



# Restoring Natural Areas to Prevent Secondary Invasions

A LAND MANAGER'S GUIDE



# Preventing Secondary Invasions: NATIVE REVEGETATION

for natural areas



Open forest understory, Clair Ryan, MIPN.org

Landowners play a critical role in the fight against invasive plant species, which spread aggressively and harm the environment, economy, and human wellbeing. This series of factsheets is intended to help landowners in the Northeastern and Midwestern US rebuild native plant communities on working and conservation lands while controlling invasive plants.

## Private Land Health Matters

Over the last 150 years, conversion of forests, prairies, and wetlands has forever altered these ecosystems. In Illinois, for example, less than .01% of land is undisturbed by people.<sup>1</sup> These changes, together with increased global trade, have allowed invasive plants to proliferate. Collectively, invasive species are considered the second largest threat to biodiversity behind habitat loss.

About 88%<sup>2</sup> of all land in the Northeast<sup>3</sup> is in private ownership, though the amount by state varies from 63–99%. About 56% of the region's forests are in non-corporate private ownership.<sup>4</sup> Invasive plants don't respect property lines, so addressing infestations and ecosystem health on public land alone will not get the job done. Private landowners are absolutely critical partners in the work to control and prevent the spread of invasive species. To facilitate public-private partnerships, the US Forest Service (USFS) and Great Lakes Restoration Initiative support Cooperative Invasive Species Management Areas (CISMAs)<sup>5</sup> – sometimes called CWMAs or PRISMs. CISMAs work with private landowners to support invasive plant treatment.

## Why Revegetate?

**To minimize new infestations or secondary invasions.** Most invasive plant seeds love disturbed bare ground. Physical removal of invasive plants causes soil disturbance and without native revegetation, return of invasives is likely.



**To plan for success.** Removing invasive plants gives property owners a chance to think about their top priorities for their land. Is there a need to control erosion or flooding? Are there fish or game species habitats that should be enhanced? Is timber harvest planned? These goals are achievable with good planning and the right plant selection.



**To be part of the solution!** Habitat for native pollinators, birds, and wildlife is dwindling. Your land can provide resources for critters, fight off invasive plants, and meet your needs!



## Native Plants vs. Invasive Species



Spring beauty, Clair Ryan, MIPN.org

Generally, only high quality remnant areas (never developed) and immediately adjacent lands are able to naturally regenerate a diverse native plant community once invasives are removed unless the landowner plays an active role.<sup>6</sup>

**Native plants** evolved over thousands of years in a particular region or ecosystem. They are adapted to the local climate and soil conditions, and often require fewer inputs to thrive long-term. Wisely selected and sited native plants are highly competitive, can reduce erosion and flooding problems, and can attract pollinators and wildlife, including game species.

**Dense native revegetation is the best protection against invasive plants taking hold.**

**Invasive plants** are non-native, often able to thrive in a variety of conditions, and grow quickly and densely to the point of disrupting ecosystems. When revegetating your land, if you cannot plant entirely with native species, it is critical that you avoid invasive plant species that are still occasionally sold for wildlife or erosion control including black locust (outside of its native range<sup>7</sup>) and Japanese honeysuckle.



# Preventing Secondary Invasions: SITE-APPROPRIATE SPECIES

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The key to restoring health to any plant community through revegetation is to put the right plants in the right locations. Matching climate suitability and nutrient, light, and moisture availability relative to the plants' needs are key starting points. It is also critical to choose plants that are likely to meet your site goals as a whole and for any trouble spots in particular.

**Plan it out.** Beyond soil, water, and light, different plant species have different requirements and provide different benefits. Before planning you need to take a solid inventory of your site characteristics, looking at 1) **moisture**, with particular attention to flood-prone spots and dry areas, 2) **soil**, with third-party testing for composition and characteristics if possible, and 3) **light availability** at various locations. Distinct and differing areas of large parcels may need to be considered separately.

**Role model.** Pick a reference site as a model for what you want your site to look like after revegetation. Suitable reference sites might include nearby natural areas, private conservation lands, and successfully restored sites with similar conditions as your site. You can even use your own site before it was impacted by invasives as a reference if you have good records of the pre-invasion ecology.

If your land has several ecosystem types (e.g., uplands and wetlands), you may need more than one reference site. The closer the reference is in location and character to your site, the better. It will also be important to choose a reference site with a similar land use history to yours. For example, you would not choose a pristine remnant ecosystem as a reference for a secondary growth forest or former agricultural site.

