

## **Formation of Pierce Cedar Creek Institute Interactive Tree Key for Common Plants Along Trails**

Molly Soper and Dr. Summer Silvieus  
Summer 2007  
Aquinas College Biology Department

### **Abstract**

A good understanding of location is crucial to any research project. The objective of this project was to learn more about the plant communities at the Pierce Cedar Creek Institute (PCCI), located in Hastings, MI. An interactive key was built in order to assist visitors to the center in identifying common plants along a trail at PCCI. While only one trail was surveyed, many of the plants found are common throughout the property, and thus the key is useful for more than just the trail surveyed. Relevés were used to survey the trail for common plants and to get a general description of the trail. The use of relevés allowed for a quicker plant community survey than doing a comprehensive sweep of the entire trail. It is hoped that later research conducted at Pierce Cedar Creek will be aided from the findings and knowledge gained from this project.

### **Background**

Although PCCI is a relatively new biological field station, there have been previous surveys of the property done. One example of previous work was the survey completed by Slaughter and Skean. In this study, 394 species of vascular plants were found throughout the Pierce Cedar Creek property (Slaughter 2003). Many plants found by Slaughter and Skean were also found over the course of this project. Prior to this project, however, there was not an interactive key for visitors to use for easy identification of the more common plants.

The program used to create the interactive key for this project is commonly utilized. Stinger's Lightweight Interactive Key Software or SLIKS can be found as freeware available on the Internet. Advantages to SLIKS was that it is available for many different web browsers, or can be downloaded, and that it was relatively user-friendly for both the programmer and the user. (Stinger 2007). The resulting key will be available on-line and individuals will be able to download it to handheld computers as well.

## Methods

When selecting a trail to survey, it was crucial to pick one that satisfied a number of requirements. One goal of this project was to describe plants in this interactive key that visitors would most likely see and wish to identify. The Orange Trail was chosen because of the length, proximity to the PCCI visitors' center, and the number of habitats it included along its span. The Orange trail was only 1.5 miles in length, which is a manageable length for most visitors. The habitats along the trail included both prairie and forested areas, which allowed for a variety of plant species to be included.

Thirty relatively equally spaced relevés were surveyed along the Orange trail at Pierce Cedar Creek. Each of these relevés was three meters by three meters and placed on either side of the dirt trail. These dimensions were chosen because it was assumed that visitors to PCCI would be more likely to notice and question the identities of plants closer to the trail than ones back farther off the trail. The distance between each relevé along the trail was not measured, however, the location for each relevé was determined by approximate distance from the other nearby relevés (Figure 1).

Corners of each relevé were marked using red biodegradable marking tape, which was removed after data was collected. Once the boundaries were set, a general description of the plot was recorded and approximated percentages of plant coverage at specific height ranges. For each height range, the dominant life form category (herbaceous, shrubs, woody) was also noted.

