

THE WESTERN PRAIRIE FRINGED ORCHID (*PLATANThERA PRAECLARA*): MONITORING AND RESEARCH

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Abstract. Western prairie fringed orchid (*Platanthera praeclara* Sheviak and Bowles) Populations at one time extended from southwestern Missouri north to northwestern Minnesota, and from eastern Iowa to the Sandhills of north central Nebraska. It is listed as endangered in Iowa and Minnesota and candidate for threatened or endangered status in Kansas, Missouri, Nebraska, North Dakota, Oklahoma, and South Dakota. The questions are, "Why has it declined in numbers?" How have uses such as mowing for hay or grazing by cattle or no use (control) affected the numbers? In 1987, Permanently located individual plants were counted on the Sheyenne National Grasslands of southeastern North Dakota. Population trends of this orchid were compared regarding effects of mowing, grazing, and fire. The evaluation of the Permanently located individual plants, and data on total counts Per area in 1988 showed a difference between years and significant difference among grazed, mowed, or no use treatments. The western prairie fringed orchid appears very resilient, but more data will be needed to test this prognosis.

Key Words. western prairie fringed orchid, *Platanthera praeclara*, orchid, wet meadow, Sheyenne National Grasslands, North Dakota

INTRODUCTION

The western prairie fringed orchid (*Platanthera praeclara* Sheviak and Bowles) is one of the few characteristic North American tallgrass prairie orchids and appears restricted to the tallgrass habitat (Bowles and Duxbury 1986). It occurs in wet areas of the tallgrass vegetation type, often referred to as sedge meadows. Eastern prairie fringed orchid [*Platanthera leucophylla* (Nutt.) Lindl.], closely resembling western prairie fringed orchid, also occurs in wet meadows, but its distribution is more easterly. Western prairie fringed orchid has larger flowers and a longer nectar spur than eastern prairie fringed orchid (Sheviak and Bowles 1986). Western prairie fringed orchid occurs mainly west of the Mississippi River in the tallgrass prairie region, while eastern prairie fringed orchid extends primarily eastward from the Mississippi River.

Western prairie fringed orchid reaches its northern range limit in the Red River Valley of northern Minnesota. It ranges south through the eastern Dakotas, central Nebraska, eastern Kansas, and northeastern Oklahoma (Dusk and Fletcher 1943, Magrath 1973, Magrath and Taylor 1978). Its distribution extends eastward in a narrowing pattern through southern Minnesota, Iowa, and northern Missouri, and it is known to be present at this time in these various locations at varying densities. Many subpopulations appear extant, with others very limited in numbers. The western prairie fringed orchid has been proposed for listing as threatened and endangered. Presently the greatest number of plants appear to be in southeastern North Dakota and northwestern Minnesota. Bowles and Duxbury (1986) reported western prairie fringed orchid was dispersed across several thousand hectares of the southeastern North Dakota area, and it comprised several indistinct subpopulations and isolated outliers. Precise delineation of these was difficult because of the irregular terrain.

In North Dakota, the western prairie fringed orchid has been found in Ransom and Richland counties, mainly on the Glacial Sheyenne Delta. It occurs as widely scattered plants probably as viable populations or subpopulations in wet meadows, also known as sedge meadows or as interdunal sedge meadows (Bowles and Duxbury 1986). The Glacial Sheyenne Delta was formed near the end of the Wisconsin Glaciation where glacial meltwater of the glacial Sheyenne River emptied into Glacial Lake Agassiz and deposited sands, clays, and gravels. A layer of nearly impervious lake sediments is below the delta formation. This layer is responsible for the relatively high water table of the area (Manske and Barker 1988).

