



**Key to Vermont Agroforestry Species Spreadsheet**  
**A project of the Farm to Plate Agroforestry Priority Strategy Team**  
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**SHEET ONE: SPECIES**

**NAMES**

- **Genus and species.** Current scientific names from WorldFloraonline.
- **Common name.** From USDA Plants Database or other sources if not present there.
- **Family.** From WorldFloraonline.
- **Cultivars.** Notes if cultivars exist, be they for food, timber, agroforestry functions, or resistance to pests and diseases spreading with climate change.

**COMMERCIAL PRODUCTS**

- **Cultivated commercial wood product.** Grown in timber plantations for hardwood or softwood products.
- **Cultivated commercial food product.** Grown commercially as food for market in USA.
- **Other cultivated commercial product.** Other products e.g. medicinal etc.
- **Commercial forest products.** Wood products commercially harvested from forests but not grown in plantations.
- **Potential product (not currently grown for US market).** Products that could be developed but are not yet marketed in the US to our knowledge.

**ORIGIN**

- **VT native.** Native in at least one county in VT according to GoBotany.
- **Northeast native.** Native in at least one county in Northeast US according to GoBotany.
- **Naturalization Status.** *Orange:* naturalized in at least one county in VT according to GoBotany. *Red:* Present on the VT Invasive Watch List.

**SUITABILITY**

- **USDA Zone.** Minimum and maximum USDA zone, from USDA Plants Database and other sources.
- **Is Zone 6 too hot.** *Red:* zone 6 is too hot for this species, indicating that by end of century in high-emissions scenarios, all but the coldest parts of Vermont could be too hot for it. *Yellow:* Zone 7 is too hot for this species, meaning that southern Vermont could be too hot in high-emission scenarios.
- **Cold snap vulnerability.** *Red:* highly vulnerable to cold snaps. *Orange.* Vulnerable to cold snaps.
- **Wet soils, dry soils, sand tolerant, clay tolerant, poor drainage tolerant, excessive drainage tolerant.** “Yes” indicates that the species is tolerant of the condition in question.
- **Soil pH.** The range of pH tolerated by the species.
- **Wetland indicator status.** *Obligate wetland (OBL):* Essentially only found in wetlands. *Facultative wetland (FACW):* found in wetlands 2/3 of the time. *Facultative (FAC):* Found in wetlands about 1/2 of the time. *Facultative upland (FACU):* Mostly found in

uplands, but in wetlands 1/3 of the time. **Obligate upland (UPL)**: Essentially only found in uplands. Most can be modified with “+” or “-“.

- **Flood tolerance.** **Red**: Intolerant. **Yellow**: some flood tolerance for short periods. **Light green**: Flood tolerance (unspecified). **Dark green**: Tolerate months of flooding.
- **Shade tolerance.** **Light green**: Tolerant of partial shade. **Dark green**: Tolerant of full shade.

#### FORM AND HABIT

- **Form.** Tree or shrub.
- **Height.** Height at maturity in feet.
- **Habit.** **Standard**: single-stemmed tree. **Multistemmed**: Multiple stems from single crown. **Thicket**: spreading to form thickets.
- **Growth rate:** **Slow**, **medium**, and **fast**. Mostly from USDA Plants Database.
- **Years to bearing.** Number of years until fruiting, for species used for fruit or nut production.
- **Pollinator required for commercial fruit or nut production.** For commercial fruit and nut products only.
- **Lifespan.** **Short**, **medium**, and **long**. Mostly from USDA Plants Database.
- **Coppice.** **Light green**: Resprout from base after hard pruning. **Dark green**: Listed as a top coppicing genus in Krawczyk’s *Coppice Agroforestry*.
- **Nuisances.** Suckering, spiny, and other potentially problematic traits. **Orange**: One nuisance trait. **Red**: Two nuisance traits.

