2017 Management Plan Update

For

The Albany Pine Bush Preserve

March *2017*

Globally Rare, Nationally Significant, Locally Distinct

2017 Management Plan Update

For

The Albany Pine Bush Preserve

Location of Action:	Albany County, City of Albany, Town of Colonie, Town of Guilderland, and Village of Colonie
Lead Agency:	Albany Pine Bush Preserve Commission 195 New Karner Road Albany, New York 12205
Contact Person:	Christopher Hawver, Executive Director
Prepared by:	Albany Pine Bush Preserve Commission
Date:	March 16, 2017

The Mission of the Albany Pine Bush Preserve Commission is:

TO PROTECT AND MANAGE THE UNIQUE AND ENDANGERED NATURAL COMMUNITIES AND SPECIES OF THE ALBANY PINE BUSH, FOR ECOLOGICAL BENEFITS AND CONTROLLED AND APPROPRIATE PUBLIC RECREATIONAL AND EDUCATIONAL USE.

ABOUT THIS MANAGEMENT PLAN UPDATE

1. *What is the action?*
   The adoption and implementation of a Management Plan Update for the Albany Pine Bush Preserve.

2. *Is the action subject to SEQRA?*
   At its September 15, 2016 meeting the Commission classified the 2017 Draft Management Plan Update for the Albany Pine Bush Preserve as a Type 2 Action consistent with the State Environmental Quality Review Act (SEQRA).

3. *Who is proposing to do this?*
   The Albany Pine Bush Preserve Commission. The Commission is comprised of representatives of the Towns of Colonie and Guilderland, the City of Albany, Albany County, The Nature Conservancy, the NYS Department of Environmental Conservation, the NYS Office of Parks, Recreation and Historic Preservation and four private citizens.

4. *Why was this report written?*
   The Legislation establishing the Albany Pine Bush Preserve requires that the Preserve Management Plan be reviewed and, if necessary, updated every five years. The 2017 plan updates the 2010 Preserve Management Plan and FEIS and its associated appendices. It incorporates new data and experience gained by the Commission since that document was originally prepared.

   This Management Plan Update was written to provide people who have an interest in the Albany Pine Bush Preserve with an opportunity to participate in planning its future.

5. *How much opportunity has there been for participation by others?*
   Public meetings were held throughout the processes to draft the 1993 Management Plan and FEIS, the 1996 Implementation Guidelines and FEIS, the 2002 Management Plan and FEIS and the 2010 Management Plan and FEIS for the Albany Pine Bush Preserve. Additionally public comment was requested through an advertised public hearing on October 25, 2016 held at the Discovery Center and two informational meetings held at the Crossings of Colonie on November 2, 2016 and at the Guilderland municipal library on November 3, 2016. Written comments were accepted through November 25, 2016.

6. *How should this report be reviewed?*
   It is really up to the reviewer. One can choose to read the entire report, cover to cover, or can choose to focus only on those part(s) that are of interest.

7. *What happens next?*
   The Commission will consider adopting the Management Plan Update at its March 16, 2017 regular meeting.

8. Who can I contact if I have questions?

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Acknowledgements

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In particular the Commission sincerely thanks the members of the Technical Advisory Committee and other Commission representatives for their commitment and energy in preparing this updated Management Plan:

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THE ALBANY PINE BUSH PRESERVE COMMISSION (2017)

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EXECUTIVE SUMMARY

I. Introduction

The Albany Pine Bush is a National Natural Landmark (Federal Register 78, No.161 51207, 2013) located between the cities of Albany and Schenectady, New York on one of the most extensive inland areas of sand dunes in eastern North America. It contains the best remaining example of a globally-rare inland pitch pine-scrub oak barrens; a locally distinct ecological community characterized by a sparsely treed grassy shrubland that is adapted to dry conditions and frequent wildland fires. The Albany Pine Bush supports the Karner blue butterfly, a state and federally listed endangered species, 74 other animals listed as Species of Greatest Conservation Need in New York State and two rare plants. The area also includes other natural communities, such as oak and pine forests, a diversity of wetlands, and several successional communities that have resulted from historic land use and fire exclusion. In addition to these ecological features the Albany Pine Bush Preserve contains more than 20 miles of recreational trails and the Discovery Center, the only educational facility dedicated to interpreting the history and management of inland pitch pine-scrub oak barrens.

In December of 1988, the New York State Legislature established the Albany Pine Bush Preserve Commission (Commission) and created the Albany Pine Bush Preserve (Preserve), consisting of dedicated public and dedicated private land (see Appendix A). The Commission is responsible for managing the Preserve for its protection and appropriate public use. Since its inception, the Albany Pine Bush Preserve Commission has represented a unique and successful partnership between state agencies, municipalities, conservation organizations and private citizens. Commission members include representatives of the New York State Department of Environmental Conservation (NYSDEC), New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP), The Nature Conservancy (TNC), the City of Albany, the towns of Colonie and Guilderland, Albany County, and four private citizens appointed by the Governor.

In accordance with the legislation establishing the Preserve, the *Management Plan and Final Environmental Impact Statement for the Albany Pine Bush Preserve* was prepared and adopted in 1993. A supplement to that plan, titled *The Albany Pine Bush Preserve Protection and Project Review Implementation Guidelines and Final Environmental Impact Statement* ("Implementation Guidelines") was prepared and adopted in 1996 (APBPC 1996). These plans were replaced with the Commission's adoption of the 2002 Management Plan and Final Environmental Impact Statement (APBPC 2002). The 2002 Management plan was extensively updated with the adoption of the 2010 Management Plan and Final Environmental Impact Statement (APBPC 2010). These plans have guided resource protection and management activities.

Since its inception, the Commission has been successful in working toward its legislative mandate. Positive relationships have been established between numerous municipal, state, federal and private partners for the common goal of protecting and managing the Albany Pine Bush. As a result of extensive education and communication efforts, awareness of the Pine Bush as a valuable ecological and recreational resource is growing in the Capital District. Over 3,300 acres of land have been permanently protected as part of the Preserve. More than 2,200 of these acres have been managed with prescribed fire, silviculture, mowing, planting, and/or other techniques to restore and maintain native wildlife habitat (Figure 7). The Commission has also worked closely with municipal planning departments to achieve reasonable solutions for balancing the impacts of development within the 13,000 acre Pine Bush Study Area.

Although significant progress has been made, several factors indicate that the long-term future of the Albany Pine Bush is by no means ensured. Development pressures in and around the Pine Bush continue, risking the additional permanent loss of important areas recommended for protection. Research and management activities reveal that the successful restoration and management of ecological communities in the Preserve is more multifaceted than originally anticipated. Lastly, effectively engaging Preserve neighbors will be essential to the application of various management tools (e.g. prescribed fire, tree harvest, etc.).

The legislation establishing the Preserve requires Commission review of the Preserve Management Plan every five years, and update if necessary. The 2017 Management Plan Update for the Albany Pine Bush Preserve updates previous Management Plans, the contents of which are summarized below.

II. Vision and Goals

The overall vision of the Albany Pine Bush Preserve is a continuation of the vision expressed in previous plans. The Commission will continue to work with willing landowners to create a viable Preserve. The Preserve will continue to include dedicated public and private lands that have the necessary size, contiguity, and condition to support the long-term viability of the inland pitch pine-scrub oak ecosystem, the Karner blue butterfly and wildlife Species of Greatest Conservation Need. The Preserve will also continue to protect cultural resources (historic and archeological sites), accommodate a variety of appropriate recreational and educational uses, and provide opportunities for community engagement in Commission conservation and education.

Ecological resource protection and management goals in the 2017 Plan are unchanged and include:

1. Protect and manage an ecologically viable inland pitch pine-scrub oak barrens ecosystem to achieve/maintain the long-term goal of at least 2,000 fire-manageable acres using prescribed burns and other management techniques.

2. Protect and manage linkages that improve Preserve contiguity and enhance species dispersal.

3. Protect and manage buffer areas, particularly those that facilitate the Commission's fire management program.

4. Protect and manage significant cultural and natural resources, including Karner blue butterflies and other Species of Greatest Conservation Need, water resources, and historic/archeological sites.

As with the ecological goals, the recreational use goal is unchanged and generally consistent with those outlined in the original Management Plan. The recreational use goal for the Preserve is:

> Maintain and enhance public access to the Preserve in locations where doing so will not adversely impact ecological resources.

Community engagement goals include:
1. Promote the Preserve as a community resource (awareness)
2. Create appreciation and understanding of the Preserve (knowledge)
3. Engage people in the support of the work of the Commission (action).

III. The Albany Pine Bush Preserve

This section of the 2017 Management Plan describes the history, location, size, ecological communities, rare species, and existing recreational and management facilities of the Preserve.

IV. Threats

As part of the 2010 Management Plan revision the Commission analyzed challenges to Preserve protection. This "threat" analysis indicates that development remains the primary challenge or threat to achieving Preserve goals, and ultimately to the long-term viability of the natural communities and native species that make up the Preserve. Development results in increased fragmentation of the Preserve and increased human population and infrastructure in the areas surrounding the Preserve. Both of these factors significantly increase constraints on natural ecosystem functions and effective Preserve management. Natural processes such as wildland fire, nutrient and water cycling, species population growth and dispersal, interaction of subpopulations, and response to disturbance events are diminished in fragmented habitats. The juxtaposition of developed lands with Preserve property has also increased the difficulty of fire and other ecological restoration and management practices.

Other threats to Preserve goals include invasive species (plants, pests, and pathogens), inappropriate and/or excessive public use, climate change, and overabundant deer and other wildlife. These threats can affect plant and animal survival and regeneration, alter plant and animal community composition and structure, and create nuisance and/or health problems for Preserve visitors and adjacent landowners. Public understanding and support for the various management techniques used in the Preserve may help alleviate some of these threats.

V. Ecological Restoration and Management

The overall management objective for the Preserve's inland pitch pine-scrub oak ecosystem remains the same: restore and maintain at least 2,000 acres of pitch pine scrub-oak barrens that can be managed with prescribed fire. However, based on 26 years of experience managing the Preserve, the Commission has determined that the objective of simply burning 200 acres annually, by itself, is insufficient to assure the long-term viability of the Albany Pine Bush. In addition to fire, other management techniques are needed to restore and maintain habitat. Management units have been established throughout most Preserve lands, with objectives for each unit developed. The primary focus of these objectives is to restore and maintain the pitch pine-scrub oak community, Karner blue butterfly habitat, and habitat for other rare, declining, and vulnerable species.

All management (ecological and recreational) and research/monitoring in the Preserve is guided by the Pine Barrens Viability Assessment (see Appendix B). The Assessment incorporates state-of-the-art conservation science and management information, refining research and management objectives in the Preserve. Fire management activities are guided by the Fire Management Plan (see Appendix C) which provides the required prescription parameters for weather and environmental conditions and the personnel and equipment needed to safely implement prescribed burns to achieve fuel reduction and ecological objectives. The newly added Invasive and Overabundant Species Management Plan (see Appendix E) updates the 2010 Invasive Species Management Plan, recognizing the significant threats posed by native and non-native invasive plants, pests, and pathogens. Selective mechanical (cutting, mowing, etc.) and chemical (herbicide) treatments will be utilized alone and in combination with fire management in areas where fire alone is less likely to be effective in restoring inland pitch pine-scrub oak barrens or in

reducing or eliminating certain species. These techniques are also appropriate in areas where adjacent development limits the use of fire. The Commission will also engage in the restoration of natural communities by planting native plants and will continue to encourage the use of such plants by adjacent landowners. Each of these detailed plans and the Karner Blue Butterfly Metapopulation Recovery Plan for the Albany Pine Bush (see Appendix D) are provided as appendices to the 2017 Management Plan Update and provide current and future Preserve managers with the technical overview required to meet Preserve goals.

The 2017 Management Plan Update also recommends expansion of existing Karner blue butterfly habitat and populations to advance state and federal recovery goals. Other rare, declining, and vulnerable species in the Pine Bush depend primarily on the inland pine barrens ecosystem, including associated terrestrial and wetland ecological communities. These communities should be managed to ensure the availability of essential habitat elements (e.g. food sources and plant community structure) and the long-term viability of rare, declining, and vulnerable species considered Species of Greatest Conservation Need by state and federal conservation agencies.

Monitoring the status of the inland pine barrens ecosystem, Karner blue butterfly habitat, and other natural communities and rare species is essential to improve the effectiveness of management programs and will be continued. Since 2002 the Commission has expanded active monitoring for a variety of rare and declining wildlife. Inventories of vegetation communities have also been updated.

VI. Education, Outreach and Communications

The 2017 Management Plan Update refines many of the education and outreach recommendations of the 2010 Management Plan and FEIS and includes new recommendations for Commission communications. The education, outreach and communications recommendations propose pursuing a more engaged constituency, a more defined sense of place and greater public awareness of the Preserve as globally rare, nationally significant and locally distinct. These programs also strive to develop a broader understanding of Pine Bush ecology and Preserve research and management activities among target audiences.

The Commission's education, outreach and communications programs offer Preserve visitors a variety of engagement opportunities. These programs use interpretive exhibits, trails, guided and self-guided education programs, informational kiosks, portable displays, on-line resources and social media. Technology-assisted interpretation, volunteer programs (including docents, naturalists, citizen scientists and educators), internships, school curricula and educational resources, publications, and informational meetings and mailings provide diverse opportunities to reach Capital District residents.

VII. Recreation

Recreation and public use recommendations included in the 2017 Plan Update reflect public use of the Preserve and recreational demand in the area. Recreational use of the Preserve is guided by rules and regulations promulgated by the NYSDEC on September 20, 2000. These rules and regulations are posted in summary form at all official trailhead kiosks and on the Commission's website; they are designed to protect the Preserve and those who visit it by defining appropriate activities. These activities are primarily natural resource- and/or trail-oriented. The Albany Pine Bush Resource Protection and Visitor Experience Vision is included as Appendix G. It details existing Preserve recreational opportunities and infrastructure, and provides a conceptual

framework for recreational opportunities in the Preserve while assuring that the Commission's resource protection and management goals are met.

VIII. Operations

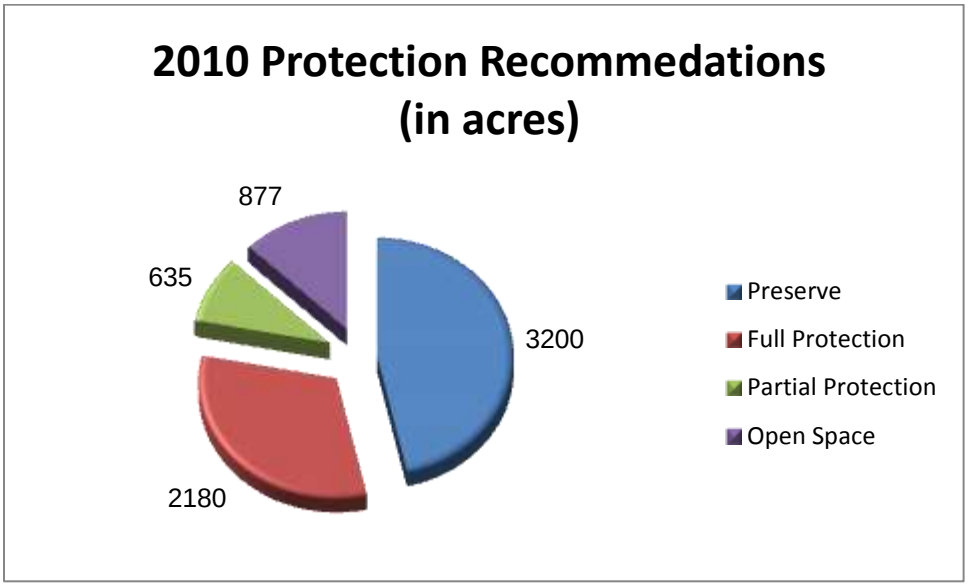
The Commission manages several structures essential to Preserve management and education programs. Stewardship and prescribed fire operations are housed in several outbuildings at 1219 Kings Road. This is also the site of the two-story "Barrens House" which provides housing for seasonal staff and interns. The 32,310 square foot Discovery Center and Commission offices are located at 195 New Karner Road.

IX. Protection

A viable Albany Pine Bush Preserve is envisioned to include 5,380 acres of the 13,000 acre study area; the Preserve currently encompasses an estimated 3,300 protected acres. The Commission has worked closely with willing landowners to protect approximately 540 acres of additional land over the last 13 years. Much of this land has been protected as a result of the support of the State of New York, The Nature Conservancy, other Commission members and the Mohawk-Hudson Land Conservancy. Approximately 3,000 acres are considered fire-manageable/restorable.

Commission experience suggests that the criteria used to develop the 2002 and 2010 Management Plans and the project review process established under the plans, are generally effective in defining protection priorities and providing Commission comment on projects that could affect the Preserve. Consequently, the 2017 protection recommendations are unchanged from those described in the 2010 plan.

As described in the 2010 Management Plan and FEIS, the 2017 Management Plan Update envisions a Preserve of approximately 5,380 acres. This vision is based on the recommendation that 2,180 acres be designated for full protection (i.e. protection of undeveloped portions of designated areas in their entirety).



The Commission will continue to actively work with willing landowners to acquire or otherwise protect lands within the Pine Bush Study/Project Review Area while respecting private property

rights. As in previous plans, an important component of the Commission's resource protection activities will also be the continued provision of review and comment on proposed development projects within the Albany Pine Bush Project Review Area.

X. Implementation

The Albany Pine Bush Preserve Commission continues to face multiple financial challenges to accomplish its mission of managing and protecting the Albany Pine Bush. These include securing the resources to support an operating budget, a capital budget, and endowments. Funding and in-kind support during the first years of the Commission came from various Commission members and the New York State Legislature. Additionally, the City of Albany provided mitigation fees associated with the interim landfill. To date, more than $30 million have been invested in the Albany Pine Bush Preserve. Operating funds are currently drawn from the New York State budget (Environmental Protection Fund), a Discovery Education Endowment established by TrustCo Bank, landfill mitigation, lease revenue, program fees, private fund raising, and grants from public and private agencies.

The fiscal projection for the next five years is based on recent growth. Operational expenses associated with achieving the Commission's vision of an ecologically viable Preserve, public recreational opportunities along with operations for the Discovery Center and associated educational and public programs are estimated at $3.1 million per year. The land acquisition and protection goals identified in this plan will require an investment of an additional $25 to $30 million.

XI. Environmental Impacts

The 1993, 1996, 2002 and 2010 Management Plans included the components of an Environmental Impact Statement (EIS). These Plans/EISs identified both beneficial and potentially adverse impacts associated with plan implementation. Ways to mitigate potential adverse impacts were also described. Consequently, the impacts of Preserve protection and management as proposed in the previous plans have already been addressed. Since there are no substantive changes proposed within the 2017 Management Plan Update, no additional impact analysis is provided. The 2010 Management Plan/FEIS is located at: www.albanypinebush.org/commission/management-plan.

It is therefore the conclusion of the 2010 environmental impact statement that there are substantial ecological and socioeconomic benefits associated with Plan implementation, and that any potential adverse impacts can be adequately mitigated.

I. INTRODUCTION

A. Albany Pine Bush Preserve and Albany Pine Bush Preserve Commission

In December of 1988, the New York State Legislature established the Albany Pine Bush Preserve and the Albany Pine Bush Preserve Commission. The legislation declared it to be in the public interest to "…protect and manage the Albany Pine Bush by establishing an Albany Pine Bush Preserve consisting of dedicated public and dedicated private land and a commission made up of representatives of state and local governments and private citizens to manage the Preserve for purposes of its protection and controlled and appropriate recreation and education purposes" (ECL, Article 46, 1988). The Albany Pine Bush Preserve is a globally-rare, nationally significant, and locally distinct open space resource located between the cities of Albany and Schenectady, New York (Figure 1). It supports the best remaining example of an inland pitch pine-scrub oak barrens ecological community, the endangered Karner blue butterfly (Lycaeides melissa samuelis), and at least 74 other wildlife Species of Greatest Conservation Need (SGCN). The Preserve has been designated a National Natural Landmark by the U.S. Secretary of the Interior, a National Heritage Area Site by the National Park Service, a Bird Conservation Area by New York State and an Important Bird Area by New York Audubon.

The Commission currently consists of representatives of the New York State Department of Environmental Conservation (NYSDEC), the New York State Office of Parks, Recreation and Historic Preservation (OPRHP), The Nature Conservancy (TNC), Albany County, the City of Albany, the Town of Colonie, and the Town of Guilderland. The Commission also includes four private citizen representatives appointed by the Governor and approved by the Senate. The Commission meets on a quarterly basis to conduct business and review the status of Preserve protection and management activities.

