

ADDITIONAL OBSERVATIONS OF THE ASSOCIATED PLANT SPECIES  
SURROUNDING POPULATIONS OF *CYPRIPEDIUM KENTUCKIENSE*  
(ORCHIDACEAE) IN WEST CENTRAL LOUISIANA

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ABSTRACT

The vegetation surrounding 23 groups of *Cypripedium kentuckiense* Reed in west central Louisiana was sampled using nearest individuals and the dominant species within a five meter radius area. Twenty-two of the study sites are located on the Fort Polk Military Installation in Vernon Parish, Louisiana and an additional sample was on the nearby Kisatchie National Forest in Natchitoches Parish. The most common associated herbaceous species was *Chasmanthium sessiliflorum*, woody vine *Toxicodendron radicans*, shrub/sapling *Hamamelis virginiana*, small tree *Ilex opaca*, and big tree *Quercus alba*.

RESUMEN

La vegetación que rodea a 23 grupos de *Cypripedium kentuckiense* Reed en el centro oeste de Louisiana se muestrearon usando el individuo más próximo y la especie dominante en un área de cinco metros de radio. Veintidós de los lugares de estudio están localizados en la instalación militar de Fort Polk en la parroquia de Vernon, Louisiana y una muestra adicional estaba en el vecino Kisatchie National Forest en la parroquia de Natchitoches. Las especies herbáceas asociadas más comunes fueron *Chasmanthium sessiliflorum*, trepadora leñosa *Toxicodendron radicans*, arbusto/árbol joven *Hamamelis virginiana*, árbol pequeño *Ilex opaca*, y árbol grande *Quercus alba*.

INTRODUCTION

In a previous paper, the vegetation around five populations of *Cypripedium kentuckiense* Reed at Fort Polk, Louisiana was reported (Allen et al. 2004). As pointed out then, this was the first report of quantitative data on the vegetation associated with *C. kentuckiense*. In this paper we report on the vegetation associated with 23 populations in west central Louisiana including the five populations included in the first report (Allen et al. 2004). *Cypripedium kentuckiense* is a rare south-eastern orchid of global conservation concern (G3) (NatureServe 2010). The habitat in Louisiana and east Texas is reported to be mesophytic wood, calcareous forest, and hardwood slope forest (Louisiana Natural Heritage Program 2003; Poole et al. 2007). In the previous report, *C. kentuckiense* was found to be associated with a forest composed of *Fagus grandifolia*, *Ostrya virginiana*, *Symplocos tinctoria*, *Quercus alba*, and *Hamamelis virginiana* in the overstory and *Toxicodendron radicans* and *Thelypteris hexagonoptera* in the understory. The purpose of this paper is to further characterize the vegetation immediately surrounding *C. kentuckiense* populations. Information on *C. kentuckiense* populations across the southeast and on other qualitative inventories of similar habitat is given in the previous paper and will not be repeated here (Allen et al. 2004).

*Cypripedium kentuckiense* is a rare orchid with a global conservation status of G3, which is defined as being at moderate risk of extinction due to a restricted range, and relatively few populations (NatureServe 2010). Within the United States, its distribution is limited to the southeastern states of AL, AR, GA, KY, LA, MS, OK, TN, TX, and VA (Flora of North America Editorial Committee 2002). Specifically, in AL, GA, LA, MS, OK, TX, and VA, this orchid is rated S1 - critically imperiled because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state or province (NatureServe 2010). It is rated S2 (imperiled with 20 or fewer) in TN, S1/S2 in Kentucky and S3 (vulnerable with 80 or fewer) in Arkansas. Furthermore, while this range of distribution seems geographically moderate, most individual populations of yellow lady's slipper are relatively small (often consisting of 1–3

plants) (NatureServe 2010). This orchid is reported from 12 counties in east Texas (Diggs et al. 2006; Liggio & Liggio 1999) and in Louisiana, is reported from 11 parishes with four from unverified reports (Louisiana Department of Wildlife and Fisheries; Natural Heritage Program 2003). Due to its rarity, beauty, and the conservational interest of a variety of parties, there have been several reintroduction projects initiated with varied results in the past (US Forest Service 2011; Loos & Philipps 2010).