#### RECOMMENDATIONS

- **National Agroforestry Center ranking.** Based on inclusion and score in forthcoming book from NAC. Once book is published, these should be updated to including individual practice suitability and other details. **Dark green**: a top ranked species by NAC. **Light green**: Recommended by NAC but not top ranked.
- **VT agroforestry expert recommended.** Recommended by experts interviewed for this project. **Dark green**: recommended by 5 or more experts. **Light green**: recommended by 3 or 4 experts. **Yellow**: Recommended by 1 or 2 experts.
- **VT agroforestry farmer recommended.** Recommended by farmer-practitioners from survey conducted for this publication. **Dark green**: Recommended by 5 or more farmers. **Light green**: recommended by 3 or 4 farmers. **Yellow**: Recommended by 1 or 2 farmers. **Red**: Recommended against by 1 or more farmers. **Grey**: Received both positive and negative ratings from farmers.

#### AGROFORESTRY SYSTEMS

- **Alley cropping.** **Dark green**: NRCS recommended. **Light green**: Used in alley cropping systems somewhere in the world.
- **Contour hedgerow.** Used for erosion control in dense hedgerows on contour between tilled strips on slopes. **Light green**: Used in contour hedgerow systems somewhere in the world. **“Potential”**: could be used, though we are not aware of such a use in practice yet.
- **Pollinator hedgerow.** Used for pollinator plantings, based on information from Xerces Society. **Dark green**: Recommended by Xerces. **“Potential”**: could be used, though we are not aware of such a use in practice yet.

- **Multistrata.** Forest farming, commercial food forest, and other multi-layered perennial cropping systems. **Light green:** Used as overstory or understory. **“Potential”:** could be used, though we are not aware of such a use in practice yet.
- **Urban food forest.** **Light green:** Used in urban food forests in the US.
- **Windbreak.** **Dark green:** Recommended by NRCS, in VT or other states as indicated. **Light green:** Used in windbreak systems somewhere in the world.
- **Living snow fence.** **Light green:** Used in living snow fences, mostly based on Cornell publications.
- **Silvopasture.** **Light green:** Used in silvopastures, primarily from US publications. **“Potential”:** could be used, though we are not aware of such a use in practice yet. **Red:** Not recommended due to toxicity to livestock.
- **Tree fodder.** Grown to feed the leaves to ruminants. **Light green:** Used for tree fodder, somewhere in the world. **“Potential”:** could be used, though we are not aware of planting for this purpose yet. **Red:** Not recommended due to toxicity to livestock.
- **Living barn.** Evergreen trees planted for winter shelter for livestock. **Light green:** Suitable. **Red:** Not recommended due to toxicity to livestock.
- **Riparian forest buffer.** **Dark green:** Recommended by NRCS, in VT or other states as indicated. **Light green:** Used in riparian buffer systems somewhere in the world.
- **Waterbreak.** This is a new practice still somewhat under development. **“Suitable”:** Flood-tolerant riparian buffer species suitable for waterbreaks.

**FUNCTIONS.** Note that attracting wildlife can be a pro or a con depending on the goals of the planting.

- **NRCS VT trees and shrubs for conservation.** These species are recommended by NRCS VT for conservation purposes.
- **Nitrogen fixation.** **Light green:** Yes, these species fix nitrogen. **Grey:** No, does not fix nitrogen. **Yellow:** May fix a small, unspecified amount of nitrogen.
- **Erosion control.** These species are used for strip-mine restoration, erosion control projects, and streambank stabilization. **Light green:** Used for the erosion control purposes described previously.
- **Bioengineering.** Used for slope stabilization along streambanks and similar purposes. **Dark green:** Recommended by NRCS VT for this purpose.
- **Wildlife habitat value.** Value to vertebrate wildlife ranked by NRCS VT: **Dark green:** very high. **Light green:** high. **Yellow:** moderate. **Orange:** low.
- **Pollinators and beneficial insects.** **Dark green:** Recommended by Xerces Society. **Light green:** Used for this purpose in USA. **Grey:** Pollinated by wind and of little or no value to pollinators.
- **Anchor lepidopteran host.** Host to large numbers of caterpillar species, serving as a food chain anchor. **Dark green:** a top genus as identified by Doug Tallamy.
- **Vertebrate food use.** Based on Hightshoe’s *Native Trees, Shrubs and Vines for Urban and Rural America*. **Dark green:** very high.
- **Bird food and shelter value.** **Light green:** Used by multiple bird families based on VT NRCS, *Bird-by-Bird Gardening*, and *Gardening for the Birds*.
- **Browse value.** Based on USDA Plants Database. **Light green:** high. **Yellow:** medium. **Red:** low.

