Report on a Survey for *Stephanomeria fluminea* in Grand Teton National Park

Prepared for the Greater Yellowstone Network Inventory

and

Grand Teton National Park

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Introduction

Examination of specimens of *Stephanomeria* by Gottlieb (1999) disclosed individuals that appeared to differ markedly in features of vegetative morphology and habitat from all known members of the genus. These individuals most closely resembled *S. tenuifolia*, but had notably wider leaves and occurred in a very different kind of environment. *S. tenuifolia* typically grows on cliffs, ledges, and rocky outcrops, whereas the specimens in question were all from stream beds of large creeks and rivers. Based on this morphological character and the unique habitat preference, Gottlieb described the entity as a new species, naming it *Stephanomeria fluminea* Gottlieb.

Although there were many collections of this species in existence, they were all from a relatively small area within Grand Teton National Park (GTNP) and adjacent areas of the Bridger-Teton National Forest (BTNF) and Shoshone National Forest. In fact, all but one of the populations known to Gottlieb were located in creeks and rivers that flow westerly into the Snake River in the general region of Jackson Hole, Wyoming. A single collection, (*Hartman, 19617*) was from the South Fork of the Shoshone River, well to the east.

An additional collection (*Hartman, 49729*) has since come to light, slightly expanding the known range of the species, but with the majority of populations still occurring within or very close to GTNP. By the end of 2000 and into 2001, it was still thought to be quite local in its distribution and very specialized in habitat preference. The narrow range and habitat specificity raised questions concerning the security of the species. Information needed to assess long-term viability includes total range of the species, numbers of individuals in existence, number and size of populations, factors influencing distribution, potential threats, and protection needed to maintain populations and habitat. Other than the general information reported by Gottlieb (1999), almost nothing was known about abundance and ecological parameters influencing distribution. Thus, a survey was requested in order to "determine the location, distribution, and status of *Stephanomeria fluminea* within Grand Teton National Park" (Greater Yellowstone Network Inventory, 2000), with the specific objectives being to:

1. Survey appropriate habitats throughout GTNP for the presence of *Stephanomeria fluminea*.

2. Document location, distribution, ecological parameters, population size, phenology, and potential threats for each site located.

Methods

Gottlieb (1999) reported the habitat of *S. fluminea* to be "impermanent, slightly raised cobble benches in the flat, gravelly beds of creeks that flood and churn after spring snow melt." Therefore, all drainages within GTNP that appeared to fit that description were surveyed intensively for this plant. Taggart Creek was briefly examined, but did not appear to provide suitable conditions.

Field surveys were conducted along seven drainages (Figure 1, Table 1, Appendix B) between July 20 and September 12, 2001. Each drainage was surveyed by walking within the stream bed between the Park boundary and the confluence with either the Snake River or Jackson Lake. Because these streambeds are, in many places, several hundred feet in width and often have multiple channels, they could not be traversed in a linear fashion, Rather, it was necessary to criss-cross repeatedly between the banks in order to visually cover as much area as possible. In general, a stream was surveyed on one side out to the main channel (or what appeared to be the main channel) in one direction, the other side surveyed on the return trip. Where the stream was too deep to wade (e. g., Buffalo Fork River), each side was surveyed in the same direction.

In some cases these streambeds were so wide and formed so many channels that, for practical reasons (i.e., time constraints), lines of traverse were too far apart to allow complete visual coverage. In extreme cases, lines were 100-300 feet apart, providing very low coverage of the stream bed. However, perhaps because the very wide channels did not provide favorable conditions, number of plants was very low, supporting the assumption that relatively few plants were not recorded. In areas where plants occurred in high densities, lines of traverse were close enough to provide 90-100% coverage, regardless of channel width. Sites with intermediate densities were surveyed at somewhat lower levels of visual coverage.

Information recorded (Appendix C) at the site of each population included location, elevation, habitat conditions, (including associated species), number of individuals present, and perceived threats (if any). Endpoints of each population (Appendix D) were recorded as UTMs, obtained with a Garmin 3-plus GPS unit. Voucher specimens were collected from each drainage, these being deposited in the Rocky Mountain Herbarium (RM) and GTNP Herbarium. Single specimens were provided to Yellowstone National Park, the Bridger-Teton National Forest, and the Teton Science School.

With two exceptions (Pacific Creek and Buffalo Fork River), the plants occurred more or less continuously within a drainage, rather than in discreet, identifiable populations. Therefore, the entire assemblage of individuals within each drainage was treated as a single population.

Results

Approximately 37 miles of stream bed was surveyed along the seven drainages displayed in Figure 1. These surveys disclosed the presence of 12,173 individuals occurring within the survey area. Number of individuals occurring in each drainage is provided in Table 1. Additionally, five sites along the Snake River (Figure 1) were spot-checked for the presence of *S. fluminea*., albeit no plants were discovered at any of these.

Information acquired from these surveys was incorporated into the state species abstract compiled by the Wyoming Natural Diversity Database. This information is displayed in Appendix A.

