Distribution, abundance, and management considerations for *Sanicula marilandica* on the northern portion of the Okanogan-Wenatchee National Forest

Sanicula marilandica in fruit

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Introduction:

Sanicula marilandica (Maryland black snake-root) is considered Sensitive on the Region 6-Regional Forester Special Status Species List. The Washington Department of Fish and Wildlife (WDFW) also considers *S. marilandica* sensitive. The Washington Natural Heritage Program (WNHP) ranks it at a level 2, indicating it is considered imperiled in the State of Washington. Globally and Nationally it has a ranking of 5, meaning it is demonstrably widespread, abundant and secure.

S. marilandica is widespread in the northeastern U.S. and eastern Canada. Its range extends westward, diminishing to the south. It is rare in British Columbia, Washington, Idaho, and Wyoming. It is not known to occur southwest of Utah. In Washington State, *S. marilandica* is at the western-most edge of its distribution, and occurs on the Colville and Okanogan-Wenatchee National Forests (Oka-Wen N.F.). Habitat for *S. marilandica* is moist, low ground in meadows, riparian floodplains, moist woods, and marsh edges. *S. marilandica* probably withstands moderate flooding, given its occurrence within floodplain habitats (Camp and Gamon, 2011). Work on this project has identified specific landforms, geology, vegetation zones, shade regimes, and disturbances that also appear to support *S. marilandica* and will be discussed in the "Discussion" section below.

Before surveys were conducted for this project, WNHP documented 38 populations in Washington. On U.S. Forest Service lands, eighteen (18) populations have been documented on the Colville N.F. Pre-project counts on the Methow R.D. were eight populations and were the only known occurrences on the Okanogan-Wenatchee (Oka-Wen) N.F. In the 2014 summer season, one unverified population was found on the Wenatchee River R.D. Populations on the Methow are all located in the Chewuch River Watershed, and all but four occur in the floodplains of the Chewuch River. One of the populations is located in an active cattle allotment, and three other populations occur adjacent to campgrounds. One population has never been relocated due to the Thirtymile Fire in 2001 that caused flooding and debris-flows. Another population was in the vicinity of 3 campgrounds that could have altered the habitat. River bed shifting could have caused the disappearance of a few populations that have never been relocated since 1979. Several populations lay adjacent to infections of an invasive weed, tansy ragwort (*Senecio jacobaea*).

Two additional populations were found during surveys efforts for this project in 2014 and four populations were located during surveys for a River Restoration project, giving a grand total of 14 populations known historically or currently on the Oka-Wen. It is difficult to estimate the number of individuals within each population, but population estimates on Element Occurrence forms give a total of 2,169 individuals. **Appendix A** and **Appendix B** shows all known and verified occurrences on the Methow Valley R.D. and Tonasket R.D., respectively.

The Forest Service is involved in Yakima Nation River Restoration projects along the Chewuch River where some *S. marilandica* populations could potentially be involved. The Chewuch River supports populations of salmonids that are currently listed under the Endangered Species Act (ESA), including spring Chinook salmon, summer steelhead, and bull trout. The restoration plan is designed to enhance fish habitat in the Chewuch River and to improve fish habitat diversity by: Increasing large wood levels

and jams within the river, increasing the quality of pool habitat, and restoring historic off-channel habitat (Chewuch River Habitat Restoration RM 11.75-13 CE Decision Memo, 2013). Floodplain habitats along the Chewuch River also support a majority of *S. marilandica* populations on the Oka-Wen N.F. These habitats also support the majority of known populations on the Methow Valley R. D.

Objectives:

This project sought to determine the distribution of *S. marilandica* on the northern portion of the Oka-Wen N.F. It also attempted to identify how many populations of *S. marilandica* are on the northern portion of the Forest from survey efforts. Considerations were also given to the factors constraining the distribution or fitness of *S. marilandica* and study how the plant responds to disturbance such as cattle grazing, exotic species and different shade regimes.

The desired result of this study would be:

1. Gain a more accurate understanding of the rarity of *S. marilandica* on the northern portion of the Oka-Wen N.F.
2. Determine the extent of the loss of individuals and/or populations of *S. marilandica* on the northern portion of the Forest.

Methods:

Survey sites were determined during pre-field analysis, using any available existing data. A potential habitat model was developed locally by David Bowden (botanist-Methow Valley Ranger District), to help determine potential suitable habitat. The model focused on habitats with gentle slopes, below 3,000 feet elevation and in deciduous vegetation. A majority of the potential suitable habitat in the model bordered a river or a stream. The habitat modelled in GIS was chosen for surveying when it fell in one of three criteria listed below:

1. The Upper and Lower Chewuch Watersheds are most likely to contain un-documented populations, so it would be search diligently.
2. One of the objectives is to determine if *S. marilandica* occurs outside the Upper and Lower Chewuch River Watersheds, so a significant amount of consideration was given to other areas. Focus was spread semi-equally over the other 5th-field watersheds that have habitat.
3. Areas with more contiguous habitat, as opposed to isolated small polygons, or with more habitats nearby in the same drainage that are more likely to support *S. marilandica*.

Several potential survey areas resulted from the above listed criteria. These potential survey areas were in the following locations with the corresponding 5th field watershed:

Methow Ranger District

- Lost River (Lost River Watershed);
- Early Winters Creek along the North Cascades Highway (Upper Methow River Watershed);
- Twisp River (Twisp River Watershed);
- Methow River (Lower Methow River Watershed);
- Chewuch River (Upper and Lower Chewuch River Watersheds)

Tonasket Ranger District

- San Poil River (West Fork San Poil River Watershed)

Pre-field work consisted of mapping the areas to be surveyed, locating occupied sites, determining the most effective approach, and using aerial imagery to identify any particular areas of interest. Known *S. marilandica* populations were identified as areas to be revisited and monitored and *NRIS* TESP revisit forms were filled out in detail for revisited populations. Some watersheds showing continuous potential suitable habitat were ruled out, as local knowledge verified these polygons as having been cleared by several surveys for previous District projects. Polygons which showed continuous habitat within the GIS potential suitable habitat model were a first priority. Each watershed had varying degrees of continuous habitat (**Appendix C**), and although some watersheds had smaller degrees of continuous habitat, surveys would still be conducted within them in an effort to equally consider areas where populations were not known to occur. The largest continuous potentially suitable habitat polygons were chosen in GIS for each of the watersheds. Most often, these polygons were those that were not separated by major landscape features. The largest continuous polygons are located in the Upper and Lower Chewuch River watersheds. Field surveys of the mapped polygons found *Sanicula* habitat only in the Upper and Lower Chewuch River watersheds, the West Fork San Poil River watershed and a small portion of the Twisp River watershed. However, surveys efforts did focus on the other watersheds in an attempt to look outside of what has been considered "typical" habitat for the species.

The Upper Chewuch River watershed holds 268 acres of potentially suitable habitat, with the largest continuous polygon being 118 acres. Potential suitable habitat for the Lower Chewuch River watershed totals 2101 acres, with the largest continuous polygon being 498 acres. In the Twisp River watershed, there was 3146 acres of mapped suitable habitat. However, field verifications estimated that approximately 90 continuous acres of actual suitable habitat exists. In the West Fork San Poil River watershed, 154 acres were considered to be continuous potential suitable habitat. The Lost River watershed has 183 acres of continuous mapped potential suitable habitat. Approximatley 349 acres of continuous suitable habitat were mapped in the Upper Methow River watershed; however, the largest continuous polygon of potential habitat (283 acres) was inaccessible due to terrain. Therefore, portions of the second largest polygon of 66 acres of continuous potential habitat were surveyed.

Survey work was performed by two Forest Service employees and one local contractor who has been conducting surveys for *S.marilandica* under contract for the Yakima Nation for local river restoration projects. Data was collected via GPS, camera and field data forms. Accessing potentially suitable habitat was accomplished using aerial maps to navigate to optimal habitat. To maximize time and effort, the typical approach taken during surveys was to survey areas that didn't require a long hike in, as surveying in suitable habitat is challenging given it is usually in dense, overgrown riparian vegetation that can be taller than the surveyor. Plants can be difficult to see, as the flowers are inconspicuous, and the leaves can easily blend in with the surrounding vegetation **(Figure 1)**. A surveyor could be within 2 feet of a plant in dense vegetation and not see it.

In some populations, plants are found in patchy clusters that can range in size from a couple plants to several dozen plants. While in other instances, only single plants are found.

Figure 1: *Sanicula marilandica* in mixed vegetation. Photo by: K. Chayka

It is thought that *S. marilandica* is associated in soils with a high calcium component. Soil samples were taken at each survey site and at sites with known *S. marilandica* to attempt to determine if there is a correlation between the species and calcareous soils. Samples were sent to a lab in Wenatchee, Washington for analysis. In addition, the cation exchange capacity (CEC) of the soils was taken. The cation exchange capacity of a soil determines the number of positively-charged ions cations that the soil can hold. This, in turn, can have a significant effect on the fertility management of the soil (Mengel, no date given).

