Monarch Meadow Survey 2021

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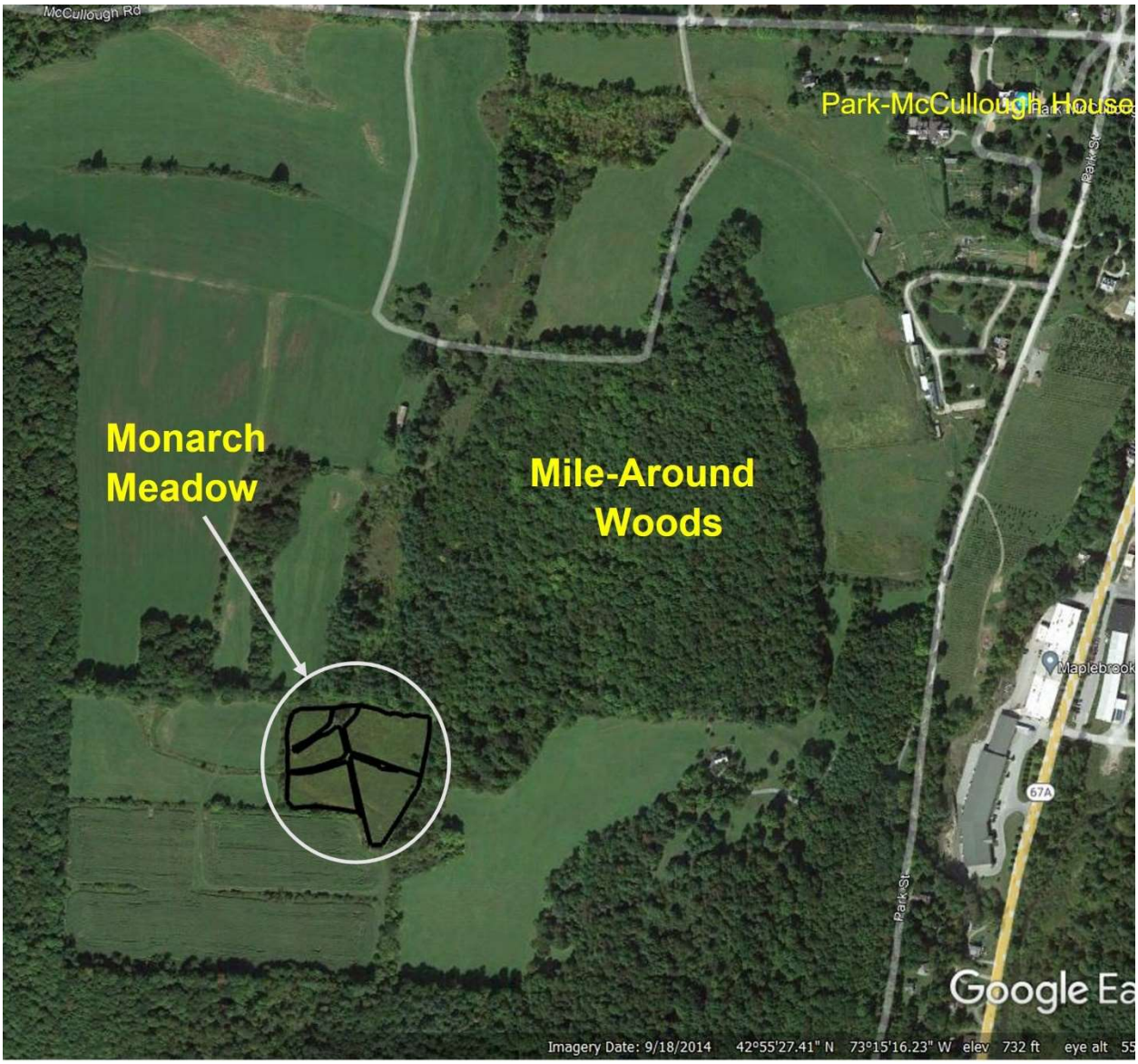
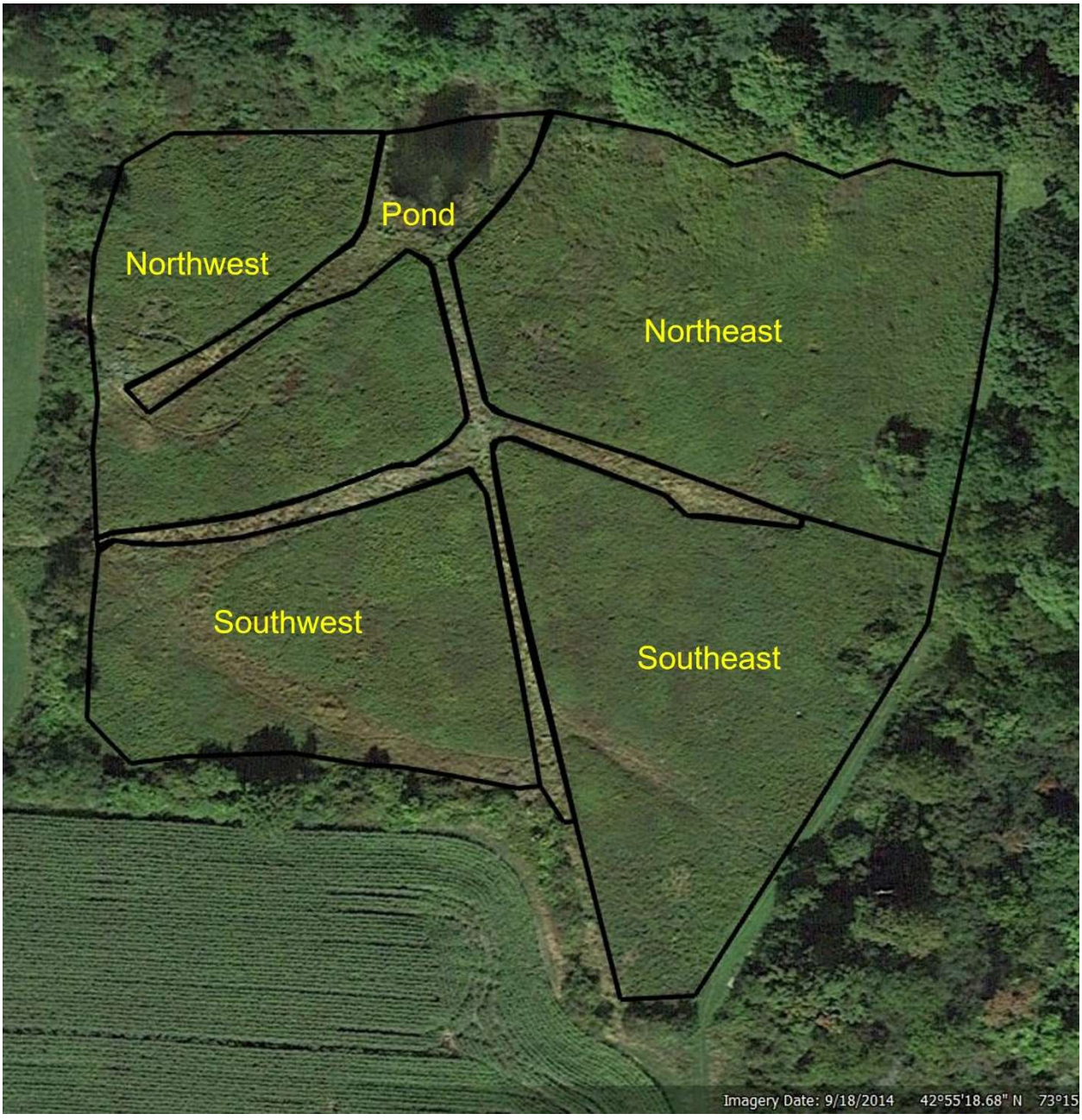
Monarch Meadow is an approximately 5-acre area near Mile-Around Woods in North Bennington, Vermont. The meadow includes many native herbaceous plants that are valuable for butterflies, moths, and other pollinator insects. There are also non-native invasive species in the area which are invading the meadow, and there is concern that they will outcompete the native plants and decrease the value of the area for pollinators.