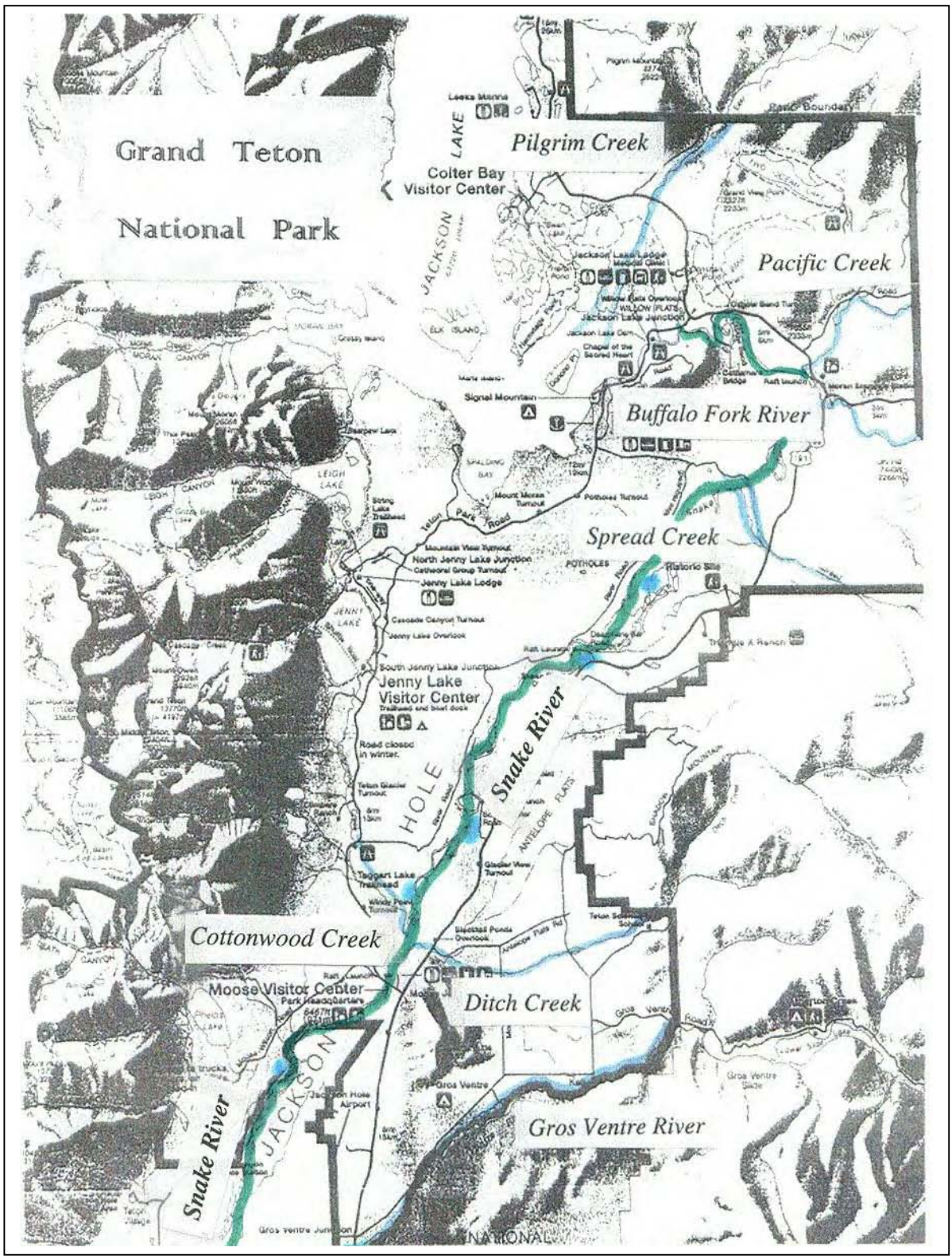


Figure 1. Survey routes. (From Grand Teton National Park Official Map and Guide)

Table 1: Drainages surveyed for *Stephanomeria fluminea*

	Miles surveyed	Number of plants recorded
Buffalo Fork River	3.4	20
Cottonwood Creek	2.8	0
Ditch Creek	6.8	2,231
Gros Ventre River (north side)	10.2	1,770
Pacific Creek	4.2	12
Pilgrim Creek	5.8	5,942
Spread Creek	3.8	2,199
Total	37.0	12,173

Discussion

Abundance

Prior to the survey of 2001, little was known concerning abundance of the newly-described species. This survey has disclosed that there are at least 12,173 individuals occurring within GTNP, and, in all likelihood, many more occur that were not counted.

Clearly, the survey methods could not possibly reveal the presence of all individuals. Because the figure provided represents plants actually observed, it also represents the minimum number occurring in the Park. An estimated 20-40% of the plants were missed, meaning that the actual number of individuals could be 16,000 or more.

It should be emphasized that these numbers only apply to the 2001 growing season. Because of the unstable environment in which these plants grow, populations probably fluctuate greatly from one year to the next, but trend data are needed to confirm this assumption.

Environmental conditions

Habitat conditions for *Stephanomeria fluminea* as reported by Gottleib (1999) and Fertig (2000) appear to be, in general, accurate, but there are many additional environmental features that appear to be correlated with occurrence that emerged from this survey. Perhaps the most striking of these is the consistency with which it occurs with certain other species

Heterotheca depressa (Teton goldenaster) is another regional endemic with a distribution similar to, albeit somewhat broader than *S. fluminea*. It also appears able to occupy a wider range of habitats. The species grows mainly within or adjacent to creek beds, but it also tolerates a variety of upland sites. Its presence did not necessarily indicate the occurrence of *S. fluminea,* but in all cases, occurrence of *S. fluminea* was accompanied by occurrence of *H. depressa,* usually in moderate to high abundance. Those sections of

streams which had high densities of *S. fluminea* almost invariably had high densities of *H. depressa*, and stream beds that had no *Heterotheca* supported no *Stephanomeria*.

Another species that appeared to correlate with *S. fluminea* was *Populus angustifolia* (narrow-leaf cottonwood). Seedlings of this species were extremely common in all of these drainages, but it was the presence of mature individuals that indicated suitable habitat for *Stephanomeria*. Those streams (i. e., Pacific Creek, Buffalo Fork River) with low abundance of mature plants within the bed supported very low numbers of *Stephanomeria* and, coincidentally, very low densities of *Heterotheca*. This situation suggests that whatever conditions are necessary for *P. angustifolia* to grow to full maturity are also necessary for the viability of *S. fluminea* and, to a lesser extent, *H. depressa*.

These conditions may be, in part, provided by topographic diversity; that is, variation in the elevation of gravel and cobble bars, and assorted depth of channels within the beds. For example, Pilgrim Creek has a strongly undulating bed, and gravel/cobble bars ranging in height from 1 to 15 feet, and supports a large population of plants. In contrast, Pacific Creek, is relatively flat. Only 12 plants were found within the entire drainage, from the Park boundary to the Snake River. Perhaps the irregularities of the terrain deflect water in such a manner as to provide a certain amount of stability in an otherwise highly unstable environment.

