

Appendix H.

Albany Pine Bush Preserve Research, Inventory, and Monitoring Plan

**ALBANY PINE BUSH PRESERVE
RESEARCH, INVENTORY AND MONITORING PLAN**

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INTRODUCTION:

The Albany Pine Bush represents one of the best remaining examples of an inland pitch pine-scrub oak barrens, and is home to a variety of rare plants and animals including the Karner blue butterfly (*Lycaeides melissa samuelis*). Created by the New York State Legislature in 1988, the Albany Pine Bush Preserve Commission is charged with protecting and managing a viable Pine Barrens ecosystem.

Research, inventory and monitoring programs are essential to assessing community status and the progress of management actions toward achieving the ecological goals and objectives outlined below. Monitoring rare communities and species is intended to document changes in distribution and abundance over time and/or as a result of management activities. For instance, Karner blue butterfly numbers have been monitored, according to specified protocols, to determine changes in numbers from year to year and to identify changes in the locations of sub-populations. Inventory efforts represent searches for species and natural communities and to provide documentation on their status. Most community inventory work in the Albany Pine Bush has been completed, though some rare species, historically identified in the Pine Bush, are still being sought. Research involves specific studies to expand our understanding of the biology of organisms and ecological processes that maintain communities and habitat. A variety of research projects have been undertaken at the Albany Pine Bush, described below, which build upon each other and contribute to setting a research plan for the next decade. In some instances research may require extensive literature reviews and not necessarily require additional field studies. Literature describing the influence of herbivory on the establishment of invasive plants, for example, may be readily available and applicable to the Pine Bush.

This research, inventory, and monitoring plan was prepared as a dynamic tool to guide applied scientific work within the Albany Pine Bush Preserve over the next five years. The objective of this plan is to ***identify and prioritize information needed to evaluate the ecological condition of the Preserve and direct Preserve management.*** Commission staff alone will not have the capacity to accomplish everything described within this plan. It is our intention, however, that while certain projects will be completed by the Commission, this plan will also be a guide for partner agencies, organizations, and academic institutions interested in advancing Preserve science and conservation.

Specific Preserve Management Goals and Objectives as outlined in the 2002 Management Plan and Environmental Impact Statement that warrant research and monitoring are:

Goal 1) Protect and manage an ecologically viable inland pitch pine-scrub oak barrens community capable of supporting a viable Karner blue butterfly population.

Objectives:

1. Acquire the necessary acreage to obtain a minimum of 2,000 acres of pitch pine-scrub oak that can be managed by fire.
2. Restore and maintain the natural plant and animal species composition of the pitch pine-scrub oak community, by continuing and expanding the Preserve ecological management programs.
3. Maintain a viable population of Karner Blue Butterflies defined as having a 95 percent probability of persistence to 100 years.

Goal 2) Protect and manage linkages.

Objectives:

1. To the greatest extent possible reduce or eliminate existing fragmentation of conservation targets (rare communities and populations of rare species).
2. Protect and manage linkages between disjunct populations of Karner blue butterfly to other populations in the Preserve.
3. Identify suitable habitat for translocation of Karner blue butterflies to establish the required number of new sub-populations to achieve Federal/ State recovery goals for the species.

Goal 3) Protect and manage significant natural resources.

Objectives:

1. Acquire, restore, and manage lands necessary to protect the remaining isolated Karner blue butterfly sub-populations.
2. Monitor and manage the Preserve's fish and wildlife resources to maintain populations that are compatible with the desired level of extractive and non-extractive human use.
3. Protect and manage wetlands, streams, and ravines that provide habitat for rare and locally important species.
4. Maintain the hydrologic processes that sustain the pine barrens vernal ponds.

Goal 4) Maintain and enhance public access to the Preserve

Objectives:

1. Maintain a system of trails to accommodate a variety of appropriate recreational uses.
2. Explore opportunities for appropriate trails on existing and newly acquired Preserve lands.
3. Provide opportunities for public observation, appreciation, and/or use of ecological/wildlife resources, without adversely impacting those resources and in accordance with NYSDEC rules and regulations.
4. Segregate incompatible uses and restrict particularly damaging uses from those areas of the Preserve that are most sensitive. Remove inappropriate or unnecessary trails from ecologically sensitive areas. Explore opportunities for relocating these trails to areas that can better tolerate recreational pressure.
5. Monitor use and enforce rules designed to control unauthorized or inappropriate uses such as dumping, the use of off-road vehicles, or trespassing on adjacent private property.

Goal 5) Enhance and expand educational and outreach efforts.

