

MORE THAN YIELDS



Cultivating Biodiversity on Your Farm

VERMONT ORGANIC FARMERS
AUDUBON VERMONT

Farms in the Northeast are critical to our culture and economy. Farmers enrich our communities, support the local economy, and preserve rural character. When good practices are followed, farm management can create healthy ecosystems and encourage biodiversity. To better support Northeast farmers and land owners, Vermont Organic Farmers (VOF) and Audubon Vermont have created this best practices guide to provide producers with information on how to manage their farms with the goal of improving biodiversity. Reading this document will help you understand why biodiversity is important, what it looks like, and what management practices promote biodiversity. We hope this guide will serve as a trusted resource on your path to improving the health and resilience of your land.



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INTRODUCTION

WHAT IS BIODIVERSITY?

Biodiversity (or biological diversity) refers to the variety of life on Earth. It encompasses living organisms at all scales—plants, animals, fungi, and microorganisms—and the ecosystems they inhabit. Biodiversity can also include genetic diversity, or the biological variation that occurs within a species. More than that, it covers the full range of processes, such as nutrient cycling, carbon and nitrogen fixation, pollination, and beneficial predation. This diversity is crucial for the functioning and resilience of ecosystems, as well as for supporting ecosystem services that contribute to human well-being, such as clean air and water, pollination, natural pest and disease suppression, and climate regulation.

WHY IS BIODIVERSITY IMPORTANT?

Biodiversity fosters resilience on farms. Farms with a diversity of crops, livestock, beneficial insects, pollinators, soil organisms, and natural habitats are better equipped to withstand challenges such as pests, diseases, extreme weather, and a changing climate. Diverse farming systems are more adaptable because different species and varieties contribute unique functions, from improving soil health and nutrient cycling to supporting pollination and natural pest control.

Awareness of biodiversity is increasing amongst consumers. Many consumers are choosing to support businesses that protect natural resources. Demonstrating a commitment to biodiversity will help your products stand out in the marketplace and give your business a competitive advantage.

HOW CAN YOUR FARM SUPPORT BIODIVERSITY?

Vermont farms play an important role in conserving biodiversity and supporting healthy ecosystems. Working agricultural lands can provide

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We approach just about every farm decision through a lens of balancing a three legged stool of ecology, ethics and economics. Fostering biodiversity seems to always be the answer that supports those foundational pillars for farm success.

Tyler Webb
Stony Pond Farm

valuable habitat for pollinators, birds, beneficial insects, soil organisms, and wildlife while also producing food and fiber. While agricultural production is the primary goal of most farms, management decisions that also consider how to enhance biodiversity can improve habitat, build resilience to extreme weather, manage invasive species, protect water quality, and enhance soil health.

Organic farmers are required to promote ecological balance and support biodiversity on their farms. Aside from being required, promoting biodiversity can benefit your farm.

Diverse crops, pastures, hedgerows, shrublands, riparian areas, forests, and other habitats support pollinators, beneficial insects, and wildlife that contribute to ecosystem services such as pollination, natural pest control and healthy soils. These ecological functions help support farms to thrive over the long term.

YOUR FARM IS NOT AN ISLAND.

Imagine your farm not as an island but as part of the larger interconnected landscape. Visualize the neighboring habitats beyond the borders of your land—fields, meadows, rivers, wetlands, and forests. Recognize that these adjacent habitats are not separate entities but integral parts of the same interconnected ecosystem. Think about how wildlife, seeds, and pollen move between different habitats, including your farm, and the importance of maintaining habitat connectivity to support healthy wildlife populations and promote genetic diversity. Consider how management practices on your farm can complement habitat conditions within the greater landscape. What can you offer on our farm that neighboring parcels do not?

HOW IS THIS GUIDE ORGANIZED?