#### STUDY SITES AND METHODS

We studied 22 Fort Polk sites located on the banks of Bird's, Liberty, and Ouiska Chitto Creeks and their tributaries on Fort Polk in Vernon Parish and one site located on the banks of a tributary of Kisatchie Bayou in Natchitoches Parish. The soil at the Vernon Parish sites is Eastwood silt loam (Soil Survey Division 2003) and at the Natchitoches Parish site is Malbis fine sandy loam (Soil Survey Division 1990).

All data from the 23 populations of *Cypripedium kentuckiense* were collected during June 2010. During this time period, all of the woody plants and most of the herbaceous ones are identifiable to species. Most of the 23 clumps were composed of 3–5 individual plants, and all plants appeared to be in good health, with some just passing the flowering stage. The area surrounding each of the 23 lady-slipper sites was examined and the five nearest individuals to the center of the clump were identified to species including herbaceous, woody-vines, shrubs (woody non-vine shorter than six feet), shrubs/saplings (woody non-vines taller than six feet and five inch or less dbh), and trees (woody non-vines taller than six feet and larger than five inch dbh). Additionally, the one dominant species within a 5m radius was also recorded for the herbaceous, woody-vines, and shrub category. All raw data collected in the field were entered and calculation of variables performed using Microsoft Excel. At each of the 23 sites, five individual plants were recorded for each of the five vegetation categories producing a total of 115 individuals per category. The relative abundance was calculated by dividing the number of times that a species was recorded by 115, the total number of observations. This was done for all five categories and each value was converted to a percent. The frequency was calculated for each species by dividing the number of sites of occurrence by the total number of sites (23). The relative frequency was calculated by dividing the frequency for a species by the total of all frequencies for the category. For herbaceous, shrubs, and woody-vines, the relative dominance was calculated by dividing the species's number of dominant sites by 23. This value was converted to a percent. Importance values for the herbaceous, woody-vines, and shrubs were calculated by summing the relative abundance, relative frequency, and relative dominance and for the shrubs/saplings and trees by the sum of the relative abundance and relative frequency.

#### RESULTS AND DISCUSSION

A total of 76 species were recorded including 24 herbaceous, 12 woody-vines, and 40 woody non-vines (31 shrubs, 19 shrubs/saplings and 16 trees note overlap in categories) (Tables 1–5). The species are listed in decreasing importance values. The top three associated herbaceous species are *Chasmanthium sessiliflorum*, *Polystichum acrostichoides*, and *Brachyelytrum erectum* (Table 1). For woody-vines, the most important species is *Toxicodendron radicans* with almost half of the importance value; *Bignonia capreolata* and *Smilax smallii* are second and third respectively (Table 2). The top three species for shrubs are *Hamamelis virginiana*, *Acer rubrum*, and *Styrax grandifolius* (Table 3). For shrubs/saplings, the top three species are *Ilex opaca*, *Fagus grandifolia*, and *Hamamelis virginiana* (Table 4). The three trees with the highest importance value are *Quercus alba*, *Tilia americana*, and *Nyssa sylvatica* (Table 5).

Almost all of the herbaceous species identified in this study were also listed by Allen et al. (2004) and six species overlapped in the top ten important species for each study. Broad beechfern (*Thelypteris hexagonoptera*) was found in association with all of the known National Forest locations in Texas (Loos & Philipps 2010). The woody vine species that dominated (importance value = 123.72) in the Allen et al. (2004) study as well as this study (importance value = 128.28) was *Toxicodendron radicans*. Seven of the shrub/sapling species reported in the top ten in importance value in Allen et al. (2004) were also in the top ten in the shrub and/or shrub/sapling categories in this study. The top five tree species in our study were *Quercus alba*, *Tilia americana*, *Nyssa sylvatica*,