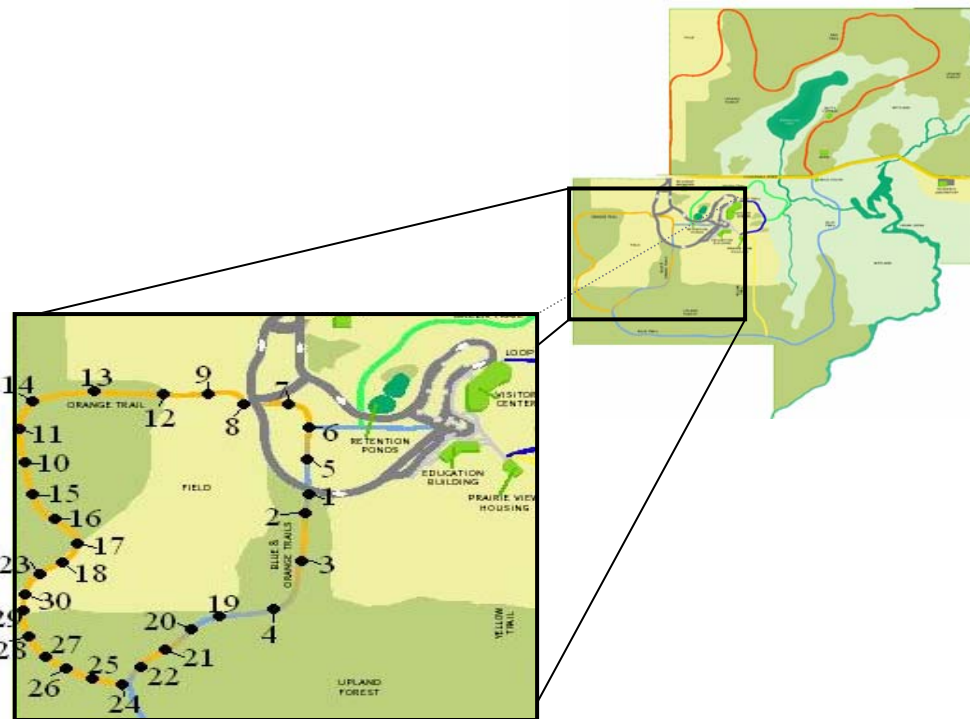
After the initial description of each relevé, the most common plants in the plot were identified. Once acknowledged, the plants were characterized based on a number of features: flower arrangement, flower color, petal and sepal numbers, stamen and carpel numbers, flower diameter, leaf arrangement, leaf structure, teeth, hairiness, vein type, leaf apex and base shapes, petiole length, leaf length and width, stem type, stem texture, presence or absence of prickles, stem color, and diameter at breast height (DBH). These features were chosen because they are characteristics easy for visitors unfamiliar with plant morphology to notice and discern. Five samples of each identified species were characterized and measured. Utilizing five samples allowed for ranges and averages of each feature to be noted. After being characterized, several digital photos of the entire plant and its distinguishing feature were taken. These photos will be incorporated into the interactive key. The time spent in the field at PCCI was from May 17th, 2007 to July 27<sup>th</sup>, 2007.

Once all field data had been collected, individual species characteristics were inputted into an electronic database and then utilized to create an interactive identification key. This key was made from software called Stinger's Lightweight Interactive Key Software or SLIKS and was coded for using html. Twenty-three plant characteristics were incorporated into the key, each with multiple choices. For example, one characteristic was flower color and it had six different flower color options to choose from included reds to blues. Each identified plant species was coded into the program using the field data.

## **Results**

From Figure 1, it is possible to see that the relevés were not done in numeric order around the trail. Due to weather and other events it was easier to create the relevés in this order. Despite not being in order, a relative distance was kept standard between each relevé. See the included Appendix for complete descriptions and plant coverage from each relevé.

Sixty different species of plants were identified along the Orange Trail (Table 1). Of the sixty species, thirty-seven plants were herbaceous and twenty-three were woody. Fifty-four different genera were represented. Invasive species found included Garlic Mustard (*Alliaria officinalis*), Dame's Rocket (*Hesperis matronalis*), and the Autumn Olive (*Elaeagnus umbellata*). Shown in Table 1 are the names and locations of the samples recorded. Samples taken within a relevé are marked by the number relevé they were found in. Most of the samples were taken at the Pierce Cedar Creek Institute, however, due to short flowering schedules, rarity, short life spans, or lack of rain, some measurements were taken from herbarium samples instead of live plants. The specimens in the Pierce Cedar Creek and Aquinas College herbariums were used for this data.



**Figure 1: Relevé Location Map along Orange Trail and Property Map of Pierce Cedar Creek.** (used with permission from PCCI)

**Table 1: List of plant species found at PCCI and relative location along Orange Trail.**

**O** - Sampled along the Orange Trail, but not inside a relevé

**PH** - Pierce Cedar Creek Herbarium samples

**AH** – Aquinas College Herbarium samples

Scientific Name	Common Name	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
<i>Acer Negundo</i>	Box-Elder	11	12	15	O	O
<i>Acer rubrum</i>	Red Maple	19	25	28	O	O
<i>Acer saccharum</i>	Sugar Maple	4	25	27	O	O
<i>Achillea millefolium</i>	Yarrow	5	16	O	O	O
<i>Alliaria officinalis</i>	Garlic Mustard	11				
<i>Amphicarpa bracteata</i>	Hog Peanut	3	13	O	O	PH
<i>Arabis glabra</i>	Tower Mustard	9	10	12	15	
<i>Campanula americana</i>	Tall Bellflower	25	O	O	O	O
<i>Carya ovata</i>	Shagbark Hickory	4	4	6	14	O
<i>Cerastium vulgatum</i>	Mouse Ear Chickweed	3	6	19	O	O
<i>Chrysanthemum leucanthemum</i>	Ox-Eye Daisy	6	O	O	O	O
<i>Circea lutetiana</i>	Enchanter's Nightshade	20	22	26	24	25