Vermont farms support a variety of habitats, many of which occur naturally, while others exist only because the landscape is managed in some way. Habitats are the natural environment where wildlife can live, grow, and/or reproduce. For the purposes of this guide, we focus on three habitats that are commonly found on farms: grasslands, shrublands, and riparian areas. Each habitat and its role in supporting biodiversity is described below. We also include recommendations for enhancing biodiversity within active production areas, recognizing that crop fields and managed pastures can provide important habitat when thoughtfully managed.





NATURAL HABITATS

Grasslands

Grasslands are open fields dominated by grasses and other non-woody plants. They provide foraging and breeding habitat for a variety of wildlife including monarch butterflies, smooth green snakes, Eastern Meadowlarks, and Bobolinks, and grasslands adjacent to waterways can provide nesting habitat for wood turtles.

Much of New England's forests were cleared between 1600 and 1800, and grasslands became the dominant land cover in the region. These grasslands were maintained in Vermont through the late 1800s primarily through sheep grazing. Since that time, grassland habitat has declined significantly in the state as some fields reverted back to forest and others were converted to row-crop agriculture or developed. In today's agricultural landscape, many remaining grasslands are used as hayfields or pastures. Intensification of grassland management via more frequent cutting, intense grazing, and fragmentation also contributed to the decline in grassland habitat.



CHARACTERISTICS OF HIGH-QUALITY GRASSLAND HABITAT

Vegetation Composition

- Healthy, biodiverse grasslands will feature 50–75% grass cover, including native species such as bluejoint grass, big and little bluestem, woolly panic grass, and switchgrass.
- The remaining vegetation can consist of forbs such as goldenrods, vetch, red clover, Joe-pye, and others, and feature few to no woody plants.

Size and Shape

- Fields that are at least 10–25 acres are best for grassland birds.
- Suitable fields are square, rectangular, or circular in shape, and provide a large interior area with a low edge effect. Oblong or irregular shaped fields are less suitable.

Location on the Landscape

- Fields should be located near other open fields rather than surrounded by other habitats and land uses such as forest, shrubland, or human development.

Impacts of Invasive, Non-Native Species

- Healthy fields will contain few or no invasive species such as wild/poison parsnip, spotted knapweed, wild chervil, garlic mustard, phragmites grass, reed canary grass, or bedstraw.
- Many of these invasive species outcompete grasses and create conditions that are unsuitable for nesting grassland birds.

BENEFICIAL MANAGEMENT PRACTICES FOR MAINTAINING BIODIVERSE GRASSLAND HABITATS

Cutting and Pasturing Regimes for Large Fields

- In areas between 10–20 acres, cut or graze before May 20 and after July 24, or wait until after July 15. Ideally if the cut is delayed until July, cut before any invasives go to seed.
- In areas over 20 acres with few invasive species and nesting Eastern Meadowlarks, cut or graze July 15 or later.
- Pasturing during the critical times of the breeding season may work for areas with low stocking rates and/or long rest periods.
- For all hayfields, remove grass after cutting.
- If the grassland is near a stream, maintain at least a 35-foot buffer of unmanaged area to protect foraging and nesting wood turtles.

Smaller or Isolated Grasslands

- For areas less than 10 acres, manage for pollinators and other wildlife by cutting later in the season (if no invasives are present). It is possible to wait until the first frost for the maximum benefits to pollinators and other wildlife.

Bonus Action

Eastern Bluebird and Tree Swallow boxes can be added along fence lines or borders of grassland and pasture areas. Boxes should be cleaned every spring.

Removal of Invasive/Non-Native Species

- In fields that are becoming overwhelmed by invasive plant species, mowing earlier may be warranted to prevent further spread and seed dispersal.

Shrublands

Shrublands are dominated by woody, typically short (less than 20 feet), plant species, although trees, grasses, and other non-woody plants are present as well. These natural communities can include hedgerows, fallow field corners, forest edges, or areas of young forest. These diverse ecosystems provide an abundance of resources for wildlife. A few notable species that can be encountered in shrubland habitats are swallowtail butterflies, weasels, and American Woodcocks, and shrublands bordering waterways may be home to wood turtles. Additionally, Champlain Valley shrublands can support both Golden-winged and Blue-winged Warblers.