The Commission is a unique public/private partnership, a public-benefit corporation and a NYS Public Authority that works with willing landowners and a number of municipal, state, federal, and private partners to assure the protection and management of the natural and cultural resources of the Albany Pine Bush. It has no regulatory authority beyond Preserve borders. In advancing its mission to protect and manage the Albany Pine Bush, the Commission believes in a balanced approach that takes into account the positions and recommendations of its members as well as input from property owners, interest groups, and the general public. In that regard, the Commission developed a strategy to more fully engage people in the Preserve and build broad-based, sustained local support for Preserve protection and management. The strategy is designed to reinforce the Preserve's brand as globally rare, nationally significant, and locally distinct and to establish the Preserve's position as the place with which to affiliate for those interested in conservation science, ecology, and natural history in the Capital District.

The Commission has been remarkably successful in its mission, with significant progress made toward achieving an ecologically viable Preserve. To date, over 3,300 acres have been protected and more than 2,200 acres managed through the use of prescribed fires, mowing and cutting vegetation, controlling invasive species, and establishing native plantings. Tens of thousands of visitors enjoy the recreational benefits of the Preserve every year, including thousands of local school children. The 20 miles of marked trails and the rules established by the NYSDEC allow for a variety of non-motorized recreational activities within the Preserve.

The Commission maintains a Technical Advisory Committee that includes representatives of all the involved agencies, municipalities, and TNC. The Technical Advisory Committee meets

regularly with Commission staff to discuss technical issues, such as the status of Preserve protection efforts, management activities, and education and outreach programs. The Committee also reviews pending development projects within the Pine Bush Project Review Area and helps formulate the Commission's position on these projects.

The Commission currently maintains a staff of 22, including:

Executive Director	Director of Finance/Operations
Conservation Director	Education Program Director
Communications Director	Stewardship Director
Conservation Biologist	Field Ecologist
Fire Management & GIS Specialist	Community Engagement Coordinator
Outreach Coordinator	Education Program Manager
Discovery Center Manger	Office Manager
Lead Educator	Preserve Steward and Botanist
Visitor Services Specialist	5 part-time Visitor Services Associates

The Commission also hires seasonal staff and interns as needed to support Preserve management (e.g. prescribed burning program), research (e.g. Karner blue butterfly monitoring), and educational (e.g. Education programs) activities. The Commission operates on an annual budget of $3,129,000 (fiscal year 2015/2016), but also relies on grants, and in-kind support from member agencies, organizations and municipalities. The Commission has also developed a dedicated corps of volunteers and partners that assist with activities such as research and monitoring, boundary and trail marking, invasive species control, native plant restoration, interpretive services and educational programming.

B. Summary of Preserve Planning and Management

Environmental Conservation Law (ECL) Article 46 requires that the Commission prepare a Management Plan for defining the protection and beneficial public use goals for the Preserve and the means for their attainment. Further ECL Article 46 states that the Commission must review the management plan not less than once every five years and propose amendments as needed. Work on the first Preserve Management Plan began in 1990, when the public and private lands to be dedicated to the Preserve totaled less than 1,700 acres. At that time, the Commission had no full-time staff and no permanent offices. Preserve management activities were in the research stage and formal recreational and educational facilities and programs were essentially nonexistent. The first *Management Plan and Final Environmental Impact Statement for the Albany Pine Bush Preserve* (APBPC 1993) was adopted by the Commission in May of 1993.

The 1993 Plan included inventory information on the natural resources, cultural features, land use, recreational facilities, and educational needs associated with the Albany Pine Bush. That Plan also included, by reference, a Fire Management Plan for the Albany Pine Bush Preserve prepared for the Commission by TNC (Zaremba et al. 1991). Goals, objectives, and specific management recommendations for the Preserve were developed based on the analysis of inventory information, input from the public and data from various published and unpublished sources. These goals, objectives, and management recommendations addressed 1) natural resource protection, 2) natural resource management, 3) public use, and 4) information and education. The 1993 Management Plan proposed an administrative structure and financial plan for the Commission, and included an Environmental Impact Statement (EIS) in accordance with

the requirements of State Environmental Quality Review (SEQR). At the time the 1993 Management Plan was adopted, the Preserve included approximately 1,900 acres.

The Commission implemented protection, management, recreational, and educational programs guided by the recommendations of the 1993 Plan. In 1994, the Commission hired its first Executive Director, bringing full-time Commission staff to five individuals. By January 1995, the Albany Pine Bush Preserve included approximately 2,200 acres of land, of which it was determined approximately 1,630 acres could be restored to, or maintained as, inland pitch pine-scrub oak barrens. However, development and human use pressures continued to threaten the integrity and contiguity of the Pine Bush. Development-related impacts raised serious concerns regarding the long-term viability and protection of the Albany Pine Bush and the rare species and natural communities it supports. These impacts also resulted in legal action from Save the Pine Bush (a local volunteer activist group dedicated to the protection of the Albany Pine Bush) demanding that the recommendations of the 1993 Plan be strengthened. These actions required that the Commission clarify issues related to Preserve size and protection strategies. One important issue was the amount of land suitable for fire management. The 1993 Management Plan provided only general estimates of fire-manageable land. Commission staff noted that development projects were being approved without a detailed analysis of the amount of "burnable" acres in the Preserve, the amount of land needed to meet the threshold of at least 2,000 fire-manageable acres, or the amount of land outside of the Preserve that could be burned or purchased as buffer to allow for fire management within the Preserve.

To address these issues, the Commission's staff and Technical Advisory Committee prepared a supplement to the 1993 Management Plan, referred to as *The Albany Pine Bush Preserve Protection and Project Review Implementation Guidelines and FEIS* (APBPC Tech. Comm. 1996). Adopted by the Commission in February 1996, the Implementation Guidelines applied the protection criteria set forth in the 1993 Management Plan to: 1) identify lands recommended for acquisition or other protection to ensure the future viability of the Albany Pine Bush Preserve, and 2) provide a framework for the review of proposed projects that may impact the Preserve to guide municipalities and other involved agencies in their decision-making processes. A total of 1,730 acres of then unprotected land were recommended for full protection and incorporation into the Preserve. The Preserve envisioned by these recommendations would total 3,950 acres, of which approximately 2,390 were considered fire-manageable. The Implementation Guidelines also proposed a coordinated review process for all projects potentially affecting the Preserve and/or its management.

The principles of the 1996 Implementation Guidelines have guided the Commission's resource protection and project review efforts to the present. Since adoption of the 1996 Implementation Guidelines, approximately $30 million has been invested in protection and management of the Preserve. The State of New York has contributed significantly to this effort. Millions of dollars have been expended on the protection of hundreds of acres within the Preserve through state funding mechanisms, including the Environmental Protection Fund and the 1996 Clean Air/Clean Water Bond Act. Approximately 540 acres have been added to the Preserve since 2002, bringing its total size to over 3,300 acres. While most of these lands have been purchased in fee, the Commission has also utilized innovative means of land protection such as land swaps, conservation easements and management agreements. More than 2,200 of these acres have been managed with prescribed fire, mowing, planting, and other techniques to restore and maintain native habitat (Figure 7). As a result of ongoing research, much has been learned about the Commission's ability to restore and manage the various ecological communities that make up the

Preserve. In addition, various public access, recreational, and educational opportunities have been provided and are utilized by 100,000 visitors each year.

In 2002 the *Management Plan and Final Environmental Impact Statement for the Preserve* (APBPC 2002) was prepared to update and refine protection, management, recreation, education, and outreach goals and strategies for the Preserve. Significant progress has been made. However, the long-term future of the Albany Pine Bush is by no means assured. Development pressures in and around the Pine Bush continue. Since 2002, approximately 190 acres of land that were recommended for full or partial protection in the 2002 Management Plan have been lost to development. Development pressure in Pine Bush municipalities continues and additional unprotected areas remain at risk. Research and management activities have also refined restoration and management objectives. The Commission reviewed all of these factors in 2007 and determined it was appropriate to update and revise the Preserve Management Plan. The *2010 Management Plan and Final Environmental Impact Statement* (APBPC 2010) refined ecological management, education and Preserve use objectives and updated protection recommendations. The protection recommendations resulted in a revised Pine Bush Protection and Project Review Area (Study Area) boundary and a recommendation for protecting at least 5,380 acres between Fuller Road in the City of Albany and the Woodlawn Preserve at the Schenectady County boundary.

The 2017 Management Plan Update includes a revised financial plan and refined education, outreach, and communications strategies, as well as an updated invasive and overabundant species management plan (Appendix E). The 2017 Management Plan Update does not propose any changes to ecological restoration and management strategies described in earlier plans and environmental impact statements (APBPC 2010).

C. Implementing the 2017 Management Plan

The 2017 Management Plan Update replaces previous management plans for the Preserve and incorporates new information and experience obtained by the Commission since preparation of the previous plans. This Plan provides a framework for Preserve management for the next five years and beyond.

The Albany Pine Bush Preserve Commission diversified financial support of its mission of managing and protecting the Albany Pine Bush Preserve. Currently, operational funds are provided from the New York State budget (Environmental Protection Fund), a Discovery Center Education Endowment from TrustCo Bank, City of Albany landfill mitigation funds, private fund-raising, as well as grants from public and private agencies. The financial plan for implementing the 2017 Management Plan over the next five years is based on a similarly diversified and expanded funding base. Operational expenses associated with achieving the Commission's vision of an ecologically viable Preserve with enhanced public recreational and educational opportunities are estimated at $3.1 million per year. To achieve all the land protection goals identified in this plan will require an estimated investment of an additional $30 million. As in the past, strong support from the State of New York, member agencies, municipalities, and organizations of the Commission and other public and private partners will be critical to the Commission's implementation of this management plan.

II. COMMISSION VISION AND GOALS

A. Introduction

The vision for the Albany Pine Bush Preserve is guided by ECL Article 46 and previous Preserve Management Plans. Protection goals address land acquisition and other means of resource protection necessary to create a viable Preserve. Ecological resource goals address land protection as well as restoration and maintenance of native species, ecological communities, and ecological processes within the Preserve. Community engagement goals address knowledge and appreciation of the Preserve's resources through a constituency-centered approach that enhances Commission involvement with surrounding community members and partners.

B. Commission Vision

The mission for the Albany Pine Bush Preserve Commission is to "…protect and manage the Albany Pine Bush by establishing an Albany Pine Bush Preserve consisting of dedicated public and dedicated private land and a commission made up of representatives of state and local governments and private citizens to manage the Preserve for purposes of its protection and controlled and appropriate recreation and education purposes" (ECL, Article 46, 1988). In order to achieve this mission, a vision for creating and managing the Albany Pine Bush Preserve was outlined in previous Management Plans. Consistent with these documents the current vision is a cooperative partnership between the Commission and private landowners to develop a viable Preserve, manage, protect and restore unique ecological resources, engage core audiences, build constituent support, and provide appropriate public benefits consistent with its enabling legislation. The vision includes dedicated public and private lands that have the necessary size, contiguity, and condition to maintain the natural ecological processes that support the long-term viability of the inland pitch pine-scrub oak barrens and builds broad-based, sustained local support for Preserve protection and management. The vision also provides for the protection of cultural resources, accommodates a variety of recreational uses, and engages surrounding communities through enhanced volunteer, education and outreach opportunities.

C. Ecological Resource and Protection Goals

The Preserve envisioned in this plan meets the following ecological resource protection and management goals and objectives:

Goal 1: Protect and Manage a Viable Inland Pitch Pine-Scrub Oak Barrens Ecosystem

Objectives

1. Acquire the necessary acreage to obtain a minimum of 2,000 acres of pitch pine-scrub oak barrens that can be managed by fire.

2. Restore and maintain the natural plant and animal species composition of the inland pitch pine-scrub oak barrens ecosystem by continuing and expanding the Preserve's ecological management programs.

These objectives are important for several reasons. First, in order to maintain the long-term viability of the constituent pine barrens natural communities, enough land must be protected and managed to maintain and/or simulate natural ecological processes such as fire. Second, it is

essential to protect enough land to support large enough populations of rare, declining, and vulnerable species to ensure their persistence. Sufficiently large populations are necessary to maintain genetic diversity, to prevent the extirpation of a species, and maintain essential ecological functions (e.g. pollination, seed dispersal, trophic dynamics, etc.). Finally, it is essential that the natural variation of embedded ecological communities (successional northern sandplain grassland, pitch pine-scrub oak barrens, pitch pine-scrub oak thicket, pitch pine-oak forest) within the inland pitch pine-scrub oak barrens ecosystem be restored and/or maintained.

Particularly important is the relationship between the inland pitch pine-scrub oak barrens ecosystem and fire. While other management techniques (such as mechanical and chemical treatment) may serve to limit successional processes and assist in natural community restoration, there is no compelling evidence that these methods can successfully replicate the natural ecological process of fire (Menges and Gordon 2010). The importance of fire and its role in shaping the Albany Pine Barrens has been described in Section III of this Management Plan and in previous Management Plans and reports (Zaremba et al. 1991; Gebauer et al. 1996).

Ecological restoration of degraded pine barrens and areas not currently supporting pitch pine-scrub oak vegetation is an essential step toward a viable Preserve and sustainable populations of rare species. Specific ecosystem viability and ecological restoration goals are described in Sections V and VII. The degree to which existing plant communities are restorable to pitch pine-scrub oak barrens communities are described in Table 10. Successional southern hardwood forest, pine plantation, brushy cleared land, or cropland are considered 100 percent restorable. Additionally, certain natural communities, such as successional northern hardwood forest, Appalachian oak-pine forest, and pine-northern hardwood forest are considered partially restorable depending on soils, slope and hydrology. However, these latter communities historically occurred in the Pine Bush (in ravines and on pockets of mesic soils) and should not be completely converted to pitch pine-scrub oak communities.

Goal 2: Protect and Manage Linkages

Objectives

1. Increase the contiguity of the Albany Pine Bush Preserve to the greatest extent possible to reduce or eliminate fragmentation.

2. Provide dispersal opportunities to maintain the genetic diversity of species.

3. Acquire, restore, and manage lands that “in-fill” the existing Preserve and/or provide linkages between isolated portions of the Preserve. Of special importance are linkages connecting disjunct subpopulations of Karner blue butterfly (and other SGCN) to other subpopulations in the Preserve.

4. Establish new Karner blue butterfly subpopulations to achieve recovery goals for the species.

Edge-effects associated with Preserve fragmentation and development decrease the Preserve’s effectiveness as a long-term reservoir for biodiversity and limit the Commission’s ability to effectively restore and manage the Preserve’s ecological resources. Creating linkages and in-filling decreases Preserve fragmentation. Linkages provide dispersal routes among protected lands. Such dispersal is essential for maintaining genetic diversity and population integrity

throughout the Preserve. The Albany Pine Bush Preserve currently consists of several semi-isolated areas of varying size. The Commission's goal is to provide multiple and sizeable connections of suitable habitat between all areas of the Preserve, because plant and animal species cannot be directed to disperse within specific corridors. The Commission has made progress protecting linkages, particularly in the Rapp Road corridor, where recent acquisitions and ecological restoration have strengthened the connection between the main body of the Preserve and the Rensselaer Lake area.

Dramatic declines in the populations of the Karner blue butterfly in the Albany Pine Bush and throughout its range can be attributed to habitat loss and fragmentation as a result of development and fire suppression (Fuller 2008, USFWS 2003). Karner blues cannot survive on a given site indefinitely; instead subpopulations disappear and appear across the landscape, taking advantage of newly established habitat that results after a disturbance such as fire. Consequently, linkages are essential for enabling the Karner blue (and other SGCN wildlife) to move around the landscape. In addition, it is also essential that new subpopulations of Karner blues be established within the dispersal range of the existing colonies, to allow movement of individuals between the isolated subpopulations and areas of suitable habitat within the Preserve.

Goal 3: Protect and Manage Buffer Areas

Objectives

1. Acquire or protect through fee title acquisition, conservation easements, management agreements, or set asides any open lands adjacent to the Preserve that, if developed, would inhibit fire management on protected lands, impact water resources, or significantly increase impacts from adjacent land uses.

2. Maintain existing open space parcels, such as the current or future closed portions of the Albany landfill, National Grid power line rights-of-way, New York State DOT lands, Cook Park, the Pinehaven Country Club, etc., by obtaining management agreements with owners or working with municipalities to ensure that the design of any development of such sites is consistent with Preserve management activities.

3. Work with municipalities to encourage open space protection.

4. Explore the possibility of obtaining smoke easements from landowners to reduce potential conflict with fire management activities in the Preserve.

Article 46 of the ECL provides for the establishment of buffer zones critical to maintaining the long-term integrity of the Preserve. Buffer areas are essential to permit or improve the manageability of Preserve lands. Smoke management, perhaps as much as the management of fire itself, limits the extent of prescribed burns in the Preserve (Hawver 1996). By creating buffers, potential smoke and fire management impacts on the surrounding area can be reduced. Buffers also minimize encroachment and other impacts from peripheral development and help protect wetlands and water resources in and near the Preserve. Watershed protection is essential to maintain hydrologic processes which enable several Pine Bush wetland systems to persist. Finally, many of the buffer areas could be used for recreational activities. This would better allow the Preserve to serve as an open space and recreational resource to the Capital District, while protecting the unique communities and rare species that reside there.

Goal 4: Protect and Manage Significant Cultural and Natural Resources

Objectives

1. Acquire, restore, and manage lands necessary to recover the Karner blue butterfly.

2. Monitor and manage the Preserve's wildlife resources to advance the goals of the State Wildlife Action Plan for Species of Greatest Conservation Need (NYSDEC 2015).

3. Protect and manage wetlands, streams, and ravines that provide habitat for rare and locally important species and maintain the hydrologic and pyric processes of pine barrens vernal ponds.

4. Protect sites that contain known historic or archeological resources.

5. Segregate incompatible uses and restrict particularly damaging uses. Remove inappropriate or unnecessary trails from ecologically sensitive areas. Explore opportunities for relocating trails to areas that can better tolerate recreational pressure utilizing the Albany Pine Bush Preserve Resource Protection and Visitor Experience Vision guidelines.

6. Monitor use and enforce rules designed to control unauthorized or inappropriate activities such as dumping, the use of off-road vehicles, or trespassing on adjacent private properties.

As described by the New York State Legislature (ECL Article 46) and elaborated upon in previous Management Plans, the primary purpose of the Preserve is to protect the rare pine barrens communities and other ecologically significant resources. Studies prepared for the initial Management Plan (1993) identified rare species, significant ecological communities, as well as cultural resources within the Pine Bush study area. Additionally, research and Commission investigations undertaken since 1993 have revised and expanded natural community mapping, updated wetlands descriptions (Mattox 1994), updated rare species status as well as identified ecosystem viability (Appendix B) and endangered species goals (Appendix D) for the Preserve. Since the Karner blue is protected under both the federal and state endangered species acts, protection of this butterfly is an important goal in and of itself. The State Wildlife Action Plan (NYSDEC 2015) describes conservation strategies for rare and declining wildlife, which are considered Species of Greatest Conservation Need (SGCN) by state and federal agencies. Seventy (75) SGCN have been documented in the Albany Pine Bush since 1980.

The Albany Pine Bush Preserve lies within NYSDEC Wildlife Management Unit (WMU) 4J. NYSDEC management goals and the recommendations of NYSDEC biologists will be used in coordination with the Commission's biodiversity conservation goals and the recommendations of TNC and other scientists to determine wildlife population objectives and how to attain them in the Preserve. Several archeological surveys have also been completed within the Albany Pine Bush Preserve Study Area (Hartgen 1991, 2006, 2007, 2008, 2009, 2013, 2015; Landmark Archeology 2011, 2012), and will be used to guide cultural history conservation in the Preserve.

D. Community Engagement Goals

To achieve its legislative mandate and to maximize public benefits, the Commission has adopted a constituency-centered approach to facilitate community engagement.

Goal 1: Promote the Preserve as a community resource (awareness)

Objectives

1. Use the Preserve as an anchor to establish a sense of place for neighbors.

2. Further establish the Discovery Center as the gateway to the Preserve.

3. Create focused community outreach including outreach events, on-line resources, publications, social media, marketing and partnerships with community organizations.

4. In alignment with the Albany Pine Bush Preserve Resource Protection and Visitor Experience Vision (Appendix G) maintain a system of trails in the Albany Pine Bush Preserve.

5. Provide a variety of controlled and appropriate educational and recreational uses in accordance with NYSDEC rules and regulations for the Preserve and WMU 4J.

