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Habitat Characteristics of *Sidalcea nelsoniana* Piper (Malvaceae) at Walker Flat, Yamhill County, Oregon

Abstract

The habitat characteristics of Nelson's checkermallow (*Sidalcea nelsoniana* Piper), a species proposed for listing by the U.S. Fish and Wildlife Service as threatened or endangered, were studied at Walker Flat, the site of the plant's largest population in the northern Oregon Coast Range. A proposed water supply reservoir would flood the site, eliminating the population. It was therefore necessary to discover if the site was unique or was critical habitat for the species. We found that *S. nelsoniana* is not habitat specific, but occurred in a variety of plant communities—grass meadows, sedge marsh, and heterogeneous wetland and riparian communities. *S. nelsoniana* exhibited tolerance for disturbance and for a variety of soil conditions. Soil textures ranged from clay to loam and exhibited considerable chemical variation. The species was not found on those portions of the site where soils remained wet throughout the growing season. The tolerance of *S. nelsoniana* for a variety of habitats may account for previous inconsistent reports about habitat preferences.

Introduction

Nelson's checkermallow (*Sidalcea nelsoniana* Piper) has been reported as endemic to the Willamette Valley of Oregon by Hitchcock (1957) and Hitchcock and Cronquist (1961). Descriptions of its habitat have been inconsistent and occasionally contradictory (Hitchcock 1957, Hitchcock and Cronquist 1961, Peck 1961, Meinke 1982). In 1984, the species was found at Walker Flat in the Coast Range of western Yamhill County, Oregon, where the City of McMinnville Water and Light Department (MWLD) has proposed to build a water supply reservoir.

S. nelsoniana is listed as a Category 2 plant, those for which information is inadequate to determine if listing as threatened or endangered is appropriate. They are, however, treated as under petition for listing (Fish and Wildlife Service 1985). This paper reports on studies undertaken at Walker Flat in 1985 to document the population size of *S. nelsoniana* there and the physical and chemical characteristics of the habitats in which it occurred.

Methods and Materials

Aerial photographs of Walker Flat were examined and vegetation cover types were identified and mapped on a large-scale contour map of the area. Sixteen grids were established for the inventory of *S. nelsoniana* (Figure 1). Grids were laid out in 15 m by 15 m blocks along a central baseline. All of the open areas of the site were entirely within grids. Forested margins and dense tree stands were searched during the flowering season.

The grids were mapped block by block on 2 and 3 July 1985. Each 15 m by 15 m block was divided into 1 m^2 plots (225 plots per block), which were examined individually. This technique yielded frequency values for *S. nelsoniana* at each grid (Frequency = [number of plots in which *S. nelsoniana* occurred/total number of plots examined] $\times$ 100). The relative cover of *S. nelsoniana* was visually estimated at each grid after mapping was completed. Mapping data were summarized and frequency values were calculated for each grid.

Ten stations for collection of physical and chemical habitat conditions data (HC stations) were established on 12 April 1986 (Figure 1). Their locations were randomly determined. Labeled stakes were driven into the ground to mark each station.

The first habitat conditions measurements were taken on 12 April 1985, followed by

