**Monitoring plan for an occurrence of *Platanthera integrilabia* in Savage Gulf State Natural Area, Tennessee**

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**Project Justification**

The federally endangered species *Platanthera integrilabia* is known only from about 60 occurrences (Boyd et al., 2016), predominantly along the Cumberland Plateau. This species has been listed since 2016 and is vulnerable to habitat alteration caused by human use, particularly habitat fragmentation and the suppression of natural fire regimes (USFWS, 2016). The suppression of natural fire has created a change in forest composition as a result of succession. One occurrence in Savage Gulf State Natural Area, known as the Meadow Creek site, is being jointly managed by the Tennessee Department of Environment and Conservation (TDEC) and the US Fish and Wildlife Service (USFWS), with the aim of creating a viable population at the Meadow Creek site. Some field work has been accomplished to restore the habitat of the Meadow Creek site to promote reproductive success for *P. integrilabia*.

The goal of this monitoring plan is to provide a simple, replicative monitoring regime that can be carried out annually (USDA, 2003), to provide information about the status of the Meadow Creek population. This plan is designed to be accomplished during the primary flowering season of *P. integrilabia* and should be consistently carried out at a date close to the previous years’. This sampling protocol should be able to be accomplished by a small group of individuals in a single day.

**Questions**

The main question this monitoring plan will address is whether or not the variation in abundance of *Platanthera integrilabia* in the Meadow Creek occurrence changes from year to year. The information provided by data collection will allow an assessment to be made for the following ancillary questions: What abiotic variations at this site occur over time? What is the current abundance of flowering *P. integrilabia* at the Meadow Creek site in Savage Gulf State Natural Area annually? What portions of the Meadow Creek site do not contain *P. integrilabia*? What forest composition characterizes the site, and how does differing composition impact *P. integrilabia*? By creating a simple procedure for data collection, we hope to collect an estimate of population size for *P. integrilabia* and investigate the relationship between *P. integrilabia* survival and forest composition.

**Monitoring Approach**

A group of 2-5 individuals working together to measure transects and to correctly count the number of flowering plants will be more effective than having one individual performing these tasks (Alexander et al, 2012). The measuring tape for the boundary will be kept within the flat region of the site, along the southern border, in between the upward slopes that occur on both sides of the Meadow Creek site. Using a 100-meter soft measuring tape and a compass, we will establish starting points for 20 transects. The transect paths will occur perpendicular to the tree line, along the southern border of the site. The southern border is approximately 80 meters in length. Each starting point will be marked with a bright tag that will shape the transects about 4 meters apart. This should establish about 20 transect starting points.

Of the 20 potential transect starting points, five transects will be selected at random, using a random number generator phone application to select five transect starting points (which should be numbered 1 to 20). These five transects will be labeled A-E and will be randomly selected each year that this site is monitored. By randomly selecting the transects that are being observed each year, we hope to reduce sampling bias that may occur due to oversampling of areas that contain flowering *P. integrilabia*, or bias that could occur during population estimation due to presence-only data rather than presence-absence data. By minimizing sampling onsite to five transects, we will be able to estimate the abundance of *P. integrilabia* in a streamlined way that can be accomplished annually and easily replicated. This will allow abundance measurement to be comparable across time.

Once five transect starting points (Transects A-E) are selected, transects will be run from the southern border to the northern border of the Meadow Creek site, using a 100-meter soft measuring tape and compass to orient. The northern border lies before the upward slope surrounding the site and is uneven with respect to the distance from the southern border. This means that some transects will be longer or shorter than others. A photograph should be taken from the starting point of each transect point on the southern border, facing toward the northern border of the site. The Meadow Creek site has been actively managed in recent years (Geoff Call, class interview), being transformed from a wooded, shaded site to an open, sunny, grassland type habitat. Future management plans at Savage Gulf State Natural Area include the introduction of a prescribed fire regime. As active management is applied to the site, photos from years previous will help characterize environmental conditions that occurred at the site, at that time. Environmental conditions can be correlated with population characteristics among the Meadow Creek occurrence and inform future management decisions.

Once Transects A-E are chosen, a sampling area, referred to as a ‘belt’ will be established along either side of each transect line. The belt will be 0.5m on each side, resulting in a 1m-wide transect. Each sampling transect will be measured from south to north until the northern edge of the occurrence is found. The northern edge of the occurrence is found when the plot starts to incline. If it has rained recently, the edge of the plot can also be found when there is not visible standing water. If the soil is visibly dry, the edge is best found where the incline begins.

After Transects A-E are established, and the distance from the southern to northern border will be measured to within the closest centimeter and recorded on the Data Collection sheet. Each Transect will be divided into three equal “Subtransects” by taking the length of the Transect and dividing it by three. The Subtransects will be labeled by location as “South,” “Central,” or “North.” (For example, if a transect has a length of 60.00 meters, the South transect will be between 0 meters and 20 meters, the Central transect between 20 meters and 40 meters, and the North transect between 40 meters and 60 meters.)

The Data Collection sheet will be used at this stage to begin recording abundance. The number of flowering plants in each belt transect will be counted and recorded on the data sheet. Any flowering plant within the subtransects should be counted and recorded. The total flowering plant count for the transect should also be recorded as the sum of plant counts recorded in the three subtransects. By counting only the number of flowering *P. integrilabia*, rather than including information about vegetative plants that we cannot confidently identify and are densely distributed, we can reduce the overall workload while still collecting valuable data that will allow an assessment of species abundance. From our counts, we can calculate the average number of plants per square meter, as well as a rough estimate of the total population size within the study area. Population density for the site can be simply estimated by summing the total number of individuals for the sample and dividing the sum by the total area sampled (which will change year to year). In order to calculate the area sampled, add all the transect lengths, it will equal the area sampled because each transect is 1 meter across. As population density varies over years of sampling it will be possible to recognize trends in population size and inform our understanding of the reproductive success of *P. integrilabia*.