Goal 2: Foster appreciation and understanding of the Preserve (knowledge)

Objectives

1. Provide Discovery Center and other exhibits that engage audiences.

2. Deliver Preserve-centric education and interpretive programs.

3. Enhance efforts to communicate information about current management activities in the Preserve.

Goal 3: Engage people in the support of the Preserve to foster an understanding that it is globally-rare, nationally-significant and locally distinct (action)

Objectives

1. Use a variety of strategies including focus groups, information sessions, volunteer opportunities, and strategic partnerships to build constituency.

2. Develop opportunities that allow people to show their support.

3. Cultivate ambassadors who amplify the conservation messages of the Commission in the community.

III. THE ALBANY PINE BUSH PRESERVE

A. Introduction

This section briefly describes the history of the Albany Pine Bush Preserve, along with its existing location, size, ecological communities, rare species, and recreational and management facilities. This section includes a review of study area boundaries and additional discussion of the ecological processes that shape the natural communities of the Pine Bush.

B. Background

Origin of the Albany Pine Bush

Approximately 20,000 years ago, the retreat of the Wisconsin ice sheet resulted in the creation of a lake that geologists refer to as "Glacial Lake Albany." The lake resulted from glacial meltwater which could not flow north due to the retreating ice sheet (LaFleur, 1976). Flow from the Mohawk Valley emptied into this lake forming a large delta with layers of silt, sand, and clay deposited on the lake bottom. When Lake Albany drained approximately 12,000 years ago, the sand deposits were exposed to wind and shaped into dunes. The sandy, well-drained soils in this area were eventually dominated by communities and species adapted to dry conditions and periodic fires. Although its exact size cannot be documented, this ecosystem, characterized by extensive areas of pitch pine-scrub oak barrens, at one time covered between 25,000 and 68,000 acres in the area between Albany and Schenectady (Rittner 1976). A similar sand plains habitat occurs in other parts of Glacial Lake Albany, including areas near Saratoga Springs and Glens Falls. However, while these areas still support several rare species, they lack the distinctive dune complexes and intact pine barren communities found within the Albany Pine Bush.

Land Use History

Human use of the Pine Bush has had profound effects on the ecological communities we find today. Studies in other pine barrens (Motzkin et al. 1999) as well as within the Albany Pine Bush (Finton 1998) indicate the importance of historic land use (agriculture, logging, etc.), recurring wildland fire, and variations in substrate on the formation of pine barrens and associated communities.

Human occupation/use of the Pine Bush began approximately 10,000 years ago by Paleo-Indian hunting groups (Barnes 2003). Europeans arrived in the Albany area in the early 1600s. Early settlers traveled through the Pine Bush as settlements formed and grew west of Albany (Barnes 2003). The Kings Highway bisected the pine barrens, but development through the 17th and 18th centuries seems to have been limited to a few taverns along the highway. Along with providing transportation routes that facilitated trade, travel, and military activities, the Pine Bush also provided vast quantities of wood for fuel, lumber, and tar. Late 18th and 19th century developments in industry and transportation (e.g. glass works and steam-powered riverboats) increased demand for this wood supply. Apparently, the area was generally considered a wasteland (Barnes 2003, Rittner 1976). In the mid 19th century, dunes were mined and much of the area gradually became a dumping ground (Zantopp 2000).

Land use in the Pine Bush went through rapid changes in the 20th century. Finton (1998) analyzed aerial photographs taken in 1928, 1940, and 1990 to determine how land cover had changed during that period. The dominant trend is clearly an increased dominance of hardwood forest and

developed land, including the conversion of agricultural land, grassland/heath, and pitch pine (Pinus rigida) - dominated communities, to areas developed for commercial and residential purposes (Finton 1998).

Soils are poor in the Albany Pine Bush, but there has been wide-spread soil disturbance as a result of agricultural and development activity in the area during the past two centuries (Finton 1998; Gebauer et al. 1996). These kinds of disturbances appear to have resulted in increased dominance of pitch pine forest and invasion by species not native to the Pine Bush, such as black locust (Robinia pseudoacacia). In all, these kinds of human activities undoubtedly had profound effects on the composition of vegetation currently found in the Albany Pine Bush.

Fragmentation of the Pine Bush also increased during the 20th century, especially with the construction of the NYS Thruway (I-90), which runs through the heart of the Pine Bush, in 1952 and the Albany landfill in 1969. Today the Pine Bush is criss-crossed by an extensive transportation network including major interstate highways (I 87 and I90), U.S. Route 20, state highways (Routes 155, 146, and 5), county roads (Route 156), and a number of local roads. All provide key access to the growing communities of the region. The prevalence of road infrastructure has made this area of the Capital District highly desirable for growth and development; the Pine Bush is located at the crossroads of the Capital District.

Establishment of the Albany Pine Bush Preserve

While some recognized the Albany Pine Bush as an area worthy of protection in the early 20th century, actual protection of land in the Pine Bush did not commence until the early 1970s. In 1973 the NYSDEC purchased 450+ acres of land that became known as the Pine Bush Unique Area. Since the creation of the Albany Pine Bush Preserve Commission, additional land acquisition/protection by the City of Albany, the NYSOPRHP, the towns of Colonie and Guilderland, the NYSDEC, and The Nature Conservancy followed.

During the mid-1980s, a series of development proposals in the Albany Pine Bush, including the proposed expansion of the Albany Landfill, led to the preparation of several environmental impact statements and associated studies. The seminal study by Givnish et al. (1988) and Givnish 1995) detailed that about 2,000 fire-manageable acres must be protected and managed to assure the long-term survival of the Albany Pine Bush and the endangered Karner blue butterfly (Givnish et al. 1988). Givnish (1995) later clarified these minimum area requirements. Protection of this minimum area became a condition for permit approval for the landfill expansion.

In December of 1988, the New York State Legislature established the Albany Pine Bush Preserve Commission. The legislation recognized the Albany Pine Bush as a "…landscape of rare and endangered natural communities and species…especially valuable as an open space resource and, if properly managed, as a passive recreational area and educational laboratory" and declared it would be in the public interest to "…protect and manage the Albany Pine Bush … for purposes of its protection and controlled and appropriate recreation and education purposes." Since the establishment of the Commission, approximately 3,300 acres of public and private land have been protected as part of the Preserve (Figure 8).

Study Area/Project Review Area

The Albany Pine Bush Preserve Commission focuses its protection and management efforts within the Albany Pine Bush Preserve Study Area. The Study Area, also referred to as the Pine

Bush Project Review Area in the 1996 Implementation Guidelines, was originally described in the 1993 Management Plan to include portions of City of Albany, the Town and Village of Colonie, and the Town of Guilderland. Based on the public comments received during the 2002 Management Plan update, the possibility of expanding the study area boundaries was explored as part of the 2010 Management Plan update process. Expanding the boundaries to the Albany/Schenectady County border was justified based on the historic extent of the pine barrens, the presence of remnant areas of pitch pine-scrub oak barrens, and the complementary conservation efforts in/adjacent to the Woodlawn Preserve in Schenectady. The 2010 expanded study area contains approximately 13,000 acres and is bounded on the north by Route 5 (Central Avenue), to the south by Route 20 (Western Avenue), to the east by Fuller Road, and on the west by a line running along the Albany-Schenectady County border, I-890, the I-90/I-890 Ramp, the New York State Thruway, Lone Pine Road, and Route 146 (Figure 8).

C. Ecological Resources

Ecological Communities in the Albany Pine Bush

Ecological communities represent assemblages of species that occur together in a definable area within a given period, have the potential to interact with one another, and depend on similar ecological processes and conditions to maintain themselves (Grossman et al. 1998). Communities within the Albany Pine Bush have been mapped and described by several different sources. Communities within the Preserve area were first mapped by the New York Natural Heritage Program prior to preparation of the 1993 Preserve Management Plan (Schneider et al. 1991). Mattox (1994) located and described–but did not map–wetlands. Communities were mapped again during preparation of the 1996 Implementation Guidelines within the proposed Pine Bush Protection Area (APBPC Tech. Comm. 1996) and again in 2004 by the Commission. Finton (1998) used a different classification system in mapping the 1928, 1940 and 1990 vegetation in a portion of the study area. Since these communities were mapped, a National Vegetation Classification has been developed by Grossman et al. (1998). Table 1 lists the communities found in the Albany Pine Bush by both the New York Natural Heritage Program designation and the National Vegetation Classification names.

For the 1996 Implementation Guidelines, Commission staff mapped natural communities in the study area between 1993 and 1995. Aerial photographs were used for mapping and field visits when appropriate were used to verify the general structure and composition of the communities as well as delineate boundaries. The boundaries were digitized at a scale of 1:24,000 by the Albany County Planning Department. Vegetation community boundaries were mapped again in 2004 and 2013 using QuickBird satellite imagery and Geographical Information Systems (GIS) software. The location and extent of these communities within the Pine Bush Protection Area is illustrated in Figure 3. Table 2 lists the acreage of these communities, as classified according to the New York Natural Heritage Program classification system (Edinger et al. 2014) with local modifiers based on the Commission's experience with restoring desirable ecological functions for rare wildlife habitat for each PPSOB variant.

Table 1. Ecological Communities of the Albany Pine Bush Preserve.[1, 2]

NY NATURAL HERITAGE PROGRAM CLASSIFICATION	NATIONAL VEGETATION CLASSIFICATION
Appalachian oak-pine forest	*Pinus strobus-Quercus* (*alba, rubra, velutina*) forest or Eastern White Pine-(White Oak, Northern Red Oak, Black Oak)
Pitch pine-scrub oak barrens Pitch pine-scrub oak thicket Pitch pine-scrub oak forest	*Pinus rigida-Quercus ilicifolia-Lespedeza capitata* woodland or Pitch Pine-Bear Oak-Roundhead Bushclover Woodland
Pine – northern hardwood forest	*Pinus strobus-Pinus resinosa-Cornus canadensis Forests* or White Pine-Red Pine-Canadian Bunchberry Forest
Red maple hardwood swamp	*Acer rubrum-Fraxinus (americana, pennsylvanica)-Lindera benzoin-Symplocarpus foetidus* Forest or Red Maple–(Green Ash, White Ash)-Northern Spicebush-Skunk Cabbage Forest
Shallow emergent marsh	*Calamagrostis canadensis-Phalaris arundinacea* herbaceous vegetation or Bluejoint-Reed Canary Grass Herbaceous Vegetation *Carex stricta* seasonally flooded herbaceous alliance or Tussock Sedge Seasonally Flooded Herbaceous Alliance
Successional northern hardwoods	*Quercus rubra-Acer rubrum-Betula* spp.-*Pinus strobus* forest or Northern Red Oak-Red Maple-Birch species-Eastern White Pine Forest
Successional southern hardwoods	*Acer platanoides-Robinia psuedoacacia-Pinus sylvestris* Exotic Ruderal Forest
Successional northern sandplain grassland	*Vaccinium angustifolium /Schizachyrium scoparium – Carex lucorum* Shrub Herbaceous Vegetation or Northern Sandplain Grassland
Unpaved road or path	
Sand mine	
Brushy cleared land	
Landfill	

[1] New York Natural Heritage Program. 2015. Online Conservation Guide for Pitch Pine-Scrub Oak Barrens. Available from: http://www.acris.nynhp.org/guide.php?id=9953. Accessed March 6th, 2017.
[2] NatureServe Explorer. 2015. Available from: http://explorer.natureserve.org. Accessed March 6, 2017.

Table 2. Estimated Area of Community Types Mapped within the Albany Pine Bush Preserve and Study Area.

COMMUNITY TYPE	PRESERVE (acres)	STUDY AREA (acres)
Natural Communities		
Pitch pine-scrub oak variants	1,217	1,800
Pitch pine-scrub oak forest	621	1,200
Pitch pine-scrub oak barrens & thicket	358	620
Successional Northern Sandplain Grassland	238	
Appalachian oak-pine forest	1,062	2,200
Red maple hardwood swamp	105	400
Other wetland communities	137	450
Open water	36	30
Successional Communities		
Successional northern hardwoods	260	1,200
Successional southern hardwoods	448	2,200
Successional old field	0	300
Disturbed/Cultural Uses		
Developed	35	4,400
Total	3,300	12,980

Area calculations are estimates based on interpretation of aerial imagery illustrated in Figure 3.

Summary descriptions of the major communities that occur within the Albany Pine Bush are presented below; these descriptions are based on available literature and Commission experience.

Pitch Pine-Scrub Oak Communities

Pitch pine-scrub oak communities dominate the Albany Pine Bush landscape and have been the focus of conservation efforts to date. These communities 1) are dominated by pitch pine and other species dependent on frequent disturbance by fire; 2) tend to occur on sandy soils that have low nutrients and wide ranges of soil moisture during the growing season; and 3) provide habitat for numerous rare species, especially birds, reptiles, moths and butterflies.

Based on Gebauer et al. (1996), Finton (1998), Bried and Gifford (2008), Edinger et al. (2014) and more than 25 years' experience, the Commission identifies four successional variants or embedded communities that make up the inland pitch pine-scrub oak barrens ecosystem in the Albany Pine Bush. Those communities include successional northern sandplain grassland, pitch pine-scrub oak barrens, pitch pine-scrub oak thickets, and pitch pine-scrub oak forest. These four variants are generally defined by differences in the percent cover of pitch pine and scrub oak. Average thresholds for identifying each successional variant or embedded community are outlined below. Specific guidelines and rationale for these ranges of cover are further detailed in Bried and Gifford (2008). It's important to note that Edinger et al. (2014) do not differentiate pitch pine-scrub oak thickets from pitch pine-scrub oak barrens; a future refinement of these community descriptions by the NYNHP may therefore be warranted.

Pitch pine-scrub oak barrens (PPSOB) (G2/S1) are a shrub-savanna community with 20 to 60 percent cover of pitch pine that are maintained by fire frequencies of 6-15 years. Scrub oak (*Quercus illicifolia* and *Q. prinoides*), dominates an open-canopied shrub layer with an ideal average density of approximately 30% cover (Bried and Gifford 2008); huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium angustifolium* and *V. pallidum*), sweetfern (*Comptonia peregrina*), New Jersey tea (*Ceanothus Americana*), prairie willows (*Salix humilis, S. h. tristis*) and Eastern dwarf cherry (*Prunus pumila var. susquehanae*) are common. Grasses include big bluestem (*Andropogon gerardii*), little bluestem (*Schyizachyrium scoparium*), and Indian grass (*Sorghastrum nutans*). Common herbaceous species include bush clover (*Lespedeza capitata*), Pennsylvania sedge (*Carex pensylvanica*), and, in some areas, blue lupine (*Lupinus perennis*). Characteristic pitch pine-scrub oak barrens birds include prairie warbler (*Dendroica disolor*), eastern towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypsis trichas*), field sparrow (*Spizella pusilla*), whip-poor-will (*Caprimulgus vociferous*), blue jay (*Cyanocitta cristata*), and pine warbler (*Dendroica pinus*).

Pitch pine-scrub oak thickets (PPSOT) resemble barrens in plant species richness, but have a much higher density of scrub oak, >50% cover on average, (Bried and Gifford, 2008) and a lower density of grasses. In addition, according to Gebauer et al. (1996), some portions of this community may have higher densities of huckleberry. Edinger et al. (2014) does not differentiate between pitch pine-scrub oak barrens and thickets; the G2/S1 rank applies to both collectively.

Successional northern sandplain grassland (SNSG) (G4?/S3) (Edinger et al. 2014) is the community that represents the earliest successional variant of the inland pitch pine-scrub oak barrens ecosystem (Edinger personal communication, 2017). It is dominated by areas of open sand and native grasses including big bluestem, little bluestem, and indian grass. Typical herbaceous species include round-headed bushclover, common milkweed (*Asclepias syriaca*), wild blue lupine and dotted horsemint (*Mondarda punctata*), with stiff-leaf aster (*Ionactis*

linariifolius), whorled loosestrife (*Lysimachia* quadrifolia) and other native herbs present in lesser quantities. Woody species can include pitch pine seedlings/saplings and shrub species listed above; collectively woody species provide less than 25% cover. SNSG are relatively short-lived but can be maintained as grassland via fire and/or mechanical removal of woody plants. In the Albany Pine Bush SNSG appear to provide important habitat for many vertebrate (birds, reptiles and amphibians) and invertebrate (butterflies, ants, tiger beetles, solitary bees and wasps) SGCN wildlife, including the endangered Karner blue butterfly.

Pitch pine-scrub oak forest (Gebauer et al. 1996) are also called *pitch pine-oak forest* (Edinger et al. 2014) (G4G5/S4) contain similar species but with >60% tree cover composed of pitch pine, white oak (*Quercus alba*), red oak (*Q. rubra*), or black oak (*Q. velutina*). The shrub and herbaceous layers may be sparser than in the three variants described above. Large areas of pitch pine-scrub oak forests in the Albany Pine Bush and other northeastern pine barrens appear to be almost exclusively the product of past agriculture disturbance (e.g. plowing) of pitch pine-scrub oak barrens and thickets (Finton 1998, Gebauer et al. 1996, Motzkin et al. 1999).

Forest Communities

Appalachian oak-pine forest (G4G5/S4) represents the largest area of forest in the Albany Pine Bush. It is a mixed forest dominated by oaks and pines. Black oak, red oak, white oak, and scarlet oak (*Quercus coccinea*) dominate the canopy along with white pine (*Pinus strobus*) and pitch pine, although white pine is more abundant. Red maple (*Acer rubrum*), eastern hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*) and black cherry are common, occurring at lower densities. Shrubs include witch hazel (*Hammamelis virginiana*), serviceberry (*Amelanchier* spp.), hazelnut (*Corylus americana, C. cornuta*) along with blueberries and huckleberry. Groundcover is relatively sparse (Edinger et al. 2014).

This community tends to occur on sandy ravines in pine barrens. Characteristic bird species include sharp-shinned hawk (*Accipiter striatus),* Cooper's hawk (*Accipter cooperii*), red-shouldered hawk (*Buteo lieatus*), eastern towhee, wood thrush (*Hylocichla mustelina),* pine warbler, and pileated woodpecker (*Drycopus pileatus*).

Wetlands

Wetlands are also significant communities within the Pine Bush. While the majority of wetlands found in the Pine Bush are not unique to the area, they are important components of the larger ecosystem, and are essential to supporting the diversity of plant and animal life found in the Preserve. Mapped wetlands within the Pine Bush are shown in Figure 4. The largest wetland type is the red maple-hardwood swamp, described by both Edinger et al. (2014) and Mattox (1994).

Red maple-hardwood swamp (G5/S4S5)is a forested community dominated by red maple and may include ashes (*Fraxinus pennsylvanica, F. nigra, F. americana*), elms (*Ulmus Americana, U. rubra*), and yellow birch (*Betula alleghaniensis*). The shrub layer can be very dense and include winterberry (*Ilex verticillata*), red osier, silky, and gray dogwoods (*Cornus sericea, C. ammomum, C. foemina*), arrowwood (*Viburnum recognitum),wild raisin (V. cassinoides*), and highbush blueberry (*Vaccinium corymbosum*). The herbaceous layer includes cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), and sensitive fern (*Onoclea sensibilis*). There may be openings with other herbaceous species such as skunk cabbage, (*Symplocarpus foetidus*), and sedges (*Carex* spp.). Shrub swamps are found where the canopy is sparse or nonexistent, and the shrubs listed above are dominant.

Shallow emergent marsh (G5/S5) is a wetland community dominated by herbaceous plants, including bluejoint grass (*Calamagrostis canadensis*), reed canary grass (*Phalaris arundinacea*), rice cutgrass (*Leersia oryzoides*), sedges (*Carex stricta, C. interior, C. lacustris*), three-way sedge (*Dulichium arundinaceum*), and loosestrife (*Lysimachia thrysiflora, L. terrestris*). Other species include bur-reed (*Sparganium americanum*), tear thumb (*Polygonum sagittatum*), and Joe-Pye-Weed (*Eupatorium maculatum*). Mattox (1994) provides detailed descriptions of the shallow emergent marsh community type. This type may grade into the deep emergent marsh where deeper water and aquatic plants, such as yellow pond lily (*Nuphar luteum*), white water-lily (*Nymphaea odorata*), common cattail (*Typha latifolia*), and bulrush (*Scirpus tabernaemontanii*) become dominant (Mattox 1994, Edinger et al. 2014). Shallow emergent marshes may also grade into sedge meadows where lower water levels and sedges become dominant. In general, the red maple-hardwood swamp, shallow emergent marsh, deep emergent marsh, and sedge meadow often form a complex mosaic, with variations in vegetation resulting from differences in water depth occurring spatially and temporally. These wetlands occur on fine mineral and/or organic soils. Red maple hardwood swamps, shrub swamps, and emergent marshes harbor several amphibians including American toad (*Anaxyrus americanus*) spring peeper (*Pseudacris crucifer*), bullfrog (*Lithobates catesbeianus*), wood frog (*Lithobates sylvaticus*), and green frog (*Lithobates clamitans*).