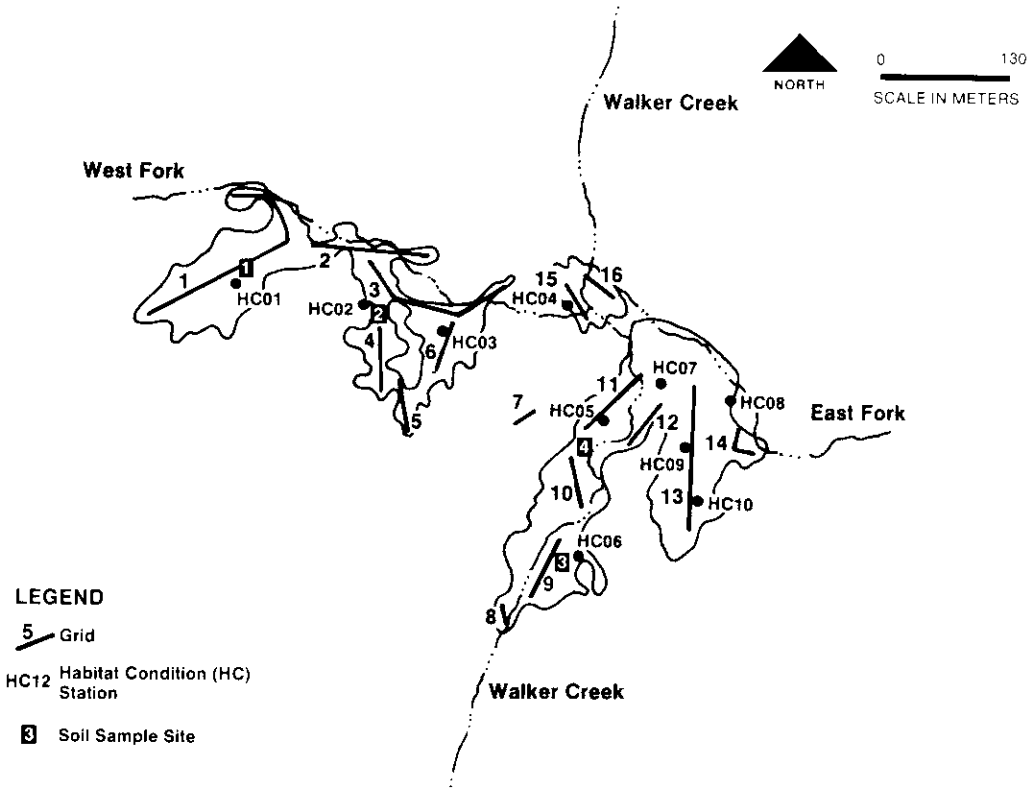

Figure 1. Approximate locations of mapping grids at Walker Flat.

sampling at monthly intervals through 19 March 1986. Air temperature, soil pH, soil temperature, and soil moisture were measured at each station. Since soil temperature, pH, and moisture measurements required disturbing the soil, each sample was taken at a different location within a 1 m radius of the stake.

Air temperature was measured by hanging a mercury thermometer on a shaded branch as near as possible to the stake marking the station. It was allowed to equilibrate for at least one minute before it was read to the nearest 0.5°C. Mean air temperatures for each sampling day were calculated. A recording thermometer was installed on 10 April 1985 at MWLD's weather station at McGuire Dam, about 1.1 km from Walker Flat and at approximately the same elevation. During data analysis, comparisons were made between temperatures at sampling stations and those at McGuire Dam for the same time period.

Precipitation records from McGuire Dam and from the National Weather Service station at Haskins Dam, located about 7.5 km from Walker Flat and at a lower elevation, were obtained to document precipitation patterns at Walker Flat.

Soil pH was measured on a sample taken from the bottom of a 10 cm deep, freshly dug, hole, using a pH Computer Acid/alkaline Soil Tester (Environmental Concepts). Soil temperatures were measured with a dial-type thermometer with a 30-cm stainless steel probe, scribed at 5 cm, 10 cm, and 20 cm from its tip. It was pushed into the soil to the 5 cm depth and allowed to equilibrate for about 1 minute, then a reading was taken to the nearest 0.5°C. This procedure was repeated at 10 cm and 20 cm, without removing the probe from the soil. Mean soil temperatures were calculated at each depth for each sampling day.

Soil moisture was measured with a "Quick Draw" Soilmoisture Probe (Soilmoisture Equip-

ment Company). The probe was inserted into a 20-cm deep hole made with the coring tool supplied with the instrument. After about one minute, during which the tip of the probe was allowed to reach approximately the same temperature as the soil, adjustments began and were continued until the reading (in centibars of soil suction [1 centibar = 1 kPascal]) became constant.

Soil texture and chemistry samples were taken at four sites on 13 August 1985. The sites were representative of the different habitats in which *S. nelsoniana* was relatively abundant. Samples 1, 2, and 3 were taken near stations HC01, HC02, and HC06, respectively. Sample 4 was taken about 50 m south of HC05. Soil from just beneath the surface to about 20 cm deep was mixed thoroughly. Plant material and stones were removed to the extent possible. Samples were analyzed by the Oregon State University (OSU) Soils Testing Laboratory and Soil Physics Laboratory.