Alternatively, the irregularities may influence the amount of water available to the plants at crucial points during the growing season. While plants were observed growing at all levels within a stream bed, they were always well away from visibly wet or saturated soil. Excessive moisture seems to be more of a problem than too little, and the raised gravel and cobble bars may elevate the plants sufficiently to adjust the soil water content.

Several other plant species (Table 2) were also commonly associated with *S. fluminea*, albeit not with the consistency as those listed above. Abundance of these varied from one drainage to another.

Shading is another factor that seems to influence occurrence. Most sites were characterized by little (less than 10%) or no vegetative canopy coverage. Occasional individuals or small patches were found under coverage of up to 50%, and a single sub-population of 5 individuals was discovered under a nearly closed canopy of *Populus angustifolia*, on an old flood plain of the Gros Ventre River. Sites with the highest densities of plants were always in full sun, and with little competing herbaceous vegetation.

Table 2. Plant species commonly associated with *Stephanomeria fluminea*

Species name	Common name	Growth form
Agrostis stolonifera	Redtop	Perennial graminoid
Epilobium ciliatum	Willow-herb	Perennial forb
Epilobium suffruticosum	Shrubby willow-herb	Perennial forb
Heterotheca depressa	Teton goldenaster	Perennial forb
Lupinus polyphyllus	Prairie lupine	Perennial forb
Melilotus officinalis	Yellow sweet-clover	Perennial forb
Poa pratensis	Kentucky bluegrass	Perennial graminoid
Populus angustifolia	Narrow-leaf cottonwood	Tree
Solidago missouriensis	Missouri goldenrod	Perennial forb
Trifolium hybridum	Alsike clover	Perennial forb

Substrate may also be significant. All of the drainages that support *S. fluminea*, both within and outside of the Park, flow from sedimentary strata of the Gros Ventre Range and volcanics of the Absaroka Range. The one creek (Cottonwood) flowing from the west that had physical attributes similar to those flowing from the eastern ranges has its origin in the Teton Range which is composed mainly of metamorphosed granitics, notoriously low in nutrients. Not surprisingly, *Heterotheca depressa* was also absent.

This situation of substrate specificity is not unique to *Stephanomeria* or *Heterotheca*. Sabinske and Knight (1978) identified numerous cases in which plant species in Jackson Hole occurred exclusively on one side of the Snake River or the other. They also noted that some of these were further restricted to substrates derived from specific drainages, and concluded that these species distributions were controlled by the mineralogy and sedimentation patterns particular to those drainages.

It should be pointed out that these apparent correlations between environmental conditions and plant occurrence are the products of observation rather that being statistically defensible conclusions attained from intensive data-collecting. Factors influencing plant presence or absence are often difficult to evaluate and much more investigation would be necessary before critical habitat features could be clearly identified.

Potential threats

Stephanomeria fluminea appears to have relatively few threats, at least under current land management practices. Most of the habitat exists within GTNP, the Teton Wilderness, or the Washakie Wilderness, and appears safe from most of the disruptive activities that pressure many plant populations. However, there are some existing conditions that could become concerns in the future if land use patterns change.

This plant appears to be closely tied to a particular hydrologic regime that could be modified by activities such as gravel extraction or water diversion for irrigation. While these disruptive forces are unlikely to occur in the Park, it is possible that they may occur on the BTNF or Shoshone NF. Because all of the drainages which support the species

originate on Forest Service land, the likelihood of disruptive activities occurring is greater than it may initially appear.

In fact, a major gravel quarry was recently constructed near Spread Creek on the BTNF, just east of the Park boundary. This quarry is far enough from the main stream that it is unlikely to influence plants within that drainage, but if such a quarry were located closer to a stream bed, it could potentially have a detrimental effect on the resident population. Clearly, management of Forest Service land will be crucial to maintaining suitable habitat for the species.

Grazing and trampling by large ungulates (livestock and/or wildlife), do not seem to be major sources of mortality. The plants emit a strong odor which may repel herbivores, and very few plants showed any feeding damage. In the Park, livestock grazing is permitted in the vicinity of Spread Creek and to the west of the Gros Ventre River near Kelly, but there was no evidence of grazing or trampling of plants in these areas.

Concluding remarks

This survey has provided basic information concerning the abundance and distribution of *Stephanomeria fluminea* within Grand Teton National Park. However, many questions persist regarding the overall status of the species, and its chances for long-term survival.

The total number of plants occurring throughout the species range remains uncertain. While those drainages indicated were thoroughly surveyed, there appears to be additional habitat along the Snake River that was not investigated. Examination of selected sites along the river failed to reveal any plants, but one collection (*Williams 976*) indicates that the species was historically present, and may still be. Exact location of this collection is not clear.

No surveys have been conducted to document the abundance or extent of populations outside the Park. Information concerning short-term and long-term trends is also lacking. Because of the dynamic nature of the plants' environment, number and location of individuals almost certainly change from year to year, and monitoring programs are necessary to determine fluctuation in population size.

Finally, there is some question as to the taxonomic status of some of the sub-populations encountered. Many individuals had narrow (less than 2mm wide) cauline leaves, and appeared to be intermediate to *S. tenuifolia*. Gottlieb (1999) was also aware of these plants, and suggested that they might be hybrids involving *S. fluminea* and *S. tenuifolia*. If this is the case, actual abundance of *S. fluminea* becomes difficult to assess.

Literature cited

Fertig, W. 2000. *Stephanomeria fluminea*. State species abstract. Wyoming Natural Diversity Database, Laramie, Wyoming

Gottlieb, L. D. 1999. A new species of *Stephanomeria (*Asteraceae) from Northwestern Wyoming. Madroño 46:58-60.

Greater Yellowstone Network. 2000. Draft Project Statement: Status survey for *Stephanomeria fluminea* within Grand Teton National Park.

Sabinske, D. and D. Knight. 1978. Variation within the sagebrush vegetation of Grand Teton National Park. Northwest Science 52:195-204.