The LTA (Landtype Association) and the potential suitable habitat model were overlaid in GIS where there was a relationship of known *S. marilandica* populations and specific LTAs. Soil sample results and an attempt to hypothesize why populations prefer certain soils, geological features and vegetation zones will be discussed in the "Discussion" sections below.

Results:

During the summer field season of 2014, surveyors visited thirteen sites, conducting surveys of approximately 126 acres of *S. marilandica* habitat. These surveys documented two new populations occupying approximately 1/16th of an acre in size.

The Methow River (Lower Methow River Watershed) showed potentially suitable habitat through the GIS model, but could not be surveyed due to the Carlton Complex Fire of 2014. Much of the habitat is assumed to have burned, and the area was closed due to the fire for a large portion of the field season.

Lost River (Lost River Watershed):
No *Sanicula marilandica* populations observed.

Approximately 3 acres were all that were surveyed in the Lost River Watershed due to the number of rattlesnake dens in the area. Surveyors encountered rattlesnakes each day while conducting surveys. Given the type of suitable habitat for *S.marilandica* that includes dense shrubs and little visibility of were the feet are stepping, it was deemed too dangerous to continue surveys in the area.

Early Winters Creek along the North Cascades Highway (Upper Methow River Watershed):
No *Sanicula marilandica* populations observed. Two sites, totally 6 acres were surveyed in the Upper Methow River Watershed.

Figure 2: Habitat along Early Winters Creek - Upper Methow River Watershed. (Photo by Linda Knight)

Potential suitable habitat along Early Winters Creek was thought to be too segmented and discontinuous to support *S. marilanidica.* Some gentler slopes adjacent to Early Winters Creek were surveyed which supported healthy stands of western redcedar (*Thuja plicata*). One of these areas in particular was along a meandering seep through a healthy stand of redcedar, where *Botrychium* species were found **(Figure 2)**. A small number of riparian species commonly found growing with *S. marilanidica* were present, which included: Red osier dogwood (*Cornus stolonifera*); Alder spp. (*Alnus*); Saskatoon serviceberry (*Amelanchier alnifolia*); Douglas-fir (*Pseudotsuga menziesii*); and Engelmann spruce (*Picea engelmannii*). Some areas with the riparian vegetation listed above were on steeper slopes in deeply incised drainages, thought to have been too steep to support *S. marilanidica.* Additional areas of potential suitable habitat in this watershed were located on an island of Forest Service land, surrounded by private landowner; surveyors were not granted permission to access F.S. land.

Twisp River (Twisp River Watershed):
No *Sanicula marilandica* populations observed. Three areas, totally 41 acres were surveyed in the Twisp River Watershed.

Much of the area defined by the potential suitable habitat model for *Sanicula* in the Twisp River Watershed didn't appear to be actual suitable habitat when ground -truthed. Much of the Twisp River is narrow and steep with not much of a gentle gradient floodplain. A good portion of the habitat is shrubby upland vegetation with a small deciduous component of *Holodiscus discolor* (oceanspray)*, Salix scouleriana* (Scouler's willow) and *Amelanchier alnifolia* (Saskatoon serviceberry). The shrub component in the understory has come in dense after timber sales and burns. Other field observations from the Twisp River include: There are not many aspen stands of significant size that could support *Sanicula;* (Dogwood) *Cornus stolonifera* is too dense and forms monocultures without other species able to survive; There are not as many animal trails or signs, especially moose, as the Chewuch River; There is an absence of large contiguous floodplain habitat in the Twisp River where *Sanicula* is typically found.

Figure 3: Twisp River Suitable Habitat (Photo by Linda Knight)

There are more continuous pieces of potentially suitable floodplain habitat on both sides along the north-western portion of the Twisp River, to the north of Mystery Campground **(Figures 3-5)**. Survey focus was on the gentle gradient, broad floodplain in riparian habitats, with shady, cool, mesic microsites and shrubby vegetation that typically associates with *S. marilandica.* The largest piece of potential suitable habitat surveyed in the Twisp River was located on the other side of the River from Poplar Flats Campground. Habitat was a broad floodplain with numerous very old, overgrown meandering broad, shallow channels; there was no scour with deep duff and soil.

Figure 4: Twisp River Suitable Habitat (Photo by Linda Knight)

Figure 5: Twisp River Suitable Habitat (Photo by LindaKnight)

Within the best suitable habitat surveyed, most channels seemed to be cut off from the main Twisp River (which was dry at the time surveyed). Cool, mesic microsites were abundant with *Athyrium felix-femmina* (Lady fern) dominating in some areas. Very little surface moisture was noted, but species present seemed to indicate subsurface moisture. Numerous, large animal trails through dense shrubs and abundant browsing was noted. Surveyors questioned whether or not some of the animal browsing was by moose. Typical species were: *Populus balsamifera* (black cottonwood); quaking aspen (*Populus tremuloides*); grand fir (*Abies grandis*); *western* white pine (*Pinus monticola*), subalpine fir (*Abies lasiocarpa*); Oregon boxleaf (*Paxistima myrsinites*); *Symphoricarpos albus* (snowberry); and Sword fern (*Polystichum munitum*).

<u>Chewuck River (Upper and Lower Chewuch Watershed):</u>

14 documented populations of *Sanicula marilandica*

This watershed on the Methow Valley Ranger District contains 8 known sites of *S.marilandica*, 2 additional populations were located during survey efforts for this project and 4 for the River Restoration project. Surveys were conducted over 70 acres to locate additional populations and to focus in habitats similar to those of known occurrences. Typical habitats in this area are the narrow transition zone between mesic- riparian and upland vegetation where the micro topography is flat. Approximatley three populations have been found in dry conifer-hardwood forests, on the upper river bank bench in a dry river terrace. The above mentioned population probably gets water only during high water events, not regularly or even yearly. One population was found in an open pine forest with shrubs waist high. Other occurrences have been found in mixed conifer-deciduous forest with a thick, overgrown shrub layer. Typical plant associations are:

- Quaking aspen (*Populus tremuloides*) /common snowberry (*Symphoricarpos albus*);
- Quaking aspen (*Populus tremuloides*) /red-osier dogwood (*Cornus stolonifera*);
- Black cottonwood (*Populus balsamifera* ssp. trichocarpa)/mountain alder (*Alnus incana)*;
- Black cottonwood (*Populus balsamifera* ssp. trichocarpa)/mountain alder (*Alnus incana)*- red-osier dogwood (*Cornus stolonifera*);
- Black cottonwood (*Populus balsamifera* ssp. trichocarpa)/common snowberry (*Symphoricarpos albus*);
- Engelmann spruce (*Picea engelmannii*)/ common snowberry (*Symphoricarpos albus*) and red-osier dogwood (*Cornus stolonifera*)

Populations that have been documented in drier habitats are in the following Plant Associations: Douglas-fir (*Pseudotsuga menziesii*)/ common snowberry (*Symphoricarpos albus*) and pinegrass (*Calamagrostis rubescens*).

The second largest population of *S. marilandica* is located off the West Chewuch Road. The population sits on a bench in an aspen stand surrounded by a dry upland Ponderosa pine-bitterbrush forest. The potential Plant Association is quaking aspen (*Populus tremuloides*) /common snowberry (*Symphoricarpos albus*). Estimated number of individuals is upwards of 800. The site was initially found in 1992, and the population size was estimated at 300 clumps (number of individuals in clumps was not recorded). Between the initial visit and the revisit in the 2014 season, a fire had swept through the area and burned the aspen stand at a moderate-high severity. It is estimated the fire burned the stand 10 years ago. Downed and decaying birch litters the ground. A majority of the aspen is young, averaging 15-20 feet tall with a dbh of 1-3 inches. Disturbance indicator species such as Virginia strawberry (*Fragaria virginiana*) and bracken fern are abundant in the understory.

Figure 6: Approach to large *Sanicula* population through dry Ponderosa forest.

There are very few older, decadent aspen having a dbh of 10 inches. Upper canopy cover through the stand is very open; however, the low shrub layer is moderately dense providing filtered shade. The lower canopy layer is bracken fern (*Pteridium aquilinum*) with scattered snowberry with an estimated cover of 5%. The densest patches of *Sanicula* were located under the scattered bracken fern and snowberry, where shade was moderate. A spring runs through the 1-acre aspen stand, and its margins are dominated by solid stands of *Equisetum*. *Sanicula* was not located near the spring or in the *Equisetum* stands where the soil moisture is the highest. A majority of the plants were located in the eastern portion of the aspen stand, where the flowering *Sanicula* plants were also located. Numbers decrease westward in the stand; this could be a result of having most of the flowering portion of the population in the eastern side of the stand. The population could be advancing westward and increasing in numbers through seed dispersal from wind, insects and small animals.

Figure7: Recovering burned aspen stand.