Objectives:

1. Create a greater public awareness and appreciation of Pine Bush ecology and Preserve management through expanded educational opportunities and programs.
2. Increase the visibility and image of the Preserve and continue to develop a sense of stewardship on the part of the public.

Past Research, Inventory, and Monitoring

A great deal of research, inventory, and monitoring has been conducted in the Albany Pine Bush. The cumulative effort has built the current scientific understanding of the Preserve, and has formed the basis for its management. The monitoring, research, and inventory plan is focused on filling the gaps in scientific knowledge, but a detailed summary of previous work is beyond its scope. A list of representative works is provided at the end of this document, and we encourage readers to consult Barnes (2003) for an excellent overview of Albany Pine Bush natural history.

Recommended Monitoring, Research, and Inventory 2010-2015

MONITORING:

Management: Monitoring is needed to evaluate the effectiveness of management activities in meeting objectives described above. While great progress has been made with prescribed burning, silviculture, restoration planting, and controlling invasive species, more work is needed to critically evaluate preserve management, recreation, education, and outreach practices.

Priority tasks include:

- Track key viability components described in the Albany Pine Bush Pine Barrens Viability Assessment (Appendix B), specifically:
 - size and extent of pitch pine-scrub oak barrens including total area, patch size, core area, and amount of suitable Karner blue butterfly habitat;
 - fragmentation and edge effects including patchiness, patch isolation distance, and perimeter/area ratio;
 - prescribed fire regime including area burned, return interval, and seasonality;
 - biotic patterns including distribution and abundance of native and non-native plant and animal species.
- Develop an analysis framework to evaluate landscape-level and plot-specific vegetation change (Appendix B).
- Compare floristic quality and conservatism of managed vs. unmanaged areas and over time in established plots (Appendix B).
- Assess spatial and temporal recruitment patterns of pitch pine.

- Incorporate the New York Invasiveness Ranking Protocol into preserve-wide assessment of invasive plants (Appendix B).
- Critically evaluate biological, chemical, mechanical, and pyric alternatives to controlling overabundant plant species such as oriental bittersweet, aspen, and scrub oak.

Karner Blue Butterfly and Inland Barrens Buckmoth: Monitoring the distribution and abundance of these species will continue to determine both changes in their status and the effectiveness of habitat management activities.

Priority tasks include:

- Estimate the size and distribution of Karner blue and Buckmoth populations.
- Evaluate competing methods for estimating size and indexing change in Karner blue populations.
- Conduct count-based population viability and trends analyses for the Karner blue.
- Continue to implement Karner blue habitat monitoring, especially in restoration patches, and improve the statistical efficiency of lupine abundance estimation.
- Track the distribution of buckmoth populations and establish transect surveys for buckmoth larval clusters.

Other Wildlife Monitoring: Regular breeding bird surveys as well as periodic surveys for amphibians, reptiles, mammals, and invertebrates are recommended to assess changes in wildlife population composition and distribution. These surveys will be designed to correlate populations with plant communities so that changes in species populations can be used to indicate potential and actual changes in the status of ecological communities. This will require simultaneous quantitative descriptions of wildlife populations and their habitat.

Specific monitoring and analysis is needed to identify:

- Easily monitored species indicative of a) habitat types and conditions, b) management progress, c) spatial or trend patterns of difficult-to-monitor species.
- The current breeding bird species diversity and distribution throughout the Preserve.
- Migratory bird diversity and value of the Preserve as a migratory stop-over.
- Prairie warbler reproductive success and relationship to source-sink dynamics.
- The species diversity and distribution of mammals (carnivores and herbivores) in the Preserve.
- The species diversity and distribution of reptiles and amphibians in the Preserve.
- The species diversity and distribution of insects in the Preserve.
- The potential for successful reintroductions of the regal fritillary butterfly and ringed boghaunter dragonfly.

GIS-Based Monitoring: The recently completed Albany Pine Bush Pine Barrens Viability Assessment (Appendix B) is intended as a framework to measure ecological conditions and restoration progress and will require extensive GIS-based analyses.

Priority tasks include:

- Assess Preserve-wide cover of aspen and black locust relative to suggested viability thresholds.
- Track relative cover of pine barrens forest versus pine barrens shrubland across the preserve.
- Measure overall amount, core area, patchiness, patch sizes, patch isolation distances, and perimeter/area ratios for pine barrens habitat.
- Conduct detailed ecological integrity assessment similar to that being used in the New Jersey Pinelands, which will help evaluate current APB management-area and zoning designations and help with developing habitat conservation plans for wetlands.

