

About the West Virginia Planting Tool

<https://tagis.dep.wv.gov/seeds/>

The WV Planting Tool recommends native species for habitat restoration projects, wetland mitigation sites, erosion control, rights-of-way, and pollinator gardens in West Virginia. Recommendations are customized based on the location in West Virginia, the purpose of the planting project, and whether or not the planting site is a wetland. Results can be displayed as “top choices only” or as a full list of all of the recommended species likely to thrive at a particular site. Results are categorized as trees, shrubs, vines, forbs, graminoids, or ferns/fern allies. Information is provided for each recommended species including Common Name, Scientific Name, Growth Form, Height, Sun/Shade, Soil Moisture, Bloom Period, Flower Color, Life Cycle, and Natural History Notes.

The WV Planting Tool was compiled by Elizabeth Byers, WVDEP Watershed Assessment Branch, during 2020-2022, with key assistance from the following experts: WVDEP: Sara Miller, Mike Shank, Dustin Lowers; WVDNR: James Vanderhorst, Sue Olcott, Brian Streets, John Burkhardt; WVU: Donna Ford-Werntz; WV Wesleyan College: Kathy Gregg; WV Native Plant Society: Chris Gatens, Kevin Campbell; and Rod Bartgis.

The 71 customized planting locations are based on 55 counties and 5 ecoregions. Note that ecoregion boundaries cross 14 counties, splitting them into two, or in the case of Webster and Greenbrier counties, three planting zones. The WVDNR “Seed Zones” map created by James Vanderhorst at WVDNR was used to define the ecoregions: Ridge & Valley/Blue Ridge (RV), Allegheny Highlands (AH), Greenbrier Valley and Allegheny Mountain (AMG), Cumberland Mountains (CM), and Western Allegheny Plateau (WAP).

Methods and Criteria

Species were selected for recommendation according to a two-step process. First, the most common and abundant native species for each of 71 geographic areas in the state were selected based on more than 200,000 georeferenced plant records from WVDNR, WVU Herbarium (WVA), WVDEP, and the Global Biodiversity Information Facility (GBIF). The list of recommended species was then vetted by expert botanists at WVDEP, WVDNR, WVA, WV Wesleyan College, and the WV Native Plant Society.

The GIS map of geographic areas and database of recommended species for each scenario (location, wetland/upland, purpose of planting, number of results to display) were transformed into a public website by WVDEP’s Technical Applications and GIS Unit, using programming tools in SQL, Python, CSS, Javascript, and HTML.

The three categories for purpose of planting, with their recommendation criteria are:

- **Restoration.** Examples include habitat restoration, wetland mitigation sites, or wildlife conservation planting. Criteria are Frequency ≥ 10 , Average cover $\geq 10\%$, Coefficient of Conservation ≥ 4 , Additions: a few species that don't quite meet criteria but are deemed valuable for restoration, Exclusions: a few species meet criteria but have issues such as

pervasive pathogens. Species recommended for wetland and buffer mitigation in West Virginia by the US Army Corps of Engineers are given greater weight in this section.

- **Erosion Control.** Examples include open soil revegetation, pipelines, powerlines, and highway rights-of-way. Criteria are native, sun or partial shade, common, tolerant of human disturbance (Coefficient of Conservatism range 1-5), and with documented abundance on roadsides or in grasslands.
- **Pollinator gardens.** Examples include gardens, yards, and hedgerows. Criteria are native, relatively common, with high documented pollinator value for hummingbirds, butterfly nectar, honeybees, native bees, pollen, or as butterfly larval hosts. Showy species are given greater weight in this section.

Importance value calculations

Species exported from the WVDNR (166,628 records) and WVDEP (3,814 records) databases were screened to include native non-invasive vascular plants with > 4% cover. Globally rare species and poison ivy were excluded. Species exported from the GBIF (30,336 records from Carnegie Natural History Museum Herbarium, iNaturalist, and PlantNet) were screened to include native non-invasive vascular plants with locational accuracy < 1000 m. WVA vouchers (27,194) were screened to include native non-invasive vascular plants.