Figure 8: *S. marilandica* leaves in recovering, burned aspen stand

The largest Oka-Wen population of *S. marilandica* is located off the East Chewuch road, along both sides of a spur which dissects an aspen stand. This area has had past management activity as evidenced by spur roads and cut tree stumps. The aspen stands shows signs of an aspen maintenance treatment, as there are cut conifer stumps within and bordering the aspen stand. A majority of the population is located 1/8th of a mile in on the old spur road. Plants are in scattered clumps or occurring individually. Some plants are tucked under dense snowberry patches in a scattered and patchy distribution. Other plants are under a more open canopy of aspen. Plant Association is quaking aspen (*Populus tremuloides*) /common snowberry (*Symphoricarpos albus*). Some individual plants were located along the spur road leading to the main population, and one plant was found growing in the spur road.

This population may be involved in a River Restoration project. There is a population of tansy ragwort between the river where machinery will be working, and the *Sanicula* population. The concern is that tansy could spread into the population as machinery passes through the infested area, then to areas adjacent to the *S. marilandica* population.

<u>San Poil River (West Fork San Poil River Watershed): Tonasket Ranger District</u>
Two populations of *Sanicula marilandica* with an estimated 105 individuals total.

Finding these populations on the Tonasket Ranger District was significant, as none have been previously located. The two populations are decribed individually, as they were found in notably different habitats. Surveys along the San Poil covered 6 acres.

The first population (30 individuals), was growing on the floodplain shelf above the San Poil River. *S. marilandica* were growing in scattered patches for 300 feet along the river. Plants were found under tall

shrubs, under a dense forest canopy. Estimated tree canopy cover was 80%, and shrub canopy cover was 60%. The Plant Association was Douglas-fir (*Pseudotsuga menziesii*) / gray alder (*Alnus incana*) - Lewis' mock orange (*Philadelphus lewisii*). Other associated species included: oceanspray (*Holodiscus discolor*); prickly currant (*Ribes lacustre*); common snowberry (*Symphoricarpos albus*); red-osier dogwood (*Cornus stolonifera*); and twinflower (*Linnaea borealis* ssp. *Longiflora*).

The second population (75 individuals), was located 1/2 of a mile downstream from the first population. *S. marilandica* was growing on a floodplain sandbar, with a heavy shrub component, but little overstory cover. Tree cover was estimated at 10%, while the shrub canopy was 100%. Plants were located 1-3 feet above the river level. The Plant Association was Douglas-fir (*Pseudotsuga menziesii*) /Saskatoon serviceberry (*Amelanchier alnifolia*). Other associates were: common snowberry (*Symphoricarpos albus*); hawthorn (*Crataegus*); thimbleberry (*Rubus parviflorus*); Columbian monkshood (*Aconitum columbianum*); and goldenrod (*Solidago*).

A population of reed canarygrass was documented growing adjacent to the larger population.

The surveyor noted that due to the dense vegetation along the river, only 1/2 mile was surveyed. More populations could exist, if more surveys were conducted. There are approximately 148 acres of continuous potentially suitable habitat for *S. marilandica* available for surveying in this area of the San Poil River.

Discussion:

S*. marilandica* on the Oka-Wen seems to be influenced by landforms, geology, vegetation zones, disturbances and shade. It could also be dependent on habitat factors such as water availability, shade, and competition. These factors are discussed in detail below.

Shade:

S*. marilandica* seems to respond differently to different shade regimes and canopy cover seems to play a role in the number of individulas in a population. Dense shade by shrub and sub-canopy layers may inhibit seedlings and seed dispersal. In these dense canopies, seed dispersal could be accomplished through animals. A canopy that is too open and dry, with bare ground and little organic matter accumulation, seems to make *S. marilandica* nutrient deficient as its leaves appear shriveled and chlorotic. The largest, continuous and healthiest populations were found in moderately to dense shrub and sub- canopies under a relatively open tree canopy. These populations were located in habitats with filtered-shade, but not under a highly dense shrub or sub-canopy layer. Large populations span more than an acre in size and plants are more evenly spread throughout. In other moderately sized populations, patchy clumps of *S. marilandica* are found in more open overstory canopies with a high sub-canopy that inhibits a low-shrub cover. Smaller sized populations with scattered individuals or single plants seem to be more common in dense shade canopies with cover as high as 96%, mostly by shrub and sub-canopy layers.

Disturbances:

Fire and aspen maintenance:
In the two largest populations, disturbances appear to have benefited the *S. marilandica* populations. These disturbances were probably not severe or frequent enough to alter the soil environment. Habitat factors that supported *S. marilandica* were already in place before the disturbance. Fire seems to have stimulated and released the population in the aspen stand mentioned above, by decreasing the amount of competing overstory vegetation, as well as creating a nutrient pulse in the soil. The effect of site management in the aspen stand that supports the largest known population of *S. marilandica* seems to also have stimulated plants. These disturbances increased the available soil moisture, in turn increasing nutrient cycling which increased soil nutrient availability.

Invasive plants:
Invasive plants such as reed canarygrass (*Phalaris arundinacea*), diffuse knapweed (*Centaurea diffusa*), tansy ragwort, and cheatgrass (*Bromus tectorum*) have been documented near *S. marilandica*. None of the populations are currently affected by invasive plants. However, these invasives can quickly spread and establish, and can be difficult to treat given limitations of available treatments and general species characteristics. Currently, the Oka-Wen N.F. does not have NEPA in place that allows appropriate treatments of invasive plants in most of the *S. marilandica* habitats. Once the Okanogan-Wenatchee Invasive Species EIS has been completed, it will approve treatments of invasive weeds in *S. marilandica* habitats with appropriate chemicals.

Cattle grazing:
One population of *S.marilandica* is within a grazing allotment. This population has now been fenced off to protect *S. marilanidca* populations and keep cattle out. Several years ago, before enclosure fences were installed, surveyors noted that *S. marilandica* was being browsed, but not to the point that the population was being affected. This could have been due to the time of year when more palatable plants were available, and *Sanicula* was not heavily targeted. Livestock can affect vegetation directly by consumption and trampling and indirectly by soil compaction. Consumption reduces photosynthesis, trampling may break stems and leaves, while soil compaction can injure root systems and decrease soil aeration and water retaining capacity (Weatherill and Keith, 1969). Most species of *Anemone*, *Aralia*, *Fragaria*, *Lathryus*, *Prenathes*, *Rubus* (dewberries), *Sanicula*, *Thalictrum* and *Vicia* have reportedly decreased with grazing. We too noted that these genera were adversely affected by heavy grazing (Weatherill and Keith, 1969)

Landtype Association (LTA) *and S. marilandica* Interrelationships:
Certain topographic expression and soil site factors were common for all known *S. marilandica* populations. Generally, most all populations occur within valley bottoms or swales, which have deep volcanic ash surface soils with relatively deep accumulation of organic matter (OM), and available near surface ground water provides more than adequate moisture throughout the growing season. These

surface horizons of volcanic ash have fine sandy loam textures with a tremendous amount of pore space for rooting plants and soil water movement.

From the analysis of GIS modeling, there was a relationship of known *S. marilandica* populations and specific LTAs. Hence, the hypothesis is that there is a relationship between specific LTA's and *S. marilandica*. Whether the relationship is merely topographic expression or soil site conditions or both is not known at this time.

LTA's at each location visited is described, and an assessment is made to the likelihood that specific soil-site conditions provide suitable habitat for *S. marilandica.*

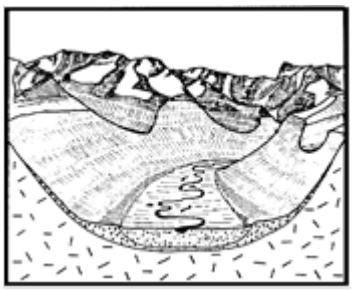
Soil Site Assessment

An interview with Carl Davis, a certified retired U.S.F.S. soil scientist and principle author of the *Landtype Association (LTA) of North Central Washington*, was conducted to aid in the description and interpretation of Landtype Associations and Soils. Landtype Associations are defined by the integration of map unit criteria: topographic expression, geomorphic process, geology, soil, potential natural vegetation, and local climate. Collectively, these features become diagnostic factors that control or strongly influence biotic distribution, hydrologic function, and ecological functions including natural disturbance regimes (Swanson 1979). Some diagnostic site features are more controlling of ecological processes than others and therefore should be used to partition landscapes (Bailey 1996).

In order to evaluate whether or not *S. marilandica* prefers certain geomorphic processes (topographic expression), geology, soils or Vegetation Zones (Potential Natural Vegetation (PNV)), the potential suitable habitat model was overlaid with the Landtype Associations via GIS. The Landtype Associations model was used to examine the soil- site characteristics for known *S. marilandica* populations.
North Central Washington LTAs have a connotative numbering system. Each LTA polygon is identified by a three character symbol. The first character is an upper case letter (which describes the landforms). The next character is a lower case letter (describing the geologic groups). The third character is a number (which describes the Vegetation Zones (PNV). For example Nu2 is a (N) **Glaciated Trough Valley Bottoms**, (u) **Undifferentiated Geology,** (2) **Douglas-fir Group**. This report will not give the full description of the LTA, but rather briefly describe the relevant attributes within the pertinent LTA.

