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**STATUS OF *PLATANThERA PRAECLARA* SHEVIK & BOWLES
(WESTERN PRAIRIE FRINGED ORCHID) IN THE PLATTE RIVER VALLEY
IN NEBRASKA FROM HAMILTON TO GARDEN COUNTIES**

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ABSTRACT

During June and July, 1991, a search for western prairie fringed orchid was conducted in the Platte River Valley in central and west-central Nebraska. No orchids were found in the 370 sites surveyed. Factors which may contribute to the scarcity of this orchid in the area surveyed include drought conditions in the previous three years; habitat alteration by draining, ditching, herbicide application, mowing for hay, crop cultivation and planting of non-native species for hay fields; invasion of the area by trees; and the presence of alkaline soils in some areas.

† † †

The western prairie fringed orchid, *Platanthera praeclara* Sheviak & Bowles, has long been considered conspecific with *Platanthera leucophaea* (Nutt.) Lindl., now known as the eastern prairie fringed orchid, but Sheviak and Bowles (1986) feel that the two are genetically isolated due to different pollen vectors.

Platanthera praeclara is distributed throughout the western tallgrass prairie, and is replaced eastward by *P. leucophaea*. The orchid was once more common in the eastern portion of Nebraska (Aughey, 1873, note on herbarium specimen at University of Nebraska–Lincoln, cited in Freeman and Brooks, 1990), and occurred at sites along the Platte River and also in the Sandhills. Historical records are lacking, however, from that region of the Platte River Valley upstream of Kearney County (Freeman and Brooks, 1990; Sutherland, 1974). Human impact in the Midwest has altered the orchid's ecosystem to such an extent that the plant has become even more uncommon than it once probably was, and it is now afforded legal protective status by both the state of Nebraska and the federal government (Department of the Interior, Fish and

Wildlife Service, 1975). The most likely habitats for western prairie fringed orchid were determined to be wet prairie, subirrigated sedge meadows and the transition zone between wet and dry prairie (Bowles, 1983; Bowles and Duxbury, 1986; Freeman and Brooks, 1990; also Antlfinger, Currier, Fritz, and Sutherland, pers. comm.).

The Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District initiated a study to determine to what extent this plant may occur in areas potentially affected by the continued operation of Federal Energy Regulatory Commission (FERC) Projects 1835 and 1417 in the Platte River basin (the Sutherland and Kingsley Projects).

METHODS

We searched for the orchid within a mile of the Platte River in Nebraska, from 6 miles northeast of Phillips, Hamilton County, westward to Lewellen, Garden County, on the North Platte River and to Ogallala, Keith County, on the South Platte River (Fig. 1). The survey was conducted during the flowering period from 17 June to 9 July, 1991, by the authors and by Phillip Moore and Gerald Toll.

The authors visited Nine-Mile Prairie in Lancaster County with Mike Fritz on 12 June 1991 to observe the western prairie fringed orchid population there. One plant was in bloom at the time of the visit and several vegetative plants were also seen. The habitat and environmental factors pertaining to this population were noted. In addition, we visited Mormon Island Crane Meadows in Hall County on 17 June 1991 to observe the orchids and their habitat; seven were found in bloom or in bud. We believed this habitat

would be more typical of suitable Platte River Valley sites than was the upland, tallgrass prairie ecosystem at Nine-Mile Prairie. In addition, species thought to indicate potential orchid habitat were noted. These included *Amorpha canescens*, tall wetland-inhabiting sedge species such as *Carex emoryi* and *C. lanuginosa*, *Calamagrostis stricta*, *Cicuta maculata*, *Glycyrrhiza lepidota*, and *Scirpus pungens*, as well as such animals as *Speyeria idalia* (Regal Fritillary), bobolink, and upland sandpiper. It was noted that orchids grow in disturbed microhabitats within this wet meadow, in areas of transitional moisture content, between wet sedge-filled swales and the zone of *Calamagrostis* in slightly drier locations.

