Turning Objectives into Action: Adaptive Planting on Vermont Lands

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WHY DO WE NEED PLANTING GUIDELINES?

Vegetation management and habitat restoration on Vermont's more than 360,000 acres of public land requires more than ecological intent—it demands a shared, science-based approach that bridges research, management, and on-the-ground realities.

We recognize the importance of balancing ecological goals with challenges such as planting stock availability, site limitations, limited staff resources, and increasing climate change impacts and novel stressors.

To meet these challenges, the Vermont Agency of Natural Resources (ANR) developed the *Planting Guidelines for ANR State Lands* (2025) — to help ANR state land managers navigate decision-making for planting projects on state lands. The guidelines also provide transparency to the public about ANR's expectations for protecting and enhancing biodiversity and ecological resilience.

The guidelines advance six primary objectives for Vermont state lands:

- Protect and enhance native biodiversity and ecosystem function.
- Protect genetics of locally adapted plant species and populations.
- Avoid introduction of non-native invasive plants, pests, and pathogens.
- Provide guidance on adaptation plantings to address novel stressors such as climate change, pests, and pathogens.
- Provide a framework/tool for project development and review.
- Raise awareness and educate ANR staff on best practices for successful planting projects.

Beyond these objectives, the guidelines create a common foundation for learning and refinement, encouraging feedback from state land managers to strengthen future iterations and identify emerging needs.

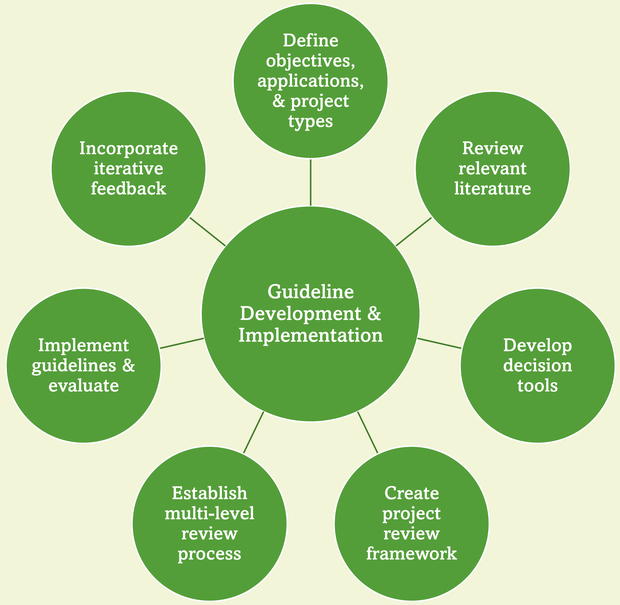
What the guidelines are not:

- They are not regulatory or permitting documents.
- They are not comprehensive planting manuals.
- They do not apply to all land types and do not cover every restoration or adaptation scenario.
- They are not intended for rare, threatened, or endangered species recovery.
- They are not prescriptive blueprints and are not static.

PROCESS AND DEVELOPMENT OF THE GUIDELINES

Development of the guidelines was led by ANR's Departments of Fish & Wildlife and Forests, Parks & Recreation in collaboration with land managers, foresters, biologists, ecologists, and watershed planners. The process included:

- Reviewing existing forest adaptation and restoration frameworks used in Vermont and the Northeast.
- Identifying management objectives and recurring project types across ANR lands.
- Developing a decision framework ("keys") linking objectives, site factors, and planting recommendations.
- Incorporating feedback from field staff at multiple points in the development process.



This process produced a document that provides both statewide direction and site-specific guidance. Using an iterative approach and practitioner feedback from projects in developed landscapes, riparian buffers, and post-harvest regeneration, we aim to evaluate whether the guidelines improve consistency, communication, and ecological alignment across departments and project types.

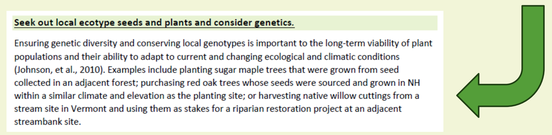
The guidelines are available online and can also serve as a resource for those implementing planting projects on private lands.

Scan me!

PROJECT TOOLS

The guidelines produced a suite of adaptive decision tools, including:

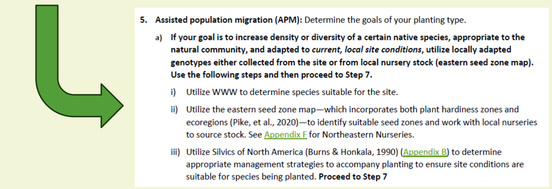
General Guidelines: Overarching principles for planting on ANR lands, offering broad guidance on planning, species selection, and adaptive management to support consistent, science-based restoration across diverse project types.



Seek out local ecotype seeds and plants and consider genetics.