State, federal, and other agencies often have great published resources and staff willing to help launch private restoration projects. Check out:

- USDA's Forest Service and Natural Resource Conservation Service, local or regional offices <sup>8</sup>
- State agencies such as departments of natural resources and natural history surveys
- Local soil and water conservation districts and non-profit organizations focused on native landscapes or conservation

Careful observation of your land will give you the necessary information, but it may save time and yield better results to have your site professionally assessed. Visit [www.mipn.org/cwma-resources/site-revegetation/](http://www.mipn.org/cwma-resources/site-revegetation/) for a list of Midwestern site revegetation contractors.

If you have one or more reference sites, you can use the plant inventories from those sites as your starting point for a revegetation planting list.

**Chemical warfare?** Some plant species exude chemicals that prevent growth of other species, a.k.a. allelopathy. Some of the Northeastern region's worst invaders, including Amur honeysuckle (*Lonicera maackii*) and garlic mustard (*Alliaria petiolata*) do this. Among native plants, black walnut (*Juglans nigra*) is notorious. If you have a lot of black walnut, look for species that resist its chemical effects. If you have recently managed a dense infestation of an allelopathic invasive, you may need to use nursery-grown plants and/or adjust seeding rate to compensate.

Another important consideration is that some herbicides used in natural areas can impact native planting through residual soil activity. If you used a product with a longer half-life in soil (e.g., containing imazapyr, picloram, or 2,4-D), you may need to delay revegetation for at least a season.

**Oh deer.** Unfortunately, native plants tend to be more palatable to deer than invasives. If your land has high deer density, you may need to consider fencing them out or working with other local land managers, governments, and hunters to reduce deer populations. If this isn't possible, you may need to choose deer-resistant native species to see success.

**Climate change.** Current and projected changes in climate are likely to cause native plants to move their ranges northward. We recommend avoiding plants that are already in the southern extent of their range at your location. Generally, this would include species that are easily stressed by heat, humidity, and drought.

**Maintenance matters.** Plants generally need a little bit of TLC during establishment. If you know you can't realistically provide extra care then favor more hardy species during your initial planting phase, especially at disturbed sites recovering from heavy invasion. You can always add species later, after a primary native plant community is established.

Photo credit: Steven Katovich, Bugwood.org

# Preventing Secondary Invasions: NATIVE PLANT SOURCES

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False blue indigo in pots, Audubon Society of Western Pennsylvania

*"Acts of creation are ordinarily reserved for gods and poets, but humbler folk may circumvent this restriction if they know how. To plant a pine, for example, one need be neither god nor poet; one need only own a good shovel."*  
– Aldo Leopold (from *A Sand County Almanac*)

This flyer is intended to help landowners find sources of native plant material to re-establish native plant communities in their woodlands or natural areas, particularly after invasive plant removal, to prevent re-invasion.

**Choose vendors wisely.** Always look for a reputable native plant nursery closest to your physical location. Watch out for big box stores and online retailers that don't specialize in native plants – they may offer stock from outside your region or worse – sell known invasive species. A reputable vendor will provide appropriate native plants for your natural area AND the information needed to succeed. Vendors dealing exclusively with native plants, particularly those that routinely supply material for large restoration projects, are more apt to carry a wide variety of properly labeled native stock. Never buy live plants from an unverified source that may have been dug up from a natural area. When revegetating a large area, it will be important to find a vendor that offers bulk pricing. If buying online is your only viable option, look for the closest reputable native plant nursery that is willing to ship. Ask other nearby landowners for recommendations!

Many state agencies and conservation organizations maintain lists of native plant nurseries and vendors. To help centralize these resources for the Midwest, USFS funded a regional directory that can be accessed here: [www.mipn.org/cwma-resources/site-revegetation/](http://www.mipn.org/cwma-resources/site-revegetation/) County extension offices and native plant societies may have additional sources.

## Choose seeds/stock wisely.

**Insist on quality control/contamination testing.** Invasive plant seeds can be tiny and can be spread to new places as a contaminant in seed mixes.<sup>9</sup> When buying native plant seeds, ask vendors how they test for contaminants. Also, beware of generic mixes sold across a broad geographic area, which may contain species not native to your location.