**CHARACTERISTICS.** These increase compatibility with companion crops and forages.

- **Deciduous/evergreen.** Deciduous trees and shrubs are better companions for cool-season crops and forages. Evergreen species are desirable for certain applications like windbreaks, and required for outdoor living barns. **Dark green:** evergreen. **Light green:** deciduous.
- **Summer canopy density.** Mostly from USDA Plants Database and Hightshoe. A more open density offers more shade to crops and forages grown beneath the trees. **Light green:** open canopy. **White:** medium density. **Red:** High density.
- **Rooting depth.** Deeper roots compete less with crops and forages growing beneath the trees. **Light green:** deep roots. **White:** medium root depth. **Red:** Shallow roots.
- **Allelopathy.** Allelopathic trees produce herbicides that inhibit growth or germination of other species nearby. **Yellow:** mildly allelopathic, most other plant species are not significantly bothered. **Orange:** medium allelopathy. **Red:** Highly allelopathic, by the time trees are 10 years old they can suppress or kill susceptible species growing nearby.

### PEST AND DISEASE ISSUES

An asterisk (\*) indicates that the pest or disease is moving north with climate change. Note that this is not a comprehensive list. Throughout, **red** indicates “dealbreaker” issues that make planting that species unwise, and **orange** indicates significant issues worth considering before planting.

- **Disease issues.** These are diseases that affect the species in question. This focus is on diseases moving north with climate change.
- **Alternate disease host.** The species in question hosts a disease that affects other crop or forest species of importance in Vermont.
- **Insect issues.** These are insect pests that affect the species in question. This focus is on insects moving north with climate change.
- **Alternate insect host.** The species in question hosts an insect that affects other crop or forest species of importance in Vermont.

### OTHER INFORMATION

- **Transplant type.** Whether the species is planted from bareroot, container, live stakes, or other methods.
- **Notes.** Any additional details that did not fit elsewhere in the spreadsheet.

## **SHEET TWO: FUNCTIONAL CULTIVARS**

This sheet lists cultivars noted or selected for use in particular agroforestry systems and/or for particular agroforestry functions. Where possible the source (breeding program) and provenance (geographic origin) are noted.

### **SYSTEMS**

The systems columns note suitability for use as windbreak, riparian buffer, alley cropping, silvopasture, tree fodder, multistrata, living snow fence, and hedgerow systems. Most cells just say “yes” if that use is noted, but a few provide additional details.

### **FUNCTIONS**

These columns note recommended use for erosion control, bioengineering (slope stabilization etc.), and wildlife.

### **SHEET THREE: RESISTANT CULTIVARS**

This sheet focuses on cultivars that are resistant to pests and diseases that are or are projected to be moving north into Vermont with climate change, or those present in southern or low-elevation Vermont and moving north or upslope within the state.

The top portion of the sheet (rows 2-16) lists the pests and diseases in question, and the woody plant species they impact. **Blue** indicates that resistant cultivars are available, while **red** indicates that such cultivars do not yet exist.

The remainder of the sheet lists resistant cultivars of woody plants, and what pests or diseases they resist. **Light green** indicates moderate or non-specified resistance, while **dark green** indicates high levels of resistance.

## SOURCES

In addition to the interviews and farmer survey conducted for this project, the following references were used.