Vegetation on the Glacial Sheyenne Delta consists of native forest, woodland and grassland communities and nonnative (cropland) replacement communities with associated cultivated and introduced plant species. The Delta has been divided into 11 habitat types on the basis of similar plant species composition, soil type, and topography (Manske and Barker 1988). Eight habitat types consist of native vegetation and three of replacement (cropland) vegetation. The habitat types with closely related characteristics and distribution were grouped into four habitat associations. The Hummocky Sandhills Habitat Association consists of 26,516 ha, 50% of the Sheyenne National Grasslands. The topography is gently rolling and undulating hummocks (small hills) with relief usually of 1.7 to 3 m and slope of 5 to 10%. Soils are primarily loamy fine sand which have typically moderate to low water holding capacity but with high moisture due to a high water table. This habitat association is divided into four habitat types. The Lowland Grassland Habitat Type exists on the foot and toe slopes and has an area of 5,157 ha (10%). Soils are fine sandy loams with moderate to low available water holding capacity but with high soil moisture because of a high water table. The vegetation is the woolly sedge-northern reedgrass-Baltic rush (*Carex lanuginosa* - *Calamagrostis inexpectata* - *Juncus balticus*) sedge meadow community. This sedge meadow plant community appears to be the habitat type where the western prairie fringed orchid is located. This plant community covers a total of 7,338 ha (14%) (Manske and Barker 1988).

The Deltaic Plain Habitat Association consists of 15,693 ha, 30% of the Glacial Sheyenne Delta. The topography is nearly level with relief usually 0.3 to 0.6 m and small areas of relief of 0.3 to 1.7 m with slopes mostly less than 2%. Soils are primarily loam with high to moderate available soil moisture. The entire association has a high water table. This habitat association is divided into three habitat types, the Midland Grassland Habitat Type, the Lowland Habitat Type (*Carex lanuginosa* - *Calamagrostis inexpectata* - *Carex* spp. sedge meadow community), and the Cropland Habitat Type. The Cropland Habitat Type is a large portion of this association because of the nearly level topography and good fertile soil. This also very likely was occupied by western prairie fringed orchid before conversion to cropland.

During 1984- 1985, a systematic mapping effort recorded approximately 2,000 flowering individuals. Most of the population is on the Sheyenne National Grasslands, managed by the USDA Forest Service (Bowles and Duxbury 1986). Population characteristics of this species on the Sheyenne National Grassland, the area where it now is most abundant, remain unknown. Knowledge is lacking on the effects of fire, grazing, or mowing on populations of orchids. Woody vegetation on sedge meadows not properly managed may increase with unknown effects on the orchid populations. On other sites where woody vegetation is greatly reduced or lacking, the population characteristics of the orchid are unknown. The effects of repeated summer mowing for hay with follow-up grazing by cattle and the effects of fire or the lack of fire are also unknown (Barker 1983). Fire has been shown to increase seed stalk production on other species (Ehrenreich and Aikman 1963, Probasco and Bjugstad 1977).

The estimated 100-year decline of the population level throughout North America of the western prairie fringed orchid was mainly due to the conversion of its virgin prairie habitat to intensive agriculture-cropland (Bowles and Duxbury 1986). Decline has been recorded since 1969 in Kansas and Nebraska. Several intact sites remain where it should exist but is sparingly present. The immediate need is to determine why the plants are only sparingly present, what factors may increase the population, and later determine how to expand the population to new sites. The current management practices that may negatively or positively affect the orchid are summer mowing for hay, utilization by cattle, and fire or lack of fire. No data exist indicating whether or not any one or all of these treatments may benefit or threaten the survival of the western prairie fringed orchid.

The purpose of this paper is to describe the stronghold of the western prairie fringed orchid in southeastern North Dakota, the five-year plan to monitor populations levels, and discuss the preliminary (two years) research data.

METHODS

Five-Year Monitoring Plan

To monitor population trends, systematic counting and mapping of the plants during inflorescence will be done when the flowering is at its peak for a five-year period. This will need concentrated efforts on the Lowland Habitat Type. General reconnaissance and close examination of the area for plants will be done to monitor the total population count of all known western prairie fringed orchid locations on the Sheyenne National Grasslands. A person knowledgeable in identification of the western prairie fringed orchid will traverse potential sites on selected grid systems. Travel lines will be 30 m apart, giving a viewing distance of 15 m on each side of the traverse line. These data will be recorded on Forest Service maps on the Sheyenne National Grassland by site, allotment, pasture, and previous treatment.