<i>Cirsium hillii</i>	Pasture Thistle	7	8	14	O	O
<i>Cornus drummondii</i>	Roughleaf Dogwood	22				
<i>Crataegus sp.</i>	Hawthorn	11	O	O	O	O
<i>Daucus carota</i>	Wild Carrot	6	15	18	30	O
<i>Desmodium glutinosum</i>	Pointed-Leaved Tick-Trefoil	26	O	O	O	PH
<i>Dianthus armeria</i>	Deptford Pink	17	O	O	O	O
<i>Elaeagnus umbellata</i>	Autumn Olive	2	9	15	21	O
<i>Erigeron annuus</i>	Daisy Fleabane	17	23	29	O	O
<i>Fraxinus pennsylvanica</i>	Green Ash	3	13	20	26	O
<i>Galium aparine</i>	Cleavers	1	2	5	10	
<i>Geranium maculatum</i>	Wild Geranium	3	20	AH	AH	PH
<i>Geum canadense</i>	White Avens	17	18	19	29	O
<i>Heliopsis helianthoides</i>	False Sunflower	23	30	O	O	O
<i>Hesperis matronalis</i>	Dame's Rocket	12	AH	AH	AH	AH
<i>Hieracium anurantiacum</i>	Orange Hawkweed	16	O	O	O	O
<i>Hieracium pretense</i>	King Devil/ Meadow Hawkweed	5	O	O	O	O
<i>Juglans nigra</i>	Black Walnut	10	17	O	O	O
<i>Leonurus cardiaca</i>	Motherwort	14	20	29	O	O
<i>Lepidium campestre</i>	Cow-Cress	5	15	AH	AH	AH
<i>Monarda fistulosa</i>	Wild Bergamont	30	O	O	O	O
<i>Morus rubra</i>	Red Mulberry	8	O	O	O	O
<i>Osmorhiza claytonii</i>	Sweet Cicely	3	O	O	O	PH
<i>Ostrya virginiana</i>	Ironwood/ Hops Hornbeam	4	27	28	AH	PH
<i>Oxalis stricata</i>	Yellow Wood-sorrel	9	19	O	O	O
<i>Parthenocissus quinquefolia</i>	Woodbine	3	10	11	13	O
<i>Penstemon sp.</i>	Beardtongue	18				
<i>Phytolacca americana</i>	Pokeweed	27	O	O	O	O
<i>Pinus sylvestris</i>	Scotch Pine	14	O	O	O	O
<i>Podophyllum peltatum</i>	May-Apple	1	27	27	29	O
<i>Potentilla recta</i>	Rough-Fruited Cinquefoil	3	7	12	21	O
<i>Prunella vulgaris</i>	Heal-All	19	22	24	25	O
<i>Prunus serotina</i>	Black Cherry	6	21	O	O	O
<i>Quercus rubra</i>	Red Oak	21	26	25	28	24
<i>Robinia pseudoacacia</i>	Black Locust	7	O	O	O	O
<i>Rosa carolina</i>	Pasture Rose	6	18	O	O	O

<i>Rosa multiflora</i>	Multiflora Rose	12	13	24	O	O
<i>Rubus sp.</i>	Brambles/ Raspberry	1	3	9	16	O
<i>Rudbeckia hirta</i>	Black Eyed Susan	30	23	O	O	O
<i>Sassafras albidum</i>	Sassafras	14	O	O	O	O
<i>Silene cucubalus</i>	Bladder campion	7	8	12	O	O
<i>Taraxacum officinale</i>	Common Dandelion	1	5	10	O	O
<i>Toxicodendron radicans</i>	Poison Ivy	28	O	O	O	O
<i>Trifolium auream</i>	Hop Clover	7	O	O	O	O
<i>Trifolium pretense</i>	Red Clover	5	16	18	O	O
<i>Ulmus Rubra</i>	Slippery Elm	2	14	22	29	O
<i>Veronica peregrina</i>	Purshlane Speedwell	1	20	20	O	O
<i>Veronica serpyllifolia</i>	Thyme Leaved Speedwell	9	AH	AH	AH	AH
<i>Vitis riparia</i>	Grapevine	8	12	23	O	O

## Discussion and Conclusion

Because the Orange Trail included both prairie and forested areas, it was possible to find and include plants that only grow in these specific habitats. For example, many red oaks (*Quercus rubra*) were sampled in their forested habitats along the trail. More generalized-habitat plants like the Multiflora Rose (*Rosa multiflora*) were found in both the forested and the open prairie areas. Many of these sixty species were common plants all along this trail.