Importance value (IV) was calculated as follows:

IV = Ecoregion IV + County IV. Note that ecoregion and county IVs are calculated in the same way. The difference is that the ecoregion values are averaged over the entire ecoregion, which includes multiple counties or parts of counties. Adding the average ecoregion value helps to fill out the species list for counties that are under-sampled.

Ecoregion IV = [Sum of WVDNR plot-species (Cover)] + [Sum of WVDEP wetland assessment-species (Cover)] + number of GBIF records + number of WVU Herbarium records (only for counties that are contained in a single ecoregion)]. The total for the target ecoregion is prorated by dividing by the number of counties (approximating partial counties), in the ecoregion: AH 5, AMG 4, CM 10, RV 7, WAP 30. This value is weighted double (multiplied by 2) compared with the county value, since some counties are under-sampled.

County IV (portion of county within an ecoregion) = [Sum of WVDNR plot-species (Cover)] + [Sum of WVDEP wetland assessment-species (Cover)] + number of GBIF records + number of WVA records (only for counties that are contained in a single ecoregion)].

Records without an abundance (cover) value were arbitrarily assigned a weight of 1. Records with abundance values were assigned a weight = % cover. Most WVA vouchers do not have coordinates or ecoregion locations. WVA records for counties that are not fully contained within one ecoregion were omitted from the totals.

The impact of the weighting is that WVDNR vegetation plots & WVDEP wetland assessments dominate the scores for species that are abundant in natural habitats. For species that are less abundant in natural

habitats but widespread, WVA and GBIF make a significant contribution to the scores and sometimes dominate.

Thresholds for inclusion in results queries

From the final list of 328 recommended species statewide, thresholds were set for inclusion in results for each scenario based on the geographic distribution of each species within the state. Species excluded from this version due to pervasive pathogens are *Fagus grandifolia*, *Fraxinus* (all species), *Tsuga canadensis*, and *Ulmus americana*. Since planting these species may have benefits to conservation, particularly if pathogen-resistant strains are identified, it is possible they will be included in future versions. Thresholds for additional species are shown below.

IV \geq 5 is the default for all species, except as noted below.

IV \geq 3 for 11 species with generally lower cover & abundance but with desirable qualities (e.g. pollinator value): *Amaranthus hybridus*, *Bidens laevis*, *Cirsium discolor*, *Crataegus crus-galli*, *Diervilla lonicera*, *Helianthus giganteus*, *Helianthus strumosus*, *Ionactis linariifolius*, *Rhododendron prinophyllum*, *Rudbeckia hirta* var. *hirta*, and *Veronicastrum virginicum*.

Platanus occidentalis and *Liriodendron tulipifera* are excluded from the Allegheny Highlands results since they occur only along a few low-elevation streams in that ecoregion.

Certain species with high IV have custom thresholds for inclusion, based on their distribution in West Virginia. They are:

<i>Acer nigrum</i> > 10	<i>Geum canadense</i> var. <i>canadense</i> > 5
<i>Acer pensylvanicum</i> > 100	<i>Hypericum densiflorum</i> > 13
<i>Acer saccharinum</i> > 50	<i>Ilex montana</i> > 10
<i>Acer spicatum</i> > 10	<i>Juglans nigra</i> > 26
<i>Alnus incana</i> ssp. <i>rugosa</i> > 200	<i>Juncus brevicaudatus</i> > 50
<i>Alnus serrulata</i> > 20	<i>Juncus subcaudatus</i> var. <i>subcaudatus</i> > 10
<i>Amelanchier laevis</i> > 10	<i>Liquidambar styraciflua</i> > 10
<i>Apios americana</i> > 5	<i>Magnolia fraseri</i> > 10
<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i> > 100	<i>Nemopanthus mucronatus</i> > 100
<i>Betula lenta</i> > 100	<i>Oxalis montana</i> > 100
<i>Betula nigra</i> > 10	<i>Oxydendrum arboreum</i> > 50
<i>Calamagrostis canadensis</i> var. <i>canadensis</i> > 10	<i>Photinia melanocarpa</i> > 50
<i>Carex gynandra</i> > 10	<i>Photinia pyrifolia</i> > 50
<i>Carya alba</i> > 63	<i>Picea rubens</i> > 1000
<i>Carya glabra</i> > 50	<i>Pilea pumila</i> var. <i>pumila</i> > 10
<i>Cornus amomum</i> > 50	<i>Prunus pensylvanica</i> var. <i>pensylvanica</i> > 10
<i>Cornus florida</i> > 10	<i>Quercus ilicifolia</i> > 10
<i>Dryopteris campyloptera</i> > 50	<i>Quercus stellata</i> > 50
<i>Elymus virginicus</i> var. <i>virginicus</i> > 10	<i>Quercus velutina</i> > 50
<i>Eriophorum virginicum</i> > 100	<i>Rhododendron arborescens</i> > 10
<i>Gaylussacia baccata</i> > 100	<i>Rhododendron calendulaceum</i> > 10