TABLE 1. List of herbaceous species recorded from 23 *Cypripedium kentuckiense* sites in west central Louisiana.

| species                           | abundance | frequency percent | dominance | importance value |
|-----------------------------------|-----------|-------------------|-----------|------------------|
| <i>Chasmanthium sessiliflorum</i> | 12        | 52.17             | 7         | 51.48            |
| <i>Polystichum acrostichoides</i> | 8         | 34.78             | 4         | 28.89            |
| <i>Brachyelytrum erectum</i>      | 9         | 39.13             | 3         | 26.93            |
| <i>Thelypteris hexagonoptera</i>  | 14        | 60.87             | 2         | 23.90            |
| <i>Solidago caesia</i>            | 13        | 56.52             | 1         | 23.23            |
| <i>Scleria oligantha</i>          | 9         | 39.13             | 1         | 21.26            |
| <i>Dichantherium commutatum</i>   | 9         | 39.13             | 0         | 19.95            |
| <i>Desmodium glutinosum</i>       | 9         | 39.13             | 1         | 19.75            |
| <i>Dichantherium boscii</i>       | 5         | 21.74             | 2         | 17.59            |
| <i>Mitchella repens</i>           | 3         | 13.04             | 1         | 11.50            |
| <i>Phaseolus polystachios</i>     | 5         | 21.74             | 0         | 10.41            |
| <i>Carex albicans</i>             | 4         | 17.39             | 0         | 8.02             |
| <i>Cynoglossum virginianum</i>    | 2         | 8.70              | 1         | 7.60             |
| <i>Elephantopus tomentosus</i>    | 2         | 8.70              | 0         | 4.77             |
| <i>Dioscorea villosa</i>          | 2         | 8.70              | 0         | 3.25             |
| <i>Aster lateriflorus</i>         | 1         | 4.35              | 0         | 2.38             |
| <i>Carex debilis</i>              | 1         | 4.35              | 0         | 2.38             |
| <i>Melica mutica</i>              | 1         | 4.35              | 0         | 2.38             |
| <i>Ruellia carolinensis</i>       | 1         | 4.35              | 0         | 2.38             |
| <i>Salvia lyrata</i>              | 1         | 4.35              | 0         | 2.38             |
| <i>Sanicula canadensis</i>        | 1         | 4.35              | 0         | 2.38             |
| <i>Spigelia marilandica</i>       | 1         | 4.35              | 0         | 2.38             |
| <i>Viola</i> spp.                 | 1         | 4.35              | 0         | 2.38             |
| <i>Viola walterii</i>             | 1         | 4.35              | 0         | 2.38             |
| <b>Total</b>                      |           |                   |           | <b>300</b>       |

TABLE 2. List of woody-vine species recorded from 23 *Cypripedium kentuckiense* sites in west central Louisiana.

| species                            | abundance | frequency percent | dominance | importance value |
|------------------------------------|-----------|-------------------|-----------|------------------|
| <i>Toxicodendron radicans</i>      | 53        | 60.87             | 12        | 123.72           |
| <i>Bignonia capreolata</i>         | 17        | 34.78             | 2         | 38.02            |
| <i>Smilax smallii</i>              | 7         | 21.74             | 3         | 28.22            |
| <i>Smilax tamnoides</i>            | 8         | 17.39             | 3         | 27.27            |
| <i>Smilax pumila</i>               | 10        | 26.09             | 1         | 23.95            |
| <i>Parthenocissus quinquefolia</i> | 7         | 26.09             | 1         | 21.34            |
| <i>Vitis rotundifolia</i>          | 2         | 8.70              | 1         | 9.72             |
| <i>Smilax glauca</i>               | 4         | 13.04             | 0         | 8.93             |
| <i>Smilax bona-nox</i>             | 2         | 8.70              | 0         | 5.38             |
| <i>Smilax rotundifolia</i>         | 2         | 8.70              | 0         | 5.38             |
| <i>Vitis</i> spp.                  | 2         | 8.70              | 0         | 5.38             |
| <i>Rubus argutus</i>               | 1         | 4.35              | 0         | 2.69             |
| <b>Total</b>                       |           |                   |           | <b>300</b>       |