However, the method of using relevés introduced the possibility that not every species found on the Orange rail was included in the survey. In this project, the use of relevés proved to be an effective method for the time span spent in the field along the trail. A one hundred percent sweep of the trail would have taken too much time and it is hypothesized that it would not have added many more species. Those species that were missed may have been more rare in abundance along the trail and therefore less likely for a visitor to encounter as well. Towards the end of the sampling process, additional samples were taken outside of relevé boundaries, but still on the Orange Trail. This helped to give multiple samples of already identified plants to be used in averages, but also allowed for the identification of additional species such as the Orange Hawkweed (*Hieracium anurantracum*).

Some sources of potential error in this project could have included the time of year plants were identified. Frequently plants had stopped flowering or had not yet flowered before

characteristics on five different samples could be taken. Because of this, some features of some species were examined on herbarium sheets instead of in the field. The weather could have contributed unknown errors to this project also. The summer was very hot and dry compared to typical Michigan weather for the time of year. Many plants were drying quickly in the field from lack of rain, which may have skewed some measurements.

When designing and coding the interactive key, one of the main focuses was usability by visitors. The resulting plant key created allows a person to choose a few of and unknown plant's characteristics, click a few of the choices, and see possible identifications and photos in just mere moments. This key may be placed in a kiosk at the PCCI visitor's center. People may utilize the key at that space, or download it to a portable computer and access the key in the field while looking at the plant in question. At this time, the key is usable, but still is in need of additional testing for ease of use and possible errors.

One problem that may come up is that if the user selects a characteristic not listed for their plant it could eliminate the plant they have. For example, if flower color was used to identify a Wild Geranium (*Geranium maculatum*), the plant would be eliminated from the key because this information was not available when *G. maculatum* was sampled; it was past its flowering time. To correct this problem, additional samples from the field or herbarium sheets should be examined for the missing characteristics in this key.

Though this project on the interactive key for plants along the Orange trail is concluded, there are areas for further work. When identifying the plant species, the most current and accepted names based on phylogenetic analysis were used. However, due to recent and future work on plant evolution and speciation, the interactive key will need to be checked and updated periodically for the best accuracy in species names. Other continuations of the project include surveying other trails at the Pierce Cedar Creek Institute, and adding more species to the key. The interactive key will be most effective and most helpful if more of the property were surveyed. It would also be possible to collect, press and mount plant specimens to increase the number of plants in the PCCI herbarium. Besides a continuation of this project, other research could be done on any single plant species found and identified.

We would like to thank the Pierce Cedar Creek Institute for the URGE grant that supported this project, Aquinas College for use of the herbarium and facilities, all the staff at

Pierce Cedar Creek, especially Matthew Dykstra and Michelle Skedgell for all their help, and the creator of the SLIKS software used to make the interactive key.

## **References**

Slaughter, Bradford S. and J. Dan Skean, Jr. 2003. *Annotated Checklist of Vascular Plants in the Vicinity of Cedar Creek and Brewster Lake, Pierce Cedar Creek Institute, Barry County, Michigan*. Michigan Botanist.

Stinger software info



## Appendix I. Complete description data collected for individual relevé plots

<b>Relevé 1</b>	Plants >4m: 0%
17 May 2007	Plants 2m-4m: 0%
Part Sun; Part Shade	Plants 1m-2m: 0%
	Plants .5m-1m: <5% -- Shrubs
	Plants .1-.5m: 100% -- Herbaceous
<b>Relevé 2</b>	Plants >4m: <5% -- Woody
18 May 2007	Plants 2m-4m: <5% -- Woody
Mostly Shaded	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 8% -- Mixture
	Plants .1-.5m: 95% -- Herbaceous
<b>Relevé 3</b>	Plants >4m: <5% -- Woody
23 May 2007	Plants 2m-4m: 8% --
Mostly Shaded; young trees	Plants 1m-2m: <5% -- Shrubs
	Plants .5m-1m: <5% --
	Plants .1-.5m: 100% -- Herbaceous
<b>Relevé 4</b>	Plants >4m: 15% -- Woody
23 May 2007	Plants 2m-4m: <5% -- Woody
Mostly Shaded; tall young trees	Plants 1m-2m: <5% --
	Plants .5m-1m: <5% --
	Plants .1-.5m: 80% --
<b>Relevé 5</b>	Plants >4m: 0%
25 May 2007	Plants 2m-4m: 0%
Full Sun; Prairie Area	Plants 1m-2m: 0%
	Plants .5m-1m: <5% -- Herbaceous
	Plants .1-.5m: 100% -- Herbaceous