Beegel (2018) *Tree selection guide for mid-Atlantic silvopastures*

Breth (2008) “Managing fire blight in new apple plantings”

Buchman (2020) *Grower’s guide for hybrid poplar plantations for biomass production*

Burgess (2016) “Current and projected distribution of *Phytophthora cinnamomi*, one of the world’s worse plant pathogens”

Coder (1999) “Potential allelopathy in different tree species”

Cooley (2020) *New England tree fruit management guide*

Cornell KhanLab (nd) “Disease susceptibility ranking of apples”

Cornell University WillowPedia

Cortés (2018) *Major forest insect and disease conditions in the United States: 2018*

Ellis (2008) “Verticillium wilt of raspberry”

Fruit Growers News (2016) “Blueberry types identified for resistance, susceptibility to pathogen”

Gabriel (2018) *Silvopasture*

GoBotany online database

Gordon (2018) *Temperate agroforestry systems*

Gullio (2021) *Scientific review of the impact of climate change on plant pests*

Hanelt (2001) *Mansfeld’s encyclopedia of agricultural and horticultural crops*

Harbey (2022) “Scientist’s warning on climate change and insects”

Heavey (2012) *Living snow fences: Species matrix for New York state*

Hightshoe (1988) *Native trees, shrubs and vines for urban and rural America*

Hogmire (1995) *Mid-Atlantic orchard monitoring guide*

Irwin (1996) “Outdoor living barn: A specialized windbreak”

Jacke and Toensmeier (2005) *Edible forest gardens*

Kirn (2016) “Planting guidance for the revegetation of riparian areas in Vermont”

Kuhns (2009) *The buffer handbook plant list*

Lee-Mäder (2014) *Farming with native beneficial insects*

Lesk (2017) “Threats to North American forests from southern pine beetle with warming winters”

Mader (2011) *Attracting native pollinators*

Matthews (2018) *Assessing potential climate change pressures across the coterminous United States: Mapping plant hardiness zones, heat zones, growing degree days, and cumulative drought severity throughout the century*

Orange Pippin Fruit Trees catalog online

Reidmiller (2018) *Impacts, risks, and adaptation in the United States: Fourth national climate assessment*

Shane (nd) “Performance of new fire blight resistant pears”

Sideman (2023) *NE small fruit management guide*

Smith (2023) “Agroforestry tree and shrub species selection manual: Methods for species selection”

Tallamy (nd) “20 most valuable woody and perennials native plant genera in terms of supporting biodiversity in Mid-Atlantic region”

Teixeira da Silva (2015) “Allelopathic potential of select gymnospermous trees”

Toensmeier (2016) *The carbon farming solution*

University of Vermont (2021) *The Vermont climate assessment*

Unruh (2022) *The grazier’s guide to trees*

USDA (nd) *Climate change pressures in the 21<sup>st</sup> century: Shifts in growing degree days, plant hardiness zones and heat zones*



USDA Forest Service (2017) *The forestry reclamation approach: Guide to successful reforestation of mined lands*

USDA NRCS (2023) *Field Office Technical Guide: Michigan*

USDA NRCS (2023) *Field Office Technical Guide: Vermont*

USDA NRCS (2023) *Field Office Technical Guide: Wisconsin*

USDA NRCS (2021) “Pollinator value of NRCS plant releases used in conservation plantings”

USDA Plants online database

Vermont Department of Environmental Conservation (1994) *Native vegetation for lakeshores, streamsides, and wetland buffers*

Vermont Invasives online database

Vermont Urban and Community Forestry Program (2022) *Vermont tree selection guide*

Wenhua (2011) *Agro-ecological farming systems in China*

Whitlow (1979) *Flood tolerance in plants: A state-of-the-art review*

Wisconsin NRCS (nd) “Wisconsin NRCS approved agroforestry species”

Wolfe (2008) “Projected change in climate thresholds in the Northeastern US: Implications for crops, pests, livestock, and farmers”

Wolfe (2018) “Unique challenges and opportunities for northeastern US crop production in a changing climate”

World Flora online database