2012 *Cypripedium candidum*
Monitoring Activities in Minnesota

Derek Anderson and Janeen Ruby
Minnesota Biological Survey
Minnesota Department of Natural Resources

November 2012
Introduction

*Cypripedium candidum* Muhl. ex Willd. (small white lady’s-slipper) occurs in the northeast and north central United States and in south-central and southeast Canada. The habitat is primarily deep-soil mesic prairies. Wet prairies, certain types of sedge meadows, and calcareous fens can also support this species. It does not occur in habitats with a history of livestock grazing or crop production (Minnesota DNR 2008).

The impetus driving the monitoring of this species is the recently completed Minnesota Prairie Conservation Plan (Minnesota Prairie Plan Working Group 2011). This document was a collaborative effort between The Nature Conservancy, the Minnesota Department of Natural Resources, the US Fish and Wildlife Service, the Minnesota Board of Water and Soil Resources, the Lessard-Sams Outdoor Heritage Council, the Prairie Chicken Society, Pheasants Forever, and The Conservation Fund, as these are groups that have an interest or stake in conserving Minnesota’s prairie landscape. The plan contains recommendations for protecting, enhancing, and restoring Minnesota’s prairie heritage. It also mandates monitoring as a means to measure the success of prairie conservation in the state and to evaluate impacts on animal and plant populations. *Cypripedium candidum* was chosen as one species that could be used to measure the success of the conservation plan. The criterion for success for native prairie plants is; “stable or increasing native prairie orchid populations, specifically the small white lady’s slipper and the western prairie fringed orchid.” The plan states that these two species were chosen because they are correlated with high quality prairie, intact hydrology, and intact below-ground processes (fungal associates). Additionally, Minnesota has the country’s largest populations of these species and a large, robust data set available for analysis and evaluation.

*Cypripedium candidum* is extant in 16 U.S. states and 2 Canadian provinces. Minnesota has the largest number of populations of any state or province in the range of *C. candidum*. Minnesota has over 100 occurrences (NatureServe 2012). The actual number of Element Occurrences (EOs) in Minnesota’s Natural Heritage Information System (NHIS) is 387. However, the actual number of biological populations may be smaller, probably between 100-300. A number of mapped records are in close proximity to each other and could be combined, and some EOs reference extirpated or historic records. These 387 EOs are distributed across 52 counties in Minnesota. In contrast, Wisconsin has 70 EOs distributed across 12 counties; and Manitoba has 19 extant populations (plus 2 that are likely extirpated). In addition, Michigan has extant populations in 19 counties; Iowa has extant populations in 18 counties; and North Dakota has extant populations in 10 counties (NatureServe 2012, Wisconsin Natural Heritage Program pers. comm., Manitoba Conservation Data Centre pers. comm.).

Population sizes vary greatly, but Minnesota has some of the largest populations in the range of this species and a higher number of large populations than other states and provinces. Wisconsin’s largest population is currently a few hundred plants, although this population had been up to 10,000 plants in the past and was set back by flooding in 2008. In Manitoba, about 4 populations have 500-1000+ plants. (Wisconsin Natural Heritage Program pers. comm., Manitoba Conservation Data Centre pers. comm.)

Comparing *C. candidum* counts from site to site, and from state to state or province is difficult. Past data reflect that some counts were of flowering culms (ramets). Other counts were of clumps, that were believed by the observer to be an individual plant (genet). However, even when observers intend to count individual plants, there is no way to know exactly where one plant ends and another begins in
situations where density of clumps and stems is very high. In the past, there has not been a standardized way of defining a genet for the purpose of monitoring this species.

**Methods**

Our monitoring objective is to determine if *C. candidum* populations are increasing, decreasing, or stable. (See stated Minnesota Prairie Conservation Plan success criterion in introduction.) Our goals were to more accurately track the size and extent of particular *C. candidum* populations, and to do this in the context of their associated site conditions (including management practices and selected environmental conditions). Two major concerns that we would like to be able to address are the effects of management activities, especially grazing, and possibly the effects of hydrologic alterations on populations of *C. candidum*.

Our assumptions have been that Biotics Element Occurrences are a fairly accurate reflection of the current status of our populations, however about ¼ of populations have not been visited in 30 years, and at least half have not been visited in 20 years. It is important to confirm our present understanding and improve our information on the distribution and abundance of plants within selected populations. This information is required to make comparisons over time of the species’ population status, (i.e. are populations stable, increasing or decreasing).