Appendix A. Species information

Classification

Scientific Name: *Stephanomeria fluminea* Gottlieb (Gottlieb, 1999).
Holotype: USA: Wyoming, Teton County, gravel bars in Pilgrim Creek, north of trailhead in Bridger-Teton National Forest, north of boundary with Grand Teton National Park, T46N R116W S20 E1/2. 7200 ft., 15 May 1998. *Gottlieb and Ford 9807* (DAV).

Common Name: Teton wirelettuce, streambank wirelettuce.

Family: Asteraceae (sunflower family).

Status

US Fish and Wildlife Service: None
Agency status: None

Heritage Rank

Global: G2? State S2?
WYNDD Plant list: State endemic (High Conservation Priority)

Description

Stephanomeria fluminea (Figure 2, 3) is a perennial forb from creeping rhizomes, with short-tomentose stems, branches and leaves. Basal leaves are oblong or oblanceolate with entire to sparsely-toothed margins. Stem leaves are 35-45 mm long and 2-5 mm wide with oblong-oblanceolate blades with entire margins. Heads are subtended by 5 main bracts 8-10 mm long, surrounded by shorter bractlets 2-4 mm long. Each head has 5 (rarely 6) pink or white ray flowers. Fruits are tan, ribbed achenes 4-4.5 mm long, with pappus of white, plumose bristles (Gottlieb, 1999; Fertig, 2000).

Figure 2. *Stephanomeria fluminea*, flower heads and habit.

Figure 3. Line drawing of *Stephanomeria fluminea* by W. Fertig (from Fertig, 2000)

Similar Species

Stephanomeria tenuifolia has narrow stem leaves less than 2 mm wide. *S. runcinata* has leaves with lobes pointing backward toward the base. *Lygodesmia juncea* is glabrous and has smooth pappus bristles (Fertig, 2000).

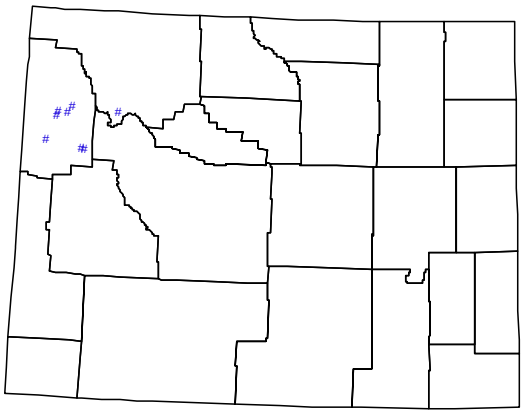
Flowering/Fruiting Period

Late July-September.

Distribution

Endemic to Absaroka and Gros Ventre ranges and Jackson Hole in Park, Sublette and Teton Counties (Figure 4), Wyoming (Fertig, 2000).

Figure 4. Wyoming distribution of *Stephanomeria fluminea.*



Habitat

Gravel/cobble bars and alluvial terraces along large creeks and rivers (Figure 5) at 6300-7800 feet.

Figure 5. Habitat of *Stephanomeria fluminea* along the Gros Ventre River.

Managed Areas

Grand Teton National Park, Bridger-Teton and Shoshone National Forests.

Threats

Gravel quarrying, water diversion for irrigation.

Appendix B. Description of drainages surveyed for *Stephanomeria fluminea*

Buffalo Fork River - Lava Creek to Snake River

The Buffalo Fork River (Fig. 6) is characterized by low, more or less uniformly elevated gravel and cobble bars. Vegetation within the stream bed varied from one end of the survey area to the other, but, in general, consisted of high densities of *Populus angustifolia*, most of it in seedling stage, with very few mature individuals. Other common species were *Salix boothii* and *S. geyeriana*, with such introduced herbaceous species as *Agrostis stolonifera*, *Phleum pratense*, and *Artemisia biennis*. *Epilobium ciliatum* and *Chenopodium album* were also common, but more widely scattered.

Even in late summer, this stream had significant amounts of water flowing through it. The relatively high streamflow and lack of elevated sites may account for the low total number (20 at 3 sites) of plants observed in this drainage.