RESEARCH:

Fire Regimes: Given what has been learned about fire management, it will be important to expand on the relationship of different fire regimes (frequency, seasonality, etc) on achieving management objectives.

Specific research is needed to evaluate:

- The response of both woody and herbaceous species to dormant vs. growing season burns, especially given the different impacts of fires observed during the dormant and growing seasons to litter and organic layers of the soil.
- The characteristics (intensity, severity, season) of fires that foster the successful recruitment and establishment of pitch pine, scrub oak, heath species, lupine, and other nectar sources.
- The effects of fire on other Preserve plant communities including wetlands (vernal ponds, shallow emergent marshes), Appalachian oak-pine, and pine-northern hardwood forests, particularly with respect to oak regeneration.
- The effects of fire on the availability of nitrogen and other nutrients and how the relationship of fire and nutrient availability affects the long-term maintenance of barrens communities.

Habitat Restoration & Fragmentation/Urbanization: Research is needed to evaluate the effects of habitat restoration and habitat fragmentation on plant and animal species recruitment, diversity, and movement patterns. It is recommended that specific research initially investigate the effects of fragmentation on rare species whose population dynamics operate at the patch level.

Specific research should address:

- Assumptions underlying the attributes, indicators, and thresholds proposed in the Preserve viability assessment regarding fragmentation (Appendix B).
- How future landscape-scale vegetation cover and composition may look, as predicted by computer modeling (LANDIS or STELLA), under competing threat (climate change, urbanization) and management scenarios.
- Spatial and temporal recruitment patterns of pitch pine, including the influence of herbivory.
- Appropriate methods for native plant establishment on closed portions of the Albany landfill.

- Appropriate methods for native plant restoration in areas dominated by invasive species (locust and aspen clones, abandoned agricultural fields).
- Species survival and movement in pitch pine-scrub oak patches of varying sizes and distances to the nearest patch.
- The extent of barriers, particularly roads, to species movement.
- Invasibility of pine barrens patches based on size, distance to propagule sources, and other factors.
- FRAGSTATS analysis to quantify in detail the fragmentation and urbanization context of the Preserve.
- Impacts of light pollution on nocturnal Species of Greatest Conservation Need and on our ability to conduct rare moth surveys as part of pine barrens viability assessment (Appendix B).

Herbivory: Deer have been identified as a threat to the Preserve in that they have been shown to reduce the ability of component plant species to reproduce (Section IV). Small mammals also impact plant species regeneration. Woodchucks and rabbits have been observed browsing on both pitch pine and lupine, and rodent populations have been shown to impact pitch pine and scrub oak regeneration in the New Jersey Pinelands (Unnasch 1990).

Specific studies are needed to determine:

- The impacts of herbivory on woody and herbaceous species recruitment and establishment.
- The interaction between herbivory and ecological management, (i.e., does Preserve management facilitate herbivory?)

Recreational User Impacts: As improved education and outreach efforts increase the number of visitors using the Preserve, the direct and indirect impacts of visitation will also increase. Information is needed to evaluate those effects.

Specific research is needed to determine:

- The number of current visits within specified areas of the Preserve.
- The relationship of visitor use to invasive species abundance (e.g., people as vectors).
- The direct impacts of visitors to soils and vegetation along trails.
- The impacts of visitors on wildlife populations (e.g., increased numbers of generalist species and decreased numbers of rare, conservative species), including the trail zone of influence (Appendix B) in different habitat types.

Vernal Ponds, Sedge Meadows, and Red-maple Hardwood swamps:

Basic information is needed on the hydrology, fire regime, and water chemistry of vernal ponds, sedge meadows, and red-maple hardwood swamps.

Specific research is needed:

- Distinguishing characteristics of pine barrens vernal ponds, such as plant indicator species, especially quantifying differences with common vernal pools.
- Diversity patterns of wetland-dependent fauna, especially the charismatic taxa (birds, amphibians, reptiles, dragonflies, damselflies).

- Relative influence of landscape vs. site management in controlling (predicting) the occupancy of herpetofauna and Odonata.
- Seasonal and interannual hydroperiods of vernal wetlands, and the relationship of surface to groundwater flows.
- Effects of fire on plants and animals that use these wetlands. A pollen core or charcoal dating may help determine historic fire frequency.
- Vernal wetland water chemistry (macro- and micro-nutrients, pollutants, etc.).

Frost Pockets: Information is needed on seasonal microclimate dynamics, size, distribution, and species composition of such areas as well as whether they can provide potential habitat for rare species like the Karner blue butterfly.