All diagrams below are from the "*Landtype Associations of North Central Washington (Wenatchee, Okanogan, and Colville National Forests)".*

1. LTA Nu2 (N) Glaciated Trough Valley Bottoms, (u) Undifferentiated Geology, (2) Douglas-fir Group.



Parts of the Twisp River (Twisp River Watershed) fall in this LTA. All the areas surveyed in along Early Winters Creek (Upper Methow River Watershed) and Chewuch River (Upper and Lower Chewuch River Watersheds), fall within Nu2.

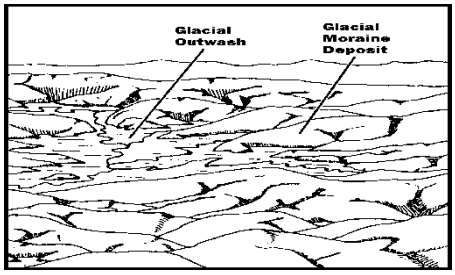
This LTA is primarily located on the Okanogan (northern) portion of the Forest, and secondarily on the Wenatchee (southern end of the Forest).

Most of the populations of *S. marilandica* are located in this LTA, as is the biggest population (estimated over 1000 individuals).

As illustrated in the block diagram, this LTA is located in very broad valley bottoms. Soils in this LTA are depositional and composed of relatively deep volcanic ash surface horizons. Near surface ground water is readily available through the growing season and these soils can support dense, riparian associated species.

Specific soil great groups in LTA *Nu2* are as followings: **Typic Vitrixerands (most common soils within LTA)**. These soils have greater than 14 inches of volcanic ash surface soil horizons with relatively deep OM accumulation. This soil supports dense ground cover (best sights for *S. marilandica* within this LTA). Minor amounts of **Fluventic Haploxerolls**, which are old floodplain deposits that are typically supported by grass and supports moderately dense vegetation. There are shallow volcanic ash surface horizons which correspond to moderately productive sights for *S. marilandica* within this LTA. **Xerofluvents**, which are recent, flood deposits that are void of volcanic ash and are comprised mostly of sand gravels and cobbles (poor sites). This group supports pioneer species such as Black cottonwood.

2. LTA La2 (L) Glacial Moraines, (a) Foliated Crystalline Rocks, (2) Douglas-fir Group.



All the areas surveyed in Chewuch River (Upper and Lower Chewuch River Watersheds), fall within La2.

A majority of this LTA is located on the Colville National Forest, with a smaller amount on the northern portion of the Oka-Wen, and even smaller amounts on the southern end of the Forest.

The second largest population of *S. marilandica* on the Oka-Wen is located in this LTA (estimated over 800 individuals). This population is mentioned above as being located within the aspen stand that burned 10 years ago. One other population (estimated at 48 individuals) is also located in the LTA.

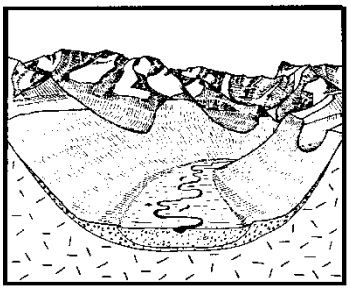
As illustrated in the block diagram, this LTA is located in low undulating topography.

Soils in this LTA are depositional and composed of relatively deep volcanic ash surface horizons much like LTA *Nu2.* Near surface ground water is readily available in the swale or lowland topographic positions through the growing season and these soils can support relatively dense vegetative. Substrates in this LTA are composed of gravels, sand and boulders and have a low clay content which typically is associated with a low CEC (cation exchange capacity), and base elements such as calcium, magnesium and manganese. Soil surface is composed of volcanic ash (fine sandy loams), which have fairly high CEC's and suitable levels of base elements. *La2* is composed of deep volcanic ash layers (over

14 inches) and there is deep organic matter accumulation. Annual recruitment of the organic layer, which is also responsible for high CEC and base elements, is dependent upon fine material from existing vegetation (such as fruiting bodies, leaves and twigs, as opposed to large woody material).

Specific soil great groups in LTA *La2* are as followings: **Typic and Humic Vitrixerands (most common within LTA)**. These soils have greater than 14 inches of volcanic ash surface soil horizons with relatively deep OM accumulation. Also these soils can have aquic soil moisture regimes which indicate that the surface horizons are continually wet for a good portion of the growing season (most productive for *S. marilandica* within this LTA). **Vitrandic Dystroxerepts** are minor amounts of these soils and have shallow volcanic ash surface horizons with mineral soil components being relatively low in base saturation. These are very infertile soils that are weakly developed and low in nutrient cycling for herbaceous and shrubby material. The only fertility for ground cover vegetation is tied up in the thin layer of volcanic ash (least productive for *S. marilandica* within this LTA). **Vitrandic Haploxeralfs** are minor amounts of these soils that have very thin volcanic ash over a forested soil (not as supportive for *S. marilandica* within this LTA).

3. LTA Nj2 (N) Glaciated Trough Valley Bottoms, (j) Meta-Sedimentary Rocks – Marine, (2) Douglas-fir Group.



Areas surveyed in the Twisp River (Twisp River Watershed) and Lost River (Lost River Watershed) falls within Nj2.

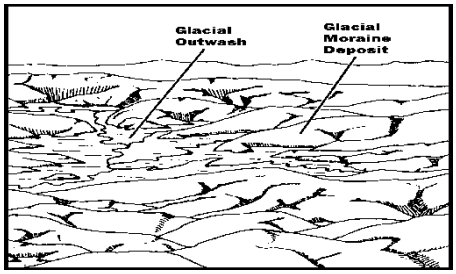
This LTA is predominately found on the Okanogan (northern portion of the Forest).

As illustrated in the block diagram, this LTA is location in very broad valley bottoms.

The LTA *Nj2* and the LTA *Nu2* were formed by the same geomorphic process (which is a glacial fluvial outwash). LTA *Nj2* has basically the same soil site features except that *Nj2* has a difference in substrate material. With *Nj2*, the geologic material is more uniform and is made up meta-sedimentary rocks that can be more basic to calcareous in nature. In contrast, *Nu2* has an undifferentiated substrate of which is a mix of substrates that could have any bedrock, (undifferentiated). *S. marilandica* has fibrous roots, thus relatively shallowly rooted and confined to the surface soil layer (which is volcanic ash in both *Nj2* and *Nu2*). If the species had a deeper rooting pattern, *Nj2* would have better base nutrient materials for *S. marilandica*. Like *Nu2*, subsurface water in *Nj2* is more than adequate to support *S. marilandica*.

Specific soil great groups in LTA *Nj2* are essentially the same as within LTA *Nu2*.

4. LTA Lj2 (L) Glacial Marine, (2) Douglas-fir Group**.**



Portions of areas surveyed in the Lost River (Lost River Watershed) are within this LTA.

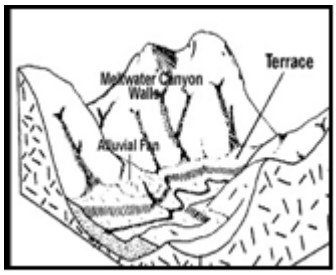
This LTA is predominately found on the Okanogan (northern portion of the Forest).

As illustrated in the block diagram, this LTA is location in low undulating topography.

Soils in this LTA are depositional and composed of relatively shallow volcanic ash surface horizons. Near surface ground water is readily available only in the swale or lowland topographic positions through the growing season and these soils can support moderately dense vegetative conditions. *Lj2* has similar geologic substrates as LTA *Nj2* above, but was formed by different geomorphic processes. The geologic material is uniform and is made up of meta-sedimentary rocks that can be more basic to calcareous in nature and the surface soil layer is volcanic ash. As with *Nj2*, if *S. marilandica* had a deeper rooting pattern, *Lj2* would have a large amount of base nutrient materials to support the species.

Specific soil great groups in LTA *Lj2* are as followings: **Vitrandic Haploxerepts and Vitrandic Haploxerolls**. These soils have less than 10 inches of volcanic ash surface horizons over poorly developed soils, which are moderately productive soil for *S. marilandica*.

5. LTA **Mu2** (M) Meltwater Canyons and Coulees, (u) Undifferentiated, (2) Douglas-fir Group.



Areas surveyed in the San Poil River (West Fork San Poil River Watershed) and Lost River (Lost River Watershed) falls within Mu2.

This LTA is predominately found on the Colville National Forest. Then, secondarily on the Okanogan end of the Okanogan-Wenatchee N.F.

The *Mu2* Landtype was formed by major flows of glacial melt water, which was funneled and channeled into the area. As a result, *Mu2* has steep canyon walls which are shallow to bedrock. The surface soil is composed of a relatively shallow layer of volcanic ash. The bottoms will have a volcanic ash influence, as they were deposited after the glacial melt. However, *Mu2* will not have as thick of a volcanic layer or as much organic material as the LTA's mentioned above. These sites are drier as they are further from the crest, and there is not as much subsurface water available to vegetation. The vegetation is typically very dense immediately adjacent to a water source, and then becomes less dense away from the riparian area as you move towards the canyon walls. The annual recruitment of organic materials on the soils is less than other LTA's mentioned above.