A survey of native, non-native, and invasive plants in Monarch Meadow was performed on multiple dates from May through November 2021 (see Appendix). This allowed identification of various species as they leafed out and flowered throughout the season. The Google Earth map below shows Monarch Meadow as of 9/18/2014. The area was divided into 5 sections: Pond and Swales, Northwest, Northeast, Southeast, and Southwest. Plants were surveyed in each section.



The pond and swales in Monarch Meadow are best classified as Shallow Emergent Marsh (Thompson and Sorenson 2005). This area provides valuable wetland habitat. The surrounding meadow is a transitional open area where the native vegetation was removed for farming in the past. The meadow is dominated by native herbaceous plants, such as goldenrod, Joe Pye weed, wild bergamot, boneset, asters, and milkweed, which are important for pollinators. The area would be expected to transition over time to a woodland community like the nearby Northern Hardwood Forest (Thompson and Sorenson 2005). However, Monarch Meadow is surrounded on three sides by hedgerows which are heavily populated by invasive species. The invasive species have begun to spread into the meadow and will change the normal succession unless they are managed.

Goldenrod, Joe Pye weed and boneset in bloom in Monarch Meadow.

Invasive shrubby species are most common in the easternmost portions of the Northeast and Southeast sections in an approximately 15-meter strip adjacent to the trail. These invasive species appear to have significantly increased since the Google Earth image on 9/18/2014. Bittersweet and multiflora rose are abundant in this area. There are occasional honeysuckle (several large shrubs), common buckthorn, and European spindle tree. Native trees and shrubs, including sugar maple, trembling aspen, hickory, willow, gray dogwood, high bush cranberry, and black raspberry, have also started to colonize the meadow in this area.

Invasive species were not as prevalent in the remaining meadow. Shrubby species, including honeysuckle, bittersweet and multiflora rose, were occasionally found scattered throughout the meadow. Herbaceous invasive species were also found. Reed canary-grass and cypress spurge were locally abundant in the marshy area of the Pond and Swales section. Wild parsnip was occasionally present in the Southwest section. The Southwest section also contains native shrubs, including gray dogwood and meadowsweet.

Two hundred twenty-one native shrubs, including red osier dogwood, silky dogwood, elderberry, buttonbush, black willow, and black birch, were planted May 2021 at the northern border of the Northeast section. Their purpose is to provide a shrubby transition between the forest and meadow. These shrubs will support pollinators, and provide habitat for bird species.

Management of Invasive Species

The 15-meter strip on the east side of Monarch Meadow should be a priority in the treatment of invasive species. Yearly mowing with a brush mower is needed to control the shrubby invasive plants. If the goal is to retain the area as a meadow with herbaceous pollinator plants, then mowing could also be used to decrease the native woody plants found in this area. If the goal is to allow natural succession to a woody community, then the native trees and shrubs could be located and marked prior to mowing. The planted native shrubs in the northern portion of the Northeast section will be protected from mowing activity.

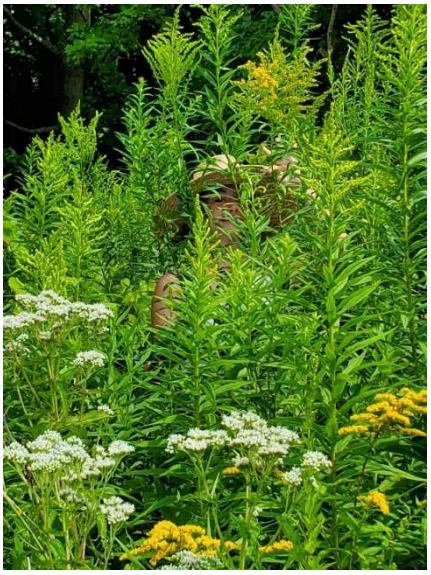
A rotational mowing schedule is needed over the entire meadow to control the scattered shrubby invasive plants. Standing perennials provide winter habitat for pollinators. Therefore, mowing is best done in the early spring after the overwintering lepidopterans and other insects become active. However, the area may not be dry enough to mow in early spring, and mowing may need to be done in late fall. If mowed in the fall, a portion of the area should be left each year for overwintering habitat. The area could be visited in the late spring or early summer to remove any shrubby regrowth by hand.