Early discussions in monitoring led to contacting organizations from neighboring states to determine what other types of monitoring were being conducted on this species. We chose to follow the model of the Chicago Botanic Gardens, Plants of Concern monitoring protocol, since using similar protocols developed by other organizations could ease future, interstate data comparisons. In the Plants of Concern approach, citizen scientists were engaged in collecting data on the rarest plants of the greater Chicago area, including *C. candidum* (Chicago Botanic Garden, Plants of Concern 2012). The Chicago Botanic Gardens has a Level 1 and Level 2 protocol for monitoring *C. candidum*. Their Level 1 monitoring included a data collection sheet that captured spatial information, population data (number of plants in reproductive and sterile states, associates, etc.), as well as threats and management concerns/needs. Plants of Concern Level 1 form was adapted to create a monitoring form for populations at Minnesota sites (Appendix A). Plants of Concern Level 2 monitoring includes measuring demographic characteristics of the population within a permanent plot. We did not conduct this level of monitoring in 2012.

In addition to Plants of Concern Level 1 data, we included a more detailed breakdown of individual plants on our data sheet to provide some measure of reproductive success. We adopted the Plants of Concern definition of an individual plant as a stem or clump separated 15 cm or more from the next nearest stem or clump. We proposed to count numbers of fertile plants and sterile plants separately. We then further subdivided fertile and sterile classifications into plant size classes: single stemmed individuals, small clumps (2 to ≤ 10 stems), and large clumps (>10 stems).

Monitoring sites were chosen across the species’ range in the state of Minnesota (Figure 1). In the pilot season of this study, sites were chosen from a number of ecological sub-sections across the state where moderate to large populations were known to exist. Preference was directed toward sites in public or conservation ownership to ensure site access in subsequent years of monitoring. The monitoring sites included state Wildlife Management Areas, Scientific and Natural Areas, USFWS Waterfowl Production Areas, The Nature Conservancy preserves, and Native Prairie Bank easements on private land.
Populations (as known) ranged in size from a few hundred plants to several thousand plants. The spatial extent of populations ranged from less than 1 acre to as many as 80 acres. Monitoring sites were also chosen where populations might be impacted by changes in management regimes, such as conservation grazing.

Baseline data were collected for each population that was visited. The Garmin GPSMap 76CSx unit was used to collect spatial data. The units were accurate to three meters and collected data were projected in UTM zone 15, NAD 83. These data were used to map the lady’s-slipper population boundaries at each site. Plants within the population were counted. Where possible the number of vegetative/sterile plants, the number of flowering plants, and clump size class (based on number of stems) was recorded in a plot or in a subset of the population count. Threats to populations (if present) were noted. These included invasive species, woody encroachment, and grazing/trampling. A percent cover, or percent of population impacted rating was estimated for each threat observed. It was also noted if any site management (burning, woody species removal, invasive species removal, mowing/haying, etc.) had occurred on the site over the last year. If there was evidence of management activity on the site, the percentage of the $C. \ candidum$ population affected by the activity was estimated and recorded.

**Results**

During the 2012 season, we visited 18 sites across the state of Minnesota to monitor the status of $C. \ candidum$ (Figure 1). We counted over 22,000 orchids at 16 of those sites. Two sites had frost damage too severe to be able to efficiently count plants. Two Minnesota Biological Survey staff members put in over 20 days of field work. DNR staff and volunteers spent over 260 hours searching for orchids.

**Phenology**

We made phenology observations of shoot and bud development and blooming time at several sites across the state to determine the best dates to monitor the orchids. These observations led us to begin our monitoring on May 17th, when the species appeared to be at peak anthesis. Our monitoring efforts were completed on June 1st, when the flowers of most plants had faded.

Weather factors impacting $C. \ candidum$ populations in 2012 included a record-breaking early and warm spring (Minnesota Climatology Working Group), a late season frost, and drought conditions. The late season frost occurred on May 30th, 2012 in the Crookston area. In the early morning of May 30, Derek Anderson observed 30°F on the bank thermometer in Crookston, MN. This frost was likely localized and more severe in low-lying areas. The lowest hourly temperature recorded at the Crookston airport that morning was 34°F at 5:14 a.m. Drought and/or frost damage made counting plants difficult to impossible at two sites in the northwest, Pembina and Dittmer WMAs.

Photo page 1 shows some development stages of $C. \ candidum$ in 2012. Documentation on our phenologic observations follows. They are divided geographically into southern, central, and northwestern sites.