Pine barrens vernal ponds (G3G4/S2) are associated with the pitch pine-scrub oak community (Bried and Edinger 2009; Edinger et al 2014). Vernal ponds are generally small (<5 acres) and consist of three-way sedge, woolgrass (*Scirpus cyperinus*), cinnamon fern, leatherleaf (*Chamaedaphne calyculata*), mountain holly (*Nemophanthus mucronatus*), and sphagnum moss (*Sphagnum fallax*). Small trees such as red maple, gray birch (*Betula populifolia*), and pitch pine may occur along the edges or on hummocks. Most of the pine barrens vernal ponds occur in low valleys between the dunes.

Spotted salamander (*Ambystoma maculatum*), Jefferson salamander (*A. jeffersonianum*), blue-spotted salamander (*A. laterale*), spotted turtle (*Clemmys guttata*), and other amphibians and reptiles occur in these wetlands. Several birds such as green heron (*Butorides virescens*) and red-bellied woodpecker (*Melanerpes carolinus*) also use wetlands for habitat (Schneider et al. 1991).

Successional Communities

Successional northern hardwoods are a hardwood or mixed forest type that occurs on sites that have been cleared and consists of quaking aspen (*Populus tremuloides),* big-tooth aspen (*Populus grandidentata*), balsam poplar (*P. balsamifera*), pin cherry (*Prunus pennsylvanica*), black cherry (*P. serotina)*, red maple, white pine, paper birch (*Betula papyrifera)*, gray birch, white ash (*Fraxinus americana*), or American elm. Reproduction of canopy dominants is generally low, as these are early successional, shade intolerant species. Shrub and herbaceous species, if present, are similar to those found in successional old fields, such as meadowsweet (*Spiraea latifolia*), hazelnut (*Corylus americana or C. cornuta*), or fire suppressed pine barrens, such as scrub oak.

Successional southern hardwoods also occur on formerly cleared (logging, farming) sites. Dominant trees include gray birch, hawthorns (*Crataegus* spp.), sassafras (*Sassafras albidum*), and introduced species such as black locust. Shrub and herbaceous layers are similar to successional northern hardwoods, though blackberry (*Rubus allegheniensis*), dewberry (*R. flagellaris*), and raspberry (*R. occidentalis*) are more common.

D. Ecological Processes

Ecological Processes in Pine Barrens and Forests

Fire Dependent Communities

There is extensive literature on the ecological processes of pitch pine barrens, some of which has been completed since the adoption of the 1993 Management Plan and the 1996 Implementation Guidelines (Forman 1979, Olsvig 1980, Young 1993, Gebauer et al. 1996, Bernard and Seischab 1996, Grossman et al. 1998). These studies indicate that the occurrence and maintenance of pitch pine barrens depends on low nutrient soil conditions and frequent disturbance, primarily by fire. A study of five pine barrens, including the Albany Pine Bush, indicated that historic land uses (e.g., timbering, agriculture) were also major factors in determining the composition of present-day pitch pine barrens communities (Finton 1998).

In fire dependent communities, substrate conditions and disturbance from fire shape the communities by creating conditions favorable to species that tolerate disturbance and fire effects (Whelan 1995). Pine barrens species are adapted to a combination of fire and coarse, droughty, nutrient-poor, acidic soils. Absent fire, the pitch pine-scrub oak community in the Albany Pine Bush would likely succeed to pitch pine-oak, pine-northern hardwood, and/or Appalachian oak-pine forest, depending on seed source, soil conditions, and random events. In these communities, fire is less frequent, intense, or severe. Variations in species composition and abundance result from alterations in environmental conditions (light, temperature, nutrient availability) that result from interactions between plant species. As soil organic content and nutrients increase and light reaching the forest floor decreases, shade tolerant species begin to dominate the understory (Tilman 1988). These species utilize nutrients more efficiently than pitch pine and other disturbance adapted species (Streng and Harcombe 1982, Little 1979). These species reach the canopy as the early oak and pine dominants are eliminated as a result of death or wind-throw.

Fire in the Albany Pine Bush

Historically, fire has played a large part in creating and/or maintaining the dominance of pitch pine and scrub oak in the Albany Pine Bush (Lewis 1976). The most comprehensive documentation of post-settlement wildfires in the Albany Pine Bush is found in Zaremba et al. (1991). These researchers suggest that fires before 1900 were probably larger than recent ones. Fire suppression began in the Pine Bush around 1900 and became more successful, although not completely so, after 1940. Most recent fires have been associated with human activity.

Fire Frequency

Historically, multiple fires occurred in the Albany Pine Bush during any given year. Zaremba et al. (1991) report a range of 2 to 15 fires per year, with one major fire (10 to 100+ acres) and six smaller fires (<10 acres) occurring in an average year. They also state that other researchers have posed a "natural" fire frequency of 3 to 15 years and propose that pine barrens communities in the Pine Bush would burn, on average, every 10 years. Within the pitch pine-scrub oak barrens and pitch pine forest communities, fires were likely intense. Fires within scrub oak-dominated communities were likely crown fires, moving rapidly through thick areas of scrub oak. The litter layer may have been partially or completely consumed, depending on fuel and weather conditions.

Fire Return Interval

Based on an extensive literature review of fire in the Pine Bush and other northeastern pine barrens (Appendix B), a 3 to 20 year and 20 to 40 year fire return interval should be appropriate to maintain pitch pine-scrub oak barrens/thickets and pitch pine-scrub oak forests, respectively. As opposed to fire frequency, fire return interval means that to maintain high-quality viable pine barrens communities, the entire area of the barrens and pitch pine forest communities would experience fire once every 3 to 40 years.

Fire Season

The table below summarizes the findings of Zaremba et al. (1991) for fires occurring within the Albany Pine Bush, based on historic records. In general, the highest number of fires has occurred during the spring, when most species are either dormant (April) or beginning to leaf out (May). Winter and summer (growing season) fires were less numerous, with the number of fires increasing in the fall, probably due to the accumulation of dry leaves and litter following the growing season. Both growing season and dormant season prescribed fires are considered essential to maintaining pine barrens communities (Bried and Gifford 2008), since fires naturally occurred throughout the year and their effects vary with seasonal timing.

Table 3. Average Number of Historic Fires by Month.[1]

	J	F	M	A	M	J	J	A	S	O	N	D
Small Fires	1	3	15	36	14	4	13	4	7	11	5	0
Large Fires	0	2	2	17	15	4	2	3	1	4	4	0
Totals	1	5	17	53	29	8	15	7	8	15	9	0

[1] Source: Zaremba et al. 1991.

Other Factors Affecting Vegetation in the Albany Pine Bush

Clearing

Clearing pine barrens to bare soil creates conditions favorable for pitch pine to seed in. However, it may take more than 100 years for scrub oak, huckleberry, and lowbush blueberry to regain their former abundance, since they do not spread readily by seed (Jordan 1999). Clearing probably results in the brushy cleared land community type, with species composition dependent on soil conditions (porosity, fertility, microflora/microfauna), remaining root stock, and seed sources.

Soil moisture, temperature and chemistry

The sandy soils of the Albany Pine Bush are underlain by silts and clays deposited during the formation of Glacial Lake Albany. Much of the Pine Bush is underlain by a shallow aquifer, and the depth to groundwater varies significantly (Dineen 1975, 1976, 1982). Exposed sand can be very hot in the sun and dry out quickly after rainfall. Where groundwater is close to the surface, water availability is more constant. Therefore, small changes in topography can create wide variation in plant species composition. Variations in the amount of organic matter can also alter soil moisture, soil chemistry and nutrient conditions for plants.

Ectomycorrhizal fungi

Unlike soil moisture and nutrients, the importance of soil fungi to woody plant communities is less understood in the Albany Pine Bush. Obligate relationships with ectomycorrhizal fungi are

particularly important to woody plants (Smith and Read 2008) and appear to be particularly important to the establishment of pine species (Hayward et al. 2015). Horton (unpublished data) suggests that the apparent lack of natural pitch pine recruitment in former black locust sites in the Albany Pine Bush may be attributable to insufficient ectomycorrhizal fungi communities in these sites. Understanding the relationship between fire, soil chemistry and soil fungi may help inform and improve restoration efforts in the Preserve.

Frost

Low-lying areas create "frost pockets" as cool air settles into topographical depressions and kills vulnerable spring plant growth. In the Pine Bush many of the depressions between dunes experience multiple spring time killing frosts annually and it appears plants species vulnerability to these events is variable (e.g. scrub oak leaves easily killed while trembling aspen appears very tolerant). As a result, scrub oak is less dense in these frost-pockets, which are dominated by sedges and grasses, but also support scattered willows (*Salix* spp.), heath shrubs, and pitch pine (Young 1993).

Herbivory

Insects, rabbits, and deer feed on pine barrens plants. Severe insect outbreaks may have profound effects on forest and woodland composition. Browsing/girdling by rabbits, voles, and deer on pine sprouts may kill some of the pines that re-sprout after fire. Browsing also can reduce the survival of pitch pine seedlings (Gill 1997).

Ecological Processes in Wetlands

Wetland communities are varied in the Albany Pine Bush. The type, size, and location of these wetlands largely depend on substrate (organic vs. mineral soils), fire history, and water depth. Varying water depths over time play a key role in determining how plant communities are distributed. So, when a forested wetland becomes permanently inundated, the trees and shrubs may die back, but the herbaceous component, in the seed bank, germinates and becomes dominant. If water levels subside, woody species again begin to dominate. In the Albany Pine Bush, periodic fire historically opened areas dominated by woody species for colonization by herbaceous plants and was likely an important process in wetland communities that are only seasonally inundated, especially pine barrens vernal ponds and shallow emergent marshes.

E. Rare, Declining and Vulnerable Species

For its size the Preserve supports a disproportionately large diversity of rare species (McCabe et al. 1993) including 75 wildlife Species of Greatest Conservation Need (SGCN) identified in the State Wildlife Action Plan for New York (NYSDEC 2015). This represents 20 percent of the 366 statewide listed SGCN and includes 43 birds, 8 reptiles, 4 butterflies, 5 moths, 4 mammals, 3 amphibians and 3 fish. (Table 4). This list includes state and federally listed endangered and threatened species, and wildlife listed Special Concern in New York State. Additionally, the Commission has identified two plants (*Poa paludigena* and *Malaxis bayardii*) in the Albany Pine Bush that are considered rare (S1 & S2) in New York State according to the New York Natural Heritage Program. The association between rare, declining, and vulnerable plant and animal species and ecological communities in the Albany Pine Bush is shown in Table 4. Inland pitch pine-scrub oak barrens communities hold the greatest number of rarities, though there are also several species within the forest and wetland communities.

Table 4. Ecological Communities and Wildlife Species of Greatest Conservation Need (SGCN) documented in the Albany Pine Bush since 1980[1].

ECOLOGICAL COMMUNITIES	STATUS[2]	SPECIES
INLAND PITCH PINE-SCRUB OAK BARRENS		
Invertebrates		
	H	A Geometrid Moth (*Erastria coloraria)*
	S	A Noctuid Moth *(Chaetaglaea cerata)*
	S	A Noctuid Moth *(Chytonix sensilis)*
	S	Brown-bordered Geometer (*Eumacaria madopata*)
	H	American Bumble Bee (*Bombus pensylvanicus*)
	H	Ashton's Cuckoo Bumble Bee (*Bombus ashtoni*)
	H,T	Frosted Elfin *(Callophrys irus)*
	H,SC	Henry's Elfin *(Callophrys henrici)*
	S,SC	Inland Barrens Buckmoth *(Hemileuca maia maia)*
	H,E[3]	Karner Blue Butterfly *(Lycaeides melissa samuelis)*
	H,SC	Mottled Duskywing Skipper *(Erynnis martialis)*
	H	Rusty-patched Bumble Bee (*Bombus affinis*)
	H	Yellow Bumble Bee (*Bombus fervidus*)
	H	Yellow-banded bumble bee (*Bombus terricola*)
Amphibians & Reptiles		
	H,SC	Blue-spotted Salamander (*Ambystoma laterale*)
	H,SC	Eastern Box Turtle (*Terrapene Carolina*)
	S,SC	Eastern Spadefoot (*Scaphiopus holbrookii*)
	H,SC	Eastern Hognose Snake (*Heterodon platirhinos*)
	S,SC	Eastern Worm Snake (*Carphophis amoenus amoenus*)
	S,	Fowler's Toad *(Anaxyrus fowleri*)
	S,SC	Smooth Green Snake *(Llochlorophis vernalis*)
	H,SC	Spotted Turtle *(Clemmys guttata*)
Birds		
	S	American Woodcock (*Scolopax minor)*
	S	American kestrel (*Falco sparverius*)
	S	Blue-winged Warbler (*Vermivora pinus)*
	S	Black-billed Cuckoo (*Coccyzus erythropthalmus)*
	H	Brown Thrasher (*Toxostoma rufum)*
	H	Bobolink (*Dolichonyx oryzivorus*)
	H,SC	Common Nighthawk (*Chordeiles minor*)
	H,SC	Eastern Whip-Poor-Will *(Caprimulgus vociferus)*
	H	Eastern Meadowlark (*Sturnella magna*)
	H,SC	Golden-winged Warbler *(Vermivora chrysoptera*)
	H,SC	Grasshopper Sparrow (*Ammodramus savannarum*)
	H,SC	Horned Lark (*Eremophila alpestris*)
	S,T	Northern harrier (*Circus cyaneus*)
	S,E	Peregrine Falcon (*Falco peregrinus*)
	S	Prairie Warbler *(Dendroica discolor)*
	H,SC	Red-headed Woodpecker (*Melanerpes erythrocephalus*
	S,SC	Red-shouldered hawk (*Buteo lineatus*)
	S	Scarlet tanager (*Piranga olivacea*)
	H,SC	Vesper sparrow (*Pooecetes gramineus*)

[1]The New York Natural Heritage Program considers rare species occurrences documented since 1980 as present in the Preserve.
[2]Status: H = High Priority SGCN, S = SGCN, SC = Special Concern, E= Endangered, and T = Threatened. [3] = Federally Endangered.

Table 4. Continued

ECOLOGICAL COMMUNITIES	STATUS	SPECIES
FORESTS		
Birds		
	H	Bay-breasted Warbler (*Setophaga castanea*)
	S	Black-throated blue warbler (*Setophaga caerulescens*)
	H	Canada Warbler (*Cardellina canadensis*)
	H	Cape May Warbler (*Setophaga tigrina*)
	S	Cerulean warbler (*Setophaga cerulea*)
	S	Northern goshawk (*Accipiter gentilis*)
	S,SC	Red-shouldered hawk (Buteo lineatus)
	S	Ruffed grouse (*Bonasa umbellus*)
	S	Scarlet tanager (*Piranga olivacea*)
	S	Wood thrush (*Hylocichla mustelina*)
	S	Worm-eating warbler (*Helmitheros vermivorea*)
Mammals		
	S	Eastern red bat (*Lasiurus borealis*)
	S	Hoary Bat (*Lasiurus cinereus*)
	H	Little brown myotis (*Myotis lucifugus*)
	S	Silver-haired bat (*Lasionycteris noctivagans*)
WETLANDS & OPEN WATER		
Amphibians and Reptiles		
	H,SC	Blue-spotted salamander (*Ambystoma laterale*)
	S,SC	Eastern spadefoot (Scaphiopus holbrookii)
	S	Fowler's toad (*Anaxyrus fowleri)*
	H	Musk turtle (*Sternotherus odoratus*)
	H,SC	Spotted turtle (*Clemmys guttata)*
	S	Snapping turtle (*Chelydra serpentine*)
	H,SC	Wood turtle (*Glyptemys insculpta*)
Fish		
	H	American eel (*Anguilla rostrate*)
	S	Brook trout (*Salvelinus fontinalis*)
	S	Longnose sucker (*Catostomus catostomus*)
Birds		
	S,SC	American Bittern (*Botaurus lentiginosus*)
	H,SC	American Black Duck (*Anas rubripes*)
	S,T	Bald Eagle (*Haliaeetus leucocephalus*)
	S	Blue-winged teal (*Anas discors*)
	S	Bonaparte's Gull (*Chroicocephalus Philadelphia*)
	S	Great egret (*Ardea alba*)
	S	Greater yellowlegs (*Tringa melanoleuca*)
	S	Horned grebe (*Podiceps auritus*)
	S	Laughing Gull (*Leucophaeus atricilla*)
	S	Louisiana waterthrush (*Parkesia motacilla*)
	H	Olive-sided flycatcher (*Contopus cooperi*)
	S, T	Pied-billed Grebe (*Podilymbus podiceps*)
	H	Rusty blackbird (*Euphagus carolinus*)
	H	Semipalmated sandpiper (*Callophrys pusilla*)
	H, T	Upland Sandpiper (*Bartramia longicauda*)

[1]The New York Natural Heritage Program considers rare species occurrences documented since 1980 as present in the Preserve. [2]Status: H = High Priority SGCN, S = SGCN, SC = Special Concern, E= Endangered, and T = Threatened. [3] = Federally Endangered.

The Karner blue butterfly is the best-known rare species in the Albany Pine Bush. The NYSDEC listed the Karner blue as an endangered species in 1977. On December 14, 1992, the United States Fish and Wildlife Service designated the Karner blue butterfly a federal endangered species pursuant to the Endangered Species Act of 1973 (57 Federal Register 59236, 1992). Listing of the Karner blue was prompted by a dramatic decline documented in populations of the butterfly throughout its range. Karner blue butterflies have declined regionally and in the Albany Pine Bush by over 90 percent between 1980 and 2000. This decline has been largely attributed to loss of habitat due to development and fire suppression (Schweitzer 1985, Schweitzer 1988, Givnish et al. 1988, 57 Federal Register 59236).

The Commission's understanding of Karner blue butterfly recovery (ecology and management) has advanced substantially since 2002 as a result of Commission participation on state and federal recovery teams. A Federal Karner Blue Butterfly Recovery Plan was completed in 2003 (USFWS 2003). This plan prescribes national recovery (down-listing and de-listing) goals for the species. As a member of the New York State Karner Blue Butterfly Recovery Team, the Commission has also worked with NYSDEC, NYSOPRHP, and The Nature Conservancy to prepare a draft New York State Karner Blue Butterfly Recovery Plan, prescribing specific recovery criteria in four areas of eastern New York State. As a requirement of that state plan, the Commission has prepared the Karner blue butterfly Recovery Plan for the Albany Pine Bush Meta-population Recovery Unit (Appendix D). Implementing this Plan has resulted in an increase in the size of the Albany Pine Bush metapopulation from fewer than 1,000 in 2007 to more than 18,000 in 2015.

In the Pine Bush a metapopulation of Karner blues requires at least 320 acres of suitable habitat consisting of not less than five sub-populations, collectively capable of supporting at least 7,600 butterflies in four out of five years (Appendix D). Suitable habitat patches must provide at least 12.4 acres of habitat and contain at least 810 stems of lupine per acre, with appropriate amounts of adult nectar sources, overstory and grass cover. Additionally each subpopulation must be situated within the dispersal range (1km or 0.62mile) of at least two other subpopulations. Additional details are provided in Appendix D.

Ecological Processes that Affect Rare, Declining, and Vulnerable Species

Rare, Declining, and Vulnerable Species and Fire Dependent Communities

Several rare, declining, and vulnerable wildlife species in the Albany Pine Bush, including shrubland birds, reptiles, butterflies, solitary bees and wasps, ants, beetles and moths, utilize its fire dependent communities and appear to benefit from the Commission's prescribed fire management program. Three endangered and threatened species–the Karner blue butterfly, frosted elfin (*Callophrys irus*), and persius duskywing skipper (*Erynnis persius persius*)–all depend on blue lupine as a larval food plant. Research in the Pine Bush and the Concord (NH) Pine Barrens strongly suggests early spring fires can increase nutritional quality of lupine and increase Karner blue butterfly egg production (Fuller et al. 2010). Lupine and other herbaceous nectar sources and native grasses colonize disturbed areas of exposed sand such as power line rights-of-way, sand mines, and road-side margins. In a natural setting, suitable habitat for these and other species is likely maintained through frequent (one fire every 2-5 years) low severity surface fires.