Herbaceous invasive species, such as reed canary-grass and cypress spurge in the marshy areas, and wild parsnip in the Southwest, can also be treated by mowing. However frequent mowing, including summer mowing to decrease seed production, would be needed to control these plants. This mowing schedule would decrease habitat for pollinators and birds. Therefore, the best option would be frequent and repeated hand-pulling if these plants are considered major problems in the plant community.

The hedgerows surrounding Monarch Meadow are heavily infested with invasive species and are the source of the invasives in the meadow. A major effort is needed to remove these invasive species and replace them with native shrubs and trees.

On the way to Monarch Meadow in the Fall, I noted that Japanese barberry and burning bush are common along the Mile-Around Woods trail, as well as an occasional European spindle tree. Currently garlic mustard is being hand-picked by devoted volunteers each spring. Removal of these shrubby species is needed as well using similar methods to minimize impact to the surrounding vegetation, including Spring ephemerals. This could be accomplished by hand-pulling or digging up the smaller shrubs, and cutting larger shrubs and wrapping the stumps to prevent regrowth.

Plant Sampling



All plant species found in Monarch Meadow in 2021 were recorded and are listed in the Appendix. Each of the 5 sections were surveyed on multiple dates from May through November. The plants were placed in categories (abundant, locally abundant, common, or occasional) indicating how often they occurred in each area. We had originally planned a more quantitative plant survey. A series of quadrats were to be established along transects in each of the five sections of Monarch Meadow. The percentage cover of each plant species could then be estimated. However, this turned out to be impossible due to the height of the plants. This photo taken by Becky Manning on August 11 shows a person standing in the goldenrod which is clearly over her head.

Drone photographs of the area were taken to determine if these would provide an accurate technique for measuring vegetation and changes over time. These photos were reviewed, and general vegetation types could be identified (See photos below). For example, wetland could be distinguished from drier meadow vegetation. Large shrubs could be identified, but smaller shrubs often blended in with the herbaceous vegetation. Shrubby invasives, such as bittersweet and multiflora rose which tend to trail over an area, could not be identified beneath the tall goldenrods. Use of a drone for detailed mapping of the area would also require expensive software to develop an orthomosaic corrected for lens distortion, camera tilt, perspective, and topographic relief. Such correction is necessary to allow maps to be to be compared for changes over time, and to be used for measuring distances and areas.

Drone photo looking west over Monarch Meadow taken by Becky Manning.

Drone photo of Northwest area of Monarch Meadow taken by Becky Manning.

If more quantitative data is desired, sampling could be best accomplished in early summer when the plants have leafed out but the herbaceous vegetation has not reached its full height. Plant sampling to determine changes over time would be best done at the same spots at the same time each year. Transects should be marked at both ends with permanent stakes, so that they can be returned to year after year. Stakes for transects could have multiple uses, such as holding educational signs with information on the plants and pollinators. Vegetation can either be measured as distance over the transect or at a series of points on the transect. This would have less inter-observer variation than quadrats which require subjective estimates of the percentage cover of each species. Such sampling would require a significant time commitment, and it should be determined whether it would provide more valuable data for management of the area than a less quantitative survey such as the one performed this year.

References

Eliman, Ted and New England Wild Flower Society. 2016. Wildflowers of New England. Timber Press Field Guide, Portland, Oregon.

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Gleason, Henry A. and Arthur Cronquist. 1991. Manual of vascular plants of northeastern US an adjacent Canada. The New York Botanical Garden Press, Bronx, New York.

Magee, Dennis W. and Harry E. Ahles. 2007. Flora of the Northeast, A Manual of the Vascular Flora of New England and Adjacent New York. University of Massachusetts Press, Amherst, Massachusetts.