*Fagus grandifolia*, and *Pinus taeda* while the Allen et al. (2004) study's top five tree species were *Fagus grandifolia*, *Quercus alba*, *Symplocos tinctoria*, *Nyssa sylvatica*, and *Ostrya virginiana*. Some of the lack of overlap between the two studies could be attributed to the use of three woody nonvine categories in this study compared to two in the 2004 study by Allen et al.

The Fort Polk military installation offers a unique and valuable opportunity to conduct ecological research due to the vast areas of restricted, and thus, undisturbed habitat. This study generated a list of associated species for *Cypripedium kentuckiense* based mainly on the Fort Polk populations. These association data should be similar across much of the southern range of the species, especially in Louisiana and east Texas.

TABLE 3. List of shrub species recorded from 23 *Cypripedium kentuckiense* sites in west central Louisiana.

| species                       | abundance | frequency percent | dominance  | importance value |
|-------------------------------|-----------|-------------------|------------|------------------|
| <i>Hamamelis virginiana</i>   | 16        | 34.78             | 6          | 50.53            |
| <i>Acer rubrum</i>            | 14        | 34.78             | 2          | 31.40            |
| <i>Styrax grandifolius</i>    | 10        | 21.74             | 3          | 28.32            |
| <i>Symplocos tinctoria</i>    | 8         | 13.04             | 3          | 23.95            |
| <i>Pinus taeda</i>            | 7         | 26.09             | 1          | 18.33            |
| <i>Euonymus americanus</i>    | 9         | 17.39             | 1          | 17.44            |
| <i>Arundinaria gigantea</i>   | 5         | 13.04             | 2          | 16.99            |
| <i>Fagus grandifolia</i>      | 6         | 21.74             | 1          | 16.14            |
| <i>Ulmus alata</i>            | 3         | 13.04             | 1          | 10.90            |
| <i>Tilia americana</i>        | 2         | 8.70              | 1          | 8.72             |
| <i>Viburnum dentatum</i>      | 4         | 13.04             | 0          | 7.43             |
| <i>Vaccinium elliotii</i>     | 3         | 13.04             | 0          | 6.56             |
| <i>Quercus falcata</i>        | 3         | 8.70              | 0          | 5.24             |
| <i>Acer barbatum</i>          | 2         | 8.70              | 0          | 4.37             |
| <i>Carya cordiformis</i>      | 2         | 8.70              | 0          | 4.37             |
| <i>Crataegus spathulata</i>   | 2         | 8.70              | 0          | 4.37             |
| <i>Ilex opaca</i>             | 2         | 8.70              | 0          | 4.37             |
| <i>Prunus serotina</i>        | 2         | 8.70              | 0          | 4.37             |
| <i>Chionanthus virginicus</i> | 0         | 0.00              | 1          | 4.35             |
| <i>Vaccinium arboreum</i>     | 0         | 0.00              | 1          | 4.35             |
| <i>Quercus incana</i>         | 3         | 4.35              | 0          | 3.92             |
| <i>Fraxinus americana</i>     | 2         | 4.35              | 0          | 3.05             |
| <i>Sassafras albidum</i>      | 2         | 4.35              | 0          | 3.05             |
| <i>Callicarpa americana</i>   | 1         | 4.35              | 0          | 2.19             |
| <i>Carpinus caroliniana</i>   | 1         | 4.35              | 0          | 2.19             |
| <i>Nyssa sylvatica</i>        | 1         | 4.35              | 0          | 2.19             |
| <i>Ostrya virginiana</i>      | 1         | 4.35              | 0          | 2.19             |
| <i>Quercus alba</i>           | 1         | 4.35              | 0          | 2.19             |
| <i>Quercus shumardii</i>      | 1         | 4.35              | 0          | 2.19             |
| <i>Rhododendron canadense</i> | 1         | 4.35              | 0          | 2.19             |
| <i>Sabal minor</i>            | 1         | 4.35              | 0          | 2.19             |
| <b>Total</b>                  |           |                   | <b>300</b> |                  |