**Southern Sites**

The orchid site at Sangl WMA in Jackson County was burned on April 23rd. On April 27th, no evidence of shoot emergence was observed there, but on May 3rd, shoots 5-10 cm tall were observed at this site. In contrast, plants in early flower were reported in eastern Martin County on May 4th. In Le Sueur County, at Ottawa WMA, $C. \ candidum$ was flowering on May 10th.
The orchid site at Expandere WMA in Cottonwood County was burned on April 26th. On May 8th, shoots ranging in height from 8 to 20 cm were observed along with developing buds completely enclosed in the shoot. A revisit of this site on May 11th found a few plants in full bloom. However, the majority of *C. candidum* plants had swelling floral buds emerging from the shoots.

Plants photographed on May 15th in Dodge County were in late bloom (showing brown spotting) however these plants may also have been affected by drought. This location was the furthest east of any we monitored this year.

By May 30th and 31st in Yellow Medicine and Lincoln Counties, some of the flowers were brown or senescing.

**Central Sites**

At Regal Meadow Preserve in Kandiyohi County, on May 11th, plants were observed with swelling buds just newly visible at the tips of leafy shoots.

**Northwest Sites**

At a site in Mahnomen County, shoots 6-9 cm tall were observed on May 11th. By May 19th, the plants at the Mahnomen County site had swelling buds which were still enclosed within the leafy shoots.

Data were recorded and summarized for each site. Table 1 lists all of the sites where we monitored *C. candidum* this year. It includes total counts, past years’ data, estimated percent reproductive, and site notes and observations. The column titled “Estimated % reproductive” is the estimated percent of counted plants that had some floral or fruit development. We did not survey any sites that were being actively grazed.

Expandere WMA had the highest number of plants counted at 9373 plants. The site with the next largest count was Plover Prairie at 4530 (north and south counts combined). At Regal Meadow Preserve 1741 plants were counted. Iron Horse SNA, Ottawa WMA, and Altona WMA all had 1000-1300 each.

At unburned sites, the percent of plants counted that were reproductive was very high, 80-100% (Lac Qui Parle WMA had only 75%, but this was based on a sample size of only 12 plants.) At burned sites, the percent of counted plants that were reproductive was much smaller: 30-40% at Expandere WMA and 50-70% at Sangl WMA.

In northwest Minnesota, *C. candidum* co-occurred with *Cypripedium parviflorum var. makasin* (small yellow lady’s-slipper) at 3 sites, Dittmer WMA, Marcoux WMA, and Pembina WMA. In addition, at one site, Mentor WMA, no *C. candidum* were observed at all, rather *C. parviflorum var. makasin* was the only species present. Upon closer examination of previously recorded data, the date of the previous observation was in July. In this case, vegetative or past bloom plants of *C. parviflorum var. makasin* were apparently mistakenly identified as *C. candidum*.

Maps of observed distributions of *C. candidum* at each site are displayed in Appendix B. This Appendix has been removed as it contains sensitive species location information.

**Discussion**

In the course of monitoring *Cypripedium candidum* during the 2012 season, several challenges were encountered. Large population sizes made it very difficult to obtain accurate and complete counts. It became obvious that we would not be able to obtain population structure data for whole populations. We re-prioritized our work to focus on mapping the geographic extent of populations and counting
numbers of plants. When time remained, we recorded some population structure data in a subset of our count or within a small temporary plot.

At some sites in the north, small white lady's slippers were growing with small yellow lady's slippers (Cypripedium parviflorum var. makasin). When this situation occurred, it was not possible to distinguish vegetative plants of one species from vegetative plants of the other species. In these cases, only reproductive plants were counted, since counts of vegetative plants may include both species and their hybrids. The situation of species co-occurrence was not found in the south.

One option for dealing with the issue of co-occurrence of the two orchid species, is to not distinguish between the two species. Where they co-occur, counts would include both species. This is based on the assumption that the two species fill a similar ecological niche at the site. Future site selection should consider dates of previous observations, or be verified by a flowering specimen in an herbarium. This should help us avoid visiting sites where C. candidum does not occur. For Minnesota's NHIS data, it would be good to review observation dates of C. candidum records to determine if any other recorded occurrences may be suspect as far as species identification.

We also learned that sampling a site the year it is burned will affect how accurately and thoroughly you can sample. The absence of dense thatch after a spring burn will make it much more feasible to find and count plants, especially vegetative plants. In a burned site, you can probably get a more accurate count of the entire population because reproductive and non-reproductive plants are both easily visible. This can be an opportunity to get a more accurate count at a particular site. However, the burn may also affect the number of plants that emerge and the number of flowering shoots. So there may be a confounding effect of burning and ease of sampling.