Specific soil great groups in LTA *Mu2* are as followings: **Vitrandic Haploxerepts (most common within LTA).** These soils have less than 10 inches of ash over poorly developed soils, making them moderately productive for *S. marilandica* within this LTA. **Typic Vitrixerands** are minor amounts of the soils with deep surface horizons of volcanic ash and relatively deep organic matter, typically more moist and found along riparian areas (most productive for *S. marilandica* within this LTA). **Andic Haploxerepts**, these soils have less than 10 inches of ash over poorly developed soils and are moderately supportive of *S. marilandica* within this LTA.

SUMMARY OF LTA SOIL RESULTS AND INTERRELATIONSHIPS

For each soil sample site, **Table 1** below lists the corresponding LTA, soil type, and soil test results. A discussion below the table touches on the interrelationships between each of these factors and how conducive they are to *S. marilandica*.

The optimum range for calcium in soil samples is between 600-4000 ppm. The optimum range for CEC for the soil types collected is between 25-33 meg/100g.

Table 1: Summary of Soil Sample Results from Areas Surveyed

Soil Sample Site	**LTA**	**Common Soil Type**	**Available Calcium Test Result (ppm)** ***	**CEC Test Result (meg/100g)** ***
Early Winters Creek (Upper Methow River Watershed). **No plants found**	Nu2	Typic Vitrixerands	Excessive (11200 ppm)	66.0
Twisp River Watershed. **No plants found.**	Nj2	Typic Vitrixerands	Optimum range (2400 ppm)	25.0
Chewuch River Watershed **at large known population (1000 + plants)**	Nu2	Typic Vitrixerands	Above optimum (4120 ppm)	38.0
Chewuch River Watershed **at known population (8 plants)**	Nu2	Typic Vitrixerands	Optimum range (2740 ppm).	33.6
San Poil River Watershed **at known population (75 plants)**	Mu2	Vitrandic Haploxerepts	Optimum range (699 ppm)	7.5

**CEC is measured in millequivalents per 100 grams of soil (meq/100g). A meq is the number of ions which total a specific quantity of electrical charges. Following are the common soil nutrient cations and the amounts in pounds per acre that equal 1 meq/100g:

Calcium (Ca^{++}) - 400 lb./acre
Magnesium (Mg^{++}) - 240 lb./acre
Potassium (K^{+}) 780 lb./acre
Ammonium (NH_4^{+}) - 360 lb./acre

Available calcium levels at Early Winters Creek (LTA *Nu2*) along Hwy 20, indicated the site had excessive levels of calcium (11200 ppm) and a much higher than normal CEC. Calcium and CEC levels could be at a higher level, from salt runoffs by winter road salting on Highway 20. Given the exceedingly high levels of calcium and CEC at this site and the influence of road salting, it is difficult to determine if soil site conditions are conducive to *S.marilandica*.

Soil samples taken from the San Poil River (LTA *Mu2*) indicate that calcium levels are within the optimum range, but at the lower levels of the range. The CEC levels are expected to be lower at this site as it is relatively arid compared to all the other sites visited. Soil site conditions in a narrow band directly along the river where soil samples were taken are conducive to *S.marilandica*. However, outside of that narrow band, soil site conditions will become less supportive to *S.marilandica*.

The *Nu2* and *Nj2* LTA's have calcium availability and CEC levels within or exceeding the optimum range. This is due to the deep surface horizons of volcanic ash and organic layers with optimum amounts soil water availability.

The second largest population falls within the *La2* LTA. This population of *S. marilandica* is located within the aspen stand that burned 10 years ago. One other population (estimated at 48 individuals) is also located in the LTA. These two populations are on the transitional zone between LTA's *Nu2* and *La2*. When *La2* is adjacent to the *Nu2*, site factors could provide ideal conditions for *S. marilandica*. The adjacency of these two LTA's combines a deep volcanic ash layer with thick accumulation of organic materials. In addition, along the transition zone between these two LTA's, there is extremely high subsurface water content from LTA *Nu2*. According to the soil tests, these ash soils have a humic horizon, which is a deep organic layer over the volcanic ash that has aquic moisture regimes (which could indicate that part of the volcanic ash layer is saturated for as many as 90 consecutive days during the growing season). *S. marilandica* seems to prefer perennially-ephemerally moist soils, but not constantly saturated soils

Soil data taken from *S. marilandica* sighting forms suggest the species prefers soils surfaces developed of a deep organic alluvium with a deep, organic, humus and litter layer. These soil-site factors are present in LTA's *Nu2*, *Nj2* and *LA2*. A dry, thick leaf and needle duff in some sites has been recorded to be 2 inches deep.

In Summary, it could be hypothesized that there are five site factors on the Oka-Wen N. F. present in the LTA model that provide potentially suitable habitat to support *S. marilandica*: 1) soils greater than 14 inches of surface volcanic ash; 2) valley bottom setting; 3) prevalent near surface ground water; 4) organic matter accumulations; 5) Douglas-fir Plant Association Group**,** which is in extensive continental climate zones on warm, dry sites. These five soil site factors predominately occur in *La2* and *Nu2* LTA's. *S. marilandica* could be highly dependent on valley bottom areas that have relatively deep surface horizons of volcanic ash with deep accumulations of organic matter, where subsurface water is readily available. As reflected in **Table 1**, this combination of LTA and soil-site features does appear to be interrelated. These LTA's and soil site conditions provide adequate nutrient cycling and organic matter recruitment to provide optimum conditions for *S. marilandica*.

Conclusion:

This project had two objectives which were: 1) gain a more accurate understanding of the rarity of *S. marilandica* on the northern portion of the Oka-Wen N.F.; and 2) determine the extent of the loss of individuals and/or populations of *S. marilandica* on the northern portion of the Forest;

These objectives will be discussed below.

Rarity of *S. marilandica* on the northern portion of the Oka-Wen N.F.:

The paragraphs below give a breakdown of the total amount of available acres of the LTA's that support *S. marilandica* to illustrate the amount of suitable habitat that exists across the Oka-Wen N.F. and on the northern portion of the Forest (see **Appendix D** for and illustration).

On the northern portion of the Forest, LTA *Nu2* is only found on the Methow Valley R.D. Of the total amount of *Nu2* on the Forest, 34% is located in the Methow Valley. Forty-six percent of the available acres of *Nu2* on the District are found in valley bottoms within the Upper and Lower Chewuch Watersheds. These watersheds support the largest number of *S. marilandica* and the biggest continuous populations. From a landscape view, this LTA comprises 0.007% (22,708 acres) of the total landscape across the Forest and accounts for only 0.002% (7855 acres) on the Methow Valley District. Of the total acres on the Forest, suitable habitats within the Upper and Lower Chewuch Watersheds account for only 0.001% (2369 acres).

Ninety-nine percent (99%) of LTA *La2* is distributed on the northern portion of the Forest (Methow and Tonasket Ranger Districts). Of the total acres on the Forest, this LTA comprises 0.03%, and only 0.06% on the northern portion. Only 0.008% of the LTA has known populations of *S. marilandica*. The Upper and Lower Chewuch Watershed support the second largest numbers of *S. marilandica* and hold 26% of the total acres of *La2* on the northern portion of the Forest.

LTA *Mu2* only occurs on the northern portion of the Okanogan-Wenatchee, and primarily occurs on the Colville N.F. This LTA makes up 0.02% of the total landscape on the Forest; 75% occurs on the Methow Valley R.D. and 25% on the Tonasket R.D. A known population of *S. marilandica* is located along the San Poil River, within LTA *Mu2.* The percentage of available *Mu2* in the San Poil Watershed is 0.05% of the total LTA acres.

Site factors within the LTA's that support known populations of *S. marilandica* (LTA's *Nu2*, *La2* and *Mu2*) are predominately present on the Methow and Tonasket R.D.'s. It could be hypothesized that the distribution of known *S. marilandica* populations is restricted, and its habitat requirements are specific. In addition, from a landscape perspective, the habitats in which *S. marilandica* are found are relatively small in scale compared to upland habitats. Project surveys on the Methow and Tonasket R.D.'s have been conducted in habitats not thought to support *S. marilandica*; survey efforts outside of typical habitats have not encountered *S. marilandica*.

Furthermore, surveying for *S. marilandica* sometimes involves climbing through thick brush that, at times, is taller than the surveyor. It is difficult to speak to the rarity of the species, as the habitat in which it occurs is very difficult to survey. Detectability frequently has a big impact on if a species is called rare, but it's actually that we have a hard time finding the species.