Study sites were chosen by examining Geographic Information System maps of the Platte River Valley (Johnson, 1990a, 1990b) and false-color infrared satellite images taken in 1983 and supplied by the Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District. Target habitat types were identified within a mile of either side of the Platte River and adjacent to the reservoirs and canal systems of FERC Projects 1835 and 1417 belonging to the Nebraska Public Power District and the Central Nebraska Public Power and Irrigation District, respectively. The

habitats selected were those identified on the maps as "wet meadow" and "wet meadows with scattered trees." Sites to be surveyed were selected by the following criteria: 1) survey sites had the appropriate habitat type; 2) access to sites appeared adequate; 3) special attention was given to areas showing scour marks or old channels since it was felt these would contain mesic to hydric ecotones. The field teams surveyed additional sites when appropriate. Locations of study sites are indicated in Fig. 1.

The crew was divided into two teams of two researchers each. The potential for a given site to contain an orchid population was visually assessed from the road at each site. Data for obviously unsuitable habitats such as cropland, alfalfa fields, or other heavily impacted areas were recorded, but no further attempt was made to search for orchids at such sites. If indicator species were present or the habitat appeared suitable for western prairie fringed orchid (moist to wet relatively undisturbed sedge meadow or grassland), parallel transects were walked by the crew members. Observers deviated from straight or parallel transects to follow ecotones at the edge of scour marks and/or swales.