Populations in Minnesota did not fit the Chicago Botanic Garden method very well, as Minnesota populations are far more extensive and numerous than the populations located in the greater Chicago region. Although we used 15 cm to define where one plant ended and another begins, it was not practical to apply this strictly at our sites. Once we established a good visual estimate of this, it was done by sight. At some sites, notably Ottawa WMA, and Iron Horse SNA, density of plants was so high, that using the 15 cm separation distance resulted in huge clumps that were 1 m by 2 m or greater. In these cases, the observer used their judgment as to where to define separate plants. Also, the Chicago Botanic Garden guidance of 50 meters of separation between sub-populations did not fit for our large populations. We applied this sub-population term more loosely to large geographic groupings of plants visible on the ground.

There is a tradeoff between the total number of plants one can count at a site with a large population, and the level of detail in the data that one can gather. We counted the greatest number of plants per search hour (453 plants/hour) at Altona WMA. The site is quite small and counting time was limited to three hours. We walked, counted clumps (a quick visual estimate of what is a genet) onto a clicker counter, and gathered GPS points frequently while counting. GPS track data were collected as well. Where no GPS points coincided with the track, that stretch of the track was considered negative data (where orchids were not found). The site where we put in the most search effort (80 hours) was at Expandere WMA. Here the detailed data we collected would allow us to identify which counting blocks had the highest density of plants, and numbers of plants could be assigned to particular geographic blocks.

The most striking apparent changes in numbers of plants counted for a site were at String Lake WPA and at Hole in the Mountain Preserve. String Lake WPA had >2000 plants in 2005 and 1060 plants counted
in 2006. This year we counted only 60 plants. At Hole in the Mountain Preserve, there were 1000s of plants observed in the wet meadow in 2007. In 2012, only a handful of plants were observed in the wet meadow habitat, and <150 were observed in the wet prairie habitat. Other sites such as the northern area of Plover Prairie had only 82 plants documented in 1988, while a total of 974 flowering plants (plus an uncounted number of vegetative plants) were documented in 2012.

We intend to continue our efforts in documenting the spatial distribution and population size of *C. candidum* at existing element occurrences. We intend to enlist the help of experienced volunteers to continue with this effort. In addition, we plan to develop and test sampling protocols that will allow for us to efficiently collect detailed information on populations at each site. While the protocol has not been developed yet, monitoring will continue across the species’ range in the state.

**Acknowledgments**

The team for planning and directing this monitoring effort includes Derek Anderson, Janeen Ruby, Nancy Sather, Fred Harris, and Welby Smith. We would like to thank Becky Marty, the DNR Northwest Regional Plant Ecologist for her assistance at Pembina WMA. This monitoring would not have been possible without the assistance of volunteers. Those volunteers included: Jerry Ibberson, Karen Ibberson, Judy Kenney, Richard Molstad, Marcia Richards, Alice Sather, Steve Saupe, Judith Sims, Donna Spaeth, Cliff Steinhaur, and Rod Sykora.

**References**


**Figures, Tables, Photos, and Appendices**

Figure 1. *Cypripedium candidum* 2012 monitoring sites

Table 1. Summary of 2012 monitoring results by site


Appendix A. Monitoring forms developed for 2012 monitoring season, with instructions.

Appendix B. Maps of monitoring sites showing observed distributions of *C. candidum* in 2012. (This Appendix has been removed as it contains sensitive species location information.)
Figure 1. *Cypripedium candidum* 2012 monitoring sites were chosen across the state, representing a variety of ecological subsections, ownership types, and management regimes. Red squares represent 2012 monitoring locations; green dots represent *Cypripedium candidum* Element Occurrences (EOs)).
Table 1. Summary of 2012 monitoring results by site, including total *Cypripedium candidum* plants counted at each site and the percent of counted plants that were reproductive. Notes on population sizes from previous years, as well as miscellaneous notes from this year’s work are also included.