Extent of the loss of individuals and/or populations of *S. marilandica* on the northern portion of the Forest:

Verified populations of *S. marilandica* have only been found to occur in three watersheds on the northern portion of the Forest. Habitats for *S. marilandica* are unique and only make up a small percentage of the total landscape. *S. marilandica* has specific habitat requirements and there is a lack of precise numbers within populations; it should be assumed that a loss of habitats, individuals or populations will affect species viability on the northern portion of the Forest and on the Oka-Wen N.F. as a whole. This report has mentioned that large populations of *S. marilandica* have been found in areas that have historically experienced some level of disturbance.

In summary, the distribution *S. marilandica* is confined to a limited number of acres on the northern portion of the Forest. The one known population on the southern end of the Oka-Wen has not been verified. As mentioned above, a loss of species or populations could affect species viability locally. In order to maintain population viability at a local level, land managers need to consider the specific habitat requirements of *S. marilandica*. These considerations may not exclude active management, and should give attention to overall ecosystem health. Observations have shown that *S. marilandica* could be indirectly stimulated by disturbances, such as fire and aspen maintenance treatments when the disturbances are not severe or frequent enough to disrupt habitat factors that support the plant. Disturbances that remove some of the sub-canopy and moderate amounts of the overstory canopy have been shown to increase the number of individuals in a population. *S. marilandica* seems to tolerate moderate-dense shade of shrubs. However, observations have indicated that too much shade by shrubs and trees can affect the viability of a population. Encroachment and increased shade by conifers and shrubs into aspen stands with known *S. marilandica*, can affect the health of populations by increasing competition for available ground water and nutrients, and limiting the amount of sunlight that reaches the ground.

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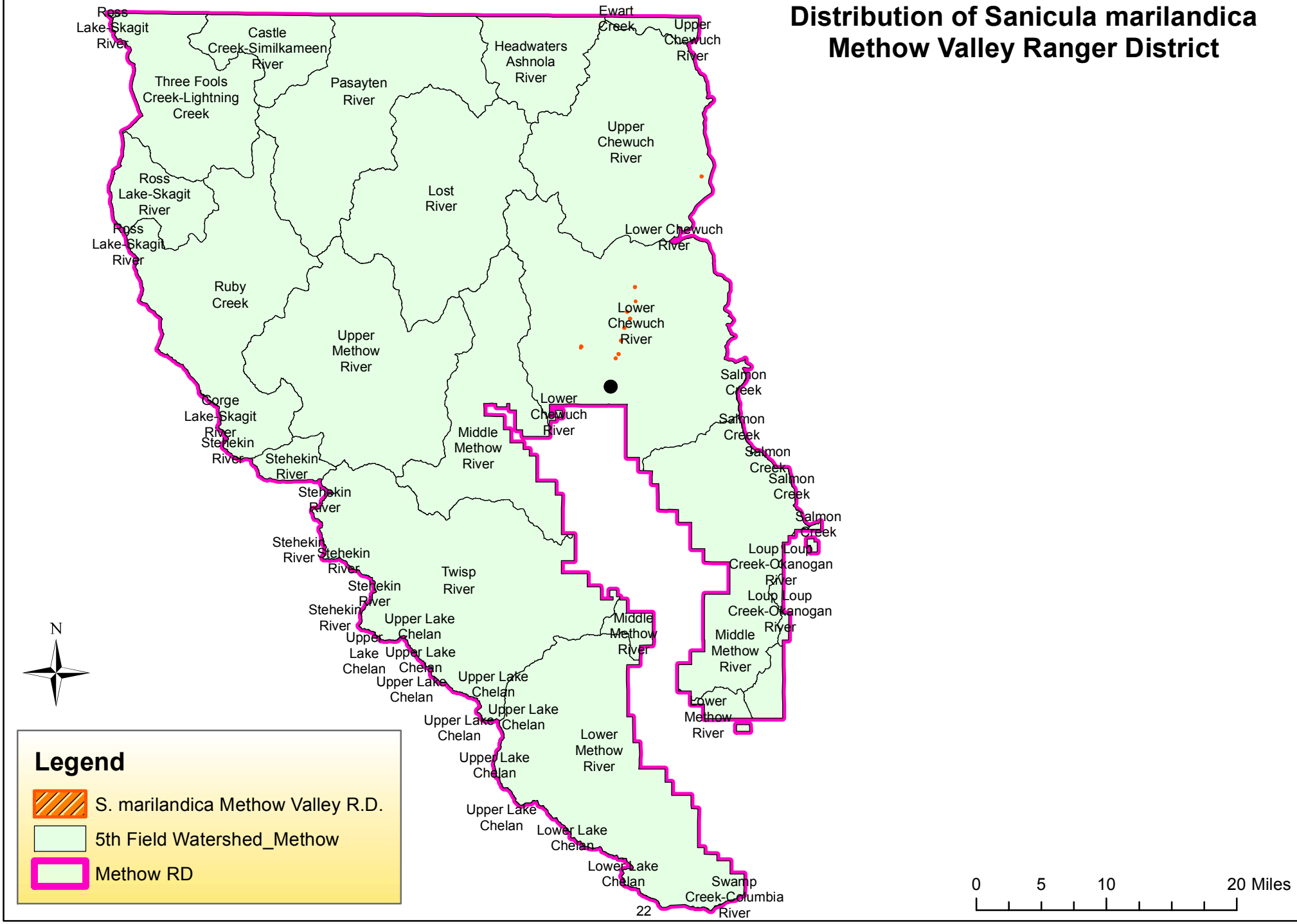
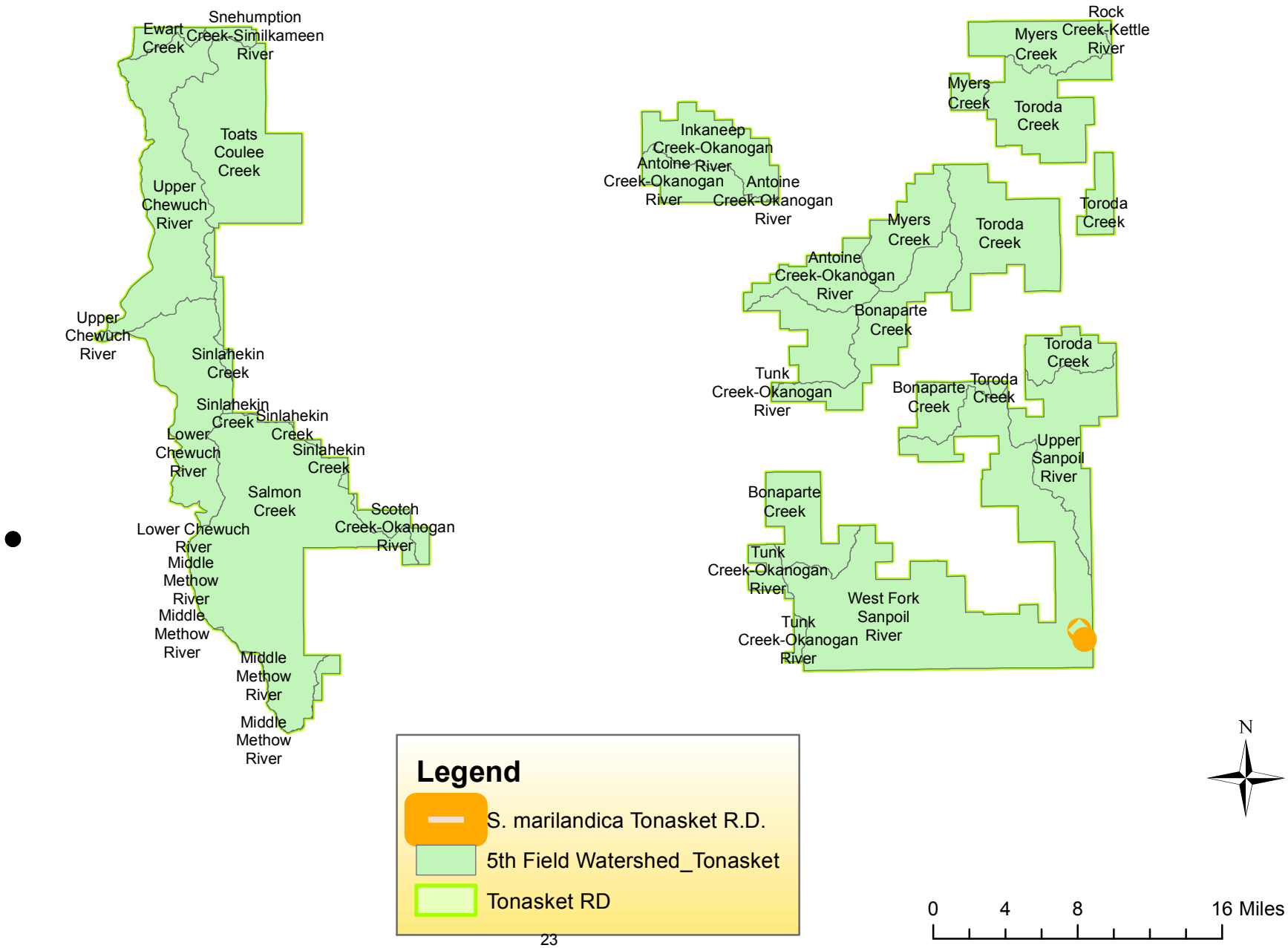
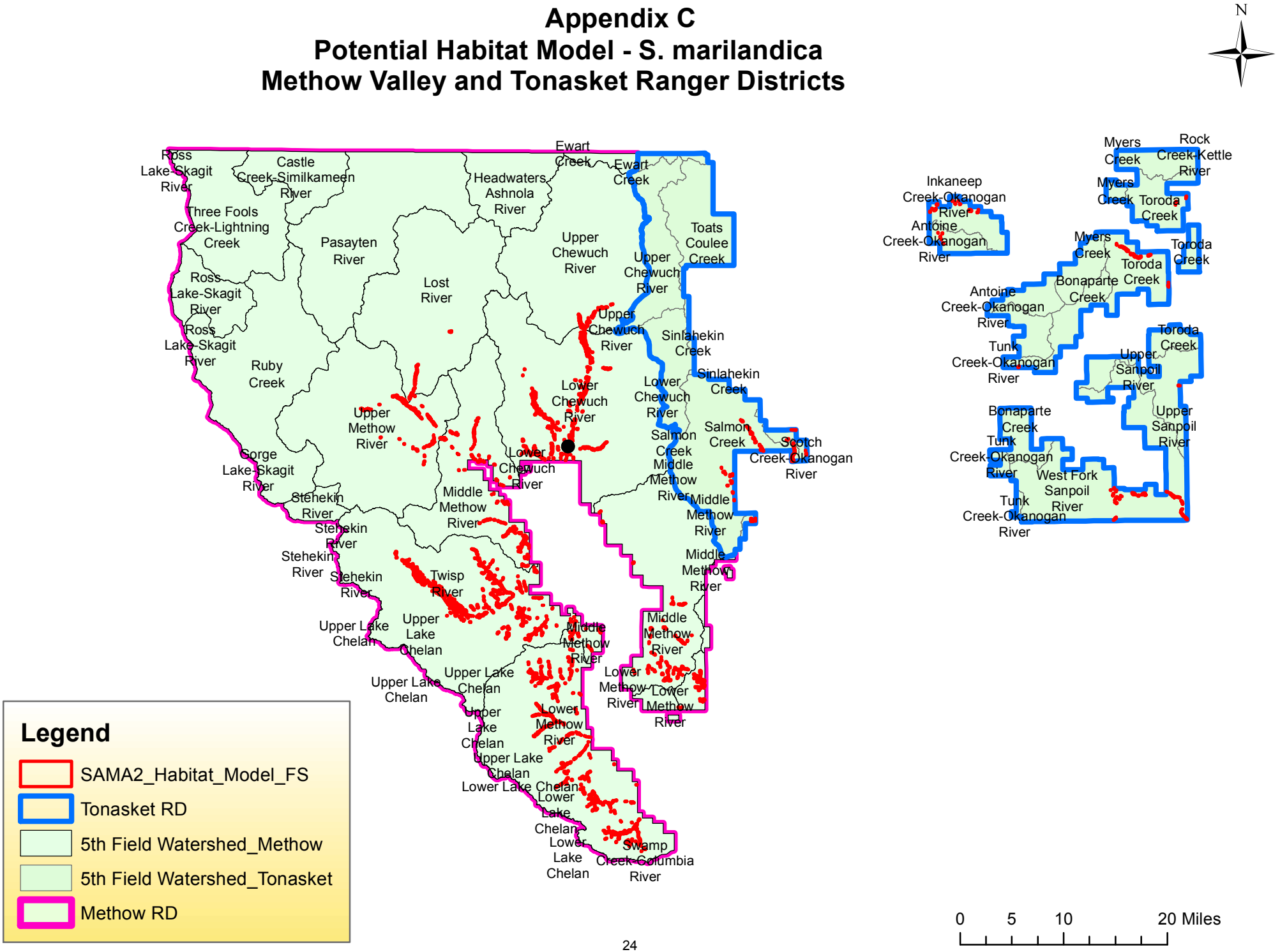
Appendix A
Distribution of Sanicula marilandica
Methow Valley Ranger District