Results and Discussion

Six vegetation cover types were identified and mapped (Figure 2): grass meadow, sedge marsh, heterogeneous wetland vegetation, riparian tree/shrub, forest, and disturbed area. The grass meadow, sedge marsh, riparian tree/shrub, and forest cover types included two or more distinct plant communities having sufficient similarity of species composition or community structure to be grouped together under a vegetation cover type map category.

The results of the *S. nelsoniana* mapping survey are presented in Table 1. Of the more than 37,000 1 m^2 plots examined at Walker Flat, 9.2 percent contained *S. nelsoniana*. The frequency of *S. nelsoniana* varied among the sixteen grids from zero to over 22 percent. Its cover never

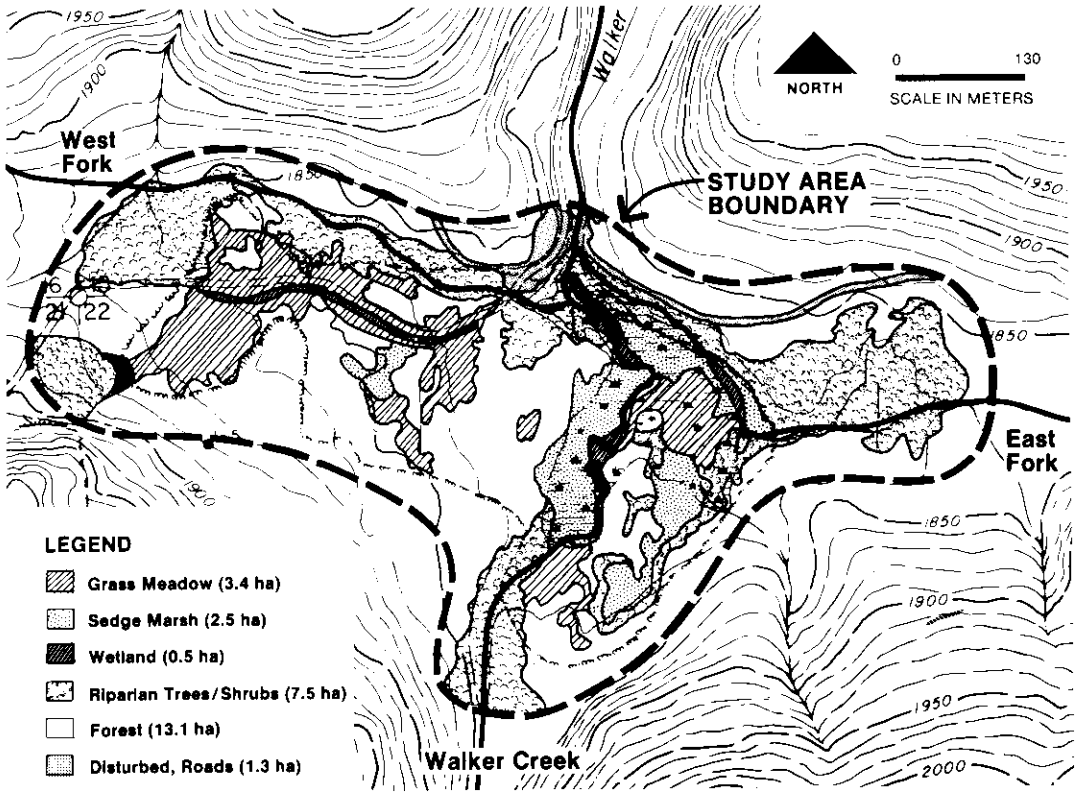

Figure 2. Vegetation cover types at Walker Flat.

TABLE 1. Summary of *Sidalcea nelsoniana* grid mapping data from Walker Flat, 1985.