<table>
<thead>
<tr>
<th>Southern Minnesota Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>County</strong></td>
</tr>
<tr>
<td>Cottonwood</td>
</tr>
<tr>
<td>Dodge</td>
</tr>
<tr>
<td>Jackson</td>
</tr>
<tr>
<td>Jackson</td>
</tr>
<tr>
<td>Lac Qui Parle</td>
</tr>
<tr>
<td>Lac Qui Parle</td>
</tr>
<tr>
<td>Le Seuer</td>
</tr>
<tr>
<td>Lincoln</td>
</tr>
<tr>
<td>Lincoln</td>
</tr>
<tr>
<td>Swift</td>
</tr>
<tr>
<td>Swift</td>
</tr>
<tr>
<td>Swift</td>
</tr>
<tr>
<td>Yellow Medicine</td>
</tr>
<tr>
<td>County</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Clay</td>
</tr>
<tr>
<td>Kandiyohi</td>
</tr>
<tr>
<td>Mahnomen</td>
</tr>
<tr>
<td>Pennington</td>
</tr>
<tr>
<td>Polk</td>
</tr>
<tr>
<td>Red Lake</td>
</tr>
</tbody>
</table>
Photo Page 1. Rough *Cypripedium candidum* phenology in 2012. Range of development within a site on a given day can vary greatly.

May 3 – Sangl WMA, Jackson County

May 11 – Expandere WMA, Cottonwood County

May 23 – Expandere WMA, Cottonwood County

May 30 – Plover Prairie, Lac Qui Parle County
Appendix A.

Monitoring forms developed for 2012 monitoring season, with instructions.
Minnesota Small White Lady's Slipper Level 1 Monitoring Form

Surveyor: ___________________________ Date: ____________

Use one form for each subpopulation. Subpopulations are separated by at least 50 meters between the closest plants in each group. Larger subpopulations with continuous plants over large acreages may also be divided into smaller “sub-units” to aid in counting. Complete the form as thoroughly as possible.

SECTION 1: SITE INFORMATION

SITE NAME: ___________________________ EO#: ____________
COUNTY: ____________________________ SUBPOPULATION #: ____________

SECTION 2: GPS

Collect a GPS Point from the approximate center of the population/subpopulation and record below. GPS the boundary if the overall population/subpopulation dimensions are greater than 13 m x 13 m. Submit the GPS points as a shapefile upon completion.

COORDINATE SYSTEM: (UTM Zone 15 N Preferred) DATUM: (NAD 83 Preferred)

UTM IS PREFERRED REPORTING METHOD

<table>
<thead>
<tr>
<th>CENTER</th>
<th>LATITUDE</th>
<th>LONGITUDE</th>
<th>Acc. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTM Easting</td>
<td>UTM Northing</td>
<td>Accuracy (m)</td>
<td></td>
</tr>
</tbody>
</table>

GPS UNIT: ____________________________ WAYPOINT(S): ____________________________

(Submit Range of Waypoints if GPSing population boundary)

SECTION 3: SUBPOPULATION INFORMATION

Each clump constitutes one (1) plant. Any stem or clump that is more than 15 cm away from a neighboring plant should be counted as an individual. If one stem in any given clump is flowering/fruited, it should be counted as a reproductive individual.

POPULATION EXTENT (Meters)

GREATEST E-W: ____________
GREATEST N-S: ____________

SOIL CONDITION

□ Dry
□ Moist, drained
□ Saturated
□ Flooded

*Space in grid below provided to aid in counting subpopulation

<table>
<thead>
<tr>
<th>Vegetative (Sterile)</th>
<th>SINGLE (1 Stem)</th>
<th>SMALL CLUMPS (2-10 Stems)</th>
<th>LARGE CLUMPS (11+ Stems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reprod. (Flower/Fruit)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Additional Information: (Include associates, native plant community, etc.)

Level I SWLS Monitoring Form Page 1 of 3
### SECTION 4: POPULATION THREATS

- **No Threats Observed**

**INVASIVE SPECIES (List)**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**WOODY SPECIES ENCROACHMENT (List)**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**GRAZING/TRAMPLING**
(Circle appropriate choice)
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

*If known, please note what type of trampling was observed in space below. Type may include wild animals, domestic animals, humans or ATV.*

### THREAT COMMENTS:

- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

### SECTION 5: SITE MANAGEMENT WITHIN THE POPULATION

For each management treatment below, estimate the percentage of the population/subpopulation affected by the various activities over the last 12 months.

**BURNING**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**WOODY SPECIES REMOVAL**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**INVASIVE SPECIES REMOVAL**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**MOWING/HAYING**
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐

**OTHER:** __________

### MANAGEMENT COMMENTS:

- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
- [ ] ☐
SECTION 6: DIRECTIONS

Give detailed directions for locating the population/subpopulation. Include: nearest town, highway/street number, parking, trails, walking directions.

SECTION 7: SITE MAP & COMMENTS

Use the space below to provide any additional details not covered in the form. Sketch a simple map and outline of the population within the site; use landmarks etc.