<b>Relevé 6</b>	Plants >4m: 15% -- Woody
30 May 2007	Plants 2m-4m: 0%
Part Sun; Part Shade Woody area Near by	Plants 1m-2m: <5% --
	Plants .5m-1m: 50% -- Woody
	Plants .1-.5m: 50% -- Herbaceous
<b>Relevé 7</b>	Plants >4m: <5% -- Woody
30 May 2007	Plants 2m-4m: <5% -- Woody
Prairie Shaded by Wooded Area	Plants 1m-2m: <5% -- Woody & Tall Herbaceous
	Plants .5m-1m: 80% -- Herbaceous
	Plants .1-.5m: 80% -- Herbaceous
<b>Relevé 8</b>	Plants >4m: 0%
31 May 2007	Plants 2m-4m: <5% -- Woody
Field/Prairie area partly shaded by trees	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 15% -- Tall Herbaceous
	Plants .1-.5m: 100% -- Herbaceous
<b>Relevé 9</b>	Plants >4m: 0%
31 May 2007	Plants 2m-4m: 0%
Prairie area shaded partially	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 50% -- Woody and Herbaceous
	Plants .1-.5m: 100% -- Herbaceous
<b>Relevé 10</b>	Plants >4m: <5% -- Woody
1 June 2007	Plants 2m-4m: 0%
Partly shaded by trees aprox. 10m off trail	Plants 1m-2m: <5% -- Herbaceous
	Plants .5m-1m: 95% -- Herbaceous
	Plants .1-.5m: 100% -- Herbaceous

## Appendix

<b>Relevé 11</b>	Plants >4m: <5% -- Woody
1 June 2007	Plants 2m-4m: 0%
Mostly Shaded; young trees; few grasses	Plants 1m-2m: <5% -- Shrubs
	Plants .5m-1m: 10% -- Herbaceous
	Plants .1-.5m: 100% -- Woody vines
<b>Relevé 12</b>	Plants >4m: 0%
6 June 2007	Plants 2m-4m: <5% -- Woody
Near prairie; Shaded	Plants 1m-2m: 0%
	Plants .5m-1m: Mostly Herbaceous; Some Woody
	Plants .1-.5m: 50% -- Herbaceous
<b>Relevé 13</b>	Plants >4m: 0%
6 June 2007	Plants 2m-4m: <5% -- Woody
Mostly Shaded	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 50% -- Woody
	Plants .1-.5m: 90% -- Woody vines; some Herbaceous
<b>Relevé 14</b>	Plants >4m: 8% -- Woody
6 June 2007	Plants 2m-4m: <5% -- Woody
Mostly Shaded	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 10% -- Herbaceous
	Plants .1-.5m: 100% -- Woody vines; some Herbaceous
<b>Relevé 15</b>	Plants >4m: <5% -- Woody
8 June 2007	Plants 2m-4m: <5% -- Woody
Mostly shaded; lots of open area around relevé	Plants 1m-2m: 10% -- tall Herbaceous
	Plants .5m-1m: 100% --
	Plants .1-.5m: 10% --