TABLE 4. List of shrub/sapling species (woody non woody-vines taller than six feet and five inch or less dbh) recorded from 23 *Cypripedium kentuckiense* sites in west central Louisiana.

| species                        | abundance | frequency percent | importance value |
|--------------------------------|-----------|-------------------|------------------|
| <i>Ilex opaca</i>              | 29        | 69.57             | 46.84            |
| <i>Fagus grandifolia</i>       | 14        | 39.13             | 24.34            |
| <i>Hamamelis virginiana</i>    | 13        | 34.78             | 22.12            |
| <i>Symplocos tinctoria</i>     | 13        | 26.09             | 19.41            |
| <i>Ostrya virginiana</i>       | 10        | 30.43             | 18.16            |
| <i>Tilia americana</i>         | 10        | 21.74             | 15.45            |
| <i>Fraxinus americana</i>      | 6         | 17.39             | 10.62            |
| <i>Acer barbatum</i>           | 4         | 13.04             | 7.53             |
| <i>Ulmus alata</i>             | 3         | 13.04             | 6.66             |
| <i>Cornus florida</i>          | 2         | 8.70              | 4.44             |
| <i>Liquidambar styraciflua</i> | 2         | 8.70              | 4.44             |
| <i>Nyssa sylvatica</i>         | 2         | 8.70              | 4.44             |
| <i>Carpinus caroliniana</i>    | 1         | 4.35              | 2.22             |
| <i>Celtis reticulata</i>       | 1         | 4.35              | 2.22             |
| <i>Ilex longipes</i>           | 1         | 4.35              | 2.22             |
| <i>Magnolia virginiana</i>     | 1         | 4.35              | 2.22             |
| <i>Styrax grandifolius</i>     | 1         | 4.35              | 2.22             |
| <i>Ulmus americana</i>         | 1         | 4.35              | 2.22             |
| <i>Vaccinium arboreum</i>      | 1         | 4.35              | 2.22             |
| <b>Total</b>                   |           |                   | <b>200</b>       |

TABLE 5. List of tree species (woody non woody-vines taller than six feet and larger than five inch dbh) recorded from 23 *Cypripedium kentuckiense* sites in west central Louisiana.

| species                        | abundance | frequency percent | importance value |
|--------------------------------|-----------|-------------------|------------------|
| <i>Quercus alba</i>            | 14        | 43.48             | 25.16            |
| <i>Tilia americana</i>         | 15        | 34.78             | 23.43            |
| <i>Nyssa sylvatica</i>         | 12        | 34.78             | 20.82            |
| <i>Fagus grandifolia</i>       | 13        | 30.43             | 20.40            |
| <i>Pinus taeda</i>             | 10        | 34.78             | 19.09            |
| <i>Liquidambar styraciflua</i> | 9         | 30.43             | 16.92            |
| <i>Ilex opaca</i>              | 10        | 17.39             | 13.89            |
| <i>Fraxinus americana</i>      | 8         | 21.74             | 13.45            |
| <i>Acer rubrum</i>             | 6         | 26.09             | 13.01            |
| <i>Carya alba</i>              | 7         | 17.39             | 11.28            |
| <i>Acer barbatum</i>           | 3         | 13.04             | 6.50             |
| <i>Ostrya virginiana</i>       | 2         | 8.70              | 4.34             |
| <i>Ulmus americana</i>         | 2         | 8.70              | 4.34             |
| <i>Quercus shumardii</i>       | 2         | 4.35              | 3.04             |
| <i>Carya ovata</i>             | 1         | 4.35              | 2.17             |
| <i>Magnolia grandifolia</i>    | 1         | 4.35              | 2.17             |
| <b>Total</b>                   |           |                   | <b>200</b>       |

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