MAP
Minnesota Small White Lady's Slipper Level 1 Monitoring Instructions

Surveyor: Write the name of the primary surveyor. List additional people in the space below if necessary.

Date: Write the date of observation. Write out the month (e.g. May, June) to avoid any date confusion.

SECTION 1: SITE INFORMATION

Site Name: Write the name of the managed area.
County: Write out the name of the county.
EO #: This is the number used to track the population in the rare features database. This number is provided.
Subpopulation #: You will need to assign a unique number to each subpopulation observed at a site. A subpopulation is any group of plants separated by more than 50 meters from the next nearest group of plants. This number will be used in subsequent years to track the fate of subpopulations. If the population is small the subpopulation will be the same as the population. Larger populations may need to be divided to aid in counting and mapping. Use features on the landscape to make logical subdivisions of larger populations.

SECTION 2: GPS

Coordinate System: Write the name of the system used while collecting GPS points. The MN DNR standard is UTM Zone 15 N. Other systems may include decimal degree, or degree decimal minute.
Datum: Write the name of the datum used while collecting GPS points. The MN DNR standard is NAD 83. Other datums may include WGS84.
Center: Record the center point of the population/subpopulation in the preferred format if possible. Also record the accuracy of your GPS unit in meters.
GPS Unit: Record the name and model of the GPS unit used to collect the data.
Waypoints: Record the waypoint number from the center of the population. Also include the range of GPS points collected if the boundary of the population was GPSed.

SECTION 3: SUBPOPULATION INFORMATION

Population Extent: Use a metric tape to record the greatest east-west and north-south extent of the population/subpopulation in meters. If the population is too large to measure on the ground, you may estimate the distance or calculate the approximate distance in the office using GIS software and your collected GPS points.

Soil Condition: Check the best choice for the moisture condition of the soil at the site. Use the following for guidance: Flooded = Standing Water; Saturated = The ground is wet, and standing water is near the surface (small pools may form around your feet); Moist, drained = Soil is wet, but apparently no water pooling around your feet; Dry = No/little moisture detected.

Count Grid: Space is provided to aid in tallying the plants observed in the population/subpopulation. Record single stem plants, small clumps (2-10 stems) and large clumps (11+ stems) separately. Also record the number of vegetative and reproductive (flowering/fruiting) plants in each category separately as well. If at least one stem of any clump is flowering, count this as a reproductive individual. Plants that are more than 15 cm apart should be counted as separate individuals.

Additional Info.: Use this space to record additional comments about the population/subpopulation. This could include associate species, the native plant community, thatch thickness, etc.
SECTION 4: POPULATION THREATS

No Threats Observed: Check this box if there are no apparent threats observed within the population/subpopulation.

Invasive Species: List any invasive species observed within the population/subpopulation. For each species identified, estimate the approximate percentage of the population/subpopulation covered by the invasive species by checking one of the estimate boxes on the left.

Woody Species List any woody species observed within the population/subpopulation. For each species identified, estimate Encroachment: the approximate percentage of the population/subpopulation covered by the woody species by checking one of the estimate boxes on the left. *In the northwest, brush prairie is common, and a number of woody species may be encountered.

Grazing/Trampling: If you are able, estimate the percentage of the population/subpopulation that has been grazed/trampled. Indicate the population has been grazed if substantial portions of the population/subpopulation appear to have been eaten. This does not include casual herbivory of plants (herbivory should be noted in the comments). Trampling of plants could occur from any number of sources (people, ATV, cattle, etc.). Please indicate the source of the trampling (if possible) in the comments.

Threat Comments: Space is provided for any additional information related to observed threats.

SECTION 5: SITE MANAGEMENT WITHIN THE POPULATION

Management Regimes: Indicate if any management activity has occurred at the site within the population/subpopulation over the last 12 months. If possible, estimate the overlap of management with the population/subpopulation.

Management Comments: Space is provided for any additional information related to site management or for any additional information

SECTION 6: DIRECTIONS

Direction Comments: Provide detailed information on how to get to the site. Include information on the best place to park, best access routes to populations. You may also want to include things to avoid such as deep ditches, thick brush, etc.

SECTION 7: MAP & COMMENTS

Comments: Space is provided for any additional details that may not have been covered elsewhere in the form. Space is also provided to draw a simple map of the site or to attach an aerial photograph.
Appendix B.

Maps of monitoring sites showing the observed distributions of *Cypripedium candidum* in 2012. (This Appendix has been removed as it contains sensitive species location information.)