Study Design

The locations of western prairie fringed orchid plants were permanently recorded starting in 1987 along research transects on five areas of different management treatments. More intensive sampling was initiated in 1988 to determine if individual plants (flowering structures) replace themselves each consecutive year or if they flower biannually or follow some other pattern. The five treatments (and their labels) were: 1) mowed for hay followed by grazing (Olerud); 2) mowed for hay according to grazing sequence (Penberthy 2); 3) grazed season-long (A-Annex); 4) burned followed by grazing (Penberthy 1); 5) burned only without livestock (Penberthy 3); and 6) no burned, mowed, or grazed (Railroad). Three subplots, with 10 plants each, were located within each treatment. Each subplot consisted of a permanently marked belt transect (50 x 2 m). The transect traversed a known community of orchid plants. All orchids within the belt transect were counted and 10 plant locations were permanently recorded. This was done by noting the location on the meter tape and measurements perpendicular to the exact location of the plant. Total percent canopy

cover, bare ground, plant litter, and cover by individual plant species by use category was estimated using 50 quadrats (20 x 50 cm) placed 1 m apart along the 50-m permanent transects (Dauenmire 1959).

Two years of data have been collected on all research treatments except the burning treatments. The area was too dry to chance a prescribed burn in the spring of 1988. This will be delayed until 1989.

In 1988 each plant was measured for existence of aboveground parts (dead or alive). Plant height and length of inflorescence were measured as an indicator of vigor. Stages of plant phenology were numerically rated as either 1) vegetative, 2) immature inflorescence, 3) flowering, 4) seed set, and 5) seed dispersal. These estimates were determined during the study of the individual plants. Photo points were located at each end of the tightened tape where steel fenceposts were installed.

RESULTS

During the period of 14 to 16 July 1987, 796 plants were counted by using a 4-wheel-drive all-terrain vehicle (ATV) to grid the wet meadows at 30-m intervals on the study sites. Of the 796 plants, 160 locations were permanently recorded.

Flowering stalks of the species emerged from the same place, at least for 1987 and 1988 for several individual plants. In some cases there were no flower stalks, and sometimes not even a plant, in 1988 where they had been present in 1987. In spite of only 30% of average rainfall during the growing season of 1988, most plants emerged (Table 1). This may be important and will be monitored.

Table 1. Orchid plant numbers by year at monitoring sites over 2-year period.

<i>Sites</i>	<i>Treatments</i>	1987	1988
Railroad	Control	24	13
Olerud	Mowed	173	125
Penberthy	Grazed	236	233
Sagvold ¹	Grazed	87	86

¹This allotment was included only in monitoring phase.

An inspection of precipitation data may provide some answers (Table 2). The plants may still be responding to the high level of precipitation in 1986. This characteristic is common for this species, i.e., plants may be very showy then seemingly disappear, likely surviving in only the vegetative stage, for several years (Currier 1984). One hypothesis is that the plants or populations are weather oriented, i.e., being showy only following growing seasons of high precipitation levels, being vegetative for long periods of time before flowering, and not being visible for long periods of time (Magrath 1973).

An unexpected number of individually located plants did grow in 1988 in spite of the drought. Fifty-five percent were relocated as alive, 30% had previous year's stem but no growth in 1988 (Table 3). No relocation was possible for 16%. It is too early to conclude anything from this preliminary data, yet snow accumulation associated with brushiness (as in the A-Annex site) could promote growth and seed stalk production not observed on grassy areas. This has been determined in the relations of stubble height, snow accumulation, and growth of forage plants (Ries and Power 1981). However, it is not known whether it was the drought of 1988 or the mowing treatment in 1987 that contributed to the difference in numbers of plants on the Olerud site in 1988. It should be noted that on the Penberthy 2 site, which had similar treatment as the Olerud site, differences were small.