Social Research: Statistically valid surveys are needed to evaluate understanding and attitudes of Preserve neighbors and visitors to Pine Bush ecology, management techniques (including fire), and actions of the Commission to protect and manage the Preserve.

Additional Threats: Research to investigate and monitor the status of threats to conservation targets is also highly recommended.

INVENTORY

Past inventories have been invaluable to management and protection planning. However, some are more than a decade old or based on outdated information (e.g., aerial photographs). Here is a list of priority inventory tasks:

- Mapping and documentation of invasive species throughout and surrounding the Preserve.
- Mapping and documentation of natural communities and cultural (human) land uses using standard methods of the New York Natural Heritage Program and current aerial photography (last completed in 2003).
- Mapping of locations of rare species.
- Mapping of locations of historic, current, and potential habitat for rare, declining, and vulnerable species.
- Inventory of rare invertebrates to update records described in the 1991 study of the New York Natural Heritage Program (Schneider et al. 1991).
- Inventory of the aquatic and wetland macroinvertebrate fauna.
- Surveys directed toward species known to have occurred historically in the Preserve, such as *Malaxis bayardii*, *Poa paludigina*, and *Williamsonia lintneri*.
- Reptile and amphibian species richness and distribution throughout the Preserve (an update of Hunsinger, 1999).
- Surveys of lichens, fungi, and bryophytes of the Albany Pine Bush.
- Surveys of soil microorganisms in various plant community types within the Preserve.

As these are completed, data should be incorporated into a GIS as well as the Heritage database.

Creating an Ecological Database

The creation of a Microsoft Access© and Geographical Information System database is highly recommended to consolidate the growing inventory and management data on Albany Pine Bush species and communities.

Specific database elements include:

- Mapping and documentation of natural communities and rare species habitat to identify changes over time.
- Characterization of the variation in structure and composition of natural communities within the Pine Bush.
- Creation of an associated database on the habitat requirements and life history characteristics of rare, declining, and vulnerable species that are found within the Preserve, including those to be tracked as part of monitoring.
- Correlation of spatial and database information by mapping existing and potential habitat of those species.
- Tracking all aspects of Preserve management (fire, chemical, mechanical, plantings, etc.).
- Tracking changes in land use—including building permits and site plans—within the Project Review Area.

This database can be used for habitat management, monitoring and protection planning by offering managers and researchers an accessible source of information on the relationship of species to Pine Bush habitat.

Examples of research, inventory, and monitoring work in the Albany Pine Bush

- Barnett, K., and B. Abbuhl. 2007. Ecology and behavior of the eastern hognose snake in upstate NY. Albany Pine Bush Preserve Commission Internal Report. 17 pages
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- Bogan, D.A. 2004. Eastern coyote home range, habitat selection and survival in the Albany Pine Bush landscape. M.S. Thesis. University at Albany, State University of New York, Albany, NY.
- Breisch, K. 2006. Eastern spadefoot toad (*Scaphiopus holbrookii holbrookii*): Albany Pine Bush Preserve. Albany Pine Bush Preserve Commission Internal Report. 8 pages
- Bried, J.T., T.H. Tear, R.R. Shirer, C.L. Zimmerman, and N.A. Gifford. 2006. Monitoring habitat quality for Karner blue butterfly recovery in Glacial Lake Albany, New York. Final report submitted to the New York State Biodiversity Research Institute. 67 pages
- Bried, J.T., P. Hunt, and W.B. Worthen. 2007. How often and how long? Studying temporal survey design for adult odonates. *ARGIA* 18(4):8-11.
- Bried, J.T. 2009. Information costs of reduced-effort habitat monitoring in a butterfly recovery program. *Journal of Insect Conservation* 13:615-626.
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- Droege, M.F. 1996. The seasonal variation in total available carbohydrates in rhizomes of huckleberry (*Gaylussacia baccata*) and its implications for fire management. M.S. Thesis. University of Massachusetts, Amherst, MA.
- Finton, A.D. 1998. Succession and plant community development in pitch pine-scrub oak barrens of the glaciated northeast United States. M.S. Thesis. University of Massachusetts, Amherst, MA.
- Forrester, J.A., D.J. Leopold, and S.D. Hafner. 2005. Maintaining critical habitat in a heavily managed landscape: effects of powerline corridor management on Karner blue butterfly (*Lycaeides melissa samuelis*) habitat. *Restoration Ecology* 13:488-498.
- Fuller, S.G. 2008. Population dynamics of the endangered Karner blue butterfly (*Lycaeides melissa samuelis* Nabokov). PhD Thesis. College of Environmental Science and Forestry, State University of New York, Syracuse, NY.
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