In Vermont, shrubland habitats are most often created by disturbance, including flooding, beaver activity, and especially logging or agricultural clearing. As grassy fields are abandoned or cleared areas are left unmaintained, they will undergo the process of natural succession—reverting back into forest. As a result, shrublands are typically a temporary habitat type that will revert to forest if not actively managed.

CHARACTERISTICS OF HIGH-QUALITY SHRUBLAND HABITAT

Vegetation Composition

- Healthy shrublands range from 30–90% shrub cover with a patchwork appearance: clusters of shrubs with a small number of trees and distributed among a network of grasses, forbs, and wildflowers.
- Species commonly seen in these habitats include native shrubs such as dogwoods, alders, viburnums, aronias, serviceberries, blueberries, and blackberries, or trees such as oaks, cherries, birches, and maples.

Size and Shape

- Productive shrublands may be as small as 2 acres, but larger areas of 10–20 or more acres provide a greater benefit to a wider range of wildlife species.



- Although shrublands may seem like “edge” habitats, many animals prefer the interior area of a shrubland. Large, generally rectangular or square plots can increase this type of “core” area.

Location on the Landscape

- Ideal shrubland habitats are typically within 1 mile of other shrublands and connected by older forest. This allows animals using the shrublands to travel between different patches of suitable land and access a wider range of resources.

Impacts of Invasive, Non-Native Species

- Healthy shrublands are at risk of competition from invasive species including but not limited to shrub honeysuckle, multiflora rose, and common or glossy buckthorn.
- Native shrub species can be dominated by fast-growing, densely packed competing invasives and within just a few seasons can greatly decrease a shrubland’s positive effect on local biodiversity.
- Fruits from non-native species are less nutritious and have a negative impact on the health of wildlife, especially migratory birds traveling long distances. Additionally, non-native species are host to vastly fewer native insect species, further reducing quality of forage for wildlife.

BENEFICIAL MANAGEMENT PRACTICES FOR MAINTAINING BIODIVERSE SHRUBLAND HABITATS

Encourage Shrubland Succession

- In open areas intended to be shrublands, reducing mowing frequency will allow woody vegetation to develop. Planting fast-growing native shrubs and tree saplings can help accelerate the process of succession.
- To better mimic natural, patchy regeneration patterns, native plantings can be installed in clusters rather than more traditional grid-like methods.

Remove Invasive/Non-Native Species

- Managing non-native plant species is crucial to maintaining healthy shrublands.
- The most successful control of invasive species not only involves removal, but also incorporates planting of native species to outcompete invasives within the target area.

Bonus Action

If safe, leave standing dead trees—or snags—standing. They provide nesting habitat for bees, predatory wasps, woodpeckers, and other cavity-nesting birds.

Thin Excessive Tree or Shrub Cover

- As shrublands age they will need to be cut back periodically. Brushcutting open areas between densely developed shrub clusters in a meandering and irregular style or in small patches will help maintain the shrubland. These managed open areas between clusters should be no more than 30 feet in width or diameter.
- Excessive canopy cover (especially of vegetation over 12 feet in height) can be thinned or cut back and maintained as described above. Retain select trees to remain in the canopy.

Riparian Buffers

Riparian habitats are transition zones that occur along the edges of rivers, streams, lakes, and other waterbodies. These habitats can be productive ecosystems and provide corridors, shelter, food, and water for many types of wildlife. Biodiverse riparian areas can support diverse plant and animal communities, improve water quality, reduce erosion, and help protect against flood events.

In Vermont, the plant component of healthy riparian areas is composed of woody shrubs and trees that both stabilize the bank as well as shade the water and keep it cool. This is important for the aquatic habitat that forms the basis of the food web and supports animals like caddisflies, rainbow trout, wood turtles, Bald Eagles, mink, and river otters.