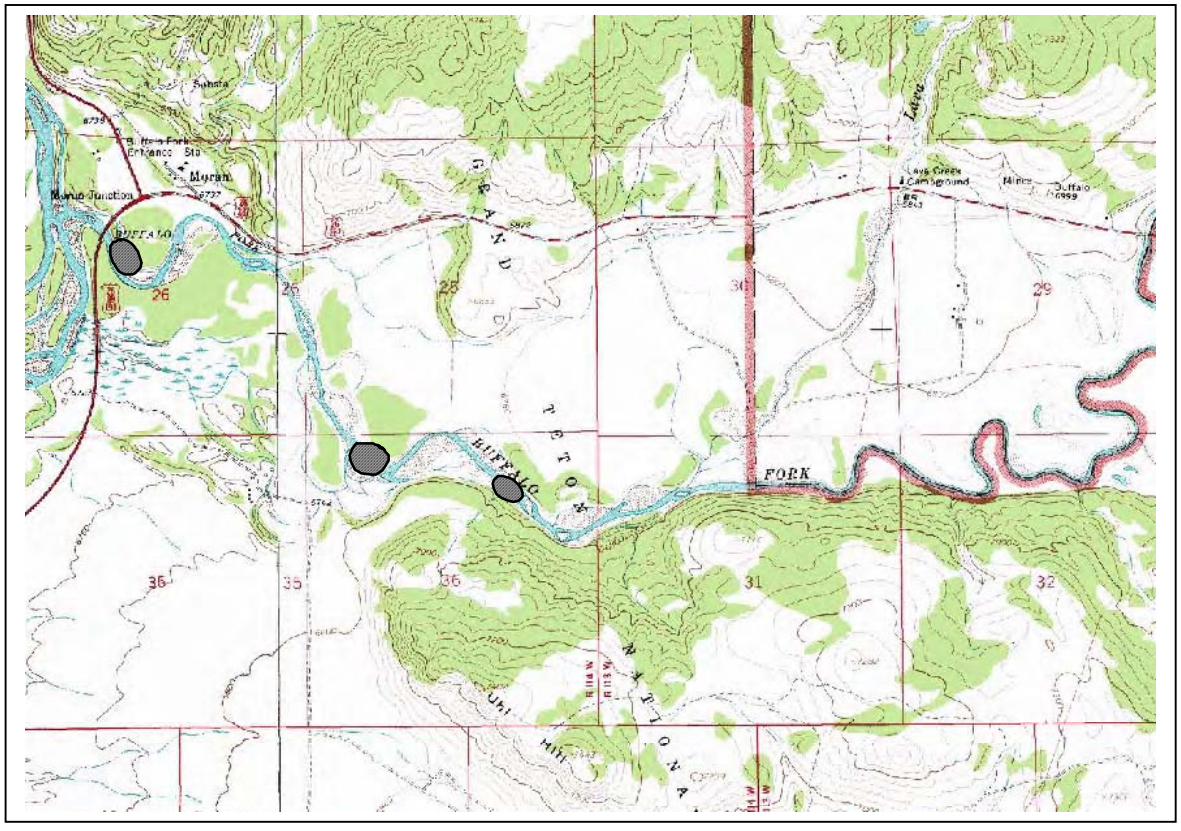


Figure 6. Populations of *Stephanomeria fluminea* along Buffalo Fork River. Moran Quad, Davis Hill Quad. T45N R113W, 114W.

Cottonwood Creek - Cottonwood Creek Picnic Area to Snake River

This drainage has stream bed morphology much like others in the area, but it differs in a number of ways, some or all of which account for completely different plant species composition. Rather than originating in the sedimentary rocks of the Gros Ventre or volcanics of the Absaroka Range, this creek has its headwaters in the Teton Range which is mainly granitic and metamorphic in composition.

Dominant tree species included *Populus balsamifera* and *P. tremuloides* with scattered *P. angustifolia*. Herbaceous cover was generally low, but *Agrostis stolonifera, Poa palustris, Cerastium arvense,* and *Rumex acetosella* were locally abundant. *Heterotheca depressa* was completely absent and, predictably, no *Stephanomeria* was found.

Ditch Creek - Eastern boundary of Park to Snake River

Although this drainage (Fig. 7) is the narrowest of the drainages surveyed, it has high coverage of mature *Populus angustifolia* within the stream bed. Other dominant species consisted of *Heterotheca depressa*, *Lupinus polyphyllus*, *Poa pratensis*, *Artemisia tridentata* and *Purshia tridentata*. The latter two species are not usually found in the stream beds of the area, but because they comprise the dominant surrounding vegetation, some individuals have become established within the creek bottom.

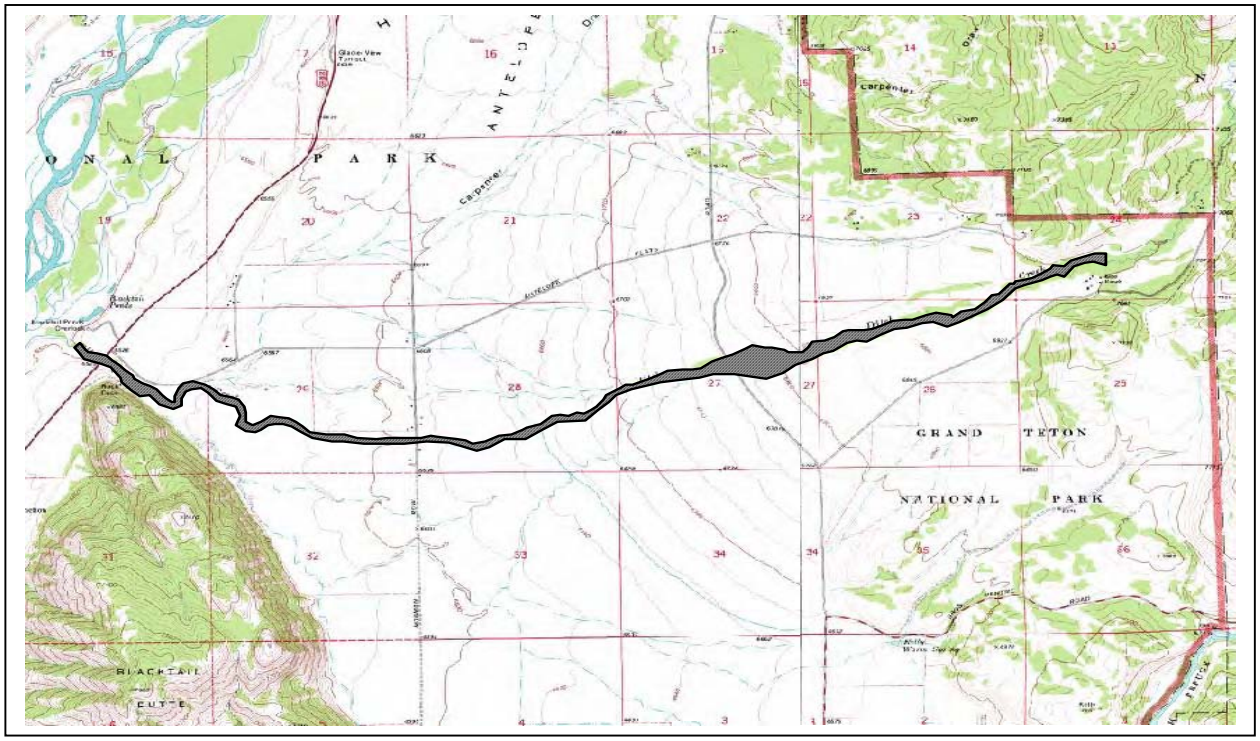


Figure 7. Extent of population of *Stephanomeria fluminea* along Ditch Creek. Moran Quad, Shadow Mountain Quad. T43N R115W.

Above Gros Ventre Road to roughly 1/4 mile west of the Park boundary, plants were scattered but abundant. Further east, the creek narrows to, on average, less than 120 feet across. Here, dense willow stands crowd the shoreline, and no plants were recorded within 1/8 mile of the boundary.