Grid No.	Vegetation Cover Type[1]	Approximate Area (ha)	Total Plots[2] On Grid	Percent Frequency[3] Per Grid	Percent Cover[4] Per Grid
01	GM, SM, WA	0.88	9002	22.21	<3
02	GM, WA	0.20	2025	15.41	<2
03	GM, WA	0.25	2476	10.42	<1
04	SM, WA	0.13	1351	5.70	<2
05	GM	0.09	899	0.89	<1
06	GM, SM	0.25	2474	7.60	<1
07	GM	0.02	225	0.89	<1
08	RI	0.05	500	0.00	0
09	GM, SM, RI	0.44	4391	5.47	<1
10	SM, GM	0.13	885	3.52	<1
11	SM, GM	0.27	2700	0.15	<1
12	WA	0.09	900	0.00	0
13	GM, SM, WA	0.58	5864	1.62	<1
14	SM, GM	0.05	450	1.11	<1
15	SM, GM	0.09	909	0.11	<1
16	GM	0.05	449	3.56	<1
TOTALS		3.57	35502		

[1]The first vegetation cover type listed covered most of the grid; the rest were also present. GM = grass meadow, SM = sedge marsh, WA = heterogeneous wetland vegetation, RI = riparian trees/shrubs.

[2]Plots were 1 m^2.

$$\text{[3]Percent frequency} = \frac{\text{number of 1 m}^2\text{ plots containing } \textit{Sidalcea nelsoniana}}{\text{total number of 1 m}^2\text{ plots in grid}} \times 100$$

$$\text{[4]Percent cover} = \frac{\text{area of grid covered by } \textit{Sidalcea nelsoniana}}{\text{total area of grid}} \times 100$$

exceeded 3 percent and was usually less than 1 percent. The distribution of *S. nelsoniana* varied considerably among vegetation cover types and plant communities. Vegetation cover types and their constituent plant communities are discussed below, together with qualitative estimates of the abundance of *S. nelsoniana* within each plant community.

Grass Meadow. S. nelsoniana occurred in all the grids that included grass meadows and reached its greatest abundance in the west grass meadow area (grids 01, 02, and 03). These communities remained relatively dry throughout the year. Most of the grasses were introduced species (e.g., meadow fescue [*Festuca pratensis* Huds.], tall fescue [*Festuca arundinacea* Schreb.], velvet-grass [*Holcus lanatus* L.], orchard-grass [*Dactylis glomerata* L.]) and occurred only in the grass meadows. Such forbs as night-blooming morning-glory (*Convovulus nyctagineus* Greene), Oregon iris (*Iris tenax* Dougl.), early blue violet (*Viola adunca* Sm.), and buttercups (*Ranunculus* spp.) were present, but their abundance did not approach that of grasses. Shrubs (e.g., serviceberry [*Amelanchier alnifolia* Nutt.], common snowberry [*Symphoricarpos albus* (L.) Blake], and clustered wild rose [*Rosa pisocarpa* Gray]) were usually

scattered throughout the meadows. Most of the areas mapped as grass meadows contained low pockets supporting dense stands of slough sedge (*Carex obnupta* Bailey). Other *Carex* species were thinly scattered among the grasses and forbs.

Sedge Marsh. The five sedge marsh communities at Walker Flat were found on soils that ranged from flooded to moderately dry.

A commonly occurring wet sedge marsh community covered large portions of grids 10 and 11, areas where *S. nelsoniana* was never found. Dominated by small-fruited bulrush (*Scirpus microcarpus* Presl.) and creeping buttercup (*Ranunculus repens* L.), this community occurred on the lower floodplain of Walker Creek and its tributaries. The soil remained noticeably wet throughout the summer.

S. nelsoniana was not found in the wet sedge marsh community where bigleaf sedge (*Carex amplifolia* Boott) and marsh violet (*Viola palustris* L.) were among the dominants. This community occurred along the main stem of Walker Creek and in the triangle formed by the confluence of the main stem and the east fork. Standing or running water was present throughout most of the summer. Most of grid 15 was in this plant community.

S. nelsoniana occasionally occurred in the drier sedge marsh community dominated by *C. obnupta* and California false hellebore (*Veratrum californicum* Durand var. *caudatum* [Heller] Hitchc.). This community was primarily at the upper ends of grass meadows (e.g., Grids 01 and 13), where drainage from adjacent uplands apparently occurred as sheet flow following precipitation.

