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Balsamorhiza rosea and Eriogonum thymoides in Benton County, Washington, 1976¹

Abstract

The distribution of *Balsamorhiza rosea* and *Eriogonum thymoides*, plants on the Smithsonian Institution's Threatened and Endangered Species List, was examined in Benton County, Washington, during the spring of 1976. Both species occupied stony, basaltic substrates on ridge crests. Apparent hybridization between *B. rosea* and *B. careyana* is described.

The major man-induced threat to ridge crest habitats is the building of television and radio communication towers and their associated access roads. Small plant populations could be extirpated by these construction activities if some provision is not made for conservation of habitat.

Introduction

Scientific and educational interest in preserving and protecting representative habitats of native plants in the United States is growing as the demand for converting wild acreages to agricultural, residential, and industrial use increases. The protection of wild habitats on federally owned lands in the Pacific Northwest for scientific and educational purposes has been pioneered by the United States Forest Service (Franklin *et al.*, 1972). There is also a renewed interest in providing protection for plant species whose populations are so low that they are in danger of becoming extinct. One of the initial steps in providing protection is the preparation of a list of species believed to be in need of protection. Such a list has been published by the Smithsonian Institution (1974) and shows two Washington shrub-steppe species, *Balsamorhiza rosea* Nels. and Macbr. (Compositae) and *Eriogonum thymoides* Benth. (Polygonaceae), as being "threatened."

This paper provides recent information concerning the occurrence of these plants in Benton County, Washington, a rapidly developing area for irrigated agriculture and industry.

History

The first list of vascular plant species of Benton County was published by St. John and Jones (1927). These authors cite herbarium specimens from the Rattlesnake Hills for both *E. thymoides* and *B. rosea*.

Hitchcock *et al.* (1955-69) describe the distribution of *B. rosea* from only three

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localities, all in south-central Washington, and the type locality is indicated as the Rattlesnake Hills. *Eriogonum thymoides* is described as being widely distributed in the shrub-steppe region east of the Cascade Mountains in Washington and Oregon, extending eastward into Idaho.

Weber (1946) collected specimens of *B. rosea* from a rocky hilltop southwest of the town of Touchet in adjacent Walla Walla County and St. John (1956) described its occurrence in Spokane County as local.

Methods

Because *B. rosea* and *E. thymoides* are both restricted to the very stony soils of ridge crests, the search was restricted to ridges. Visits were made by car and foot to the prominent ridges in Benton County in May 1976 when plants were in flower (Fig. 1).

A suspected hybrid of *B. rosea* x *B. careyana* was selected for study. Leaves and flowering stalks of ten plants were counted and the longest leaf of each plant was collected and pressed.