CHARACTERISTICS OF HIGH-QUALITY RIPARIAN HABITAT

Vegetation Composition

- Riparian buffers that replicate natural ecosystems and contain diverse species of mixed height and age class provide both structural and compositional benefits to ecosystem health.
- Healthy riparian buffers contain native trees, shrubs, grasses, and wildflowers that appear in a complex vegetation structure, with mixed age classes of both young and old plants.
- Waterways should also contain dead wood in the water and on the ground, which can provide habitat for fish, amphibians, aquatic invertebrates, and terrestrial wildlife, as well as slow down and absorb stormwater.



Size and Width

- To provide sufficient habitat for wildlife, riparian buffers should be a minimum of 50 feet wide, as measured perpendicularly from the top of the bank, although the wider the buffer the better.
- Buffers over 50 feet wide are more effective at filtering pollutants, reducing runoff, and intercepting sediment before it enters the neighboring waterbody. In addition, riparian buffers that connect to nearby forests or wetlands provide superior habitat for wildlife.

Location on the Landscape

- Riparian buffers can act as corridors on the landscape to connect patches of other habitat types, such as shrublands or forests, that are often separated by agriculture or development. These corridors allow birds and other wildlife to traverse the landscape safely leading to increased biodiversity.

Impacts of Invasive, Non-Native Species

- Similar to the negative impacts of non-native species previously listed in the shrubland section, dense stands of invasive vegetation, native riparian vegetation is prone to being out-competed by invasives.
- Dense stands of invasive vegetation, like Japanese knotweed, reduce overall plant diversity and bank stability.

BENEFICIAL MANAGEMENT PRACTICES FOR MAINTAINING BIODIVERSE RIPARIAN HABITATS

Remove and Control Invasive Non-Native Vegetation

- Focus on removing plants that degrade habitat quality and displace native plant species like knotweed, reed canary grass, phragmites, buckthorn, honeysuckle, and bindweed.

Restore Native Plant Communities

- Focus on establishing diverse native vegetation that mimics native ecosystems by using a cluster planting regime, when possible, rather than planting in rows or grids. This can be accomplished by using a variety of native trees, shrubs, and flowering plants and including high value native trees and shrubs like oaks, willows, alders, and dogwoods.

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Supporting biodiversity on our farm is important because it helps our natural allies work in our favor. Without a suitable habitat or a diversity of food sources, you'll be more limited in the benefits you might see.

Jeremy LeClair
Philo Ridge Farm



PRODUCTION AREAS

BENEFICIAL MANAGEMENT PRACTICE FOR PRODUCTION AREAS

Farmers are encouraged to manage biodiversity through the conservation and enhancement of habitat in non-production areas, but also through management practices within actively farmed fields, crop areas, and pastures.

Use Organic Farming Practices

Organic systems are designed to work with natural processes and support biodiversity above and below ground. Many of the practices outlined by the [National Organic Program](#) can help improve biodiversity on your farm.

- Build and maintain healthy soils through the use of cover crops, compost, and reduced tillage to support diverse communities of soil microorganisms.
- Implement diverse crop rotations that create a wider variety of habitats and food sources for pollinators, birds, beneficial insects, and wildlife.
- Reduce the use of harmful pesticides to protect non-target organisms including pollinators and other beneficial species. If relying on broad-spectrum pesticides approved for use on organic farms, time applications to avoid spraying during peak times of insect and pollinator activity.
- Keep soil covered to reduce erosion, conserve moisture, support healthy soil ecosystems, and provide habitat for ground-nesting bees, beetles, etc.

Work with your local NRCS, extension agent, or technical advisor to find ways to implement organic practices in your production areas.

Plant Cover Crops That Support Pollinators and Birds

Incorporate cover crops in production areas to decrease potential for soil erosion, weed suppression, pest and disease control, promote soil moisture content, and increase biodiversity.

Bonus Action

T-bar platforms attract birds of prey that can help control rodents within production areas.