S. nelsoniana was fairly common in the driest of the sedge marsh communities where *C. obnupta*, bigleaf lupine (*Lupinus polyphyllus* Lindl. var. *polyphyllus*) and Douglas' aster (*Aster subspicatus* Nees) dominated. This community was most extensive at Grid 04. Standing water was present in low pockets during April and early May, but the soil dried as the season advanced. The wet soil appeared to be due partly to poor drainage and slow percolation and partly to high seasonal water tables.

S. nelsoniana often occurred in the ecotone between pockets of *C. obnupta* in low areas and the surrounding grass meadow. This sedge marsh community was dry throughout the summer.

Heterogeneous Wetland Vegetation. S. nelsoniana was found only where the soil dried in early summer in this cover type. No consistent community composition or structure was apparent. This cover type usually occurred along ditches or drainage channels or near the creeks where water backed up behind inactive beaver dams.

Riparian Trees/Shrubs. S. nelsoniana was rarely found in areas mapped as Riparian Trees/Shrubs along Walker Creek and its tributaries.

Three distinct riparian communities occurred at Walker Flat. They formed a transition zone between wetland and upland and included elements of each, as described by Oakley *et al.* (1985). A red alder (*Alnus rubra* Bong) community on the main stem of Walker Creek is the terminus of a riparian forest that lines the banks of Walker Creek for some distance upstream. Vine maple (*Acer circinatum* Pursh) was a major component of the shrub stratum, and the herb stratum supported an abundant growth of mesic forbs. The riparian zone along the west fork of Walker Creek supported an *Alnus rubra*-conifer overstory with skunk cabbage (*Lysichitum americanum* Hulten & St. John), abundant mosses, and few large but scattered shrubs. Crown closure was nearly complete, with very little light reaching the understory. *A. rubra* and willow (*Salix* spp.), with various accompanying shrubs and a variety of understory species, grew sporadically along the banks of Walker Creek and its tributaries. Douglas' spiraea (*Spiraea douglasii* Hook.) also grew in small but dense stands near the north end of Walker Flat and scattered along the east fork.

Forest. S. nelsoniana occurred only at the edges of forest communities where sunlight reaches the ground for more than half the day. Most of the forest map units comprised second-growth conifer communities dominated by Douglas-fir (*Pseudotsuga menziesii* [Mirbel] Franco). Salal (*Gaultheria shallon* Pursh) was the most frequent understory dominant, with swordfern (*Polystichum munitum* [Kaulf.] Presl), and Oregon-grape (*Berberis nervosa* Pursh) occasionally achieving dominance. Seedling and sapling western hemlock (*Tsuga heterophylla* [Raf.] Sarg.) and grand fir (*Abies grandis* [Dougl.] Forbes) were common.

A few small, mixed conifer-hardwood stands occurred on the edges of the open areas. Western crabapple (*Pyrus fusca* Raf.) and black hawthorn (*Crataegus douglasii* Lindl.) were frequently seen in the bottomlands on the southwest side. The mixed forest communities were extremely variable as to understory species.

Disturbed Areas. The disturbed area mapped at the north end of Walker Flat is a graded parking area beside a road. It also served as a camp site, as evidenced by the presence of a fire ring and depositions of garbage and trash. It supported a thin growth of mostly weedy herbs. A few *S. nelsoniana* occurred at the edge of the parking area near the fire ring where disturbance was evident. This map category also included a gravel pit north of Walker Flat and the roads within the study area.

S. nelsoniana occurred at or near 5 of the 10 habitat conditions stations (HC01, HC02, HC03, HC06, and HC09). The other five stations were in plant communities where *S. nelsoniana* was never found or where it occurred only in the ecotones between them and adjacent upland communities.

Air temperatures at Walker Flat were higher than those recorded at McGuire Dam for the same time period. No correlation was made between air temperatures and other measured environmental parameters. Measured air temperatures at Walker Flat did, however, fall within the monthly ranges recorded at McGuire Dam.