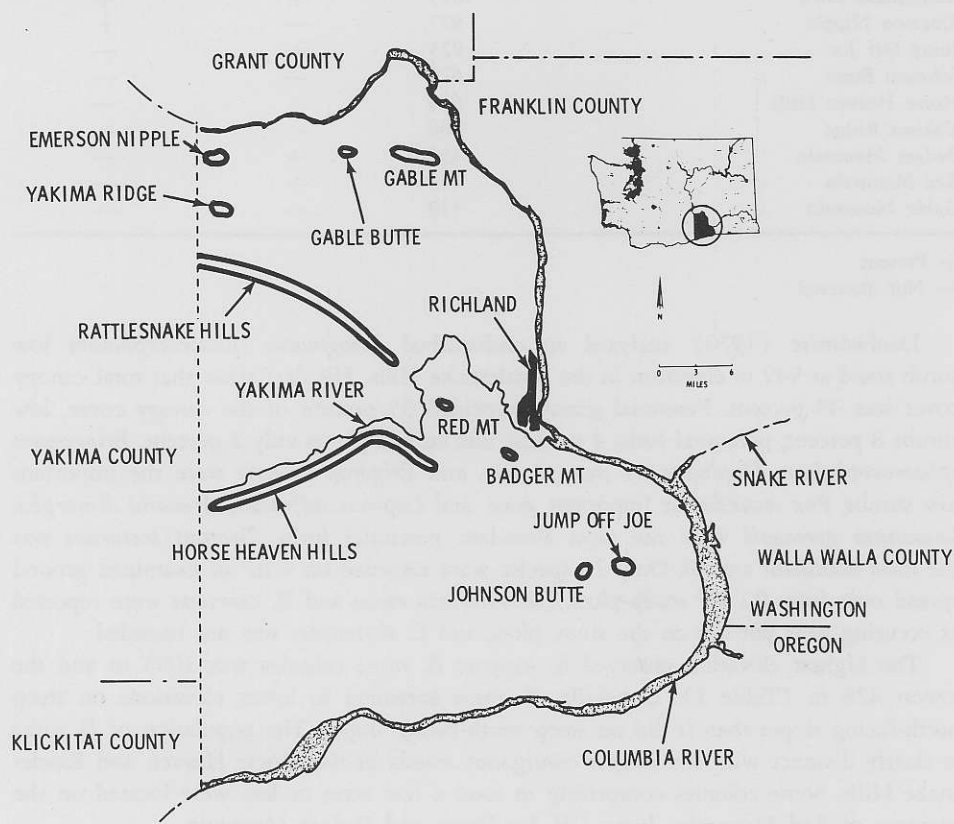


Figure 1. Map of Benton County, Washington, showing prominent ridges searched for populations of *Balsamorhiza rosea* and *Eriogonum thymoides*.

Results and Discussion

Occurrence in Benton County

The locations of plant populations found in Benton County are shown in Table 1. *Eriogonum thymoides* is probably restricted to the ridge crest habitats on Emerson Nipple, Yakima Ridge, and the Rattlesnake Hills. *Balsamorhiza rosea* was found on the Rattlesnake Hills, Jump Off Joe Butte, Badger Mountain, and Red Mountain; but it was especially abundant in the Horse Heaven Hills. *Eriogonum thymoides* was less widely distributed than *B. rosea*, and it was also less abundant when the two species occupied the same habitat. For example, a site in the Rattlesnake Hills showed that *B. rosea* plants were 45 times more numerous than *E. thymoides* (density of 18/m² compared to 0.4/m²).

TABLE 1. Occurrence of *B. rosea* and *E. thymoides* in Benton County, Washington.

Location	Elevation (maximum) meters	Taxa	
		<i>B. rosea</i>	<i>E. thymoides</i>
Rattlesnake Hills	1093	+	+
Emerson Nipple	977	—	+
Jump Off Joe	923	+	—
Johnson Butte	623	—	—
Horse Heaven Hills	624	+	—
Yakima Ridge	508	—	+
Badger Mountain	458	+	—
Red Mountain	428	+	—
Gable Mountain	339	—	—

+ Present

— Not observed

Daubenmire (1970) analyzed an undisturbed *Eriogonum sphaerocephalum* low shrub stand at 949 m elevation in the Rattlesnake Hills. His data show that total canopy cover was 49 percent. Perennial grasses provided 35 percent of the canopy cover, low shrubs 8 percent, perennial forbs 4 percent, and annual plants only 2 percent. *Eriogonum sphaerocephalum*, *Haplopappus stenophyllus*, and *Erigeron linearis* were the important low shrubs, *Poa secunda* the important grass, and *Lupinus sulfureus*, *Arenaria dimorpha*, *Lomatium gormanii* were the most abundant perennial forbs. *Bromus tectorum* was the most abundant annual. Only 20 species were recorded on 4 m² of examined ground spread over forty 0.1 m² study plots. *Balsamorhiza rosea* and *B. careyana* were reported as occurring near but not on the study plots, and *E. thymoides* was not recorded.

The highest elevation observed to support *B. rosea* colonies was 1093 m and the lowest 428 m (Table 1). Generally, *B. rosea* extended to lower elevations on steep north-facing slopes than it did on steep south-facing slopes. The population of *B. rosea* is clearly disjunct with the largest contiguous stands in the Horse Heaven and Rattlesnake Hills. Some colonies comprising in total a few acres or less were located on the summits of Red Mountain, Jump Off Joe Butte, and Badger Mountain.

Man's Influence on Ridge Crest Habitats

Deep, stone-free soils of surrounding ridges are intensively managed for dryland wheat



Figure 2. Photographs of *B. rosea* (upper), *B. careyana* (lower), and suspected hybrid plants (middle). A leaf of *B. careyana* is shown with *B. rosea* as an indication of relative plant size.

or irrigated crops and orchards so that only the ridge crests support islands of native vegetation surrounded by many acres under agricultural management.

The most obvious man-induced disturbances currently being imposed on ridge crest plant communities today are the construction of radio and television communication towers, their supporting buildings, and the service roads leading to the facilities (Fig. 2). Although the acreage occupied by such facilities is not very large, neither is the total acreage occupied by *B. rosea* and *E. thymoides*. Even when small parcels of land are pre-empted, the population on a particular site can be substantially reduced. At this time, there is no special protection provided for ridge crest habitats except in the portions of Rattlesnake Hills located within the boundaries of the Arid Lands Ecology (ALE) Reserve, a tract of land maintained in a wild condition by the Energy Research and Development Administration as a site for scientific and educational study.