Thompson, Elizabeth H., and Eric R. Sorenson. 2005. Wetland, Woodland, Wildland. A Guide to the Natural Communities of Vermont. University Press of New England, Hanover and London.

Uva, Richard H., Joseph C. Neal, and Joseph M. DiTomaso. 1997. Weeds of the Northeast. Cornell University Press, Ithaca, N.Y.

Web Resources

Google Earth. https://earth.google.com.

Native Plant Trust. Go Botany. https://gobotany.nativeplanttrust.org.

PlantNet Plant Identification. Google Play App. https://plantnet.org.

Vermont Agency of Natural Resources, Department of Forests, Parks and Recreation. Common Ferns of Vermont. https://www.vtstateparks.com/assets/pdf/ferns.pdf.

Vermont Invasives. Gallery of Terrestrial Plants. https://vtinvasives.org/gallery-of-terrestrial-plants.

Appendix. Plant List 2021.

Below is the plant list for Monarch Meadow for 2021. The survey was performed throughout the season on the following dates: May 23, May 27, June 17, August 21, September 7, and November 13. Species in each section are classified as:

Abundant – major species of the overall plant community,
Locally abundant – major species in one localized spot,
Common - seen throughout the area,
Occasional – few plants seen.

Non-native and invasive non-native plants (according to Vermont Invasives website) are listed separately. Dates listed in parentheses indicate that collections were made of these plants.

Pond and Swales

Native herbaceous plants

Chelone glabra. Turtlehead. Occasional.
Onoclea sensibilis. Sensitive fern. Common.
Carex hystericina. Porcupine sedge. Occasional. (6/18/21)
Carex vulpinoidea. Common fox sedge. Occasional. (6/17/21)
Cyperus strigosus. Straw-colored flat-sedge. (8/21/21)
Eleocharis sp. Spike-rush. Occasional.
Epilobium ciliatum subsp. *ciliatum.* Ciliate willow-herb. Occasional. (8/21/21, 9/7/21)
Eupatorium perfoliatum. Boneset. Common.
Glyceria striata. Fowl manna grass. Occasional. (9/7/21)
Juncus effusus ssp. *solutus*. Smooth rush. Locally abundant. (5/23/21, 7/23/21)
Leersia oryzoides. Rice cutgrass. Occasional. (9/7/21)
Panicum capillare. Witchgrass. Occasional. (9/7/21)
Persicaria sagittata. Tearthumb. Occasional. (8/21/21, 9/7/21)
Persicaria punctata. Dotted smartweed. Occasional.
Schoenoplectus tabernaemontani. Common or soft-stem bulrush. Occasional. (6/17/21)
Scirpus cyperinus. Common woolsedge or wool-grass. Occasional. (7/23/21)
Scirpus microcarpus. Barberpole bulrush. Occasional. (5/23/21)
Scirpus atrovirens. Dark green bulrush. Occasional. (7/23/21)
Solidago canadensis var. canadensis. Canada goldenrod. Abundant.
Veronica americana. American speedwell. Occasional.

Non-native plants

Galium mollugo Bedstraw. Occasional. (6/18/21)
Ranunculus acris. Tall buttercup. Occasional.

Invasive non-native plants
Phalaris arundinacea. Reed canary-grass. Common. (6/17/21, 7/23/21, 9/7/21)
Lonicera morrowii. Morrow's honeysuckle. Occasional.
Euphorbia cyparissias. Cypress spurge. Locally abundant. (5/23/21)