A number of other wildlife, including many SGCN, clearly benefit from wildland fire (NYSDEC 2015). Shrubland bird species, 67 percent of which have experienced significant population declines throughout the northeast since 1966 (Sauer et al. 2006), are abundant in fire-managed

Preserve lands (Gifford et al. 2010). The eastern hognose snake is also abundant in fire-managed pitch pine-scrub oak barrens in the Preserve (Stewart and Rossi 1981). Inland barrens buckmoth (*Hemileuca maia maia*), solitary bees and wasps, ants and nocturnal moth populations are also high in recently managed areas (Hoven 2009, Keene, 2014 Bried and Dillon 2015, Barber 2015, Schoppman unpublished data). Lastly, spotted turtles, previously considered primarily aquatic have been documented using managed barrens in the Preserve for foraging and nesting (NYSDEC & APBPC unpublished data).

Rare, Declining, and Vulnerable Species and Wetlands

Certain rare, declining, and vulnerable species–including several amphibians–inhabit wetland areas within the Albany Pine Bush. The Jefferson, blue-spotted, and spotted salamanders are found in mixed deciduous forests and woodlands, often under logs or other debris, as well as in adjacent wetlands. For breeding, they require ephemeral pools isolated from other water bodies. Throughout the Albany Pine Bush such wetlands are common and include pine barrens vernal ponds (Bried and Edinger 2009). The Eastern spadefoot is a primarily terrestrial toad that burrows in loose, sandy soil, but also readily utilizes semi-permanent ponds and vernal pools for breeding (Lawler, Matusky, and Skelly 2000). Spotted turtles are found in wetlands, including marshes, ponds, and streams (Ernst et al. 1994). The eastern hognose snake feeds primarily on amphibians and although terrestrial, it relies on wetlands to produce its principal food source (Hunsinger 1999; A. Breisch pers. comm.).

F. Facilities and Trails

The Commission offices are located at 195 New Karner Road, a 32,310 square foot building that also hosts the Discovery Center. The Discovery Center opened in 2007 and serves as the primary Preserve gateway for tens of thousands of visitors each year. The center is a 5,000-square foot state-of-the-art interpretive facility that hosted over 24,000 visitors in 2015. The Discovery Center offers visitors an orientation to the Preserve's globally rare ecology and management through interactive exhibits and programs. Each month Commission education staff, docents, and volunteers host numerous school programs, public programs and events at the Discovery Center.

The Commission also maintains 11 official trail-heads and approximately 20 miles of marked trails which accommodate field trips, guided programs, hiking, bird watching, nature study, cross-country skiing, mountain biking, hunting, and horseback riding. Maintenance and management equipment is housed at the Field Operations Center located on Kings Road. The Kings Road site also hosts the two-story "Barrens House" which provides temporary housing for seasonal staff and interns.

IV. THREATS

A. Introduction

An updated analysis of challenges to the protection and management of the Preserve was undertaken as part of the 2010 Management Plan. That analysis identified "threats," which represent actions, events, or circumstances that can reduce the viability of the Albany Pine Bush ecosystem. The loss of Pine Bush lands to development continues to be the primary threat to the long-term viability of the Albany Pine Bush Preserve and the rare species and natural communities it supports. Not only does development directly destroy habitat, it also increases fragmentation and limits the use of fire. Other threats include invasive species, over-abundant wildlife, pathogens, inappropriate or excessive public use, and climate change. Insufficient broad-based community support and funding can also threaten the long-term viability of the Preserve's rare communities and species.

B. Development

Development is the primary threat to achieving Preserve goals, and ultimately to the long-term viability of the natural communities and native species that make up the Preserve. According to analyses of historic aerial photographs covering a 4,800-acre portion of the Pine Bush Study Area, 46 percent of that area has been developed since 1940, with over 1,800 acres of pitch pine-scrub oak barrens and grassland/heath communities lost during the period (Finton 1998). This trend is illustrated in Figure 2.

Between 1940 and 2007, the Capital District's population grew 35 percent, from 530,000 to 821,000 residents (http://www.cdrpc.org/). The existing transportation network and municipal infrastructure (e.g. sewer and water lines) in the area has contributed to increased development pressure within the municipalities that surround the Preserve and within the Pine Bush Study Area. Utilities generally follow road infrastructure, resulting in a pattern of road frontage development typical of sprawl-like growth.

By the year 2030, the Capital District's population is expected to reach 885,048 based on status-quo population projections provided by the Capital District Regional Planning Commission (http://www.cdrpc.org/). Increases in the local population will result in greater demands on infrastructure and community services and will continue to change current land use characteristics and patterns. Even in communities with flat or slow population growth, changing demographics–especially smaller household size–are leading to new household formation and increased demand for and production of residential units.

Direct Loss of Habitat Due to Development

The most obvious impact of development is the direct loss of natural communities and species' habitat. This continued incremental loss of undeveloped land makes it increasingly difficult to ensure adequate protection of the land necessary to support natural ecosystem functions in the Preserve. Development disrupts wildlife movement/behavior and elevates levels of nutrients and contaminants in the ecosystem. In addition, development results in increased fragmentation of the Preserve and increased human population and infrastructure in the areas surrounding the Preserve. These factors significantly increase constraints on natural ecosystem functions and effective Preserve management.

Limitations on Fire Management

Increasing development and the proximity of developed lands to the Preserve places constraints on the use of fire as a management tool. Limiting the occurrence of natural and prescribed fire is a key threat to the integrity of the inland pitch pine-scrub oak ecosystem. As discussed in Section V, fire is an important factor in the survival and regeneration of several pine barrens species including some that provide food for rare species such as the Karner blue butterfly. The juxtaposition of developed lands with Preserve property has created significant difficulties in the effective use of fire as a management tool, primarily due to the impacts of smoke. Figure 5 illustrates 500-foot buffer areas adjacent to the Preserve that could be affected by smoke from controlled burns. The dominance of invasive plant species such as black locust and aspen has also limited the Commission's ability to manage certain areas of the Preserve with fire, since fire alone cannot control these species.

Limitations on Other Preserve Management Activities

Other ecological restoration and management practices, including chemical and mechanical vegetation management, reduction of deer population, etc., are also more challenging due to the proximity of developed land to the Preserve.

Fragmentation

Habitat fragmentation, or the process of dividing contiguous habitat into smaller, isolated patches (Fahrig 2003), is one of the most studied areas of conservation biology (Fazey et al. 2005). Fragmentation can greatly exacerbate the negative biological effects of habitat loss (Saunders et al. 1991, Hanski and Ovaskainen 2000). Fragmentation increases extirpation risk (Wilcove 1987, Reed 2004), not only through direct effects such as blocking dispersal, but also by facilitating threats like exotic plant invasions (Lonsdale 1999, Schmidt and Whelan 1999, Laurance et al. 2002). Effects of fragmentation are not always clear or linear, such as disruptions in insect pollinator services (Jennersten 1988), but rather represent changes at extreme thresholds or peaks at intermediate levels of disturbance (Fahrig 2003). Fragmentation may limit area-demanding mammals–including top predators (e.g. eastern coyote *Canis latrans*)–leading to increased populations of fox and other small predators (e.g., raccoons *Procyon lotor*, domestic cats *Felis catus*) and over-predation on native wildlife (Crooks and Soule 1999, Odell and Knight 2001, Kays and DeWan 2004, Manley et al. 2006). Development around minimally altered habitat may set up a staging area for dispersal of non-natives into the less disturbed areas (Luken 1997). Habitat loss, nest parasitism, and predation all tend to increase with the level of fragmentation (Andren and Angelstam 1988, Paton 1994, Robinson et al. 1995, Schmidt and Whelan 1999).

Fragmentation adversely impacts many birds, especially species dependent on grassland and forest habitat, because it results in habitat loss, nest parasitism by brown-headed cowbirds (*Molothrus alter*) as well as predation by blue jays, eastern chipmunks (*Tamias striatus*), and other species. In the Pine Bush, fragmentation has likely contributed to the extirpation of two shrubland bird species. Yellow-breasted chat (*Icteria virens*) and golden-winged warbler (*Vermivora chrysoptera*) –considered by Dettmers (2003) to be the two most area-sensitive shrubland specialists in the eastern United States–were present in the Pine Bush (Treacy 1953) but are now extirpated (Gifford et al. 2010). Their absence here likely reflects the increased physical fragmentation as well as the increased habitat heterogeneity present in the Pine Bush (Gifford et al.. 2010, Kerlinger and Doremus 1981, Beachy 2002, Askins 1998).

Direct habitat loss and fragmentation are also the two primary causes of decline in Karner blue butterfly populations (USFWS 2003) and are likely responsible for the extirpation of the northern black racer (*Coluber constrictor*) and eastern rat snake (*Scotophis allegheniensis*) (Hunsinger 1999). Gill (1997) also showed reduced pitch pine seeding survival along edges when compared to interior sections of the Preserve. In other words, pitch pine–the dominant tree species in the pitch pine-scrub oak communities of the Albany Pine Bush–cannot reproduce as successfully at the edges of the Preserve as in interior areas. Fragmentation also alters predator-prey relationships responsible for maintaining balanced wildlife populations (R. Kays, pers. comm.). Fragmentation is discussed more thoroughly in the pitch pine-scrub oak barrens viability assessment (Appendix B).

C. Invasive Plants, Pests, and Pathogens

Invasive Plants

The degree of potential impact from invasive plants depends on the species, but is often ecosystem-wide. Biological invasion is a leading cause of ecosystem dysfunction worldwide. Priority invasive species for control in the Albany Pine Bush include native aspens and non-native black locust (APBPC 2002). These species exemplify the range of impacts associated with invasive plants in the Preserve, altering plant community composition and structure as well as disrupting ecological processes including nutrient cycling, soil hydrology, and fire. Nitrogen-fixing black locust ranks as the second most abundant deciduous tree worldwide and is notorious for altering nutrient cycles in grasslands and barrens ecosystems (Rice et al. 2004). It not only enriches naturally poor soils, but also builds excessive litter-fall and closed canopies that compete with native plant species growth and recruitment. It also deteriorates natural fire regimes (Rice et al. 2004, Malcolm et al. 2008). Aspens, red maple and white pine take advantage of fire suppression. With rapid clonal establishment aspen are capable of usurping large areas of the Albany Pine Bush landscape (Milne 1985). White pine and red maple produce abundant seeds and, being more shade tolerant, can rapidly out-compete pitch pine in the absence of wildland fire. Terrestrial invasive plants also directly threaten the habitat of rare and endangered wildlife (e.g. Karner blue butterfly, frosted elfin, barrens buckmoth *Hemileuca maia maia*) in the Preserve by replacing obligate larval host plants and altering requisite microclimates. Aquatic invasive plant species can have similar impacts on plant and animal species and ecosystem processes within the Preserve's many wetland communities.

Pests and Pathogens

Introduced animal species and pathogens also present a potential threat to native Pine Bush plants and animals. Like invasive plants, the degree of impact from pests and pathogens is generally specific to the individual pest and in most cases to the infected plant or animal, although certain pests and pathogens may affect many species (e.g. Chinese snakehead fish *Channa argus*) or genera (e.g. sudden oak death). Short-term impacts can manifest in defoliation, loss of vigor, or death for the infected individual(s). At the system level, pests and pathogens can result in reduced photosynthesis and productivity and changes in microclimatic conditions. Longer-term impacts can be severe and include changes to the composition, structure, and function of plant and animal communities with wide-ranging implications for rare wildlife through changes in food production, predation rates, competition, and habitat characteristics (Lovett et al. 2006). Pest and pathogen control measures, however, may also pose a threat. For example, biological control agents and pesticide applications to control insects (e. g. gypsy moths *Lymantria dispar* and mosquitoes) or the diseases those insects may carry (e. g. West Nile Virus) may pose a risk to rare native insect populations (e.g. Karner blue butterfly, nocturnal moths).

D. Inappropriate or Excessive Public Use

The Albany Pine Bush Preserve supports many types of non-motorized recreational uses. However, if not properly managed, these uses have the potential to occur at a volume and intensity that can impact ecological systems and processes. In addition, unauthorized uses such as all-terrain vehicles (ATVs) negatively impact the Preserve. The use of unofficial trails and firebreaks for such activities has resulted in some habitat loss and fragmentation. Even on designated trails, excessive or inappropriate use has caused soil erosion and compaction, disturbance to wildlife, and damaged vegetation as well as increased trash and invasive species problems. The increasing number of Preserve visitors could have both localized and widespread impacts within the Pine Bush if not properly managed. The Commission may need to limit public use in certain areas of the Preserve, as provided for in the Preserve rules and regulations. The Resource Protection and Visitor Experience Vision (Appendix G) details recreation management in the Preserve, including strategies to minimize and mitigate potentially significant adverse impacts.

E. Wildlife Related Impacts

The primary wildlife related threat to the Preserve is an over-abundance of white-tailed deer (*Odocoileus virginianus*). The white-tailed deer populations have historically been high due to limited hunting opportunities and the urban/suburban character of the area. Numerous studies have shown that over browsing by high populations of deer can reduce, and in some cases eliminate, reproduction of certain woody and herbaceous plant species (Augustine and Frelich 1998, Buckley et al. 1998, Mattox 1994). It has been documented that browsing by deer suppresses the regeneration of pitch pine in the Albany Pine Bush. Both expert opinion (D. Schweitzer, pers. comm.) and the results of exclosure studies in the Albany Pine Bush indicate that deer feed on blue lupine and pitch pine, thereby reducing the only larval food source of the Karner blue butterfly and other rare insects. Alteration of plant species composition and community structure that results from over-browsing can also modify forest habitat and wildlife species diversity. Deer also provide long-distance transport invasive plant seeds and serve as hosts for deer ticks, which can transmit Lyme and other diseases to humans. In addition, over abundant deer can result in increased automobile accidents and damage to residential landscaping and agricultural crops on lands surrounding the Preserve.

Over-browsing by eastern cottontail rabbits (*Sylvilagus floridanus*), meadow voles (*Microtus pennsylvanicus*), woodchucks (*Marmota monax*), and other herbivores could also threaten the long-term viability of native plant populations and structure/composition of ecological communities. Predator populations appear suitable for controlling small mammals (R. Kays pers. Comm.). Wildlife-related impacts are best addressed by management actions that result in sustainable plant and animal populations as well as a balanced ecosystem.

F. Climate Change

Climate change, also called global warming, poses threats to inland pitch pine-scrub oak barrens ecology, through observed and anticipated changes in seasonal and annual temperature and precipitation patterns. Potential impacts on native plant and animal species viability in the Pine Bush may be detrimental or positive, but are currently poorly understood. The Nature Conservancy's Climate Wizard on-line modeling tool (www.climatewizard.org) indicates that even under the most conservative Intergovernmental Panel on Climate Change (IPCC) emissions scenarios, most of upstate New York will become warmer and wetter by mid-century (2050s). Indeed climate change has already been documented in New York State where the annual average

temperature has risen 2.4 degrees Fahrenheit and average winter season warming exceeds 4 degrees Fahrenheit since 1970 (Horton et al. 2014). According to Horton et. al (2014), across New York State annual average temperatures are projected to rise another 2.0-3.4 degrees Fahrenheit by the 2020s and 4.1-6.8 degrees Fahrenheit by the 2050s. Similarly regional precipitation is also projected to increase by 1-8 percent by the 2020s, and 3-12 percent by the 2050s. Changes in seasonal variability of temperature and precipitation are also likely, as is the frequency of severe weather events including storms, heat, cold and drought.

Enhanced weather variability (e.g. extremely high temperatures, severe precipitation events, etc.) is more likely to have effects on rare plant and animal species viability in the Preserve than changes in annual averages since extreme events have the potential to exceed any given specie's natural range of variability. Commission staff are working with The Nature Conservancy and federal Karner Blue Butterfly Recovery Team members in a research effort to understand the potential ramifications of altered winter and summer conditions on the Karner blue butterfly. Winter conditions are important since Karner blue eggs overwinter and are believed to be protected by the winter snow pack, temperature, and humidity (USFWS 2003). Similarly extreme heat between adult Kbb broods has been indicated as a likely cause of range-wide Kbb declines in 2012 (Karner blue butterfly Recovery Team, personal communication), and has been documented to result in high mortality of captive pupae in the Preserve (APBPC unpublished data). However, of particular concern is the potential for seasonal timing and extreme events to alter fire regimes, which are largely driven by seasonal temperature and precipitation patterns. Changes to these patters have the potential to influence the vulnerability of the Preserve to wildland fire and the Commission's ability to use prescribed fire at the desirable frequency, season and severity. Maximizing the size and condition of pitch pine-scrub oak barrens within the Preserve is likely the most effective strategy to buffer Preserve plants and animals from climate change impacts (Olson et al. 2009).

V. ECOLOGICAL RESTORATION AND MANAGEMENT

A. Introduction

This section of the Management Plan provides recommendations and guidelines for the restoration and maintenance of the Preserve's ecological resources based on the best available science and Commission experience to date. Specific ecological restoration and management objectives have been refined since the adoption of the 2002 Management Plan and are detailed in the Albany Pine Bush Pine Barrens Viability Assessment (Appendix B).

The Management Plan makes the following recommendations:

1. Specific ecological management objectives identified in the Plan will be achieved for pitch pine-scrub oak barrens, Karner blue butterfly, and wetlands. To accomplish this, the Preserve will be divided into management units, and specific fire management prescriptions will be developed for each.

2. Fire management capabilities will be enhanced to improve safety and assure achievement of ecological management objectives. Fire management activities will be guided by the Fire Management Plan (Appendix C).

3. Mechanical and chemical treatments will be used where fire alone is ineffective in ecological restoration. A comprehensive plan for the management of invasive and overabundant plant species, pests, and pathogens is included in Appendix E.

4. The Commission will engage in the restoration of natural communities through the planting/seeding of native plants and will continue to encourage the use of such plants by adjacent landowners.

5. Karner blue butterfly habitat will be maintained and expanded using ecological management techniques including prescribed burns, mechanical (mowing, tree felling, planting) and chemical treatments. Recovery objectives and management strategy details are provided in the Albany Pine Bush Karner Blue Butterfly Metapopulation Recovery Plan (Appendix D). The goal is to maintain at least 320 acres of habitat in the Preserve suitable to support an annual metapopulation of 7,600 to 13,000 butterflies.

6. Management of other rare, declining, and vulnerable species should be integrated with ecosystem management to advance the goals of the Wildlife Action Plan for New York State (NYSDEC 2015). NYSDEC and NYNHP policies, goals, and recommendations will guide rare species and overall wildlife management within the Preserve.

7. The Albany Pine Bush Pine Barrens Viability Assessment and its associated Research, Inventory, and Monitoring Plan will be guide inventory, monitoring, and research (Appendix H).

8. Building positive relationships within surrounding communities and Preserve neighbors is essential to all aspects of Preserve management.

B. Ecological Management Objectives

Ecological management objectives for the inland pitch pine-scrub oak barrens ecosystem, the Karner blue butterfly, and wetlands have been refined by Commission scientists in consultation with other scientific partners. They reflect the results of the Albany Pine Bush Pine Barrens Viability Assessment and the APB Karner Blue Butterfly Recovery Plan, Appendices B and D, respectively. The details provided in these plans will guide the application of habitat management throughout the Preserve including prescribed burning, mechanical treatments (mowing, tree felling, planting), and the use of herbicides.

The Nature Conservancy has developed a useful method to streamline complex efforts to define and monitor the health of species, communities, and ecosystems (also called conservation targets) and to identify "corrective" management actions when needed (Groves et al. 2002, Parrish et al. 2003). Generally referred to as "conservation action planning" (CAP), The Nature Conservancy approach consists of three core components: key ecological attributes (KEAs), indicators, and indicator ratings. Each category of information may be drawn from ecological models (conceptual or mathematical), best available science, expert consultations, local scientific data, and data from comparable species or communities in other locations.

The KEAs are characteristics of a conservation target that if degraded (e.g., water quality) or removed (e.g., fire) would jeopardize the target's viability or ability to persist over time. Therefore a KEA is a critical component of a conservation target's life history, physical processes, community interaction, habitat, etc. The point is to focus on what is known or believed to influence the target's persistence the most. The Albany Pine Bush Pine Barrens Viability Assessment groups attributes into four categories (slightly modified from Parrish et al. 2003): size and extent; fragmentation and edge effects; prescribed fire regime; and biotic patterns.

Table 5. Viability criteria for inland pitch pine-scrub oak barrens in the Albany Pine Bush Preserve[1].

	Size & Extent	Fragmentation & Edge Effects	Rx Fire Regime	Biotic Patterns
Key ecological attributes	Habitat amount	Patchiness	Refugia	Cover of pitch pine and scrub oaks
	Patch size	Patch isolation distance	Individual fire size	Floristic tolerance of human activity
	Core area	Perimeter/area ratio	Return interval	Invasive plant impact
	Suitable Karner blue butterfly habitat	Edge effects from roads, trails, and residential	Seasonality	Reduction of priority invasive vegetation
				Characteristic rare Lepidoptera
				Shrubland birds

[1] Detailed descriptions of the scales of measurement and indicator rating system are found in Appendix B.