<b>Relevé 16</b>	Plants >4m: 0%
8 June 2007	Plants 2m-4m: 0%
Open Field	Plants 1m-2m: <5% -- tall Herbaceous
	Plants .5m-1m: 100% -- Herbaceous
	Plants .1-.5m: 50% -- Herbaceous
<b>Relevé 17</b>	Plants >4m: <5% -- Woody
14 June 2007	Plants 2m-4m: <5% -- Woody
Mostly Shaded by trees back a ways from trail	Plants 1m-2m: 0%
	Plants .5m-1m: 80% -- Herbaceous
	Plants .1-.5m: 80% -- Mostly Herbaceous
<b>Relevé 18</b>	Plants >4m: 0%
14 June 2007	Plants 2m-4m: 0%
Partly Shaded Prairie	Plants 1m-2m: 50% -- Herbaceous
	Plants .5m-1m: 75% -- Herbaceous
	Plants .1-.5m: 50% -- Herbaceous
<b>Relevé 19</b>	Plants >4m: 5% -- Woody
21 June 2007	Plants 2m-4m: 0%
Mostly shaded; young forest area	Plants 1m-2m: 0%
	Plants .5m-1m: <5% -- Woody; some Herbaceous
	Plants .1-.5m: 90% -- Woody vines; some Herbaceous
<b>Relevé 20</b>	Plants >4m: 5% -- Woody
22 June 2007	Plants 2m-4m: 1% -- Woody
Mostly shaded; young forest area	Plants 1m-2m: 5% -- Woody
	Plants .5m-1m: 10% -- Shrubs
	Plants .1-.5m: 100% -- Mostly Woody; some Herbaceous

## Appendix

<b>Relevé 21</b>	Plants >4m: 8% -- Woody
22 June 2007	Plants 2m-4m: 10% -- Woody
Open canopy; young looking trees	Plants 1m-2m: 50% -- Very young Woody
	Plants .5m-1m: 20% -- Herbaceous
	Plants .1-.5m: 90% -- Woody vines
<b>Relevé 22</b>	Plants >4m:10% -- Woody
27 June 2007	Plants 2m-4m: 5% -- smaller Woody
Partly Sunny; Forested area	Plants 1m-2m: 20% -- Woody vines; Shrubs
	Plants .5m-1m: 5% -- Shrubs
	Plants .1-.5m: Woody vines; some Herbaceous
<b>Relevé 23</b>	Plants >4m: 0%
29 June 2007	Plants 2m-4m: 0%
Prairie on one side of trail; shaded by trees on other	Plants 1m-2m: 100% -- Herbaceous; Woody Vine
	Plants .5m-1m: 80% -- Herbaceous; Woody Vine
	Plants .1-.5m: <5% -- Herbaceous
<b>Relevé 24</b>	Plants >4m: 20% -- Woody
10 July 2007	Plants 2m-4m: <5% -- Woody
Mostly shaded; young trees	Plants 1m-2m: 10% -- Herbaceous
	Plants .5m-1m: 5% -- Herbaceous
	Plants .1-.5m: 100% Woody Vines; Herbaceous
<b>Relevé 25</b>	Plants >4m: 30% -- Woody
10 July 2007	Plants 2m-4m: 0%
Mostly Shaded very little ground cover	Plants 1m-2m: 0%
	Plants .5m-1m: <5% -- very young Woody
	Plants .1-.5m: <5% -- very young Woody

<b>Relevé 26</b>	Plants >4m:50% -- Woody
12 July 2007	Plants 2m-4m: 5% -- Woody
Mostly Shaded	Plants 1m-2m: 0%
	Plants .5m-1m: 15% -- Herbaceous; some young Woody
	Plants .1-.5m: 80% -- Woody Vines
<b>Relevé 27</b>	Plants >4m: 10% -- Woody
12 July 2007	Plants 2m-4m: <5% -- Woody
Partly shaded; young trees	Plants 1m-2m: 5% -- Herbaceous
	Plants .5m-1m:40% -- Herbaceous
	Plants .1-.5m: 90% -- Woody Vines; Herbaceous
<b>Relevé 28</b>	Plants >4m: 80% -- Woody
13 July 2007	Plants 2m-4m: 20% -- Woody
Shaded; mixture of old and young trees	Plants 1m-2m: 0%
	Plants .5m-1m: 5% -- Young Woody
	Plants .1-.5m: 90% -- Woody
<b>Relevé 29</b>	Plants >4m: 20% -- Woody
13 July 2007	Plants 2m-4m: 20% -- Woody
Partly shaded; older trees	Plants 1m-2m: <5% -- Woody
	Plants .5m-1m: 50% -- Woody Vines; Shrubs
	Plants .1-.5m: 100% -- Mostly Herbaceous
<b>Relevé 30</b>	Plants >4m: 50% -- Woody
13 July 2007	Plants 2m-4m: 10% -- Woody
Wooded on one side of trail; Prairie on the other	Plants 1m-2m: 50% -- tall Herbaceous
	Plants .5m-1m: 20% -- Herbaceous
	Plants .1-.5m: <5% -- Herbaceous