Between Mormon Row and the Snake River, the channel narrows to less than 100 feet (average), and water surfaces and goes underground repeatedly. Very few (5) plants were recorded in this section of stream bed, perhaps due to modified hydrology resulting from historical diversions for irrigation.

Gros Ventre River - Eastern boundary of Park to 1/2 miles below Highway 26/89/191

This stretch of river (Fig. 8) has abundant stands of mature *Populus angustifolia* within the bed, as well as varied elevations of gravel and cobble bars, and supported a large population of *S. fluminea*. *Heterotheca depressa* was also abundant, as was *Agrostis stolonifera*, *Melilotus officinalis*, *Chenopodium album*, *Polygonum lapathifolium*, and *Centaurea maculosa*. Other species occurred at lower abundance and in more scattered distribution.

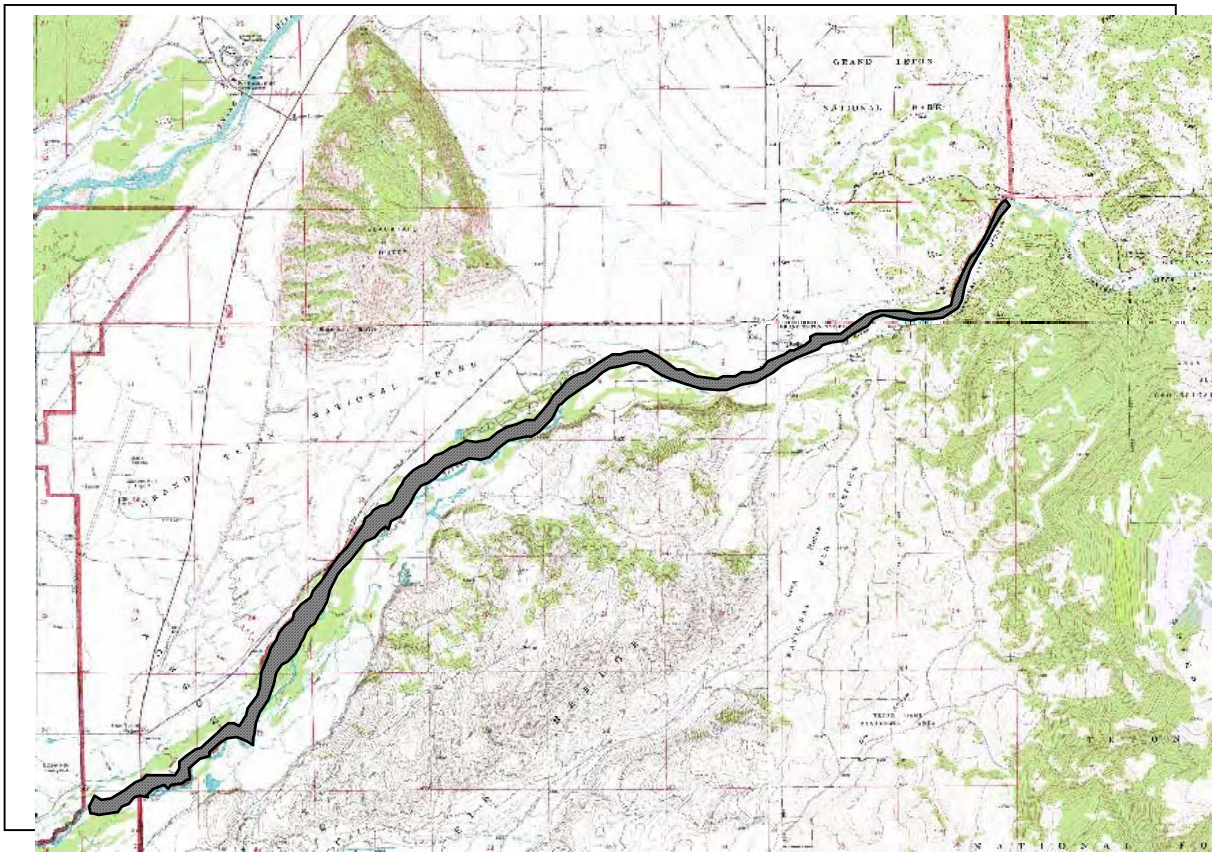


Figure 8. Extent of population of *Stephanomeria fluminea* along the Gros Ventre River. Gros Ventre Jct. Quad, Blue Miner Lake Quad, Shadow Mtn. Quad. T42N R 115W, 116W.

Although this drainage did not support the high total numbers as did Pilgrim Creek, it did have sites with some of the most robust plants and highest concentrations of plants in any of the drainages examined. A total of 726 individuals was counted in an area roughly 50 x 100 feet on a cobble bar just below Kelly. Some of these were nearly 30 inches in height with crowns that spanned 18 - 20 inches.