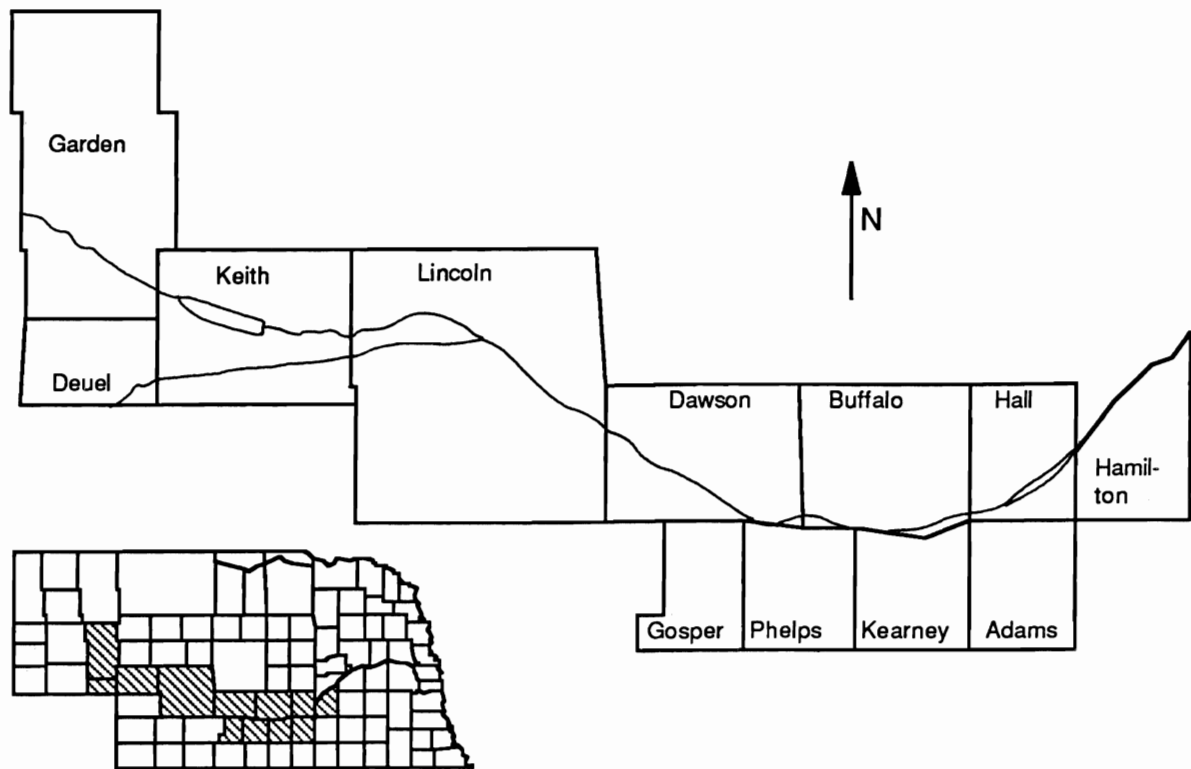


Figure 1. Counties included in the prairie fringed orchid survey. The search was conducted within a mile of the Platte River in Nebraska from Hamilton County westward to Garden County

Data regarding land usage, topography, moisture, and flora and fauna were recorded on data sheets. Each site's potential as orchid habitat was evaluated as potential orchid habitat, marginal orchid habitat, unknown, or unsuitable habitat for orchids. Sites considered potential orchid habitat were those combining moist areas with suitable ecotone and a diversity of native prairie species. Those considered marginal were somewhat wet but contained few native species or had very limited ecotone. Only 14 (4%) of the sites were judged as good habitat, and 5% were marginal; thus only a total of 9% offered any significant potential for orchids. Due to problems of access or because the field had been hayed at the time of the survey, at 24 sites (6%) the quality of the habitat could not be adequately judged.

Recognizing that the orchid might not have been in bloom even if present during the first visit to suitable habitat, crew members revisited those twenty-six sites which had native prairie vegetation and therefore the highest potential to support orchid populations.

RESULTS

Three hundred seventy sites were surveyed but no orchids were found. The most suitable habitats for orchids were in clusters in a few places, mainly north of the North Platte River, as can be seen in Table I. Most of the sites (222, or 60%) were evaluated from the roadside and not surveyed further because they were clearly unsuitable for the orchid or had been hayed at the time of the survey. One hundred forty-two (38%) of the sites were surveyed on foot. On closer examination, a number of these sites were found to be xeric, heavily disturbed by grazing, formerly cultivated fields, or recently sprayed with herbicides; such fields were ob-

served only briefly. Any field showing potential to provide orchid habitat was canvassed more thoroughly. In six cases (2%) there was no access to the field and it could not be seen from the road.

DISCUSSION

The prairie fringed orchids are dependent on adequate sunlight, mycorrhizal fungal associations, and sufficient microhabitat disturbance within the intact plant community for seedling establishment. In addition, it appears from the surviving populations that these species require a considerable amount of subsurface moisture and may need above-average precipitation in order to bloom (Bowles, unpubl. ms.). These conditions can be found in mesic to wet mesic tallgrass and Sandhill prairie and subirrigated meadows. Succession to thickets or forests creates shade that is detrimental to orchid survival (Bowles and Duxbury, 1986). Other threats to orchid populations include plowing, altered drainage patterns (Bowles, unpubl. ms.), and continued heavy grazing. Mowing on an annual or more frequent basis, especially early in the growing season, may also adversely affect orchid populations by preventing accumulation of food reserves in the tuber (Bowles, unpubl. ms.).

The known surviving Nebraska orchid populations occupy markedly different habitats, but all are mesic to wet-mesic and are relatively intact native ecosystems. One habitat, as typified by Nine-Mile Prairie, is tallgrass prairie dominated by *Andropogon gerardii*, *A. scoparius*, *Panicum virgatum*, and *Sorghastrum nutans*. Here the orchids are found in a shallow draw which may supply them with needed moisture. Another habitat type is the prairie swales and subirrigated meadows of the Nebraska Sandhills region. The third

Table I. Locations of sites judged to have most potential for western prairie fringed orchids.