Table 6. Viability Criteria for the Karner Blue Butterfly[a] in the Albany Pine Bush Preserve

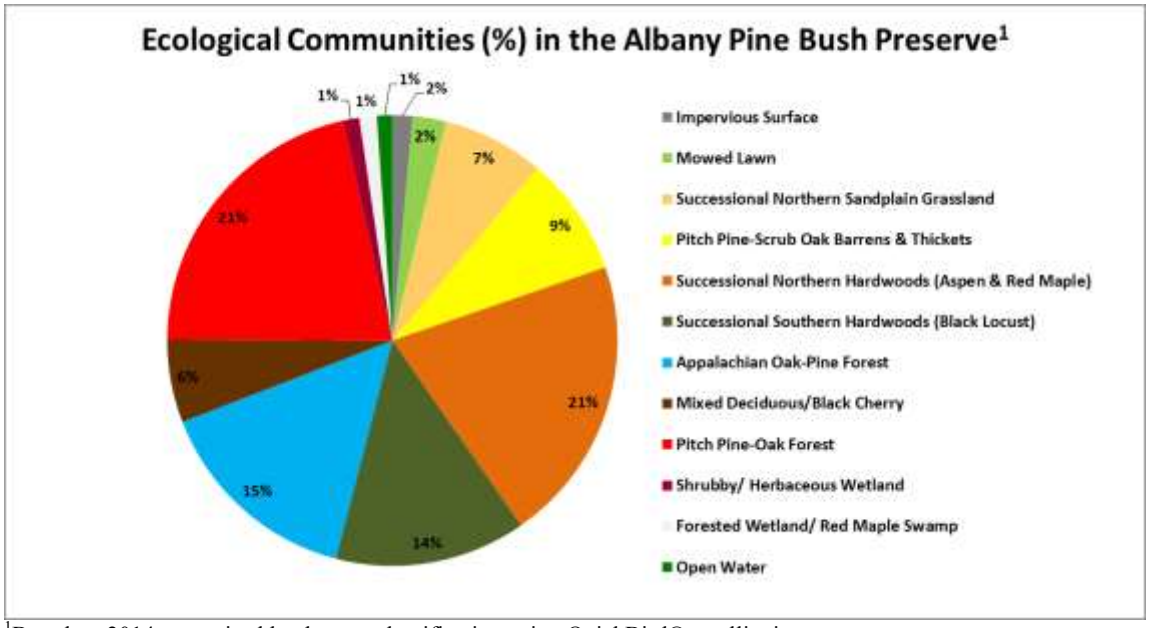
Key ecological attributes	Population size	Habitat Quality[b]	Number of subpopulations with at least two connections to other viable subpopulations
Indicators	Number of viable subpopulations in the metapopulation	Total acres of suitable habitat in the recovery area	
	1st and 2nd flight mean number of individuals in a metapopulation	Total lupine stems in the metapopulation	

[a] Detailed descriptions of the scales of measurement and indicator rating system are found in Appendix D.
[b] Indicators of habitat quality include lupine stem density, spring and summer nectar species richness, nectar density, nectar evenness, grass cover, overstory cover, and shade.

Table 7. Management Objectives for Wetland and Aquatic Communities.

WETLANDS	WETLANDS, STREAMS, AND RAVINES
	Maintain all red maple-hardwood swamp, shallow emergent marsh, pine barrens vernal ponds, and other wetland communities in the Preserve.
	Protect and manage intervening habitat types to allow for movement of plant and animal species between wetlands.
	Manage for successful survival and reproduction of native plant and animal species and few or no invasive species.
	Minimize fragmentation from roads, trails, or other human disturbance.
	Maintain a complete component of rare, declining, and vulnerable vertebrate and invertebrate species as listed in Table 4.
	Maintain natural hydrology and ensure nutrient inputs remain low.
	Establish a fire return interval sufficient to maintain native species and community variance where wetlands are adjacent to pitch pine-scrub oak barrens.
	Manage wildlife to maintain populations that are sustainable with habitat and adjacent human use.

Pitch pine-scrub oak barrens plant communities (Table 2 and Figure 3) currently dominate only 34 percent of the Preserve. As described previously, attaining a viable Preserve will require the restoration and management of at least 2,000 acres of these plant communities. Doing so will depend on restoring successional communities, including the capped Albany Landfill and surrounding City-owned lands as described in the City's NYSDEC permit issued June 2009. It will also require reversing the current distribution of pitch pine - scrub oak barrens and pitch pine scrub oak forest (Bried, Patterson and Gifford 2014; Bried, Gifford and Robertson 2015). Currently 62 percent of pitch pine - scrub oak communities in the Preserve are dominated by pitch pine forest, while only 38 percent contain the characteristic open-canopy savannah of pitch pine - scrub oak barrens and thickets. Historical agricultural practices lead to this dominance of pitch pine forest in areas of former pitch pine-scrub oak barrens (Finton 1998, Gebauer et al. 1996). As described in Appendix B and outlined in Table 11, the degree to which existing plant communities can be restored to pine barrens varies.



[1]Based on 2014 supervised land cover classification using QuickBird© satellite imagery.

C. Fire Management

As described in Section III, fire is a key ecological process that maintains the pitch pine-scrub oak communities and associated species found in the Albany Pine Bush. Both plant and animal species in the Pine Bush have developed complex adaptations and dependencies to fire. While mechanical techniques and other forms of management may mimic some of the effects of fire, they cannot serve as a substitute. Although such treatments are a critical part of the restoration process in fire-suppressed areas of the Pine Bush, fire remains the most important tool for long-term management of the pitch pine-scrub communities and the species that depend on them.

Fire management involves the appropriate use of prescribed burning techniques and the control of wildfire to assure a balance between ecological management and public health and safety. This requires a high degree of staff training and logistical support as well as a sophisticated understanding of ecological processes. The Preserve's Fire Management Plan (Appendix C) describes the Commission's fire management goals and objectives in terms of ecological communities and species populations, their ecology and the fire environment. This Plan also provides required parameters for burn prescriptions and discusses potential impacts of smoke. Current procedures for minimizing the effects of smoke and prescribed burning operations are also described. This Plan is intended to fulfill the requirements of The Nature Conservancy Fire Management Manual (TNC 2000) and the New York State Department of Environmental Conservation (6NYCRR Chapter II, Part 194 and ECL Article 46).

D. Mechanical Treatments and Herbicides

Management of Pine Barrens

The overall management goal for the inland pitch pine-scrub oak barrens ecosystem is to restore viable barrens communities that can be maintained through periodic prescribed fire treatments. The Commission uses a two-part ecosystem management strategy consisting of a restoration phase and a maintenance phase. Ecosystem restoration treatments are designed to re-establish the native plant and animal community dynamics described in Appendix B and include mechanical

treatments (e.g. mowing, cutting, scraping, girdling); chemical treatments (herbicides); restoration plantings; and high-severity fire treatments singly or in combination with other treatment types (e.g. growing season mow and burn treatments). Since 2002 these treatment methods have proven highly effective in restoring the barrens and reversing the effects of decades of fire suppression. Relatively frequent low-severity surface fires (3-15 year frequency; 10 year average) are envisioned as the most appropriate method for maintaining restored pine barrens communities and suitable Karner blue butterfly habitat over the long term. The Commission obtains all necessary permits for management activities.

Mechanical treatments include, but are not necessarily limited to, mowing, selective or improvement cuttings, clear cutting, girdling, bulldozer scraping, disking, and planting. These treatments are used to remove native and non-native invasive species, rearrange hazardous fuel loads (Bried, Gifford and Robertson 2015), remove organic soil and its associated weed seed bank, expose mineral soil, and provide a competitive advantage to important native species, such as pitch pine and lupine. Girdling has been used effectively in the Pine Bush for reducing densities of aspen. In addition, a number of native pine barrens species (e.g. heath shrubs, scrub oaks, and dwarf willows) are known to respond favorably to mowing by vigorously resprouting. Mowing can also be used to reduce the height and quantity of fuels in some areas, especially along roadsides or near power lines, to allow for the subsequent use of fire. Approximately 1,000 acres of the Preserve have been mowed since 1996. However, mechanical treatments (specifically mowing) alone cannot sustain pine barrens communities over the long term. Mowing generates organic matter in the form of both fine and coarse materials that build up and decompose very slowly (Hawver et al. 2000). This buildup of organic material alters the nutrient dynamics, especially carbon and nitrogen cycles. These soil changes eventually lead to changes in the plant community structure and composition and detrimental alterations of habitat for specialized wildlife such as the buckmoth and eastern spadefoot that depend on the lack of organic matter to complete critical life stages. The buckmoth pupates in the sandy soils and the spadefoot spends much of its life buried in the sand. However, mowing can be used to reduce canopy cover, particularly where fire suppressed scrub oak would make prescribed burning difficult or hazardous.

The restoration of old fields to suitable Karner blue butterfly habitat and pitch pine-scrub oak barrens is significantly hampered by the organic soils and associated weed seeds that accumulate. Herbicide applications may only temporarily reduce competing non-native weedy vegetation and do not expose sufficient mineral soil needed to establish native species. However, the Commission's experience in removing this organic soil by scraping with a bulldozer has proven highly effective in expediting the restoration of Karner blue butterfly habitat and pine barrens through subsequent restoration plantings. Similarly, light soil disturbance in pine barrens and Karner blue habitat can expose mineral soil and aid the recruitment of native plants through natural seeding or artificial restoration planting.

Invasive and Overabundant Species Management

A list of invasive species in the Albany Pine Bush is provided in Appendix E, Invasive and Overabundant Species Management Plan. This Plan outlines monitoring and potential control measures for a suite of invasive species (native and non-native) that have the potential to compromise the Commission's conservation goals for inland pitch pine-scrub oak barrens, pine barrens vernal ponds, and rare plant and animal species.

Invasive species include exotic, non-native, or overabundant native species that displace desirable native Pine Bush species and degrade ecosystem viability and/or wildlife habitat. They are often adapted to disturbed habitats, have the ability to disperse quickly, and grow so rapidly that they can take over habitat that would otherwise be used by native species (Randall and Marinelli

1997). Some invasive species–such as common reed (*Phragmites* communis) and purple loosestrife (*Lythrum salicaria*) –invade wetlands and displace native species, thereby altering habitat for both wetland fauna and flora. Other invasives, such as black locust and oriental bittersweet, invade upland habitats. There, they outcompete pine barrens species that provide food and habitat for a host of rare and declining wildlife species, including the Karner blue butterfly.

Chemical treatments or herbicides, as well as biological control agents are generally used to target specific species or groups of species that cannot be effectively managed by other means, described previously. Such treatments are commonly used for controlling vegetation along roadsides, railroad right-of-ways, and power lines, where mechanical removal would be difficult or expensive. Additionally, even when other treatments can be successful, labor and time constraints can make such efforts ineffective. For example, the lack of sufficient labor and the time sensitivity of aspen girdling (only two months a year) can delay fire management activities for decades and lead to the accelerated degradation of pitch pine-scrub oak communities. Restrictive herbicide applications may be the only way to effectively reduce aspen and facilitate prescribed fire before these sites are impacted by other non-native invasive species (e.g. oriental bittersweet *Celastrus orbiculatus*). Chemicals must be used only when other treatment types prove ineffective in restoring pine barrens. Furthermore, chemical treatments must be applied appropriately to avoid overuse and to prevent injury to applicators and non-target species. Herbicide use is highly regulated and all treatments will be conducted in strict accordance with applicable state laws and regulations.

Similarly biocontrol agents can be very effective in controlling non-native invasive plants, pests and pathogens. Biological control of purple loosestrife, *Lythrum salicaria*, with various insects from Europe, for example has helped successfully control the dominance of this non-native invasive wetland plant throughout many parts of North America, including the Albany Pine Bush Preserve. However, many of the caveats related to the use of chemical control agents also apply to biological control. Biological control agents have been proven to have devastating effects on native plant and animal populations when they have not been chosen carefully. For example the introduction of the tachinid fly, *Compsilura concinnata,* to control gypsy moth has had devastating impacts on many North American butterfly and moths, including many pine barrens obligate species. The release of biological control agents is regulated by the USDA and the NYSDEC. Agents approved for release in New York State are subject to individual State Environmental Quality Review (SEQR) actions coordinated by the NYS Department of Environmental Conservation and the New York State Department of Agriculture and Markets prior to release. The release of biocontrol agents requires a NYSDEC Special License (NYS ECL 11-0507 Liberation of Fish, Shellfish and Wildlife) as well as a federal USDA Plant Protection & Quarantine Permit.

E. Management Guidelines for Rare and Declining Wildlife

In the Albany Pine Bush Preserve management of rare and declining wildlife is guided by the State Wildlife Action Plan (SWAP) for New York State (NYSDEC 2015). The SWAP was prepared by NYSDEC to satisfy federal requirements that can guide the conservation of vulnerable wildlife species, called Species of Greatest Conservation Need (SGCN), and prevent the need to list such species as threatened or endangered in the future. The Albany Pine Bush contains multiple SGCN species and is a priority conservation area in the SWAP (NYSDEC 2015). As identified in the SWAP, many of these species require active management to achieve SWAP recommendations. In addition to the Karner blue butterfly, 74 other SGCN are documented in the Albany Pine Bush, including 43 birds, 4 mammals, 5 moths, 8 reptiles, 5

bumble bees, 3 butterflies, 3 amphibians and 3 fish. A list of these species is provided in Table 4. This rich biodiversity represents 19 percent of the 366 statewide SGCN.

The Commission's holistic ecosystem management largely focuses on the restoration and maintenance of suitable habitat and requisite ecosystem processes using the treatments described above. These management strategies need to account for the life history requirements of these species to ensure that critical life stages (e.g. hognose snake nesting, spadefoot breeding) are not adversely affected and that adequate refugia of untreated habitat are provided to facilitate the recolonization of treated areas by affected species. In the case of the Karner blue butterfly, for example, the Commission's NYS Special License requires that no more than one third of a sub-population is treated with fire in any given year and that adjacent thirds are not treated in consecutive years. It is important to note that wildlife are not simply housed by habitat, but themselves serve important ecosystem functions (pollination, seed dispersal, nutrient cycling, decomposition, competition, etc.) that directly contribute to ecosystem viability. As described in the Albany Pine Bush Pine Barrens Viability Assessment (Appendix B), monitoring SGCN will be important to the conservation of these species here and to understanding how Preserve management influences ecosystem viability. A truly viable inland pitch pine-scrub oak barrens will support diverse and abundant populations of associated SGCN wildlife.

Butterflies, Moths, and Other Insects

Pine barrens, including the Albany Pine Bush, are world renowned for their diverse and specialized insect populations. Many of the SGCN in the Preserve belong to this group (NYSDEC 2015) including butterflies, moths, tiger beetles, carrion beetles, bees, wasps, dragonflies and ants. These insects play many critical roles in ecosystem health including pollination, seed dispersal, decomposition, nutrient cycling, herbivory and they serve as an important source of protein for countless other wildlife species. Pollinating insects are particularly important and recovering their declining populations is the focus of the New York State and federal pollinator task forces. Commission, state and academic scientists are demonstrating that the ecosystem management strategies described above are advancing important insect conservation in the Preserve. Schoppman (unpublished 2015 data), Barber (2015), Keene (2013) and Bried and Dillon (2012) all show that sites managed according to this Plan support a diverse and abundant community of pine barren specialist insects (moths, bees, wasps, ants), including many SGCN, some of which have not been documented in the Preserve for more than 20 years (e.g. waxed sallow moth). In many cases, maintaining and/or restoring habitat for most of these insects requires the conservation of their specific host plants. For example, the mottled duskywing skipper (*Erynnis martialis*) caterpillars only feed on New Jersey tea (*Ceanothus americana*), a fire-dependent flowering shrub included in Commission restoration seed mixes that proliferates following prescribed fires. The Preserve is believed to support the single largest range wide population of this rare buttefly (Schweitzer personal communication). The recovery plan for the Albany Pine Bush Karner blue butterfly metapopulation (Appendix D) details specific management strategies for that species and its recovery is believed to benefit the other lupine feeding butterflies (frosted elfin and persius duskywing skipper) in addition to a wide variety of other insects.

Birds

Pine barrens, including the Albany Pine Bush, support important breeding season populations of many young forest bird species (Gifford et al. 2010,) and serve as critical staging areas for diverse populations of migrating birds (Kirchman, Ralston and Gifford 2011). Many of these species are also listed as SGCN in New York State. Protected state-owned lands in the Albany Pine Bush Preserve have been designated a Bird Conservation Area (BCA) by the NYSDEC and the New York State Office of Parks, Recreation and Historic Preservation, and the entirety of the

Preserve has been designated an Important Bird Area (IBA) by the National Audubon Society. The Preserve met four of the nine BCA/IBA criteria: Diverse Species Concentration Site, Individual Species Concentration Site, Species at Risk Site, and Migratory Concentration Site. The management strategies described above have been demonstrated to benefit these species (Gifford et al. 2010, Bried et al 2011). Adequate refugia will be especially important when implementing management during the spring/summer nesting season.

In addition to young-forest birds, the Preserve also supports several protected raptors and birds of forested and wetland habitats. The restoration of pine barrens will reduce forest cover here, but is not likely to affect the conservation of forest wildlife populations. Forest cover has increased considerably in New York State and throughout the Northeast in the last 50 years (Loveland and Acevedo 2008) while young-forest habitat has declined (Hunter et al. 2001, Dettmers 2003, Trani et al. 2001, Thompson and DeGraaf 2001, Fuller and DeStefano 2003). Increases are documented for more of the regions forest bird species (34 percent) than any other avian group (Sauer 2014). Given the relatively small cumulative area of pine barrens here, the anticipated decline of forest bird species in the Pine Bush is unlikely to affect overall regional conservation of forest birds. Additionally, the maintenance of the Preserve's wetlands should continue to provide habitat for a variety of wetland specialists like the American bittern (*Botaurus lentiginosus*) and green heron.

Herpetofauna (Reptiles and Amphibians)
Many of the Preserve's SGCN reptile and amphibian species are found in few other locations in New York State. Maintaining the quality of the various wetlands scattered throughout the Preserve is likely the single most effective management strategy for most of these species, although appropriately managing adjacent uplands is also important. This is especially important for the list of SGCN amphibians and for several of the reptiles. Even the terrestrial eastern hognose snake depends on these wetlands to produce ample amounts of its amphibian food supplies. All of these species also use upland habitats to varying degrees. The ecosystem management strategies described above for inland pitch pine-scrub oak barrens appear to maintain suitable habitat for terrestrial species (Pipino 2014), but it will be important to ensure that adequate refugia are provided for all of these terrestrial herpetofauna, wherever management occurs.

Guidelines for Other Fish and Wildlife Species
The Commission and NYSDEC monitor and manage the Preserve's fish and wildlife to maintain populations at levels that are compatible with Preserve goals, available habitat, and the existing type and level of human use in the area.

NYSDEC policy is to manage the state's deer herd to maintain a balance between the deer population, habitat carrying capacity, and surrounding land uses. Consistent with this policy, as currently authorized under Preserve rules and regulations, hunting is a permitted means of managing the deer population in the Preserve.

NYSDEC management goals and the recommendations of NYSDEC biologists will be used to determine wildlife population objectives for game species and the means of their attainment within WMU 4J, which includes the Preserve. Should research reveal that current hunting regulations are not adequate to achieve Preserve management goals, Commission staff should work closely with NYSDEC biologists to develop additional management approaches.

Hunting and trapping are allowed within the Preserve. To increase public awareness and reduce the potential for user conflicts in the Preserve, season dates, and a brief discussion regarding the

rationale for allowing hunting and trapping is available to the public at the Discovery Center and on the Commission's Web site.

The Commission in coordination with NYSDEC wildlife biologists maintains a registration system to control and regulate trapping within the Preserve, as provided in the current Preserve Rules and Regulations. In this way, legally trapped wildlife species (e.g. raccoon, gray fox (*Urocyon cinereoargentus*), red fox (*Vulpes vulpes*), muskrat (*Ondatra zibethicus*), coyote, etc.) can be managed in accordance with NYSDEC and Commission goals, while potential conflicts with Preserve visitors and adjacent residents can be minimized.

The Commission, in coordination with NYSDEC fisheries biologists, permits fishing at suitable waters in the Preserve, as provided in the current Preserve Rules and Regulations.