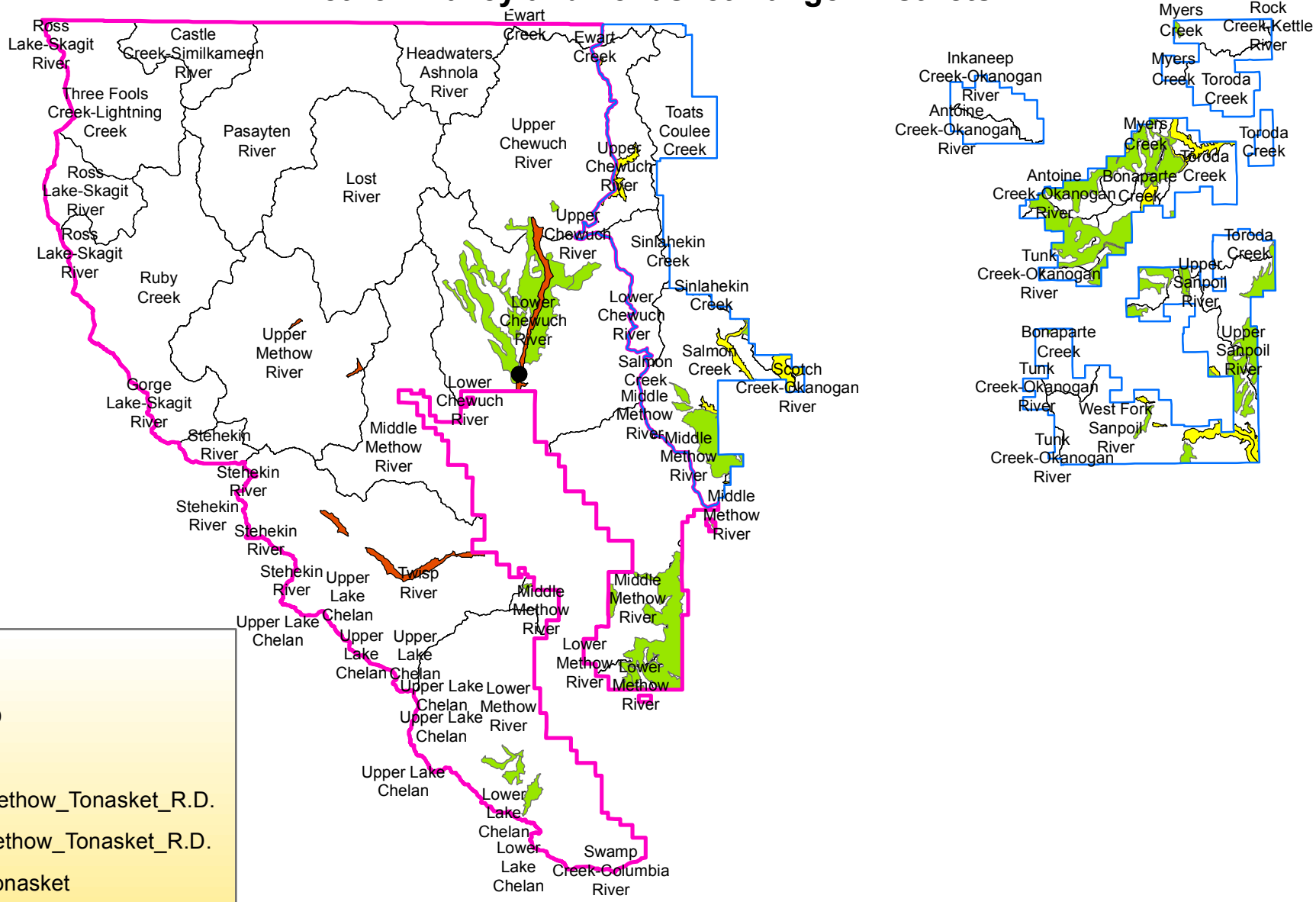
Appendix B
Distribution of Sanicula marilandica
Tonasket Ranger District



Appendix C
Potential Habitat Model - S. marilandica
Methow Valley and Tonasket Ranger Districts



Appendix D
Distributions of Landtype Associations Nu2, La2 and Mu2 Which support known S. marilanidca populations Methow Valley and Tonasket Ranger Districts