Ridge crest plant species have probably been little affected by past agricultural use. In the future, agriculture will probably have little direct impact on these species because the soil is unsuitable for cultivation. However, these communities are subjected to drift of aerially applied chemical herbicides when nearby agricultural fields are sprayed. The impact of this herbicide drift on ridge crest plant communities has not been investigated.

Temperature Gradients

Although soil stoniness appears to be a necessary component of *B. rosea* habitat, other abiotic factors are also important. Stony soils often occur on low altitude ridges, but these were not observed to support *B. rosea*. This finding suggests that climate plays an important role in determining whether *B. rosea* can successfully exist on otherwise superficially suitable substrates. Average daily maximum and minimum air temperatures are shown in Table 2. These temperatures were collected from thermographs in standard weather bureau shelters placed along an elevational gradient in the Rattlesnake Hills. *Balsamorhiza rosea* was not found on the Rattlesnake Hills where the average maximum air temperature at this time of year exceeded 19°C. It should be noted that ground level temperatures are often much higher (Hinds and Rickard, 1972). Soil water is an important consideration in plant growth, but stony soils are a difficult media in which to obtain meaningful measurements.

Balsamorhiza careyana is common in Benton County, grows on deep soils at the lowest altitudes, and extends to the highest altitudes as long as the soil profile remains partly stone-free. *Balsamorhiza careyana* often grows within a few meters of *B. rosea*

TABLE 2. Average air temperatures along an altitudinal gradient in the Rattlesnake Hills during the period April 15-May 15 inclusive for 1973, 1974, and 1975.

Station	Elevation		1973		1974		1975		Average	
	(m)	(ft)	Mx	Mn	Mx	Mn	Mx	Mn	Mx	Mn
Observatory	1075	(3530)	12.9	3.8	*13.1	*4.5	*11.4	*3.9	12.7	4.0
Anderson Rim	884	(3000)	15.9	5.3	11.4	2.2	14.0	2.5	13.8	3.3
Upper Snively	533	(1750)	*20.7	*6.4	*19.3	*6.4	*15.8	*5.0	18.5	5.9
Lower Snively	323	(1060)	*22.3	*8.6	19.4	7.6	18.2	6.0	19.9	7.5
Meteorology Station	223	(730)	22.8	6.4	20.6	6.4	20.0	5.4	21.1	6.1

* Data missing in part due to instrument failure.