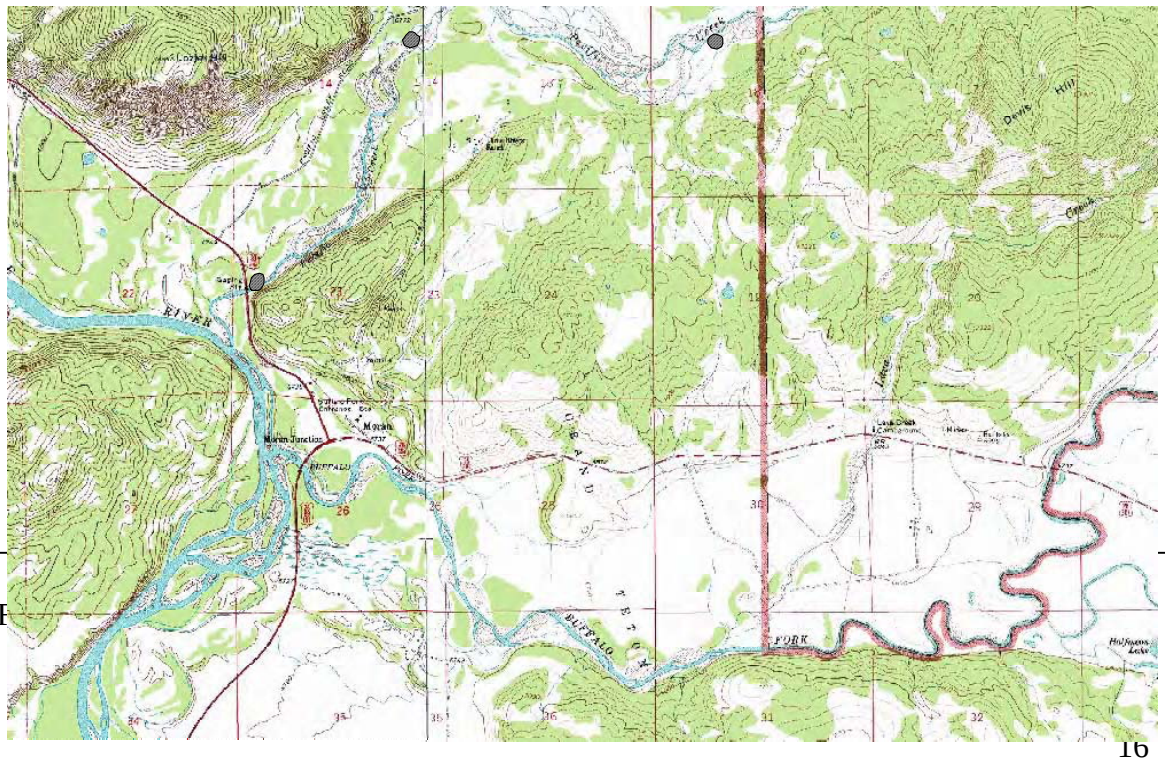
One possible explanation for the unusual growth and density is the calcareous substrate that blankets the stream bed. The Gros Ventre River flows through the Madison Limestone Formation for several miles upstream, and below limestone cliffs just above Kelly. The flush of mineral nutrients may well influence the size and abundance of this species. However, there are no experimental data to support this idea.

Because the northern shoreline of this river defines the southern boundary of the Park, only this part of the river bed was surveyed. There is no reason to believe that the south side of the river did not also support an equally healthy population.

Pacific Creek - Eastern boundary of Park to Snake River

Similar to Buffalo Fork River, Pacific Creek (Fig. 9) is characterized by few mature individuals of *Populus angustifolia*, although seedlings are common. While no species dominated, those which were common include *Agrostis stolonifera, Epilobium ciliatum, Trifolium hybridum,* and *Salix geyeriana*. *Heterotheca depressa* was present in low abundance and only twelve individuals of *S. fluminea* in three populations were recorded.

Curiously, Gottlieb (1999) reported a population of 250 to 500 plants in the Pacific Creek drainage. It is quite possible that this population no longer exists, perhaps as a result of churning during spring floods.



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Pilgrim Creek - Eastern boundary of Park to Jackson Lake

This creek (Fig. 10) is the type locality for the species, and has all of the characteristics which appear necessary to support a large population of *S. fluminea*. The wide bed is

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these higher features probably represent benches that have not been flooded in many years. One such elevated site supported a population of 652 individuals in a (roughly) 100 x 50 foot area, a decided departure from the generalized habitat description outlined by Gottlieb (1999) which suggested that annual flooding was a common site characteristic.

A total of 5,942 plants was recorded from the Park's east boundary to where the creek enters Willow Flats above Jackson Lake. Here, it diverges into multiple, narrow channels lined with willows (*Salix boothii, S. eriocephala, S. geyeriana*), the substrate becomes finer, and gravel and cobble bars become much less common. No additional plants were observed in any of these channels.

Spread Creek - Eastern Park boundary to Snake River

Spread Creek (Fig. 11) is very similar to Pilgrim Creek in stream bed morphology and plant species composition, with *Heterotheca diffusa, Populus angustifolia, Agrostis*

stolonifera, and *Melilotus officinalis* being especially common. *Stephanomeria* was also abundant, with 2199 individuals recorded, most of these between the Park boundary and Highway 26/89/191.

Below the highway, the creek bed flattens out, becomes very wide, and breaks into numerous channels. Some of these channels are heavily shaded as they cut though the dense, riparian vegetation adjacent to the Snake River. No plants were found within the shady sites, and very few were found on the broad, intervening flood plains.