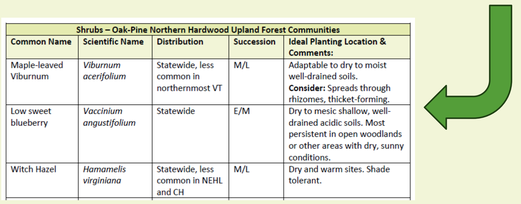
Ensuring genetic diversity and conserving local genotypes is important to the long-term viability of plant populations and their ability to adapt to current and changing ecological and climatic conditions (Johnson, et al., 2010). Examples include planting sugar maple trees that were grown from seed collected in an adjacent forest; purchasing red oak trees whose seeds were sourced and grown in NH within a similar climate and elevation as the planting site; or harvesting native willow cuttings from a stream site in Vermont and using them as stakes for a riparian restoration project at an adjacent streambank site.

Project-Specific Keys: Stepwise questions that lead users from broad objectives (e.g., floodplain restoration) to specific planting recommendations based on site factors.



5. **Assisted population migration (APM):** Determine the goals of your planting type.
   a) **If your goal is to increase density or diversity of a certain native species, appropriate to the natural community, and adapted to *current, local site conditions*, utilize locally adapted genotypes either collected from the site or from local nursery stock (eastern seed zone map). Use the following steps and then proceed to Step 7.**
      i) Utilize WWW to determine species suitable for the site.
      ii) Utilize the eastern seed zone map—which incorporates both plant hardiness zones and ecoregions (Pike, et al., 2020)—to identify suitable seed zones and work with local nurseries to source stock. See Appendix F for Northeastern Nurseries.
      iii) Utilize Silvics of North America (Burns & Honkala, 1990) (Appendix B) to determine appropriate management strategies to accompany planting to ensure site conditions are suitable for species being planted. **Proceed to Step 7**

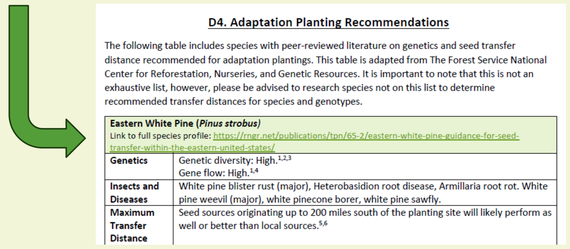
Species Selection Tables: Regionally appropriate, climate-resilient species lists organized by ecoregion and habitat.



Shrubs – Oak-Pine Northern Hardwood Upland Forest Communities				
Common Name	**Scientific Name**	**Distribution**	**Succession**	**Ideal Planting Location & Comments:**
Maple-leaved Viburnum	*Viburnum acerifolium*	Statewide, less common in northernmost VT	M/L	Adaptable to dry to moist well-drained soils. **Consider:** Spreads through rhizomes, thicket-forming.
Low sweet blueberry	*Vaccinium angustifolium*	Statewide	E/M	Dry to mesic shallow, well-drained acidic soils. Most persistent in open woodlands or other areas with dry, sunny conditions.
Witch Hazel	*Hamamelis virginiana*	Statewide, less common in NEHL and CH	M/L	Dry and warm sites. Shade tolerant.

Genetic Guidance: Emphasis on planting common species and sourcing from local or regionally adapted genotypes to prevent maladaptive plantings.

Assisted Migration Guidance: Recommendations on how to strategically select and plant species or genotypes that are expected to be better suited to future environmental conditions.



D4. Adaptation Planting Recommendations

The following table includes species with peer-reviewed literature on genetics and seed transfer distance recommended for adaptation plantings. This table is adapted from The Forest Service National Center for Reforestation, Nurseries, and Genetic Resources. It is important to note that this is not an exhaustive list, however, please be advised to research species not on this list to determine recommended transfer distances for species and genotypes.

Eastern White Pine (*Pinus strobus*) Link to full species profile: https://rngr.net/publications/tpn/65-2/eastern-white-pine-guidance-for-seed-transfer-within-the-eastern-united-states/	
Genetics	Genetic diversity: High.[1,2,3] Gene flow: High.[1,4]
Insects and Diseases	White pine blister rust (major), Heterobasidion root disease, Armillaria root rot. White pine weevil (major), white pinecone borer, white pine sawfly.
Maximum Transfer Distance	Seed sources originating up to 200 miles south of the planting site will likely perform as well or better than local sources.[5,6]

THE FUTURE OF THE GUIDELINES: ITERATIVE PLANNING

These guidelines are designed to be dynamic, with timely periodic reviews to incorporate the latest scientific advancements.

To account for the uncertainty around adaptability to novel stressors, these guidelines empower Agency staff to manage state lands as complex adaptive systems, to maintain and enhance structural and compositional diversity and redundancy across multiple temporal and spatial scales, and support multiple ecosystem services, including carbon sequestration and storage, cultural and aesthetic values, water filtration, natural community assemblages, and more.

The adaptive planting approach bridges science and implementation by converting complex ecological goals into structured, repeatable actions. The keys encourage staff to consider both current and future stressors, integrating climate adaptation directly into on-the-ground decisions.

Challenges remain, including seed source limitations, evolving pest pressures, and ensuring consistent use across departments.

Future work will include the following:

- Expanding species lists for all planting types
- Refining guidance on assisted migration monitoring
- Integrating emerging research into the guidelines
- Updating project-type keys to improve usability

By linking ecological theory with practical decision-making, the guidelines strengthen Vermont's capacity to enhance and restore resilient, biodiverse habitats that can thrive under changing conditions.

ACKNOWLEDGEMENTS

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