Northwest

Native herbaceous plants
Achillea millefolium. Yarrow. Occasional. (7/23/21)
Asclepias syriaca. Common milkweed. Occasional.
Chelone glabra. Turtlehead. Occasional
Impatiens capensis. Jewelweed. Occasional.
Epilobium ciliatum subsp. *ciliatum.* Occasional. (8/21/21)
Eupatorium perfoliatum. Boneset. Occasional.
Euthamia graminifolia. Grass-leaved goldenrod. Occasional. (8/21/21, 9/7/21)
Eutrochium maculatum var. *maculatum*. Joe Pye weed. Locally abundant. (8/21/21)
Mentha canadensis. American wild mint. Occasional. (9/7/21)
Monarda fistulosa. Wild bergamot. Common. 8/21/21
Onoclea sensibilis. Sensitive fern. Common.
Scirpus cyperinus. Common woolsedge or wool-grass. Occasional. (7/23/21)
Solidago canadensis var. *canadensis.* Canada goldenrod. Abundant. (7/23/21, 8/21/21)
Symphyotrichum puniceum. Red-stemmed aster. Occasional. (9/7/21)
Symphyotrichum lateriflorum. Calico aster. Occasional. (9/7/21)
Thelypteris palustris. Marsh fern. Occasional. (8/21/21)
Verbena hastata. Blue vervain. Occasional. (8/21/21)

Non-native plants
Ranunculus acris. Tall buttercup. Occasional. (5/23/21)
Poa pratensis. Kentucky bluegrass. Occasional. (7/23/21)
Phleum pratense. Timothy grass. Occasional. (7/23/21)

Invasive non-native plants
Lonicera morrowii. Morrow's honeysuckle. Occasional.
Rosa multiflora. Multiflora rose. Occasional.

Northeast

Native trees and shrubs
Populus tremuloides. Trembling aspen. Uncommon.
Rubus occidentalis. Black raspberry. Occasional.

Native trees and shrubs planted by the Fund for North Bennington May 2021
Swida (Cornus) sericea. Red osier dogwood.
Swida (Cornus) amomum. Silky dogwood.
Sambucus nigra. Elderberry.
Catharanthus occidentalis. Buttonbush.
Salix nigra. Black willow.
Betula lenta. Black or cherry birch.

Native herbaceous plants
Asclepias syriaca. Common milkweed. Common.
Erigeron strigosus subsp. *septentrionalis.* Northern daisy fleabane. Occasional. (7/23/21)
Eutrochium maculatum var. *maculatum*. Joe Pye weed. Common.
Lactuca canadensis. Wild lettuce. Occasional. (7/23/21, photo 9/7/21)
Monarda fistulosa. Wild Bergamot. Common.
Onoclea sensibilis. Sensitive fern. Common.
Penstemon digitalis. Tall white beardtongue. Occasional.
Potentilla simplex. Old field cinquefoil. Occasional.
Prunella vulgaris var. *lanceolata.* Heal-all. Occasional. (8/21/21)
Scirpus atrovirens. Dark green bullrush. Occasional. (8/21/21)
Solidago canadensis var. *canadensis.* Canada goldenrod. Abundant.
Symphyotrichum novae-angliae. New England aster. Occasional. (8/21/21)
Symphyotrichum lateriflorum. Calico aster. Occasional.
Urtica dioica ssp. *gracilis.* Stinging nettle. Occasional.
Zizia aurea. Golden alexander. Occasional.
Verbena hastata. Blue vervain. Occasional. (7/23/21)
Vitis sp. Grape. Occasional.

Non-native plants
Arctium lappa. Greater burdock. Occasional.
Daucus carota. Queen Anne's lace. Occasional.
Hypericum perforatum. Common St. John's-wort. Occasional. (7/23/21)
Lotus corniculatus. Bird's-foot trefoil. Occasional.
Origanum vulgare. Wild oregano. Occasional. (8/21/21, 9/7/21)
Pilosella caespitosa (*Hieracium caespitosum)*. Yellow king devil or hawkweed. Occasional. (5/27/21)
Poa pratensis. Kentucky bluegrass. Occasional.
Trifolium pratense. Red clover. Occasional.

Invasive non-native plants
Celastrus orbiculatus. Bittersweet. Locally abundant.
Euonymus europeaus. European spindle-tree. Occasional.
Euphorbia cyparissius. Cypress spurge. Locally abundant.

Lonicera morrowii. Morrow's honeysuckle. Common.
Lonicera tartarica. Tatarian honeysuckle. Occasional.
Rosa multiflora. Multiflora rose. Locally abundant.