**Seeds, plugs, or both?** When planning a revegetation effort, you will need to choose whether to start with seeds or live plants (plugs). There are pros and cons to both. Live plants usually have a higher survival rate and can stabilize eroding soil more quickly. However, they cost a lot more and take more work to install. You can combine approaches by seeding species that establish readily and inter-planting plugs of trickier species.

**Give preference to local ecotype plant stock.** Wild growing plants adapt to their environment over time and develop a unique genetic profile known as a local ecotype.<sup>10</sup> If you can buy local ecotype plants, they will likely thrive where you are and will provide optimal benefits to locally co-adapted pollinators and wildlife. Local ecotype planting also helps preserve genetic diversity among native species. The Eastern Seed Zone map is a useful tool.<sup>11</sup>

Where is this seed from?  
How was it tested for contaminants?



*A pure live seed rating is a useful indicator that a seed mix has been quality-tested.*

Which plants on my species list are most likely to germinate in a field setting?



*Prioritize plugs for tricky plants and tricky sites.*

Where do you obtain propagation stock?



*Buy as local as possible!  
If locally adapted material is not available, look for plants grown south of your location.*

***If a vendor cannot or will not answer these questions, or sells known invasive species, consider purchasing elsewhere.***



# Preventing Secondary Invasions: INSTALLATION

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*Sedge, woodland phlox and dwarf larkspur in a southern IL understory, Chris Evans, U. of Illinois, Bugwood.org*

If you've painted your home before, you know that preparation work far exceeds painting time, but is necessary to achieve quality results. It is much the same with installing native plants or seeds. If you follow the steps below, you will have a greater chance of establishing healthy native plants and warding off invasive species (re-)infestations.

## Correcting Soil Problems

The ideal soil for the greatest number of native plant species is non-compacted, well drained with organic material and a neutral to slightly alkaline pH. If your soil is not like this, you will need to think about either carefully selecting plant species for the soil you have or correcting problems. Most natural areas have too much acreage for soil supplementation to be realistic. However, if soil is truly depleted, you may want to consider planting a cover crop or "green manure" species for a year or two before working on the native plant community. Another option is to interplant desired plants with a "nurse crop" of nitrogen fixing species, but be careful to avoid invasive nitrogen fixers such as autumn olive and black locust (black locust is native to parts of temperate North America, but is considered invasive throughout much of the Midwest).



*University of Minnesota Extension*

## Timing is Everything

If you are working with live plants, your planting windows are limited to mid-spring (after last risk of frost), and early fall (before first risk of frost). If seeding, you will have more flexibility as high summer (July & August) is the only time generally considered off-limits for seeding. Seeding in fall or even into the winter before snow cover is called a dormant seeding. Here, the seed is not expected to germinate until the following spring. Seeds used for spring planting should be stratified as necessary for germination in the same season as planting (see below).



*Purdue University Extension*

## Seed Dormancy and Stratification

Most native plant seeds go through a dormant period after they are shed from their parent plant. Exposure to weather and soil conditions, particularly freeze-thaw and dry-moist cycles, typically breaks this dormancy. Some species require physical scarification by fire or animal action to germinate. The preparation of seeds for germination, either outdoors or purposefully in a controlled environment, is called stratification. Dormant season planting will typically allow seeds to stratify outdoors. If planning spring seeding, you will need to stratify the seeds indoors through a combination of dry and moist storage. Some vendors may sell pre-stratified seed, typically at additional cost. Seeding species with multi-year stratification periods is not a good strategy in locations where re-establishments of invasive plants is a concern. Use of nursery-grown plants may be a better choice for tough-to-grow species with long or complicated stratification requirements.



*USDA Forest Service*



# Planting Practices for Natural Areas



Sedge plugs, [alancyane.blogspot.com/2018/08/chfm-slope-planting-july-2018.html](http://alancyane.blogspot.com/2018/08/chfm-slope-planting-july-2018.html)



Hydro-seeding, International Erosion Control Association

Whether you're sowing seed or installing live plants, maximizing seed or root contact with the soil is the name of the game. Once seeds or plants are installed, water thoroughly and keep moist during the next several weeks (except in cases of fall seeding when watering is not required).