- Manage the timing of cover crops to maximize flowering when it's most beneficial for supporting food sources and nesting habitat for pollinators, predatory, and parasitic insects.
- Plant diverse cover crop mixes, made up of buckwheat, common sunflower, millet, winter rye, hairy vetch, lacy phacelia and clovers, to increase insect diversity and create greater structural variation of plants, which create a wider range of habitat and food sources compared to a single-species cover crop.
- Vegetative cover provided by cover crops can support native birds, especially during fall migration and winter months.
 - ▶ Waterfowl and migratory birds are attracted to cover crop areas for resting and foraging.
 - ▶ Even cover crops that will be incorporated into the soil as “green manure” in the following growing season can provide valuable winter habitat for resident birds.
- Production areas managed for summer fallow can provide food and shelter and even nesting habitat for bird species.

Work with your local NRCS, extension agent, or technical advisor to find ways to select regionally appropriate cover crops that enhance biodiversity.

Create Diversity in Cropland

Grow a diversity of crops instead of a single crop to promote beneficial insects and pollinators in your production areas.

- Incorporate different intercropping planting methods to achieve production goals and promote biodiversity. Appropriate intercropping will depend on the farm's goals, equipment, target crop and management capacity.
- Grow multiple species of crops in strips using methods such as:
 - ▶ Row intercropping—two or more crops grown in alternating rows
 - ▶ Strip intercropping—crops grown in wider strips that are managed separately but are arranged to interact beneficially with one another
 - ▶ Mixed cropping—two or more types of crops sown in the same area
 - ▶ Relay intercropping—planting a second crop in an established cover crop.

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Even within my lifetime, there have been significant ecological changes all around us and having a diverse, robust ecosystem is our best insurance policy against the next disturbance. And also, I like having other critters around to keep me company while I work!

Spencer Hardy
The Farm Upstream

- Consider adding perennial plantings (either cash crops or insectary strips) into production spaces as nesting and overwintering habitat for pollinators and other beneficial insects.
- Select a diversity of cover crops and perennials with staggered bloom times to maintain food sources throughout the growing season.
- Maintain crop residue in fields during the growing season and over winter to provide habitat, food, and shelter for beneficial insects and other wildlife while protecting soil health.
- Plan agroforestry practices where appropriate. Trees and shrubs can provide shade for livestock and valuable habitat for many species, but they reduce habitat suitability for grassland birds if planted in large open fields. Place trees and shrubs where they complement, rather than replace, important grassland habitats.
- Manage pastures for diversity using crops with variable growth structures, flowering times, and root systems including:
 - ▶ Cool-season grasses, legumes, and deep-rooted forbs to extend the grazing season, improve soil health, and provide critical food and shelter for wildlife.
 - ▶ Orchardgrass, timothy, meadow fescue, and endophyte-free tall fescue all provide a structural foundation for grazing and erosion control.
 - ▶ Legumes like white and red clovers, birdsfoot trefoil, and hairy vetch contribute to soil health by fixing atmospheric nitrogen that helps naturally fertilize the soil.
 - ▶ Avoid crown vetch which is an aggressive perennial once used for erosion control and is now considered highly invasive and undesirable.
 - ▶ Forbs (non-woody, herbaceous plants) with deep taproots that loosen and break up the soil structure to release subsoil minerals and promote diverse soil microbiology.
 - ▶ Chicory, plantain, and yarrow for a highly palatable crop for livestock and support food and shelter for beneficial insects.

Work with your local NRCS, extension agent or technical advisor to help decide how best to diversify your cropping systems and to source commercially available sources for perennial pasture mixes.

Bonus Action

Debris piles made with scrap wood, logs, leaves, as well as stone walls and mounds of soil can act as nesting, shelter, and feeding areas for birds, mammals, and insects.

Optimize Greenhouse Production

Many of the management practices described above can be used to enhance biodiversity in greenhouse production. However, greenhouses present unique conditions that require additional considerations.