Rhododendron catawbiense > 50
Rhus aromatica var. *aromatica* > 10
Rhynchospora alba > 10
Ribes cynosbati > 5
Salix nigra > 10
Sassafras albidum > 10
Saururus cernuus > 10
Solidago uliginosa var. *uliginosa* > 50

Sparganium emersum > 50
Vaccinium angustifolium > 50
Vaccinium corymbosum > 10
Vaccinium erythrocarpum > 20
Vaccinium myrtilloides > 50
Veratrum viride > 10
Vernonia noveboracensis > 12
Viburnum nudum var. *cassinoides* > 10

Top choices vs. All results

“Top choices” includes the species with the highest 4 Importance Values for trees, shrubs, forbs, and graminoids, plus the single highest Importance Value for vines and ferns. Normally 18 species are shown in the top choices results, but sometimes slightly less if, for example, there are no vines that meet the recommendation criteria.

“All results” shows all of the species that meet the recommendation criteria, sorted by growth form (trees, shrubs, vines, forbs, graminoids, ferns) and then by Importance Values, with the most highly recommended species at the top of each category. Typically, about 65 recommended species are included, with a range of 29 species to 136 species depending upon the scenario.

Acronyms

AH Allegheny Highlands
AMG Greenbrier Valley and Allegheny Mountain
CM Cumberland Mountains
CSS Cascading Style Sheets
GBIF Global Biodiversity Information Facility
GIS Geographic Information System
HTML HyperText Markup Language
IV Importance Value
RV Ridge & Valley/Blue Ridge
SQL Structured Query Language
WAP Western Allegheny Plateau
WVA West Virginia University Herbarium
WVU West Virginia University
WVDEP West Virginia Department of Environmental Protection
WVDNR West Virginia Division of Natural Resources
WVNPS West Virginia Native Plant Society
WVWC West Virginia Wesleyan College

Glossary

Coefficient of Conservatism: Value from 1-10 that describes the sensitivity to anthropogenic disturbance by individual plant species, with values of 1 indicating high tolerance for anthropogenic disturbance and values of 10 indicating very low tolerance for anthropogenic disturbance. Species with low coefficients of conservatism will often volunteer on disturbed sites, whereas species with higher coefficients may need to be planted and nurtured before they can become established.

Cover, or absolute percent cover: The percentage of the ground covered by the vertical projection of the plant crowns of a species or defined set of plants (also known as the vertical projection of foliage of plants) as viewed from above. This information is recorded for each species in WVDNR vegetation plots and WVDEP wetland assessments. Values range from 0.1% to 100% for each species in an individual plot or assessment area.

Frequency: Vegetation attribute that describes the probability of finding a species within a particular area. The frequency is based on the number of occurrences of that species in a series of sample units, such as plots, observations, or herbarium vouchers.

