers are reprinted in Appendix C.

3. Herbivory: No signs of herbivory were observed.

4. Hybridization: The mixed color populations of *Ipomopsis aggregata* in the Sierra Madre were at one time tentatively interpreted as representing two different sympatric subspecies with hybridization between the two. Hybrids are known in the group (Grant and Wilken 1988) and the adaptive or maladaptive values of hybridization have been evaluated (Melendez-Ackerman 1997, Melendez-Ackerman et al. 1997). Grant and Wilken (1988) report that the patterns of hybridization run from hybrid swarms through conspicuously segregated introgressive populations to more or less stabilized populations and races of hybrid origin. As part of 2009 surveys, collections were made to represent the range of characteristics present in mixed color colonies, and review by D. Wilken. He interpreted these mixed-color colonies to represent a highly-variable single taxon rather than a hybridization phenomenon, while maintaining that genetics work would be warranted for definitive resolution of the mixed color colonies. See the prior discussion of flower color variability under the taxonomic description.

I. Land ownership: The only possible collection of *Ipomopsis aggregata ssp. weberi* in Wyoming was in 1989 made from sections that are managed by either the U.S. Forest Service in the Medicine Bow National Forest or the Wyoming State Trust lands. All 2009 collections made on BLM-administered lands were determined and verified by D. Wilken to be *I. a. ssp. attenuata*.



## IV. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. Potential threats to currently known populations: Threats information for *Ipomopsis aggregata* ssp. *weberi* in Wyoming is not available until its presence is confirmed. Highway maintenance has been identified as a potential threat to the taxon in Colorado. Similarly, the Section 5 colonies of *I. a.* ssp. *attenuata* could be significantly affected by any widening or re-contouring of the right-of-way or indiscriminate herbicide spraying. The Battle Mountain area has had herbicide treatments to set back woody encroachment as reported in Section 28, and the affects of this treatment might account for absence of *Ipomopsis* in 2009 where it had been present in 1994. Other threats to the taxon identified for Colorado populations include recreation, grazing, and practices that bring related subspecies into contact with it leading to hybridization (Ladyman 2004).

B. Management practices and response: None identified for Wyoming BLM.

C. Conservation recommendations

1. Recommendations regarding present or anticipated activities: None identified for Wyoming BLM.

2. Notification of BLM personnel of locations on BLM lands: No coordination needs are identified for Wyoming BLM.

3. Status recommendations: *Ipomopsis aggregata* ssp. *weberi* is not known from and is not likely to occur on BLM lands in Wyoming. This makes it inappropriate for designation as Sensitive.

Updates to the Wyoming state rank of *Ipomopsis aggregata* ssp. *weberi* have been made. Updates have also been made to the state species abstract (Appendix D), which will be posted and maintained to reflect the most current information.

D. Summary: The results from this study document that *Ipomopsis aggregata* ssp. *weberi* is not known to occur on BLM lands in Wyoming nor is it likely to occur. This answers the immediate question whether it meets criteria for BLM sensitive species designation.

There are three levels of questions still unanswered in determining the status of in Wyoming. The most basic is determining whether *I. a.* ssp. *weberi* has been documented from the state and is appropriate to recognize as part of the Wyoming flora. All specimens collected in 2009 surveys have been determined to represent other subspecies, mainly *I. a.* ssp. *attenuata*. The first reported collection of this taxon (*Kastning 1923 RM*) warrants critical review by the taxonomic *Ipomopsis* expert and is the only putative specimen voucher for it in the state.

If the original determination is correct, then the next question is whether or not it is extant. No *Ipomopsis* were found in the sections where it was originally collected, but generally, at least two years of searches are warranted before characterizing a population as extirpated. The preponderance of white flower color in the nearby population of *I. a. ssp. attenuata* is not seen as directly related to the status of *I. a. ssp. weberi* unless it is a vestige of hybridization between the two taxa.

Overarching the first two questions is a possible question of taxonomic validity. Wilkens' unpublished data on phenetic variation among the *Ipomopsis aggregata* group, and other genetics work to date, point the way toward understanding a more complex phenomenon than can be addressed by existing dichotomous keys. Additional taxonomic research is being conducted by Wilken as part of ensuing *Flora of North America* work (Volume 15: Magnoliophyta: Fouquieriaceae to Boraginaceae). Genetics work may ultimately be required to resolve the matter of taxonomic validity.