County	Location	Habitat
Merrick	5 miles north and 2.5 miles east of Phillips	Floodplain tallgrass prairie
Merrick	2.5 miles west of Phillips	Floodplain tallgrass prairie
Merrick	2.75 miles west of Phillips	Floodplain tallgrass prairie
Buffalo	1.5 miles south and 5 miles east of Odessa	Disturbed floodplain tallgrass prairie
Lincoln	2 miles east and North Platte	Sedge meadow
Lincoln	0.75 miles north of North Platte	Sedge meadow
Lincoln	1 mile north of North Platte	Sedge meadow
Lincoln	1 mile north of North Platte	Sedge meadow
Lincoln	3.5 miles west and 2.25 miles north of North Platte	Wet meadow
Lincoln	2.5 miles west and 3 miles north of Sutherland	Wet prairie meadow
Keith	6.25 miles east of Keystone	Wet prairie with sedges
Keith	6 miles east of Keystone	Wet prairie with sedges
Keith	6.5 miles east of Keystone	Wet prairie with sedges
Keith	4.5 miles west and 1 mile south of Paxton	Floodplain tallgrass prairie

is floodplain prairie and/or sedge meadows typified by the Mormon Island site. The frequently-associated species listed by Freeman and Brooks (1990) are of limited value as indicators for western prairie fringed orchid habitat because they encompass the entire spectrum of typical tallgrass and sedge-meadow plants. However, these species do indicate an association with intact native plant communities of mesic to wet mesic sites.

Many factors may contribute to the lack of sightings of western prairie fringed orchids in the Platte River valley in 1991. First, aspects of the growth pattern and life history of western prairie fringed orchid make the plant difficult to detect. These plants spend much of their life cycle in dormant and/or vegetative condition, and such plants are difficult to find unless near flowering individuals. Even the most intensive survey is unlikely to report vegetative plants, and dormant plants would be impossible to detect visually. In addition, the populations of western prairie fringed orchid are known to have a patchy distribution (Antlfinger, pers. comm.) even in the most suitable habitat. Thus even a large population could easily be overlooked.

Second, it appears that weather affects the likelihood that this species will flower. A drought began along the Platte River in 1987, with 1988 and 1989 being exceptionally dry. In 1990, precipitation returned to near-normal levels, and 1991 had a surplus of moisture through midsummer (Nebraska State Hydrologist Roy Osugi, pers. comm.). If the orchid indeed initiates the flowering stem in the fall of the year preceding flowering as a response to high moisture conditions (Bowles and Duxbury, 1986), precipitation the previous year might have an important influence upon flowering. Drought-stressed orchids would likely remain dormant or produce only one or two leaves. However, Freeman and Brooks (1990) found five flowering plants at Mormon Island Crane Meadows in 1989, an exceptionally dry year following two previous dry years.

Third, and most significantly, suitable habitat for the orchid in the Platte River Valley appears severely limited. Since the mid-1800s this river valley has been a major conduit for human migration. Early writers report the floodplain denuded of vegetation by grazing livestock and wagons traveling west. In addition, the Platte River floodplain was the first large area of Nebraska converted to commercial agriculture, the white settlers first breaking ground there in 1853 (Sutherland, 1974). Soon after settlement, irrigation and drainage of fields began changing the moisture regime in the floodplain. The subsequent century has seen increasingly intensive agriculture and drainage. Consequently, very little habitat remains that would be appropriate for western prairie fringed orchid.

While nine percent of the sites surveyed during this study contained potential or marginal habitat for western prairie fringed orchid, that figure overstates the amount of orchid habitat remaining along the Platte River because this survey concentrated on floodplain meadows, the habitat most likely to contain orchids. Most of the floodplain consists of cropland, alfalfa fields, towns and other developed areas totally unsuitable for western prairie fringed orchid populations.