Table 2. Annual precipitation (mm) at Lisbon and McLeod¹, North Dakota, with emphasis on January to July percentage of normal for 1988.

Year	McLeod	Lisbon
-----mm-----		
1980	670	668
1981	904	650
1982	798	715
1983	709	661
1984	830	744
1985	634	591
1986	1092	993
1987	438	624
Average	759	705
1988		
Jan	48	19
Feb	5	4
Mar	24	14
Apr	14	0
May	181	50
June	69	70
Total	342 (60%) ²	159 (30%) ²

¹Lisbon is located 16 km west and McLeod is located 8 km east of the study area.²Percent of 8-year average midyear precipitation.**Table 3. Percent $\pm$ S.E. of individual located plants counted in 1988 that were live plants in 1987.**

Site	Treatment	Alive	Old stem ¹	No stem ¹
-----%				
Olerud	Mowed & grazed	42 $\pm$ 7.5	20 $\pm$ 10.8	38 $\pm$ 8.5
A-annex	Grazed-brushy	75 $\pm$ 8.6	18 $\pm$ 4.8	7 $\pm$ 4.8
Railroad	No use	65 $\pm$ 15.0	15 $\pm$ 5.0	20 $\pm$ 10.0
Penberthy				
	Nongrazed 1	50 $\pm$ 5.8	43 $\pm$ 8.8	7 $\pm$ 6.7
	Grazed 2	40 $\pm$ 17.3	53 $\pm$ 17.6	7 $\pm$ 3.3
Average		55	30	16

¹No living tissue above ground, old stem present or absent.

In the literature, western prairie fringed orchid plant densities have varied from 0.01 to 6 plants per m² for limited localities (Bowles 1983, Bowles and Duxbury 1986). The data collected in 1988 on the Sheyenne National Grasslands show plant densities that varied from 0.02 per m² and less. In most stands, the plants were too infrequent to be measured using 50 quadrats (0.1 m²) on a 50-m transect. Phenology, plant height, and length of inflorescence of the permanently recorded plant locations for the 1988 season show few differences among treatments (Table 4). More continuous data will be needed to compare treatments.

Table 4. Phenology, plant height (cm $\pm$ S.E.), and length of inflorescence (cm $\pm$ SE) in 1988 by treatment.

Site	Treatment	Phenology ¹	Height	Length of inflorescence
-----cm $\pm$ S.E.-----				
Olerud	Mowed & grazed	2.3	17.5 $\pm$ 1.9	4.2 $\pm$ 1.1
A-Annex	Grazed-brushy	2.7	13.6 $\pm$ 1.3	3.0 $\pm$ 0.4
Railroad	No use	2.0	16.9 $\pm$ 1.8	None
Penberthy				
	Nongrazed 1	2.0	18.3 $\pm$ 1.5	None
	Grazed 2	2.4	25.9 $\pm$ 3.5	4.8 $\pm$ 0.7

¹1 = vegetative, 2 = immature inflorescence, 3 = flowering, 4 = seed set, 5 = seed dispersal. Average for each site (treatment) at peak flowering time.

CONCLUSIONS

A monitoring and research plan are in effect for the prairie fringed orchid on the Sheyenne National Grassland. The preliminary data are inconclusive, but early indications suggest the prairie fringed orchid appears resilient, with little to no change in numbers of plants on the monitor sites between years in spite of severe drought (30% of 8-year average) in 1988 compared to 1987. The percent alive in 1988 was highest on a grazed-brushy site (A-Annex), exceeding that on the no-use site (Railroad). The characteristics measured of the western prairie fringed orchid varied considerably neutralizing will be required to determine treatment effects. This is common when working with unknown genetics of a wild plant.

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