Other wildlife management efforts within the Preserve should be directed at maintaining the full complement of species native to the natural communities historically found in the Albany Pine Bush. For many species, this can be accomplished by restoring and managing habitat as outlined elsewhere in this Plan. However, for other species with specialized life history needs or particular vulnerabilities, specialized management may be required to achieve and maintain desired populations.

F. Research, Inventory, and Monitoring

Research, inventory, and monitoring programs are essential to assessing community health and progress toward achieving management objectives, and when carefully designed can provide valuable engagement opportunities for community members. Monitoring rare communities and species is intended to show changes in their distribution and abundance over time and/or as a result of management activities. For instance, Karner blue butterfly numbers have been monitored to determine annual population changes and track progress toward local, state and federal recovery goals. Inventory efforts represent searches for species and natural communities, which provide documentation on their distribution and status as a result of management. 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 ecosystem viability.

Appendix H provides a summary of research, inventory, and monitoring needs for the next five years.

Research topics include:

1. Influence of ectomycorrhizal fungi in restoring pitch pine-scrub oak barrens in former locust sites.

2. Fire regime (frequency, seasonality, severity) dynamics necessary to maintain restored pitch pine-scrub oak barrens and SGCN (e.g. Kbb, PRAW) wildlife habitat.

3. Recreational user impacts and the effects of habitat fragmentation.

4. Vernal pond and other wetland ecology and hydrology.

5. Effects of dune topography on microclimate variability and climate change resiliency for SGCN wildlife.

6. Productivity and survivorship of regionally significant shrubland birds.

7. Awareness, knowledge and attitudes of regional residents regarding the protection and management of the Albany Pine Bush Preserve.

8. Smooth green snake habitat dynamics in the Albany Pine Bush Preserve.

Inventory needs include:

1. Lichens, fungi, and bryophytes surveys in the Albany Pine Bush Preserve.

2. Surveys of aquatic macroinvertebrates, fish, plants and birds in Preserve wetland communities, especially streams and marshes not previously surveyed.

3. Diurnal and nocturnal breeding season birds surveys.

4. Aerial surveys of plant community distribution.

Monitoring priorities include:

1. Distribution and/or abundance of obligate pine barrens Lepidoptera (e.g. Karner blue butterfly inland barrens buckmoth, frosted elfin, mottled Duskywing skipper) and their larval host plants.

2. Distribution and abundance of breeding season birds.

3. Avian productivity and survivorship in managed pitch pine-scrub oak barrens.

4. Use of managed pitch pine-scrub oak barrens by migratory birds.

5. Designing and implementing a monitoring program for indicators of inland pitch pine-scrub oak barrens viability identified above.

6. The distribution and abundance of species identified in the Invasive and Overabundant Species Management Plan.

The results of these efforts should be compiled so that they can be used in concert with existing GIS information.

Citizen Science

The Commission has created a citizen science program to provide engagement opportunities for members of the community. The program aspires to instill knowledge and appreciation of the Preserve and the Commission while also providing the Commission with scientific information that can inform restoration and management of the globally-rare, nationally-significant and locally- distinct pitch pine-scrub oak barrens found here.

VI. EDUCATION, OUTREACH AND COMMUNICATIONS

A. Introduction

Since its adoption of the first Management Plan (1993), the Commission has increased public awareness of the Albany Pine Bush Preserve. The Preserve's rare ecology, management, and urban context provide for a variety of interpretive and educational opportunities. The 1993 Management Plan proposed a program involving signs, off-site displays, on-site walks and talks, informational news releases/mailings, and an interpretive education center. To this end, the Commission enhanced its education and outreach efforts by developing an education program in 1998 and in 2007 opened the Albany Pine Bush Discovery Center, a one-of-a-kind LEED (*Leadership in Energy and Environmental Design*) Gold Certified interpretive center. The 2010 Management Plan envisioned an education and outreach program closely integrated with public use. A multi-level approach was determined to best reach the widest possible audience while controlling implementation costs.

The Commission is now poised to build upon its success and further refine education, outreach and communications recommendations to increase broad-based understanding of and support for the Preserve. Constituents are considered integral to the organization's success, to keep an organization "top of mind" and tell the organization's story in social circles, within personal or professional networks, and on social media sites. Commission goals for constituent engagement include creating a greater public awareness and appreciation of Preserve ecology and management, and increasing the visibility and image of the Preserve.

Recommendations of the 2017 Management Plan Update include:

1. Education: Communicate Preserve themes to a diversity of audiences, with a focus on target audience segments, by employing a variety of interpretive and educational techniques to increase awareness of the Preserve and its management.

2. Outreach: Continue and expand outreach that increases public appreciation of the ecological, historical, and geological resources of the Preserve and ongoing and proposed management activities within the Preserve.

3. Communications: Implement a coordinated communications strategy to distribute information and conservation messages to appropriate target audiences to increase public awareness of the Albany Pine Bush Preserve and Discovery Center.

B. Education

The intent of education at the Commission is to effectively communicate information about the Preserve to a diversity of audiences with a special focus on target audience segments. Education is a broad term that encompasses a variety of techniques utilized to communicate Preserve themes, establish emotional and intellectual connections between people and the Preserve, build constituency and promote the mission of the Commission. Interpretive techniques include guided programs, exhibits, visitor services, and web-based resources that connect the visitor to the resource, whether it be on site at the Discovery Center, the Preserve or remotely. Education initiatives target school and special interest groups and tie into pre-determined learning standards and curricula with a special emphasis on STEM (Science, Technology, Engineering and Math)-based learning. Success in achieving goals will be measured and outcomes will be utilized to inform future education.

Discovery Center
The Discovery Center serves as the central location for people of all ages to learn about the unique ecology, human history, management techniques and recreational opportunities of the Albany Pine Bush Preserve. The Discovery Center is supported by a variety of interpretative elements including interactive indoor and outdoor exhibits, special temporary exhibits, gift shop and native plant gardens. The Discovery Center provides a variety of visitor services including classrooms, public restrooms and staff who provide interpretive and wayfinding information. The Discovery Center is open to the public year-round, seven days a week. The Commission will continue to engage in currently provided interpretive and wayfinding services.

The Discovery Center exhibits, gift shop and native plant gardens need to be continually updated to reflect the most recent and substantiated knowledge and new target audiences. Additionally, evaluation of the Discovery Center exhibits' abilities to communicate key messages is an important tool that will be developed in the next 5 years. It will provide the necessary information to the Commission in updating and maintaining these exhibits. The Commission will enhance its offering of special temporary exhibits allowing it to present relevant and timely information to the public, creating a dynamic experience that constituents will return to.

Trailside Interpretation
Trailside interpretation helps to connect people to the Preserve by providing information and wayfinding. The Discovery Trail is a 0.2 mile long ADA accessible trail with interpretive signage that guides and informs visitors. Interpretive signage has also been placed in two locations along the 2.6 mile yellow trail in Karner Barrens East highlighting landfill restoration and vernal ponds. The beginning of each trailhead in the Preserve features a kiosk with interpretive elements as well as rules, regulations, maps and other important information. The Commission is currently working on updating all of the kiosks to better inform Preserve visitors. Along with the updated kiosks the Commission will add more trailside interpretation.

Interpretive Programs
Interpretive programs are guided experiences that aim to help visitors develop a deeper connection with the Preserve. The Commission continues to offer a variety of public programs on weekends, evenings and school breaks. Public interpretive programs cover a wide range of topics reaching diverse audiences. Visitors services staff based in the Discovery Center provide informal interpretation to visitors, answer questions and address needs. Volunteer Jr. Docents provide interpretation in the Discovery Center by leading activities for the public at Discovery Tables.

Interpretive Writing
Pine Bush themes are also communicated through interpretive writing venues including publications, social media posts, Commission website blog entries and guest articles in local newspapers. Interpretive writing is an important technique for communicating with audiences remotely.

Interpretive Volunteers
Interpretive volunteers provide an essential service to the Commission. These volunteers directly engage with visitors and communicate key messages in a personalized manner. Currently the Commission supports several interpretive volunteer positions including Docents, Jr. Docents, Program Assistants and Naturalists. Docents and Jr. Docents provide interpretive and wayfinding services to visitors and are based in the Discovery Center. Naturalists provide interpretive and a wayfinding service throughout the Preserve's hiking trails. Program Assistants support interpretive programming through co-leading and program preparations. Interpretive volunteers increase the Commission's ability to educate the public and will continue to be utilized.

Education Programs
The Commission offers education programs designed specifically for school and special interest groups that communicate Preserve-centric themes are curriculum-based and linked to learning standards. They are offered on-site at the Albany Pine Bush Preserve, Discovery Center and off-site, engaging a diversity of people with an emphasis on reaching target audiences. Education programs provide opportunities for the Commission to connect with neighbors and form partnerships with local schools and other organizations such as libraries and community groups. The Commission plans to expand citizen science programming, as well as enhance the availability of online educational curriculum and utilize volunteers to lead programs.

C. **Outreach**

Outreach is a strategy used by the Commission to connect with constituents in their community. The Commission recognizes that engaged constituents and public appreciation are critical to its success and works toward more fully engaging people in support of the Preserve. In order to do this the Commission must ensure its work is "constituent centered" and understand the best ways to resonate with people.

The Commission will create connections to its constituents in many ways including;

- Attend community events to interpret the Pine Bush, listen, network and create relationships with constituents
- Increase involvement in the local community to provide an open feedback loop between the public and Commission to improve communication, programs, services and resources
- Coordinate activities to engage constituents, including volunteer opportunities, citizen science, and focus groups
- Ensure the Commission is maximizing mutual partner benefits
- Provide Preserve information through interpretive writing, off-site exhibits, and web-based content

D. **Communications**

The Commission will use a variety of communication strategies for specific target audiences to reinforce the Commission's brand as globally rare, nationally significant, and locally distinct with the goal of building broad-based, sustained local support for Preserve protection and management. The Commission will also use these strategies to establish its position as an indispensable regional asset and the place with which to affiliate for those interested in conservation science, ecology, and natural history.

Methods to reach target audiences include advertising, email communication, social media, direct mail, press releases, print media, radio and television coverage, and website postings.

Successfully reaching target audiences will result in broad community acceptance of Preserve ecology and management, more informed, knowledgeable neighbors, increased program participation, and ongoing and increased political and financial support.

VII. Recreation

A. Introduction

In December of 1988 the New York State Legislature, represented in the Senate and Assembly, declared it to be in the public interest to protect and manage the Albany Pine Bush Preserve by establishing the Albany Pine Bush Preserve Commission to "…protect and manage the Albany Pine Bush by establishing an Albany Pine Bush Preserve consisting of dedicated public and dedicated private land and a commission made up of representatives of state and local governments and private citizens to manage the Preserve for purposes of its protection and controlled and appropriate recreation and education purposes. Its location at the center of a major urban area makes it especially valuable as an open space resource and, if properly managed, as a passive recreation area and educational laboratory" (ECL Article 46).

The Commission has established and maintained approximately 20 miles of official trails and ten trail heads in various locations throughout the Preserve (Figure 6). Rules guiding Preserve use were promulgated in 2000, and the NYSDEC has a full-time Forest Ranger whose jurisdiction includes the Preserve.

Specific recommendations include:

- Continue partnering with the towns of Guilderland and Colonie and the City of Albany to advance appropriate public use of, and access to, the Preserve and support for the Preserve's goals.

- Implement the Resource Protection and Visitor Experience Vision, a comprehensive recreation plan for the Preserve regarding appropriate public use of, and access to, Preserve lands.

- Continue development of an official Preserve-wide trail network and map. Improve the systems of trail marking to reduce visitor confusion and minimize resulting impacts.

- Continue to maintain and repair damaged/eroded trails and remove unnecessary or inappropriate trails.

- Reduce inappropriate use of the Preserve by ensuring the core audience is fully engaged, supportive and proud of living near a globally rare ecosystem. They are aware of the size and boundaries of the Preserve and identify themselves with this place. This will give rise to support for the partners and decision makers who protect and fund it. They participate in programs, enjoy the Preserve, volunteer and are strong ambassadors for management practices and appropriate recreational use.

B. Recreational Use

The Albany Pine Bush Preserve is a significant environmental, recreational, and educational resource that provides people with many opportunities. The long-term viability of the Preserve is enhanced when public use is appropriately managed to maximize appropriate visitor experiences while minimizing negative impacts on the plants, animals, ecological systems, and cultural resources of the Albany Pine Bush Preserve. Protection of this resource is the primary goal of the Commission and this includes managing all public use of the Preserve.

As part of the 2010 Management Plan and Final Environmental Impact Statement, the Commission produced the Resource Protection and Visitor Experience Vision (RPVEV) for the Albany Pine Bush Preserve (Appendix G). The development of such a plan was critical to more thoroughly address and incorporate the public use programs into the larger Preserve goals for land protection, ecological management and restoration, education, outreach, and appropriate recreational use. This RPVEV addresses public use of the Preserve as it relates to the protection and management of the natural and cultural resources of the Pine Bush. This Plan also provides monitoring criteria and management actions necessary to protect both the natural resources and the visitor experience of the Preserve.

The Preserve is a popular recreational and educational destination. Public use of the Preserve continues to increase and the accompanying recreation and education related stresses to the natural systems of the Pine Bush are also increasing. The RPVEP addresses the stresses created from recreation and education activities on these natural systems as well as the quality of the visitor experience. The RPVEV serves as a management tool for the Commission, providing a set of standards to ensure the long-term protection of the Albany Pine Bush Preserve as it relates to public use.

All of the elements in this RPVEV relate directly to previously developed statements of Preserve purpose and significance as well as primary interpretive themes expressed in the 2002 Management Plan and the 2003 Interpretive Planning Report for the Albany Pine Bush Preserve Discovery Center. The elements of this Plan include assembling a team to draft and review the Plan, public involvement, analyzing existing Preserve resources and visitor use, describing resource conditions and potential visitor experiences, creating public use management zones, and setting up a monitoring plan with associated management actions.

This RPVEV also establishes trail review and development standards for the existing multi-use trails and sets standards and limits for trails that may be proposed in the future. The standards established provide a level of protection designed to minimize fragmentation within the Preserve, limit the ecological impact of recreation and education activities, and carefully protect the plants and animals of the Pine Bush. At the same time, public use and visitor experiences are encouraged at a level that allows visitors to enjoy much of what the Pine Bush has to offer as a recreational and educational resource.

The RPVEV recommends that the monitoring and management actions within this Plan be initiated as part of the adoption of the 2010 Management Plan. Specific recommendations include:

- Initiate the process of implementing the standards and recommendations of the RPVEV as they relate to the existing and conceptual future recreational trail system. The conceptual revised trail system proposes a potential increase from 18.37 to 20.73 miles of trails. This trail concept also incorporates Preserve end - to - end trails both north and south of the NYS Thruway. This includes relocating trails out of sensitive areas to improve Preserve viability and rare species populations as well as linking currently isolated sections of the trail system to facilitate through hiking.

- Review legal, off-trail public recreational, and educational Preserve activities (e.g. bushwacking), particularly as they relate to endangered species habitat, consistent with the endangered species laws and permits.

- Implement resource zone monitoring at the frequencies recommended by the plan and implement management actions as necessary.

- Review the RPVEV on the same five-year cycle as the Commission's Management Plan. This regular review will consider if the RPVEV is effectively providing Preserve recreational and educational users with the experiences and opportunities outlined in this plan while also protecting the natural resources of the Preserve.

- Continue the consistent enforcement of the Preserve rules and regulations and consider additional enforcement capacity needs as appropriate.

- Continue to explore the feasibility of linking the Albany Pine Bush Preserve with other formal paths and trails within the regional context through partnerships and/or access agreements with municipalities, institutions, and private businesses adjacent to the Preserve in areas where public access is desirable, but not currently available.

The process described in the RPVEV provides a useful management tool for the Commission as it seeks to fulfill its responsibility to protect and manage a landscape of rare and endangered natural communities and species while allowing controlled and appropriate use of the Preserve for recreational and educational purposes. This plan, along with the associated monitoring and management actions, will guide future management and allow visitors to enjoy this natural area while minimizing the potential negative impacts that recreational and educational use can have on the unique and threatened resources of the Preserve.

C. Rules and Regulations

On September 20, 2000, the NYSDEC promulgated public use rules and regulations for the Albany Pine Bush Preserve (6 NYCRR Part 648). These rules are designed to achieve the following goals:

- Advance the mission of the Commission by protecting the endangered species and unique communities of the Albany Pine Bush while providing the opportunity for a variety of appropriate public uses.

- Clearly define for the public what uses are permitted and prohibited on Preserve lands and waters, as a means of avoiding conflicts and reducing hazards to Preserve visitors.

- Provide consistent rules and regulations for all dedicated and managed land of the Albany Pine Bush Preserve, regardless of ownership.

- Provide enhanced authority to enforcement personnel as they work to eliminate misuse of the Preserve.

- Provide a safe and enjoyable environment for Preserve visitors engaged in a variety of educational and recreational pursuits.

The unabridged public use Rules and Regulations for the Albany Pine Bush Preserve can be found in Appendix I. A full-time NYSDEC forest ranger, whose jurisdiction includes the Albany Pine Bush, has aided enforcement of the Rules and Regulations and monitoring of users, as well as served an ombudsman between Preserve users and the Commission.

VIII. OPERATIONS

A. Introduction

Operations include technical services, facilities management, and maintenance of physical assets to ensure effective and efficient operation of the Albany Pine Bush Preserve and safe public use of Preserve lands and facilities. APBP facilities include the Discovery Center, Field Operations Center, trails, trailheads and kiosks, and storage facilities.

B. Discovery Center

The Discovery Center Facility is a 32,310 square foot building located at 195 New Karner Road in Albany, NY. The state-owned facility is situated on an approximately 4 acres consisting of outdoor exhibits, native plant gardens, interpretive trail, public restrooms, solar panel array and a 100-space parking lot. The building encompasses two floors and a basement. The first floor houses Commission staff offices, public exhibits, gift shop, classrooms and public restrooms. The second floor houses leased office space and a large conference room. Proper maintenance of this facility is key to the Commission's ability to meet its mission. As a LEED Gold Certified facility it also represents a model for energy efficient and environmentally friendly building design and operations. Maintaining the LEED Gold certification and continually enhancing the efficiency of the building is an ongoing need.

Recommendations:

- Maintain the Discovery Center as the visible "front door" to the Preserve.
- Provide a safe, effective and LEED Gold Certified space for Commission staff offices, visitors and tenants.
- Generate building related revenue through lease of the second floor office space, rentals and gift shop sales.
- Leverage the Discovery Center facility as a community resource to build awareness of the Commission.

C. Field Operations Center and Storage Facilities

Stewardship and prescribed fire operations are housed in several buildings at 1219 Kings Road. This is also the site of the two-story "Barrens House" which provides housing for seasonal staff and interns.

IX. PROTECTION

A. Introduction

A vision for the Albany Pine Bush Preserve was presented in Figure 10 of the 2010 Management Plan and is included herein as Figure 8. This vision, along with the project review guidelines (section E below), outline how the Commission envisions a viable Preserve that can effectively conserve Pine Bush ecology as well as accommodate educational and recreational opportunities consistent with ECL Article 46. The vision for the Albany Pine Bush Preserve described in this Plan is unchanged (Figure 8).

The 2017 Vision Map (Figure 8) uses the scoring system described in the 2002 Management Plan to identify protection recommendations and project review guidelines consistent with previous Management Plans (Full Protection, Partial Protection, Open Space). Since 2002 the Commission has added approximately 565 acres to the Preserve, in great part due to the support of the State of New York, The Nature Conservancy, and other Commission members. The Commission will continue to work with willing landowners to acquire or otherwise protect lands within Pine Bush Protection Areas to build a truly viable Preserve of approximately 5,380 acres. As of this date, protected lands–including those pending incorporation into the Preserve and those protected by conservation easements or other agreements–total approximately 3,300 acres. The 2017 vision described below remains unchanged from the 2010 Management Plan and FEIS, recommending an additional 2,080 acres of Full Protection and 638 acres of Partial Protection, with 877 acres recommended to remain as open space. This vision will create ecological and recreational linkage between the Rennslear Lake Preserve and Park in the City of Albany and the Woodlawn Preserve in the city of Schenectady. These parks support important ecological and recreational resources and form eastern and western gateways to the Albany Pine Bush Preserve.

In addition to land protection, the Commission will continue to consult with municipal agencies reviewing development projects throughout the Pine Bush Study Area. The project review process described in the 2002 Plan has generally worked well in helping agencies and applicants understand the Commission's protection and management priorities. Although approximately 300 acres were developed within Pine Bush Protection Areas since 2002, in nearly all cases the potentially significant negative impacts of these developments were dramatically reduced and important environmental resources protected (e.g. Woodsfield Estates subdivision, Albany landfill expansion).