## Seeding

In general, seed should be covered no deeper than its own diameter as planting too deeply can inhibit germination. Most native perennial plant seeds do best at about ½-inch depth of planting, while grass seeds do better at about ¼-inch. If hand seeding, mixing seed with a bulk carrier like peat moss, sand or vermiculite, scattering the seeds on the soil surface, and using a hand rake to incorporate is effective. For equipment-accessible sites, use of a no-till seed drill or hydroseeding equipment is a more efficient and precise way to distribute seed evenly. If the soil is very loose before planting (if you sink more than ½-inch when you step on it), pack the soil down with a roller both before and immediately after seeding.<sup>12</sup>

Revegetating steep, erodible slopes presents a particular challenge. Experts suggest that using a variety of plants (shrubs, forbs and grasses) with different rooting depths to stabilize slopes works best long-term.<sup>13</sup> For slopes where erosion is a known problem, some extra planning efforts and expense is necessary. One potential solution is hydroseeding with a mix containing a tackifying agent to help hold soil and mulch in place. Another is use of a biodegradable (usually jute-based) erosion control fabric in the seeded area.<sup>14</sup>

## Live Plants

If using live plants, the key is to make sure the transplants establish a strong root-soil connection before they encounter stress from either summer heat or autumn frost. Before you start, make sure the plants awaiting transplant are moist in their pots. Then, dig the planting holes just slightly deeper and about twice as wide than the size of your plant plugs or pots. Make sure the soil at the bottom of the holes is loose.

Remove plants from containers by squeezing the container sides and easing the root ball out from the bottom, not by pulling the stem. If plants are rootbound (i.e., the roots conform to the shape of the container), carefully tease the smallest roots at the bottom of the plug out of formation. Put the plants in the holes and backfill so that the roots are fully covered and the root crown is just under the soil surface. Press the transplants in by treading the soil down carefully on all sides of the stems.



White and nodding trilliums, [clconroy via Morguefile.com](http://clconroy.via.Morguefile.com)

Be careful not to damage or remove the strongest root material during plant plug installation. Healthy roots lead to strong establishment and better drought resistance & erosion control.



# Preventing Secondary Invasions: EXPECTATIONS & MAINTENANCE

for natural areas



Chris Evans, U. of Illinois, Bugwood.org



Wild bergamot (foreground), Alex Katovich, Bugwood.org

**Sleep...Creep...Leap!** This saying is popular in gardening, but it holds true in planting natural areas as well. It describes the first three years of life for most perennial plants, including shrubs and trees. The first year, whether establishing from seed or transplant, the plant tends to not do much at all (sleep). And the second year, they tend to grow slowly (creep). What is actually happening is that the plants are putting all their resources into establishing deep and robust roots for a couple of years. By year three, the roots are usually strong and the plants “leap,” growing much more rapidly and flowering more reliably. However, some native woody species may take several years or even decades to mature. Unfortunately, this “slow to start” phase can leave newly revegetated sites vulnerable to encroachment by invasive plants.

**Keep an Eye Out** If you’ve just seeded or transplanted across a large area, odds are you made a significant investment! Protect it by monitoring it carefully. It helps to keep both visual and written records. Take photographs of your plantings just after installation, after germination (if using seeds), and towards the end of the first growing season. The unfortunate reality is that not all plantings will survive. Try to figure out which seed species failed to germinate and which transplants failed to establish. Then, the trickiest part is trying to diagnose why. If failure rate is moderate and similar across species, it may just be a matter of reseeding or inter-planting some new plugs of the same species mix to establish dense cover. If a particular species failed at a high rate, that species may not be well suited for conditions at the site or may have been preferentially browsed by deer or other herbivores, and the best course of action may be to replace it with something different. In the long term, make sure to monitor specifically relative to your site goals. For example, is your erosion-prone slope stabilizing? Is seasonal flooding lessened? Is native tree regeneration improved relative to the site’s invaded state?



Japanese knotweed seedlings,  
Leslie J. Mehrhoff, UConn, Bugwood.org

**Weed Away** During the first two years after seeding or transplanting in particular, it will be very important to watch for invasive plant establishment. Physically remove invasive plants by hand or with tools if the population is sparse enough, or by carefully using targeted and/or selective herbicide treatments. Try to catch weeds and invasives relatively quickly, before they establish dense, fibrous root systems (in the case of woody plants) and before they reproduce, forming dense stands that can out-compete your plantings. It will be helpful if you can either recruit volunteers or hire professionals to manage invasives while your native plantings establish. After a few years, once native cover is thriving, monitoring can be somewhat less frequent. At a minimum, you should check for aggressive invasives once a year and treat them before they mature. If your site is fire-adapted (prairie or grassland, savannah, or upland forest), a prescribed fire regimen may be the most practicable and cost-efficient option for long-term weed control.