## V. LITERATURE CITED

- Dorn, R.D. 1992. Vascular Plants of Wyoming, 2nd ed. Mountain West Publishing, Cheyenne, WY.
- Dorn, R.D. 2001. Vascular Plants of Wyoming, 3rd ed. Mountain West Publishing, Cheyenne, WY.
- Fertig, W., C. Refsdal, and J. Whipple. 1994. Wyoming Rare Plant Field Guide. Wyoming Rare Plant Technical Committee, Cheyenne Wyoming.
- Fertig, W. 1999. State Species Abstract: *Ipomopsis aggregata* ssp. *weberi*. Wyoming Natural Diversity Database. Available on the internet at [www.uwyo.edu/wyndd](http://www.uwyo.edu/wyndd)
- Fertig, W. and R. Thurston. 2003. Modeling the potential distribution of BLM Sensitive and USFWS Threatened and Endangered plant species in Wyoming. Unpublished report prepared for the Bureau of Land Management Wyoming State Office by Wyoming Natural Diversity Database, University of Wyoming, Laramie, WY.
- Grant, V. and D.H. Wilken. 1986. Taxonomy of the *Ipomopsis aggregata* group (Polemoniaceae). Botanical Gazette. 147(3):359-371.
- Grant, V. and D.H. Wilken. 1988. Natural hybridization between *Ipomopsis aggregata* and *I. tenuituba* (Polemoniaceae). Botanical Gazette 149(2): 213-221.
- Kastning, Nancy. 1990. A floristics survey of the Park and Sierra Madre Ranges, Colorado and Wyoming. Unpublished Masters thesis, Botany Department, University of Wyoming, Laramie, August, 1990.
- Ladyman, J.A.R. (2004, December 9). *Ipomopsis aggregata* (Pursh) V. Grant ssp. *weberi* V. Grant and Wilken (scarlet gilia): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available:

- <http://www.fs.fed.us/r2/projects/scp/assessments/ipomopsisaggregatasspweberi.pdf>. [date of access].
- Love, J.D. and A.C. Christiansen. 1985. Geologic map of Wyoming. U.S. Geological Survey. 1:500,000.
- Mabberley, D.J. 1997, 2<sup>nd</sup> ed. The Plant-Book. Cambridge University Press, Cambridge, U.K.
- Melendez-Ackerman, E.J. 1997. Patterns of color and nectar variation across and *Ipomopsis* (Polemoniaceae) hybrid zone. *Am. J. Botany* 84(1): 41-47.
- Melendez-Ackerman, E.J. D.R. Campbell, and N. M. Waser. Hummingbird behavior and mechanisms of selection on flower color in *Ipomopsis*. *Ecology*. 78(8): 2532-2541.
- Rocky Mountain Herbarium. 2009 (query date). On-line database. University of Wyoming, Laramie, WY. Posted at:
- Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Prepared for the Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service by the Colorado Natural Heritage Program, Ft. Collins, CO.
- USDA Forest Service – Rocky Mountain Region. 2009. Region 2 Regional Forester's Sensitive Species List. Posted at: <http://www.fs.fed.us/r2/projects/scp/sensitivespecies/index.shtml>.
- USDI Bureau of Land Management. 2001. Wyoming Bureau of Land Management sensitive species policy and list; instruction memorandum no. WY02001-040. BLM Wyoming State Office, Cheyenne.
- USDI Bureau of Land Management. 2002. Updates to Wyoming Bureau of Land Management sensitive species policy and list; instruction memorandum no. WY02001-040. BLM Wyoming State Office, Cheyenne.
- USDI Bureau of Land Management. 2010. Updates to Wyoming Bureau of Land Management sensitive species policy and list, instruction memorandum no. pending. BLM Wyoming State Office, Cheyenne. Posted electronically at: <http://www.blm.gov/wy/st/en.html>.
- USDI Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species. *Federal Register*, 50 CFR Part 17, 58(188):51144-51190.
- Wilken, D.H. 1996. Demography of *Ipomopsis aggregata* ssp. *weberi*, a rare plant of northern Colorado. pp. 13-18 in *Southwestern rare and endangered plants; proceedings of the second conference*. General Technical Report RM-GTR-283. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.