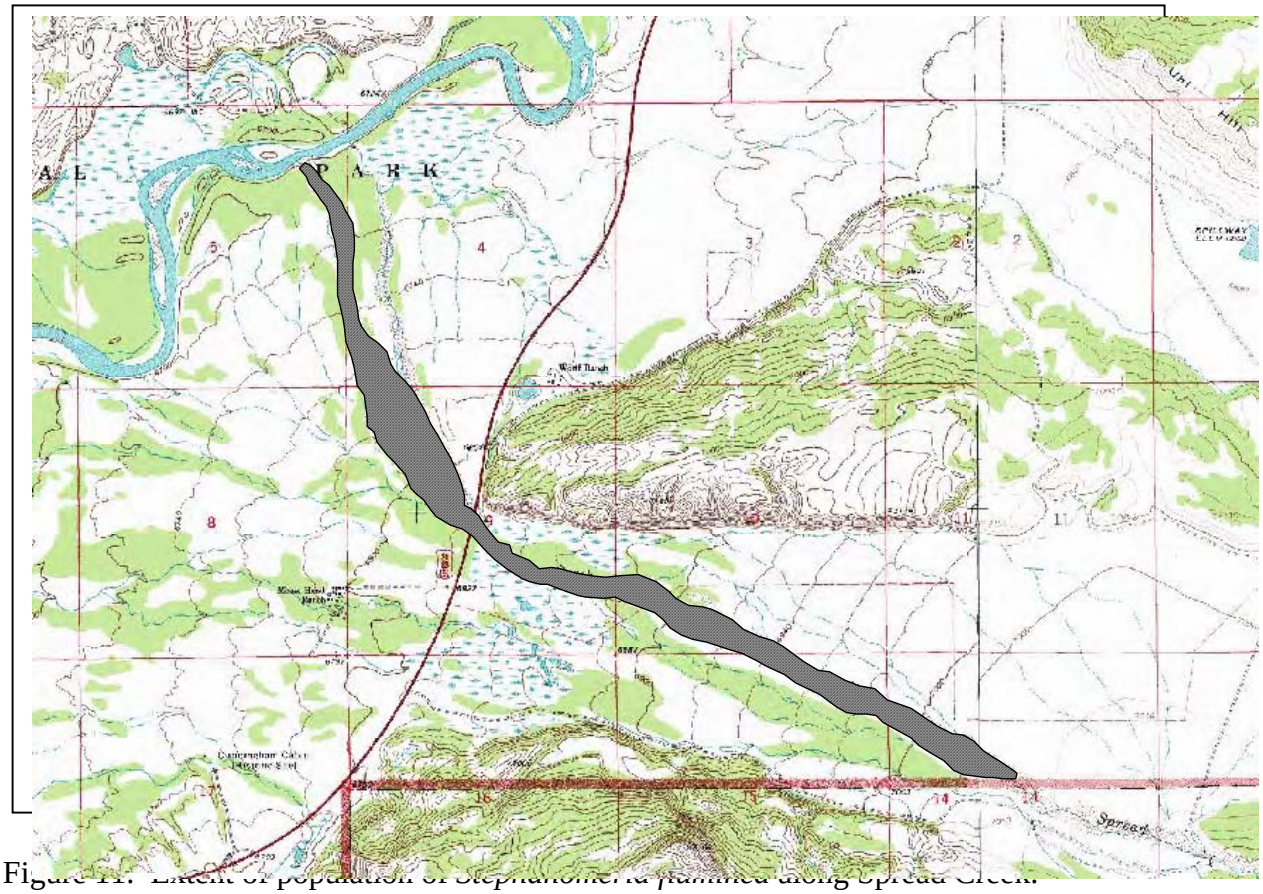

Figure 11. Extent of population of *Stephanomeria* plantlike along Spread Creek. Moran Quad, Davis Hill Quad. T44N R114W

Appendix C. Collection data, *Stephanomeria fluminea*

28 July 2001
Wyoming, Teton Co., Grand Teton National Park. T46N R114W S31 SE1/4.
North side of Pilgrim Creek, ca .3 air miles east of Highway 89/191/287, ca 7.5 air miles north of Moran. Cobble bar with *Heterotheca depressa, Populus angustifolia, Epilobium suffruticosum, Melilotus officinalis*. Elev. 6900 feet. *Markow 12170*

16 August 2001
Wyoming, Teton Co., Grand Teton National Park. T44N R114W S9 SE1/4.
N side of Spread Creek, ca .5 air miles east of Highway 26/89/191, ca .4 air miles south of Moran. Gravel bar with *Heterotheca depressa, Agrostis stolonifera, Populus angustifolia*. Elev. 6800 feet. *Markow 12212*

31 August 2001
Wyoming, Teton Co., Grand Teton National Park. T45N R114W S23 NW1/4.
South side of Pacific Creek, 100 yards east of Highway 89/191/287, ca 1 air mile southwest of Moran. Gravel bar with *Agrostis stolonifera, Heterotheca depressa, Populus angustifolia, Epilobium ciliatum*. Elev. 6750 feet. *Markow 12219*

2 September 2001
Wyoming, Teton Co., Grand Teton National Park. T45N R114W S26 NW1/4.
South side of Buffalo Fork River, ca 200 yards southeast of Highway 26/89/191, ca .5 air miles south of Moran. Gravel bar with *Populus angustifolia, Solidago missouriensis, Heterotheca depressa, Achillea millifolium, Aster ascendens*. Ten plants within 10 ft. square area. Elev. 6720 feet. *Markow 12223*

3 September 2001
Wyoming, Teton Co., Grand Teton National Park. T42N R116W S35 NW1/4.
North side of Gros Ventre River, ca 100 yards west of Highway 26/89/191, ca 300 yards southwest of Gros Ventre Junction, ca 7 air miles north of Jackson. Rocky stream bed in dry channel with *Agrostis stolonifera, Heterotheca depressa, Polygonum lapathifolium. Melilotus officinalis*. Elev. ca 6400 feet. *Markow 12224*

3 September 2001
Wyoming, Teton Co., Grand Teton National Park. T42N R115W S10 NW1/4.
Gros Ventre River Drainage, ca 1/2 air mile southwest of Kelly, ca 1 air mile east of Gros Ventre Campground, ca 100 yards north of Gros Ventre River. Cottonwood grove, 70-90% canopy coverage with *Populus angustifolia, Heterotheca depressa, Shepherdia canadensis, Poa pratensis*. Elev. 6650 feet. *Markow 12227*

4 September 2001
Wyoming, Teton Co., Grand Teton National Park. T43N 115W S27 NE1/4.
Ditch Creek, 100 yards west of Gros Ventre River Road, ca 4 air miles east of Moose, ca 14 air miles north of Jackson. Rocky stream channel with *Heterotheca depressa, Populus angustifolia, Purshia tridentata, Melilotus officinalis*. Elev. 6800 feet. *Markow 12229*

Appendix D. GPS coordinates (UTMs) and elevations (feet) of populations of *Stephanomeria fluminea*

Note: In all drainages except Buffalo Fork River and Pacific Creek, populations were continuous and, therefore, only the western and eastern extremes are reported.

Buffalo Fork River

	0539169	0540834	0541494
	4853713	4852548	4852424
Elevation	6720	6850	6860

Ditch Creek

From	0524557	to	0533311
	4834399		4835685
Elevation	6500		7000

Gros Ventre River

From	0520862	to	0533659
	4823438		4831802
Elevation	6360		6740

Pacific Creek

	0538882	0540122	0542478
	4855176	4857180	4857136
Elevation	6650	6760	6820

Pilgrim Creek

From	0532605	to	0535901
	4858999		4864123
Elevation	6840		7080

Spread Creek

From	0536145	to	0540526
	4850780		4846997
Elevation	6700		7040