Uncultivated fields may be equally unsuitable habitat. Most of the floodplain meadows are pastures or hayfields planted to introduced Eurasian species such as *Bromus inermis*, *Festuca arundinacea*, *Medicago sativa*, *Melilotus alba*, *Melilotus officinalis*, *Trifolium hybridum*, or *Trifolium pratense*. Such planted fields most likely have a history of plowing and cultivation. Therefore native vegetation has been extirpated. Meadows with native vegetation are few and the presence of such species as *Verbena stricta*, *Cicuta maculata*, *Rumex crispus*, and thistles of the genera *Carduus* and *Cirsium* indicate a history of heavy grazing.

An additional factor affecting the orchid's habitat is trampling of soil and vegetation by cattle. This has eliminated perennials in areas where cattle congregate and favored quick-growing annual species like *Hordeum jubatum*, *Bromus tectorum*, *Bromus japonicus*, *Ambrosia artemisiifolia*, *Helianthus annuus*, and *Iva xanthifolia*. Such trampling was most evident in the transition zone between wet and dry areas, the very habitat preferred by the western prairie fringed orchid.

In addition, the wet meadows and non-native pastures often show indications of herbicide applications. The western prairie fringed orchid, a monocot, would be unlikely to succumb to 2,4-D or the other most commonly used pasture herbicides, if these were applied at recommended concentrations. However, certain herbicides do kill monocots and a few of the fields surveyed had received herbicide applications that browned even such non-grass monocotyledons as *Smilacina stellata* and *Scirpus* species. At these application rates, any orchids present would be damaged or killed as well.

Uncultivated fields not grazed by livestock are usually maintained as hayfields and mowed each year, creating less-than-ideal habitat for this orchid. While the orchid is known to persist for decades in annually-mowed meadows (Freeman and Brooks, 1990), mowing prevents seed set and thus the dispersal of orchids to adjacent suitable habitat. Due to heavy precipitation in 1991, plants grew more quickly than normal and farmers were mowing many meadows early, with the

intention of obtaining two crops of hay this season. This precluded observations on the presence of the orchid in those fields.

Draining of wet meadows by ditching has also reduced the area of ecotone available to orchids. Changes in drainage have led to the extirpation of some eastern prairie fringed orchid populations (Bowles, unpubl. ms.), and could have a similar effect on the western species. This orchid is naturally limited to a narrow range of moisture conditions, needing sufficient sub-surface moisture but unable to withstand flooding for more than a month (Currier, pers. comm.). Therefore it is limited to the ecotone between wet and dry areas, a habitat that is now generally scarce along the Platte River. In many of the fields visited, this transition area was very narrow or non-existent due to the fact that the wetlands occurred in areas of sandy, well-drained soil.

Woody vegetation has developed along the river channel. Since the western prairie fringed orchid is shade-intolerant, this successional change would have extirpated it from the channel, assuming it were once present.

Western prairie fringed orchid populations could expand into such once-disturbed habitats as roadsides and unused sandpit areas near existing populations that could serve as seed sources (Freeman and Brooks, 1990). This ability to colonize disturbed areas could allow the species to grow in the wide areas of the Platte floodplain now occupied by grassy meadows, pastures, or roadsides—if seed sources were available. However, with the exception of the population at Mormon Island Crane Meadows, no seed source in these habitats is known.

Pastures containing *Sporobolus airoides* and *Distichlis spicata* are common west of North Platte. These grasses are associated with alkaline soil conditions and are not listed by Freeman and Brooks (1990) as species commonly associated with the orchid. Perhaps the frequency of alkaline soils in the western portion of the study area is the explanation for the lack of historical records of the orchid in the Platte River Valley west of Kearney County (Freeman and Brooks, 1990).

CONCLUSIONS

No orchids were found in the area surveyed for this study in 1991. Orchid habitat, probably always limited in extent, was found to be very rare. Failure to find the orchid may also have been the result of the plant's inconspicuousness during much of its life cycle or the rainfall patterns of recent years. Alkaline soil and the

lack of historical records suggest that this species' range may not have extended to the westernmost portion of the study area. Loss of suitable habitat suggests that the orchid may now be extirpated from the portion of the Platte River surveyed, except for the population now existing at Mormon Island.

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