Southeast

Native trees and shrubs

Acer saccharum. Sugar maple. Occasional. (8/21/21)
Carya sp. Hickory. Occasional. (7/23/21)
Swida (Cornus) racemosa. Gray dogwood. Locally abundant. (9/7/21)
Rubus occidentalis. Black raspberry. Common.
Salix sp. Willow. Occasional.
Viburnum opulus. High bush cranberry. Occasional.

Native herbaceous plants

Amaranthus sp. Pigweed. Occasional.
Asclepias syriaca. Common milkweed. Common.
Dennstaedtia punctilobula. Hayscented fern. Occasional. (9/7/21)
Epilobium ciliatum subsp. *ciliatum.* Northern willow-herb. Occasional. (9/7/21)
Equisetum sp. Horsetail. Occasional.
Erigeron strigosus subsp. *septentrionalis.* Northern daisy fleabane. Occasional.
Eupatorium perfoliatum. Boneset. Occasional.
Euthamnia graminifolia. Common grass-leaved goldenrod. Common.
Eutrochium maculatum var. *maculatum.* Joe Pye weed. Locally abundant. (8/21/21)
Juncus effusus ssp. *solutus.* Smooth rush. Occasional.
Lactuca canadensis. Wild lettuce. Occasional.
Leucanthemum vulgare. Oxeye daisy. Occasional.
Lobelia inflata. Indian tobacco. (9/7/21) Occasional.
Monarda fistulosa. Wild bergamot. Common.
Onoclea sensibilis. Sensitive fern. Occasional.
Prunella vulgaris var. *lanceolata.* Self-heal, heal-all. Occasional.
Solidago canadensis var. *canadensis.* Canada goldenrod. Abundant.
Solidago rugosa. Rough-leaved goldenrod. Occasional. (9/7/21)
Symphyotrichum lateriflorum. Calico aster. Occasional. (9/7/21)
Symphyotrichum puniceum. Red-stemmed aster. (9/7/21)
Symphiotrichum novae-angliae. New England aster. (9/7/21)
Vitis sp. Grape. Occasional.

Non-native plants

Ranunculus acris. Tall buttercup. Occasional.
Cirsium arvense. Canada thistle. Occasional.
Daucus carota. Queen Anne's lace. Occasional.
Galium mollugo Bedstraw. Occasional. (6/18/21)

Hypericum perforatum. Common St. John's-wort. Occasional. (7/23/21)
Leucanthemum vulgare. Oxeye daisy. Occasional.
Poa pratensis ssp. *pratensis.* Kentucky bluegrass. Occasional.

Invasive non-native plants
Celastrus orbiculatus. Bittersweet. Locally abundant.
Lonicera morrowii. Morrow's honeysuckle. Common.
Rhamnus cathartica. Common buckthorn. Occasional.
Rosa multiflora. Multiflora rose. Locally abundant.

Southwest

Native trees and shrubs
Spiraea alba var*. latifolia.* Meadowsweet. Common.
Swida (Cornus) racemosa. Gray dogwood. Occasional.

Native herbaceous plants
Amaranthus sp. Pigweed. Occasional.
Asclepias syriaca. Common milkweed. Common.
Eleocharis sp. Spike-rush. Common.
Eupatorium perfoliatum. Boneset. Common.
Eutrochium maculatum var. *maculatum*. Joe Pye weed. Common.
Monarda fistulosa. Wild Bergamot. Common.
Onoclea sensibilis. Sensitive fern. Common.
Solidago canadensis var. *canadensis.* Canada goldenrod. Abundant.
Mentha canadensis. American wild mint. Occasional.

Non-native species
Cirsium arvense. Canadian thistle. Occasional.
Ranunculus acris. Tall buttercup. Occasional.

Invasive non-native species
Rosa multiflora. Multiflora rose. Occasional.
Celastrus orbiculatus. Bittersweet. Occasional.
Pastinaca sativa. Wild parsnip. Occasional.