- Most insects and small birds travel up to escape and may become trapped and killed if they cannot find an exit. Consider adding peak vents or other escape routes for pollinators and other insects in unscreened houses.
- For greenhouses with pollinator-dependent crops (i.e. tomatoes), **practice responsible use of commercial bumblebees**. These recommendations also ally for outdoor bumble bee use (i.e. blueberries). Avoid **buying mason bees** from out of state due to the risk of disease spread.

Work with your local NRCS, extension agent, or technical advisor to help decide how best to implement biodiversity practices in greenhouses.





RESOURCES

GENERAL CONSERVATION

The Natural Resources Conservation Service (NRCS) in Vermont aims to conserve Vermont's soil, water, air, and other natural resources. NRCS delivers conservation solutions to agricultural producers and landowners implementing voluntary conservation on working lands to help feed a growing world.

Vermont Invasives provides a landing page for Vermonters interested in learning more about invasive insects, plants, and pathogens. In addition, the website is designed to guide visitors to the appropriate place to learn more and become involved in various monitoring, management and outreach efforts.

Vermont Land Trust (VLT) is dedicated to conserving land and fostering life-long connections to the farms, forests, and natural areas that define Vermont. VLT aims to support farmers through land conservation, and helps navigate the process of applying for funds (often through state and federal agencies) from start to finish.

Vermont Organic Farmers LLC (VOF) is the USDA accredited certification program owned by NOFA-VT. VOF believes that organic production enhances soil, plant, animal, and human health to protect the environment for current and future generations. Organic certification is needed to verify these production practices and to ensure that organic products are produced with integrity and transparency. VOF provides consumers with a process and label they can trust.

PLANTS AND WILDLIFE

Audubon Vermont is a state program of the National Audubon Society. For more than 100 years, Audubon Vermont has protected birds, wildlife and their habitat through engaging people of all ages in education, conservation, stewardship and action. Their Bird and Bee Friendly Farms program provides technical assistance and educational resources for farm habitat management with birds in mind.

The Bobolink Project uses donated funds to provide financial assistance to participating farmers who modify their mowing schedules so that grassland nesting birds can successfully raise their young. The Bobolink Project is a proven approach that can protect birds and farms.

Vermont Center for Ecostudies (VCE) advances wildlife conservation across the Americas through research, monitoring, and community engagement. They envision a society that sustains healthy ecosystems through science-based decision making.

Vermont Fish & Wildlife Department (FWD)'s mission is the conservation of all species of fish, wildlife, and plants and their habitats for the people of Vermont. The Department has many resources for landowners.

Xerces Society for Invertebrate Conservation is an international nonprofit organization that protects the natural world through the conservation of invertebrates and their habitats. As a science-based organization, they both conduct their own research and rely upon the most up-to-date information to guide conservation work. Their key program areas are: pollinator conservation, endangered species conservation, and reducing pesticide use and impacts.

WATERWAYS

Watersheds United Vermont (WUV) is a state-wide network of local groups dedicated to the health of their home watersheds. WUV's mission is to empower community-based watershed groups in all parts of the state to protect and restore Vermont's waters. Watershed Groups are broadly defined as a community-based organization working with individuals and communities in their local watersheds to protect and improve water quality, habitat, and flood resilience and to build social and ecological connections with Vermont's waters.

NAURAL RESOURCE CONSERVATION DISTRICTS

Natural Resource Conservation Districts (NRCs) are non-regulatory entities that work with private landowners, farms, state and federal agencies, and other partner organizations to promote and implement conservation programs. Through technical, financial, and educational assistance, Vermont's 14 NRCs act as local facilitators linking landowners and producers with the appropriate federal, state, local, and private programs to meet their management objectives.

Find your local NRC on the map [here](#), and head straight to your NRC's resources or programs page from the list below:

Bennington	Lamoille	Rutland
Caledonia	Orleans	White River
Essex	Ottawaquechee	Windham
Franklin	Otter Creek	Winooski
Grand Isle	Poultney Mettowee	



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PHOTOS

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