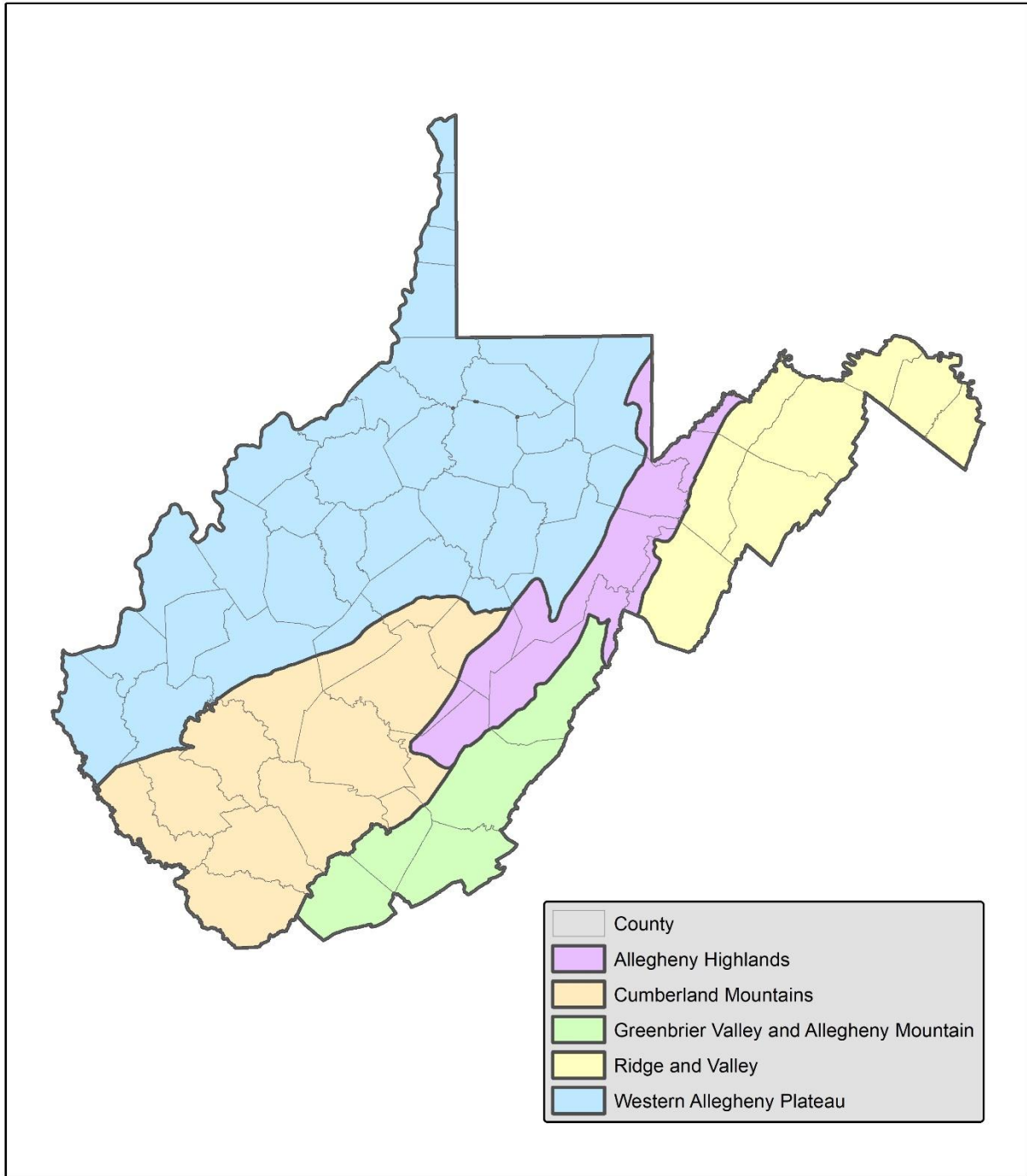
Importance Value: Measure of how dominant a species is in a given area. In this tool, the Importance Value (IV) is calculated as the sum of all of the occurrences (frequency) plus the percent cover of occurrences where it has been recorded. IV is thus based on both likelihood of occurrence and abundance in a given area. A species can score a high IV in a given area by occurring in many scattered small patches or by occurring in a smaller number of large natural stands.