To document the field annually, we suggest taking landscape pictures, facing the north side of the field. The pictures should be taken at transects one, five, ten, fifteen, and twenty. This is critical in distinguishing the overall shrubbery of the field. This will be done every year when the site is monitored.

In addition to population assessments, observations should be made by answering the following questions regarding biotic and abiotic factors in the area. These five questions should be assessed separately in each of the fifteen subtransects.

1. Is the ground level or is there an incline?
2. Is the ground wet?
3. Is there more than 1 inch of standing water?
4. Is the area shaded, partially shaded, or sunny?
5. Is the ground cover made up mostly of saplings/grasses/shrubs, fallen tree limbs/stumps, or a combination of both?

To disseminate our annual findings and promote related research, we suggest a short annual report be filed with the USFWS following *P. integrilabia* monitoring. This monitoring procedure will inform what other research needs exist for this endangered species.

**Expected Outcome**

With the proposed monitoring plan, the goal is to ultimately provide data that will be useful in conserving future occurrences of *Platanthera integrilabia.* By annually recording how many individuals of *Platanthera integrilabia* there are at the Savage Gulf occurrence in relation to traits about water level, elevation, and forest composition, there should be ample information on some of the biotic and abiotic factors that could affect the success of *Platanthera integrilabia* occurrences in general. This data could be further extrapolated to identify environmental conditions in which more *Platanthera integrilabia* occurrences could thrive. Possible future management strategies could include initiatives to re-establish historical populations or create new occurrences in suitable habitat. Hopefully, this monitoring plan can provide one of many steps towards *P. integrilabia* being removed from the federal endangered species list.

**References**

Alexander, HM; Reed, AW; Kettle, WD; Slade, NA; Roels, SAB; Collins, CD; Salisbury, V (2012) “Detection and Plant Monitoring Programs: Lessons from an Intensive Survey of *Asclepias meadii* with Five Observers.” Journal of Ecology, vol. 7, no. 12: pp. 267-276.

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Call, G (2018) Interview with the plant ecology students during laboratory.

USDA (2003) Chapter 5 – Ecological Monitoring Tools and Methods. *Multiparty Monitoring and Assessment Guidelines for Community Based Forest Restoration in Southwestern Ponderosa Pine Forests*, 45-55.

USFWS (2016) Endangered and Threatened Wildlife and Plants; Threatened Species Status for Platanthera integrilabia (White Fringeless Orchid). *Federal Register* 81(177) 62826-62833.

***Platanthera* *integrilabia* Data Collection Sheet**

**Date: \_\_\_\_\_\_\_\_ Data Collectors: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Selected Transects (m distance): A. \_\_\_\_\_\_\_\_\_ B. \_\_\_\_\_\_\_\_\_ C. \_\_\_\_\_\_\_\_\_ D. \_\_\_\_\_\_\_\_\_\_**

**(Ground cover composition may be described as grassland, transitional, or forest-dominated. Any other qualitative descriptions can be included on in the lines below.)**

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| **Transect A** | Total Length (to nearest cm) | Measured Limits (to nearest cm) | Ground Level or Sloped? | Ground Wet? (Yes/No) | > 1 inch of standing water? | Shaded, Partially Shaded, or Sunny? | Ground Cover Composition |
| **South** |   |   |   |   |   |   |   |
| **Central** |   |   |   |   |   |   |   |
| **North** |   |   |   |   |   |   |   |

**Transect A total length: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Total Length / 3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Qualitative site description: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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[Attach Transect A

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| **Transect****B** | Total Length (to nearest cm) | Measured Limits (to nearest cm) | Ground Level or Sloped? | Ground Wet? (Yes/No) | > 1 inch of standing water? | Shaded, Partially Shaded, or Sunny? | Ground Cover Composition |
| **South** |   |   |   |   |   |   |   |
| **Central** |   |   |   |   |   |   |   |
| **North** |   |   |   |   |   |   |   |

**Transect B total length: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Total Length / 3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Qualitative site description: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Transect C** | Total Length (to nearest cm) | Measured Limits (to nearest cm) | Ground Level or Sloped? | Ground Wet? (Yes/No) | > 1 inch of standing water? | Shaded, Partially Shaded, or Sunny? | Ground Cover Composition |
| **South** |   |   |   |   |   |   |   |
| **Central** |   |   |   |   |   |   |   |
| **North** |   |   |   |   |   |   |   |

**Transect C total length: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Total Length / 3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Qualitative site description: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Transect D** | Total Length (to nearest cm) | Measured Limits (to nearest cm) | Ground Level or Sloped? | Ground Wet? (Yes/No) | > 1 inch of standing water? | Shaded, Partially Shaded, or Sunny? | Ground Cover Composition |
| **South** |   |   |   |   |   |   |   |
| **Central** |   |   |   |   |   |   |   |
| **North** |   |   |   |   |   |   |   |

**Transect D total length: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Total Length / 3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Qualitative site description: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Transect E** | Total Length (to nearest cm) | Measured Limits (to nearest cm) | Ground Level or Sloped? | Ground Wet? (Yes/No) | > 1 inch of standing water? | Shaded, Partially Shaded, or Sunny? | Ground Cover Composition |
| **South** |   |   |   |   |   |   |   |
| **Central** |   |   |   |   |   |   |   |
| **North** |   |   |   |   |   |   |   |

**Transect E total length: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Total Length / 3) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Qualitative site description: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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