Individual habitat conditions stations showed some variations in soil temperatures but all followed the same trends at each measured depth. Mean temperatures at all depths were calculated. Soil temperatures were highest on 22 July 1985 (20°C at 5 cm, 17°C at 10 cm, 15.5°C at 20 cm) and lowest on 18 December 1985 (−2°C at 5 cm and 10 cm, −3.5°C at 20 cm).

Soil pH values varied somewhat at each station over the period of sampling. All stations had mean field pH values in the range 6.5 to 7.0.

Soils remained wet at three stations (HC04, HC05, and HC08) throughout the sampling period. At all other stations, soils were wet to moist (5 to 25 centibars of soil suction) in spring 1985, then dried (25 centibars and higher) as summer advanced. Soil moisture increased again through fall and winter, but reached saturation (0 centibars) only at stations HC04, HC05, and HC08. Five of the stations were within 2 meters of *S. nelsoniana* plants (HC01, HC02, HC03, HC06, and HC09). The speices was never found near the three stations where soils remained wet (HC04, HC05, and HC08). The results of soil moisture sampling indicate that *S. nelsoniana* is intolerant of permanently wet soil.

A comparison of Haskins Dam normal (1968-1983) precipitation with precipitation recorded at McGuire Dam showed that, while fall precipitation (October through December) was somewhat greater than normal, rainfall during winter and spring 1985 was nearly 40 cm short of normal. This variation may have resulted in drier than normal soils at Walker Flat during the 1985 growing season; however, the dominance of upland grass species in the grass meadow communities indicates that those areas always dry out during the summer. Runoff and seepage from adjacent slopes also may have contributed to soil moisture, but most of it was apparently restricted to drainage channels through the grass meadows.

Laboratory pH values were substantially lower than those measured in the field. Daubenmire (1974) noted that field tests for pH often give higher readings than do laboratory tests because of CO_2 in the soil that dissipates during sample handling. Although all four soil sample sites supported *S. nelsoniana,* there were substantial differences in soil chemistry as well as in soil texture (Table 2). There were especially large variations in the major nutrients. A large variation in percent organic matter also indicated substantial differences in the soils. These differences indicate that *S. nelsoniana* tolerates a fairly wide range of soils conditions.

The *S. nelsoniana* at Walker Flat were vigorous, healthy plants. Signs of predation by both insects and larger herbivores were evident, but not to the extent that the apparent vigor of the growing plants was affected. Furthermore, despite an unusually dry winter and soils that dried out considerably through the summer months, *S. nelsoniana* did not seem to be affected by water stress.

S. nelsoniana is not habitat-specific. At Walker Flat it was found in all but the wettest areas and forests. It did extend a short distance into the ecotones between herb and adjacent forest communities, as long as tree canopy was sparse. It was found in all but one of the

TABLE 2. Chemical and physical characteristics of four soil samples collected at Walker Flat, 1985.

	Sample Number			
Chemical Analysis[1]	1	2	3	4
Laboratory pH	5.5	5.1	5.3	5.3
P (ppm)	9	5	3	2
K (ppm)	281	187	168	98
Ca (meq./100g)	14.5	12.1	15.2	15.2
Mg (meq./100g)	8.1	7.8	7.6	5.2
Na (meq./100g)	0.17	0.31	0.36	0.25
B (ppm)	0.39	0.42	0.37	0.36
Total N (%)	0.34	0.32	0.38	0.30
NH_4-N (ppm)	17.0	27.9	19.9	41.0
NO_3-N (ppm)	8.1	16.5	5.7	5.7
Organic matter (%)	6.01	14.97	9.38	19.12
Textural class[2]	Silty clay loam	Clay	Clay	Loam

[1]Results reported by OSU Soils Testing Laboratory.
[2]Results reported by OSU Soils Physics Laboratory.

vegetation cover types. It was also observed to have some tolerance for disturbance. During the summer the parking area north of Walker Flat supported a weedy flora that included *S. nelsoniana*. Motorcyclists damaged Grid 04 in late June, cutting deep tracks into the grid area and churning and damaging roots and rhizomes. Despite this, *S. nelsoniana* plants along the torn paths matured and produced flowers and fruits.

The apparent tolerance of *S. nelsoniana* to a variety of habitat conditions may account for the inconsistent habitat information that was previously reported.

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