Sources

- Allen, T. J. 1997. *The Butterflies of West Virginia and Their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 388 pp.
- Butterflies and Moths of North America, <https://www.butterfliesandmoths.org/> (accessed 3.24.2021)
- Eierman, K. 2021. Larval Host Plants for Butterflies & Moths. Ecobeneficial. <https://www.ecobeneficial.com/pvg/larval-host-plants-for-butterflies-and-moths/> (accessed 3.24.2021)
- Eierman, K. 2021. Some Early Blooming Native Trees and Shrubs for Bees. Ecobeneficial. <https://www.ecobeneficial.com/2013/03/critical-early-trees-and-shrubs-for-bees/> (accessed 3.18.2021)
- Global Biodiversity Information Facility (GBIF). GBIF.org (29 March 2021) GBIF Occurrence Download <https://doi.org/10.15468/dl.wtgeq6>
- Harmon, P. J., D. Ford-Werntz, W. Grafton. 2006. *Checklist and Atlas of the Vascular Flora of West Virginia*. West Virginia Division of Natural Resources, Wildlife Resources Section, Elkins, WV. 381 pp.
- Hilty, John. 2020. *Illinois Wildflowers*. <https://www.illinoiswildflowers.info/>
- Host Plants for Butterflies and Moths, *The Native Plant Herald*. <http://nativeplantherald.prairienursery.com/2016/03/host-plants-for-butterflies-and-moths/> (accessed 3.11.2021)

- Kartesz, J.T., and C.A. Meacham. 1999. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.
- Minnesota Wildflower Information Organization. 2022. Minnesota Wildflowers: a field guide to the flora of Minnesota. <https://www.minnesotawildflowers.info>
- National Academies. 2006. Status of Pollinators in North America. National Academies Press. Washington, DC.
- Native Plant Trust. 2022. Go Botany website <https://gobotany.nativeplanttrust.org>
- North Carolina State University Extension. 2022. North Carolina Extension Gardener Plant Toolbox website. <https://plants.ces.ncsu.edu/>
- Norris, S. J. 1997. Vegetation Study of the Grasslands of Canaan Valley National Wildlife Refuge. Unpublished report, WVDNR.
- PlantNative.org: MD, VA, WV
- Pollinator Partnership and NAPP. 2017. Selecting Plants for Pollinators: Central Appalachian Broadleaf Forest. https://www.pollinator.org/pollinator.org/assets/generalFiles/CentralAppalachianrx7FINAL_170624_124216_1.pdf (accessed 4.2.2021)
- Pollinator Partnership and NAPP. 2018. Selecting Plants for Pollinators: Eastern Broadleaf Forest. <https://www.pollinator.org/PDFs/EasternBroadleaf.Oceanic.rx18.pdf> (accessed 4.2.2021)
- Rentch, J. S., R. H. Fortney, S. L. Stephenson, H. S. Adams, W. N. Grafton, and J. T. Anderson. 2005. Vegetation-site relationships of roadside plant communities in West Virginia, USA. *Journal of Applied Ecology* 42: 129-138.
- Strausbaugh, P. D. and E. L. Core. 1978. Flora of West Virginia. Seneca Books. 1079 pp.
- Tallamy, D. W. 2020. Nature's Best Hope: A New Approach to Conservation that Starts in Your Yard. Timber Press. 256 pp.
- Weakley, A. S., J. C. Ludwig, J. F. Townsend, and B. Crowder. 2012. Flora of Virginia. Botanical Research Institute of Texas Press. Fort Worth, TX. 1554 pp.
- WVDEP. 2021. West Virginia Wetland Rapid Assessment Method database export Feb 8, 2021. West Virginia Department of Environmental Protection, Watershed Assessment Branch. Charleston, WV.
- WVDNR. 2017. West Virginia Natural Heritage Program Ecology Plots2-WV database export Oct 4, 2017. West Virginia Division of Natural Resources, Wildlife Diversity Unit. Elkins, WV.
- WVU Herbarium. 2021. WVU Herbarium (WVA) specimen database export, October 2021.
- Xerces Society for Invertebrate Conservation. No. 17-049-04. Pollinator Plants of the Mid-Atlantic Region. <https://xerces.org/publications/plant-lists/pollinator-plants-mid-atlantic-region>

West Virginia Native Seed Zones



0 30 60 120 Miles

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