Appendix E

Species List for *Sanicula marilandica* ISSSSP Surveys 2014

Scientific name	Common Name	Wetland Status	Native/ Non-native	Comments
Trees:				
Abies grandis	grand fir	FACU-*	n	
Abies lasiocarpa	subalpine fir	FACU	n	
Acer glabrum douglasii	Douglas maple	FACU	n	
Alnus incana tenuifolia	mountain (thinleaf) alder	FACW	n	
Picea engelmannii	Engelmann's spruce	FAC	n	
Pinus monticola	western white pine	FACU	n	
Pinus ponderosa	ponderosa pine	FACU-	n	
Populus tremuloides	quaking aspen	FAC+*	n	
Populus trichocarpa	black cottonwood	FACW	n	
Pseudotsuga menziesii	Douglas-fir	FACU*	n	
Thuja plicata	western redcedar	FAC	n	
Trees/shrubs:				
Betula occidentalis	water birch	FACW	n	
Crataegus douglasii douglasii	Douglas' hawthorn	FAC	n	
Salix scouleriana	Scouler's willow	FAC	n	
Alnus sinuata	Sitka alder	FACW	n	At one site only up the Twisp River
Shrubs:				
Amelanchier alnifolia	Saskatoon serviceberry	FACU	n	
Arctostaphylos uva-ursi	bearberry/kinnikinnick	FACU-	n	
Berberis aquifolium	Oregon grape	FACU	n	
Berberis nervosa	cascade Oregongrape		n	
Ceanothus velutinus	snowbrush ceanothus		n	
Chimaphila umbellata	pipsissewa		n	
Cornus canadensis	bunchberry dogwood	FAC	n	
Cornus sericea (stolonifera)	redosier dogwood	FACW	n	
Linnaea borealis	twinflower	FACU-	n	
Lonicera involucrata	twinberry honeysuckle	FAC+*	n	
Oplopanax horridum	devilsclub	FAC+	n	
Paxistima myrsinites	Oregon boxwood	FACU	n	
Philadelphus lewisii	Lewis' mockorange		n	
Rhododendron albiflorum	Cascade azalea	FACU	n	
Ribes hudsonianum	northern black currant	FACW	n	
Ribes lacustre	prickly currant	FAC+	n	
Rosa gymnocarpa	dwarf rose	FACU	n	
Rosa nutkana	Nootka rose	FAC	n	
Rosa woodsii	Woods' rose	FACU	n	
Rubus parviflorus parviflorus	western thimbleberry		n	
Salix melanopsis	dusky willow	OBL*	n	
Salix species	willow species		n	
Sambucus cerulea	blue elderberry	FACU	n	
Sambucus racemosa	scarlet elderberry	FACU	n	
Shepherdia canadensis	russet buffaloberry	NI	n	
Sorbus species	mountainash		n	
Spiraea betulifolia	white spirea	FAC*	n	
Spiraea douglasii	Douglas' spirea	FACW	n	
Symphoricarpos albus	common snowberry	FACU	n	
Vaccinium membranaceum	big huckleberry	FACU+	n	
Vaccinium scoparium	grouse whortleberry	FACU-	n	
Shrubs/vines:				

Species List for *Sanicula marilandica* ISSSSP Surveys 2014

Scientific name	Common Name	Wetland Status	Native/ Non-native	Comments
Rhus radicans	posion ivy	FACW-	n	
Grasses:				
Bromus species	Brome species			
Calamagrostis canadensis	bluejoint reedgrass	FACW+	n	
Calamagrostis rubescens	pinegrass		n	
Cinna latifolia	drooping woodreed	FACW	n	
Dactylis glomerata	orchardgrass	FACU	nn	
Elymus glaucus	blue wildrye	FACU	n	
Glyceria striata	fowl mannagrass	OBL	n	
Poa pratensis	Kentucky bluegrass	FAC	nn	
Grasslike:				
Carex amplifolia	bigleaf sedge	FACW+	n	
Carex concinnoides	northwestern sedge		n	
Carex lenticularis	tufted sedge	FACW+	n	
Carex retrorsa	retrorse sedge	OBL	n	
Carex species	sedge species		n	
Ferns/fern allies:				
Athyrium filix-femina	common ladyfern	FAC	n	
Botrychium virginianum	rattlesnake fern	FAC*	n	
Equisetum arvense	field horsetail	FAC	n	
Equisetum hyemale	scouringrush horsetail	FACW	n	
Equisetum laevigatum	smooth horsetail	FACW	n	
Gymnocarpium dryopteris	Pacific oakfern	FAC*	n	
Polystichum munitum	swordfern		n	At one site only up the Twisp River
Pteridium aquilinum	western brackenfern	FACU	n	
Forbs:				
Aconitum columbianum	Columbian monkshood	FACW	n	
Actaea rubra	red baneberry		n	
Adenocaulon bicolor	American trailplant		n	
Anaphalis margaritacea	western pearlyeverlasting		n	
Angelica arguta	Lyall's angelica	FACW	n	
Antennaria racemosa	raceme pussytoes		n	
Apocynum androsaemifolium	spreading dogbane		n	
Aquilegia formosa	western columbine	FAC	n	
Aruncus sylvester	goatsbeard		n	
Aster conspicuus	showy aster	FACU	n	
Aster eatonii	Eaton's aster	FAC+	n	
Centaurea diffusa	diffuse knapweed		nn	State class B noxious weed
Circaea alpina	small enchanter's nightshade	FAC+	n	
Cirsium arvense	Canada thistle	FACU+	nn	State class C noxious weed
Cirsium vulgare	bull thistle	FACU	nn	State class C noxious weed
Clintonia uniflora	bride's bonnet		n	
Cypripedium montanum	mountain lady's slipper	FACU	n	State Watch List Species
Disporum speceis	fairybells		n	
Dodecatheon dentatum	white shooting star		n	
Epilobium angustifolium	fireweed	FACU	n	
Epipactis gigantea	giant helleborine	OBL	n	State Watch List Species
Fragaria vesca	woodland strawberry		n	
Fragaria virginiana	Virginia strawberry	FACU*	n	
Galium species	bedstraw species		n	
Geum macrophyllum	largeleaf avens	FACW-*	n	

Species List for *Sanicula marilandica* ISSSSP Surveys 2014

Scientific name	Common Name	Wetland Status	Native/ Non-native	Comments
Goodyera oblongifolia	western rattlesnake plantain	FACU-	n	
Habenaria (Platanthera) species	bog-orchid		n	
Hackelia species	stickseed			
Heracleum lanatum	common cowparsnip	FAC+	n	
Hydrophyllum fendleri	Fendler's waterleaf	FAC	n	
Lemna minor	common duckweed	OBL	n	
Lilium columbianum	Columbian lily		n	
Listera convallarioides	broadlipped twayblade	FACU	n	
Lomatium brandegei	Brandegee's desertparsley		n	
Lupinus latifolius	broadleaf lupine		n	
Lysichiton americanus	American skunkcabbage	OBL	n	
Mentha arvensis	Canadian mint	FACW-	nn	
Mitella species	miterwort		n	
Montia sibirica	Siberian springbeauty	FAC	n	
Osmorhiza chilensis	western sweet-cicely	none	n	
Parnassia fimbriata	Rocky Mountain parnassia	OBL	n	
Pedicularis species	lousewort		n	
Polemonium species	polemonium		n	
Potentilla species	cinquefoil			
Prunella vulgaris	common selfheal	FACU+	n	
Pterospora andromedea	woodland pinedrops		n	
Pyrola secunda	sidebells wintergreen	FACU	n	
Pyrola species	wintergreen species		n	
Sanicula marilandica	Maryland sanicle	NI	n	
Senecio triangularis	arrowleaf groundsel	FACW+	n	
Smilacina racemosa	fat false Solomon's seal	FAC-	n	
Smilacina stellata	starry false Solomon's seal	FAC-	n	
Solidago canadensis	Canada goldenrod	FACU	n	
Streptopus amplexifolius	claspleaf twistedstalk	FAC-	n	
Tanacetum vulgare	common tansy	NI	nn	State class C noxious weed
Thalictrum occidentale	western meadowrue	FACU*	n	
Tiarella unifoliata	oneleaf foamflower		n	
Urtica dioica	stinging nettle	FAC+	n	
Veratrum viride	American false hellebore	FACW	n	At one site only up the Twisp River
Verbascum thapsus	common mullein	FACU	nn	Okanogan County noxious weed
Veronica species	speedwell			
Viola glabella	pioneer violet	FACW+	n	
Woodsia species	woodsia		n	

* Currently accepted nomenclature and wetland indicator status follows, for the most part, The PLANTS database (USDA, NRCS, 2013).

Survey Dates: July-September, 2014 Botanist: Kelly Bariabar & Linda Knight

** Wetland Status:

Code	Wetland Type	Indicator Explanation
OBL	Obligate Wetland	Occurs almost always under natural conditions in wetlands.
FACW	Facultative Wetland	Usually occurs in wetlands, but occasionally found in non-wetlands.
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands.

Species List for *Sanicula marilandica* ISSSSP Surveys 2014

Scientific name	Common Name	Wetland Status	Native/ Non-native	Comments

FACU	Facultative Upland	Usually occurs in non-wetlands.
UPL	Obligate Upland	Occurs in wetlands in other regions, but almost always under natural conditions in non-wetlands in this region.
NA	No agreement	A decision has not been reached for this region.
NI	No indicator	Insufficient information available to determine indicator status.
Blank		No indicator information found for species.

* by indicator status denotes tentative assignment based on lack of information or conflicting views.