It’s a frustrating reality, but no matter how much planning you put into revegetating your site, regenerating a native plant community is still somewhat of an experiment. Take heart in knowing that your notes and documentation of what worked and what didn’t are valuable and that your efforts may well help your neighbors become better stewards.

# Footnotes

- <sup>1</sup> Illinois Humanities: [www.ilhumanities.org/program/immigrant-landscape](http://www.ilhumanities.org/program/immigrant-landscape)
- <sup>2</sup> Calculated from table supplied by Natural Resources Council of Maine: [www.nrcm.org/documents/publiclandownership.pdf](http://www.nrcm.org/documents/publiclandownership.pdf)
- <sup>3</sup> For these calculations, “Northeastern” is USFS Region 9: [www.fs.usda.gov/r9](http://www.fs.usda.gov/r9)
- <sup>4</sup> From the U.S. Endowment for Forestry and Communities story-map “Who Owns America’s Forests” available here: [www.arcgis.com/apps/Cascade/index.html?appid=d80a4ffed7e044219bbd973a77bea8e6](http://www.arcgis.com/apps/Cascade/index.html?appid=d80a4ffed7e044219bbd973a77bea8e6)
- <sup>5</sup> Find contact information for Northeastern CISMAs here: [www.greatlakesphragmites.net/resources/organizations/](http://www.greatlakesphragmites.net/resources/organizations/)
- <sup>6</sup> Kettenring, K.M. and C.R. Adams. 2011. Lessons learned from invasive plant control experiments: a systematic review and meta-analysis. *Journal of Applied Ecology* 48: 970-979.
- <sup>7</sup> Black locust’s pre-colonial range is thought to have been restricted to the Appalachian Mountains and parts of the Ozark Plateau. [www.srs.fs.usda.gov/pubs/misc/ag\\_654/volume\\_2/robinia/pseudoacacia.htm](http://www.srs.fs.usda.gov/pubs/misc/ag_654/volume_2/robinia/pseudoacacia.htm)
- <sup>8</sup> USFS Regional Offices: [www.fs.usda.gov/about-agency/contact-us/regional-offices](http://www.fs.usda.gov/about-agency/contact-us/regional-offices), NRCS regional and local office search: [offices.sc.egov.usda.gov/locator/app?agency=nrcs](http://offices.sc.egov.usda.gov/locator/app?agency=nrcs)
- <sup>9</sup> Contamination of conservation seed mixes with Palmer amaranth seed was a recent example in the Midwest: [conservationdigest.com/palmer-amaranth-alert-check-crp-seed-mixes/](http://conservationdigest.com/palmer-amaranth-alert-check-crp-seed-mixes/)
- <sup>10</sup> For more information on local ecotypes: [www.fs.fed.us/wildflowers/Native\\_Plant\\_Materials/Native\\_Gardening/genetics.shtml](http://www.fs.fed.us/wildflowers/Native_Plant_Materials/Native_Gardening/genetics.shtml)
- <sup>11</sup> The draft Eastern Seed Zone map: [easternseedzones.com/map](http://easternseedzones.com/map)
- <sup>12</sup> Native Connections (Michigan) provides a very helpful seeding guide here: [nativeconnections.net/blog/wp-content/uploads/2018/04/NatConnCatalog17\\_PlantingGuidelines.pdf](http://nativeconnections.net/blog/wp-content/uploads/2018/04/NatConnCatalog17_PlantingGuidelines.pdf)
- <sup>13</sup> Advice on plant selection for slopes from North Central Conservation District (Connecticut): [conservect.org/northcentral/wp-content/uploads/2020/01/planting\\_on\\_slopes.pdf](http://conservect.org/northcentral/wp-content/uploads/2020/01/planting_on_slopes.pdf)
- <sup>14</sup> For information on addressing challenging erosion problems: [www.fs.fed.us/t-d/pubs/pdf/hi\\_res/06771203hi.pdf](http://www.fs.fed.us/t-d/pubs/pdf/hi_res/06771203hi.pdf)



*This prairie, pictured in early spring, is a restored agricultural field in Northern Illinois, Clair Ryan, mipn.org*



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This material was generated under a Challenge Cost Share Agreement between the U.S. Forest Service and The Morton Arboretum, fiscal sponsor of the Midwest Invasive Plant Network.  
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