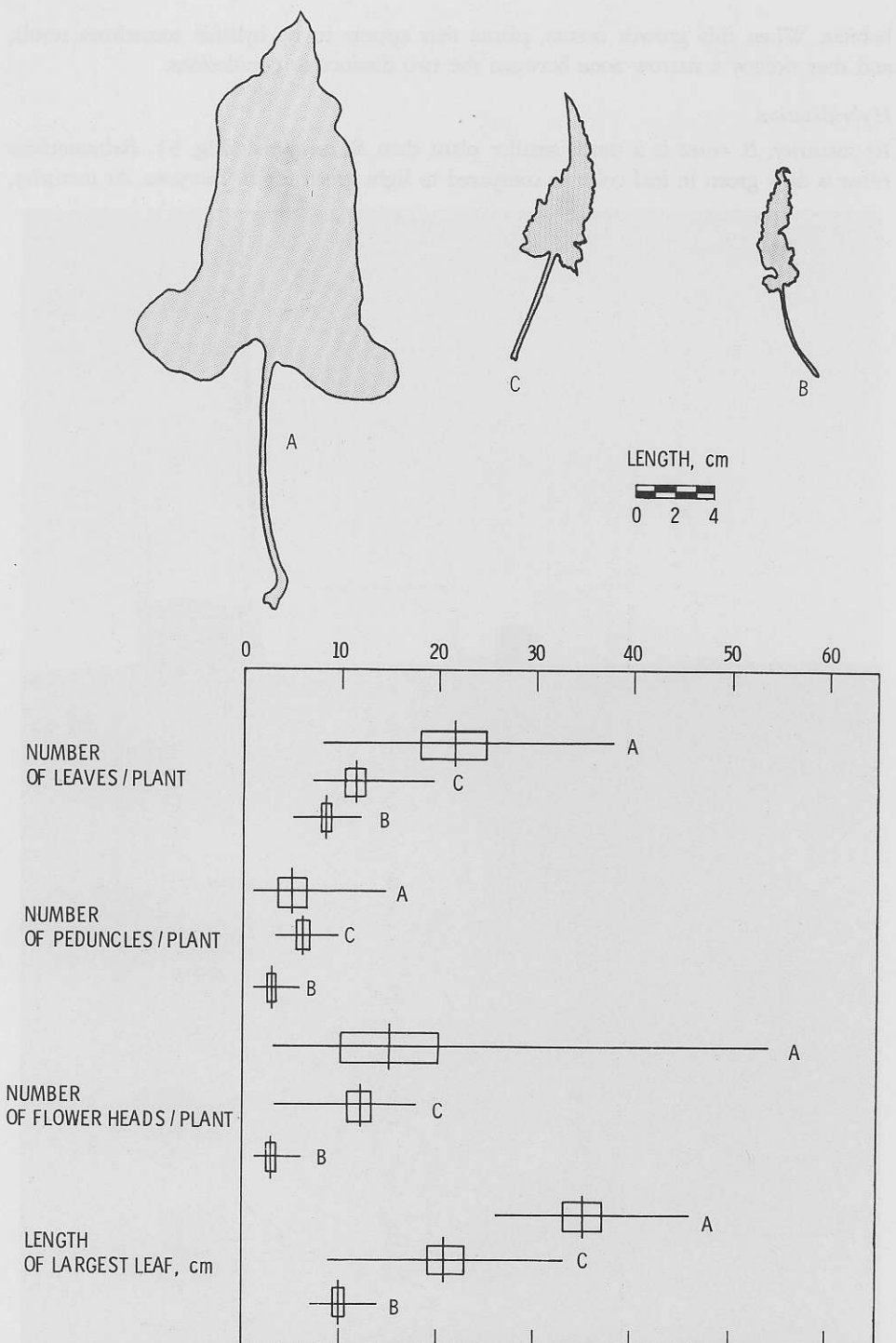


Figure 3. Leaf outlines of *B. rosea* (B), *B. careyana* (A) and suspected hybrid (C) with ancillary anatomical measurements showing range and mean values and the standard error of the mean, $n = 10$.

habitat. When this growth occurs, plants that appear to be hybrids sometimes result, and they occupy a narrow zone between the two distinctive populations.

Hybridization

At maturity, *B. rosea* is a much smaller plant than *B. careyana* (Fig. 3). *Balsamorhiza rosea* is dark green in leaf color as compared to light green for *B. careyana*. At maturity,



Figure 4. Communication facilities located on the crest of the Rattlesnake Hills. These kinds of facilities pre-empt scarce ridge crest plant habitat.

the petals of *B. rosea* take on a reddish coloration that is absent in *B. careyana*. The leaves and peduncles of *B. rosea* tend to be prostrate while those of *B. careyana* are more upright. Tracings made from pressed leaves of *B. rosea* and *B. careyana* are shown in Fig. 4 along with data showing the number of leaves per plant, number of peduncles per plant, number of flowering heads per plant, and the length of the largest leaf. The suspected hybrid is usually intermediate in regard to these measurements.

Ownbey and Weber (1943) have described suspected hybrids between *B. careyana* and *B. deltoidea*, *B. careyana* and *B. hirsuta* var. *lagocephala*, *B. careyana* and *B. hookeri*, *B. careyana* and *B. sagittata*, *B. careyana* and *B. serrata*, *B. sagittata* and *B. hirsuta* var. *lagocephala*, *B. sagittata* and *B. hispidula*, *B. sagittata* and *B. hookeri*, *B. sagittata* and *B. incana*, *B. sagittata* and *B. serrata*. They have suggested that hybridization in wild populations of *Balsamorhiza* could be treated experimentally to lead to a better understanding of speciation in plants. Weber (1946) determined the haploid number of *B. rosea* as 19 and the diploid number of *B. careyana* as 38.

Aggressiveness

Balsamorhiza rosea populations occupy relatively little total acreage and thus are vulnerable to extirpation or perhaps extinction by man's activities. However, it seems to be aggressively invading the disturbed ground, associated with mechanical scraping of roadsides. This aggressiveness could enhance its ability to survive future soil disturbances. *Eriogonum thymoides* did not seem to have this same ability, but the opportunities to observe seedling establishment of *E. thymoides* were also much less frequent.

Conclusion

Balsamorhiza rosea and *Eriogonum thymoides* occupy relatively little acreage in Benton County, Washington, but the present-day distribution is probably much like it was before man began agricultural and industrial development more than a hundred years ago. The major threat to habitat today is road building, off-road vehicular traffic, and the choice of ridge crest locations for communication transmission facilities. Future development of ridge crest sites may involve the building of wind stations to generate electricity.

Agricultural development has had little apparent impact on ridge crest sites because of poor quality soil, but the impact of herbicide drift on these ridge crest plant communities has not been investigated.

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