B. Other Planning Efforts

The protection and management of the Albany Pine Bush Preserve is guided by and complements a number of complete and ongoing national, state, and local planning efforts. This section describes those plans, how they influence protection and management of the Albany Pine Bush Preserve, and how the Vision described here assists with the implementation of those plans.

State and National Plans:

The 2017 Management Plan affects and is impacted by a number of state and federal plans including state and federal Karner blue butterfly recovery plans, the New York State Open Space Conservation Plan, and the New York State Wildlife Action Plan.

Karner blue butterfly recovery plans**:**

The Albany Pine Bush Preserve Commission participates on federal and state Karner blue butterfly recovery teams, which govern recovery within their respective jurisdictions (USFWS 2003). Karner blue butterfly (Kbb) recovery in the Albany Pine Bush Preserve is guided by the ongoing work of these teams and the federal and New York (Draft) Karner blue recovery plans. The federal recovery plan (USFWS 2003) establishes minimum recovery goals and a 20-year recovery timeline for the Kbb throughout 13 recovery units nationally. Recovery in all 13 units is requisite for down-listing/de-listing; 2016 represents year twelve of this 20 year plan. The federal "Glacial Lake Albany" (GLA) New York recovery unit is one of only two recovery units east of the Great Lakes and the only eastern recovery unit with naturally occurring wild populations of Karner blue butterflies. The federal recovery plan establishes specific recovery targets for GLA across three geographic areas. The (draft) New York State Kbb Recovery Plan identifies four recovery areas within the GLA recovery unit between Albany and Queensbury. The New York State Kbb Recovery Team is in the process of defining recovery (down-listing and de-listing) guidelines for these four areas. The recovery and management goals established for the Albany Pine Bush Preserve and the APB Kbb Recovery Plan (Appendix D) are based on these state and federal recovery plans and the ongoing work of the recovery teams and represents the best available information on Karner blue recovery in the Albany Pine Bush.

New York State Open Space Conservation Plan: The New York State Open Space Conservation Plan (2009) guides state land acquisition and recommends other land conservation strategies to protect important open space resources across New York. The 2009 Plan proposes open space resources that should be protected within each of nine NYS Department of Environmental Conservation (NYSDEC) regions. The original Open Space Plan was completed in 1992 and was based on ECL Article 49, which the Legislature passed in 1990. The law required the creation of a state land acquisition plan and the creation of nine Regional Advisory committees to identify regional open space priorities. The Albany Pine Bush and the remnant Pine Bush communities located in eastern Schenectady County are both NYSDEC Region 4 priorities in the 2009 Open Space Plan.

New York State Wildlife Action Plan (SWAP):
In 2002 Congress began funding the State Wildlife Grants (SWG) program with the intent to maintain the nation's wildlife, and in so doing to prevent new listings of endangered species. States receiving federal SWG funding were required to prepare a Comprehensive Wildlife Conservation Strategy that identifies the "species in greatest need of conservation," while also addressing the state's "full array of wildlife" and wildlife-related issues (NYSDEC 2006).

The New York State Wildlife Action Plan (SWAP), (NYSDEC 2015), identifies species in the greatest need of conservation throughout New York State. The Albany Pine Bush Preserve is highlighted as a unique and important wildlife habitat in the SWAP. The Preserve provides habitat for 75 Species of Greatest Conservation Need (SGCN), 35 of which are listed as high priority SGCN, within 6 taxonomic groups: birds; reptiles, amphibians; mammals; butterflies and moths. These species represent 20 % of the 366 SGCN documented in New York State. The SWAP guides all non-game wildlife management in the Preserve and Preserve management directly supports many of the SWAP goals, objectives, and strategies.

US Environmental Protection Agency (EPA) and NYS Stormwater Management Program:
The state's stormwater management program aims to improve the quality of the state's water by reducing the amount of pollution-laden run-off. The program is governed nationally by the Clean Water Act and the EPA's Stormwater Phase II Final Rule through a permit to NYSDEC. NYSDEC in turn permits qualifying municipalities regarding stormwater management from construction activities and operators of small municipal separated storm sewer systems (MS4s)

through its State Pollutant Discharge Elimination System (SPDES). Each of the three Pine Bush municipalities (City of Albany, towns of Colonie and Guilderland) has or is preparing a stormwater management plan and authorizes stormwater management at construction sites within its own jurisdiction.

According to the EPA (EPA 1998), sediment runoff rates from construction sites are typically 10 to 20 times greater than those from agricultural lands, and 1,000 to 2,000 times greater than those of forest lands. During a short period of time, construction activity can contribute more sediment to streams than can be deposited over several decades, causing physical and biological harm to our Nation's waters.

The protection and management vision described in the 2010 Management Plan will aid local municipalities with storm water management through the protection of important wetland resources and aquifer recharge areas. Conversely, local stormwater management plans will benefit the conservation of streams, wetlands, and associated habitats identified in the Pine Bush Management Plan and throughout the Capital District by reducing pollution and sedimentation. In particular these regulations will help protect the waters of the Hunger Kill, Kaikout Kill, and Lisha Kill and their associated wetlands, as well as the plants and animals that inhabit them.

Regional and Local Plans:

Municipal Comprehensive Plans:
(City of Albany, towns of Colonie and Guilderland, City of Schenectady).
Each of the three municipal Commission members have completed comprehensive plans (towns of Colonie 2007 and Guilderland 2000, City of Albany 2012). Additionally the City of Schenectady completed a comprehensive plan in 2008. The completed plans represent solution-oriented, proactive, community-wide visions for ensuring an exceptional quality of life for residents and businesses by balancing economic and social concerns. The Albany Pine Bush Preserve is highlighted in each of the completed plans as an important open space resource, and each plan supports the goals and recommendations of the Management Plan. Currently all three municipal Commission members actively consult the Commission's Technical Advisory Committee and staff when reviewing proposed development in the Pine Bush Study Area. Similarly the City of Schenectady and the Friends of the Woodlawn Preserve routinely consult Commission staff about Woodlawn Preserve protection and management.

In the Town of Guilderland, the Comprehensive Plan and the 2017 Preserve Management Plan complement each other in striving to protect inland pitch pine-scrub oak barrens, dunes, Karner blue butterflies, stream corridors, and important wetland resources. The Guilderland Plan also recognizes the value of the Preserve as an important recreational asset and strives to protect lands for ecological and recreational purposes in the Albany Pine Bush and other areas of the Town. It also supports the Discovery Center as an important educational resource. To assist in balancing economic development with the conservation of the Town's important open space resources, including the Albany Pine Bush, the Plan recommends clustering development, utilizing Conservation Sub-division Design, Incentive Zoning, Conservation Easements, establishing Purchase of Development Rights (PDR) and Transfer of Development Rights (TDR) programs, deed restrictions, as well as proactive consultation with the Commission on new projects in the Study Area. Within the Guilderland Plan the Pine Bush is part of the Fort Hunter/McCormack Corners, Guilderland Center, and Pine Bush/Hunger Kill planning areas.

Similarly, the Town of Colonie Comprehensive Plan strives to enhance the quality of life for its residents and businesses by prescribing a land-use zoning plan and planning guidelines that

balance economic development and open space conservation with specific recommendations throughout the Town. The Pine Bush is highlighted throughout the Colonie Plan as an important open space, recreational, and educational resource. The town-wide land use zoning law, adopted in 2007, updates previous zoning in the Pine Bush with the creation of a "Conservation Overlay District" that encourages compatible land use (eg. conservation cluster subdivision) to protect open space. As a member of the Commission, the Town's plan recognizes the recommendations of the Preserve Management Plan and recommends that all Full Protection areas identified in the Commission's Management Plan be considered priority open space conservation areas.

C. Establishment of Protection Priorities

Areas evaluated for protection are located within the Study Area/Protection Area boundary described in Section II above and illustrated in Figure 8 of this Plan.

As in previous plans, only open areas (<20 percent development) were evaluated using the ranking system because they provide most of the acreage needed to attain the four ecological resource goals described in Section II. However, portions of more highly developed areas, particularly in-holdings surrounded by Preserve lands, may satisfy one or more of the protection criteria and contribute to the functions and values of the Preserve. Therefore, developed areas within the Study Area should be considered for acquisition/protection and be subject to careful project review to ensure that additional development on these sites does not impact the Commission's ability to create or manage the Preserve.

The individual areas evaluated are indicated in Figure 8. The areas considered and their reference numbers are the same as in the 2010 Management Plan.

A total of 77 discrete areas (totaling approximately 3,654 acres) were evaluated for the Management Plan. To the greatest extent possible, the boundaries of open areas evaluated within the Study Area follow roads, natural features (such as ravines), edges of developed areas, and municipal boundaries. The boundaries do not always follow property lines; therefore, an individual area may include multiple parcels or portions of multiple parcels. Parcel ownership was not part of the evaluation process. There was also some variability in the coverage/consistency of the available geographic information system (GIS) data layers, so all acreages should be considered approximate and Protection Area boundaries used as a guide.

Protection Criteria

The evaluation process in this Management Plan consisted of the four following questions:

Criterion 1: Pitch pine-scrub oak
Does the area support existing or restorable pitch pine-scrub oak communities?

Criterion 2: Linkages
Does the area serve as a viable linkage that potentially increases contiguity and provides dispersal opportunities between existing or potential Preserve lands?

Criterion 3: Buffers
Is the area important in terms of serving as a buffer zone between the Preserve and adjacent developed areas?

Criterion 4: Significant Cultural and Environmental Resources

Does the site contain any significant cultural or natural resources, including: Karner blue butterfly habitat, water resources, and historical/archeological resources?

Areas meeting these criteria were then assigned a score for each criterion based on a more detailed site-specific evaluation.

Scoring System

Consistent with the approach used in previous plans, the value assigned to each criterion was based on the area's contribution to the viability of the Preserve. Those that contribute more received a higher possible maximum score (e.g. 20). Conversely, those that are less critical to the viability of the Preserve (but still important Pine Bush resources) received a lower possible maximum score. By assigning an area scores for each of the criteria and summing their values, the total scores provided the basis for determining protection recommendations. The scores and scoring criteria are outlined in Table 9 and are consistent with previous Management Plans.

The range of scores possible for each criterion reflects its relative importance within the ranking system. Pitch pine-scrub oak barrens, linkages, and Karner blues were ranked highest (i.e. maximum score of 20) on the basis of rarity and importance. Although buffer areas are very important to maintaining the integrity of the Preserve, they are somewhat less critical to Preserve viability than linkages, pitch pine-scrub oak barrens, and the presence of Karner blues. Buffers are most important where they facilitate fire management. For this reason, areas within 500 feet of Preserve lands that can currently be managed with fire received a high score of 16. Without such buffers, Commission experience has been that habitat restoration and management with fire is extremely difficult.

Table 8. Score Descriptions for Each of the Protection Criteria.

SCORE	**INLAND PITCH PINE-SCRUB OAK BARRENS (PPSO):** Open areas that contain varying degrees of existing or remnant PPSO communities. For detailed descriptions of the natural communities see Albany Pine Bush Inventory (Edinger et al. 2014).
20	More than 50percent of the open area supports PPSO community variants (i.e. pitch pine-scrub oak barrens, pitch pine-scrub oak thicket, pitch pine-scrub oak forest, pitch pine-oak forest) characterized by scattered to dense pitch pine in the canopy and a scrub oak dominated understory of varying densities and grassy openings that support a variety of herbaceous species. Fire will be used to maintain these areas as pitch pine-scrub oak community variants.
16	20-49 percent of the open area supports PPSO community variants. The extent of the PPSO community variant is either limited to a portion of the open area or it is intermixed with exposed areas of sandy soil or one or more of the following natural communities: pine - northern hardwood forest, Appalachian oak-pine forest, rich mesophytic forest, or successional northern hardwood forest. Each of these community types is a natural part of the Albany Pine Bush ecosystem. Consequently, it is not appropriate to eliminate them from the Preserve; rather it is appropriate to reduce their extent to historic levels since their spatial extent has increased in the absence of fire. Although there will be difficulty in restoring these areas to a pitch pine-scrub oak community variant, it is anticipated that fire will serve as the primary restoration and long-term maintenance tool with minimal use of other management techniques, except for perhaps seeding in native species on exposed sandy areas.
12	20-49 percent of the open area supports PPSO community variants. The extent of the PPSO community variant is either limited to a portion of the open area or it is intermixed with one or more of the following communities: successional southern hardwood forest, brushy cleared land, or disturbed communities (including cropland). These communities are not a natural part of the Albany Pine Bush ecosystem, but rather they represent communities that support exotic species and/or early successional weedy species typical of areas that have experienced physical disturbance. Consequently, these areas should be restored to pitch pine-scrub oak community variants. Because of the considerable difficulty in eradicating and controlling exotic and weedy species, other management tools in addition to fire will be necessary for restoration. After restoration is complete, fire will serve as the primary long-term maintenance tool.
8	Between zero and 19 percent of the open area supports PPSO community variants. The extent of the PPSO community variant is either limited to a portion of the open area or it is intermixed with exposed areas of sandy soil or one or more of the following natural communities: pine - northern hardwood forest, Appalachian oak-pine forest, rich mesophytic forest, or successional northern hardwood forest. Each of these community types is a natural part of the Albany Pine Bush ecosystem. Consequently, it is not appropriate to eliminate them from the Preserve; rather it is appropriate to reduce their extent to historical levels since their spatial extent has increased in the absence of fire. Although there will be difficulty in restoring these areas to a pitch pine-scrub oak community variant, it is anticipated that fire will serve as the primary restoration and long-term maintenance tool with minimal use of other management techniques, except for perhaps seeding in native species on exposed sandy areas.
4	Between zero and 19 percent of the open area supports PPSO community variants. The extent of the PPSO community variant is either limited to a portion of the open area or it is intermixed with one or more of the following communities: successional southern hardwood forest, brushy cleared land, or disturbed communities (including cropland). These communities are not a natural part of the Albany Pine Bush ecosystem, but rather they represent communities that support exotic species and/or early successional weedy species typical of areas that have experienced physical disturbance. Consequently, these areas should be restored to pitch pine-scrub oak community variants. Because of the considerable difficulty in eradicating and controlling exotic and weedy species, other management tools in addition to fire will be necessary for restoration. After restoration is complete, fire will serve as the primary long-term maintenance tool.

Table 8. Score Descriptions for Each of the Protection Criteria (continued).

SCORE	**LINKAGES:** Open areas providing linkages that increase contiguity and provide opportunities for dispersal between existing and potential Preserve lands.
20	Links neighboring sections of existing or potential Preserve with no development between any of the parcels OR the open area links Karner blue butterfly subpopulations to the Preserve.
16	Links neighboring sections of existing or potential Preserve with moderate to low levels of physical development between the parcels (moderate to low disturbance e.g. two lane roads or widely spaced buildings) so that dispersal of plant and animal species is moderately impacted OR links Karner blue butterfly subpopulations to areas recommended for addition to the Preserve.
12	Links neighboring sections of existing or potential Preserve, but there is a high level of development between the parcels (high disturbance, e.g. more than two lane roads or dense development) so that dispersal of plant and animal species among parcels is likely to be significantly impaired.
SCORE	**BUFFER AREAS:** Open areas that provide buffer zones, including watershed protection, reduction of impacts from adjacent development, and increased fire manageability.
16	Area provides buffer around portions of the Preserve that can currently be managed with fire (they are within 500 feet of pitch pine-scrub oak communities on existing Preserve lands).
13	Area currently provides buffer for Preserve management (including future fire management), but does not meet criterion listed above.
9	Area provides potential buffer for Preserve management or reduced impacts from nearby developed areas.
6	Area does not provide buffer functions described in the previous categories, but does provide buffer around water resources.
SCORE	**KNOWN SIGNIFICANT CULTURAL AND NATURAL RESOURCES**
20	Karner blue butterfly: Areas currently supporting a Karner blue butterfly population.
10	Areas necessary for establishment of new subpopulations of Karner blue butterflies to link remote populations to the existing Preserve. The location of these areas is defined by the assumed maximum dispersal distance of Karner blues from an existing colony (i.e. 1,000 meters).
10	Water resource protection: - A water resource including State regulated wetlands, wetlands mapped by Mattox (1994), and protected streams designated Class C(T) or higher.
5	- A water resource including: unmapped wetlands identified by Commission Staff and streams designated as lower than Class C(T).
5	Historic and archeological resources: The site harbors archeologically valuable resources, or was recommended for further archeological testing by Hartgen Archeological Associates, Inc. (1991).

Application of Protection Criteria and Ranking of Areas

To determine the degree to which an area met one or more of the four protection criteria, each area was evaluated utilizing various computerized databases. The most accurate available data sources were utilized in this analysis, including the following:

- Ecological community mapping prepared by the Commission using 2003 aerial photos and ground truthing when appropriate.
- Mapping of historic and current Karner blue butterfly colonies prepared by The Nature Conservancy and Commission staff.
- Natural Heritage Program Element Occurrence mapping.
- Mapping of state regulated freshwater wetlands.
- Mapping of wetlands by Mattox (1994).
- Tax parcel mapping from Albany County.
- Previous mapping of protection area parcels prepared by the OPRHP GIS mapping unit.

Other information utilized in the evaluation of protection criteria included 2007 digital aerial orthoimages (National Aerial Photography Program, Albany, Niskayuna, Voorheesville, and Schenectady Digital Ortho Quarter Quads) and input from Commission staff and Technical Advisory Committee members. No new field review was undertaken as part of this evaluation. Where no new information was available and/or change in status was unlikely (e.g. historical and archeological resources), information used in the 2002 Preserve Management Plan was utilized.

The best available data sources were used in this analysis.

Table 9. Score Descriptions of Protection Areas.

		ENVIRONMENTAL RESOURCES						*See Figure 8for area numbers listed below.*			
Area Location	**Area No.**	PPSO 4-20	Link 12-20	Buffer 6-16	Karner Blue 10-20	Water Resources 5-10	Hist/ Arch 5	Total Score	Approx. Acres	Protection Recommend	Municipality
NW Rt 155/Rt 20	3	16	16	13	0	10	5	60	116.32	Full Protection	Guilderland
W of Rt 155 (South)	9	4	16	13	0	10	5	48	4.02	Full Protection	Albany
Btween Curry & Thruway East	17a	12	16	9	0	0	0	37	60.54	Full Protection	Guilderland
Btween Curry & Thruway	17b	12	16	9	0	0	0	37	9.54	Full Protection	Guilderland
Between Kings and Curry Ext.	17c	16	16	16	0	0	0	48	26.76	Full Protection	Colonie
Btween Lydius & Thruway	18	4	16	16	0	5	5	42	86.19	Full Protection	Guilderland
NIMO Prow (West)	21a	20	16	20	20	10	0	86	11.71	Open Space	Colonie
NIMO Prow (West)	21b	20	16	20	20	10	0	86	15.31	Open Space	Guilderland
NiMO Prow	21c	8	16	20	0	10	0	54	35.78	Open Space	Colonie
NiMo Prow	21d	20	16	20	10	10	0	86	32.66	Open Space	Colonie
Conrail	22	0	20	13	0	0	0	33	116.37	Open Space	Colonie
Landfill	23	0	20	16	0	0	0	36	137.41	Open Space	Albany
NW Conrail/N-way	24	4	16	13	0	5	0	38	15.86	Open Space	Colonie
Rifle Range Rd Terminus	25	8	20	16	0	10	0	54	31.87	Open Space	Colonie
N Watervliet/S Conrail	27	0	16	13	0	10	0	39	24.19	Full Protection	Colonie
Golf Course Area	28	4	16	13	0	10	5	48	144.69	Open Space	Guilderland
N Pine Lane	29a	20	20	13	0	0	0	53	12.02	Full Protection	Albany
N Pine Lane	29b	20	20	16	20	5	5	86	22.83	Open Space	Albany
N Pine Lane	29c	8	20	16	20	10	5	79	1.15	Full Protection	Albany
NE Conrail/Northway	30	16	0	0	0	10	0	26	22.24	Partial Protection	Colonie
Wetland NW of City Preserve	31	8	0	13	0	5	5	31	67.04	Partial Protection	Colonie
S Hungerkill/N of Rt 20	32	4	0	9	0	10	5	28	366.14	Partial Protection	Guilderland
N Hungerkill/W Ravine bottom	33b	8	20	13	0	10	5	56	66.11	Open Space	Guilderland
N Hungerkill/Town Park	33d	8	0	13	0	0	5	26	7.14	Open Space	Guilderland
SW Rens Lake	34	12	0	13	0	10	0	35	9.01	Full Protection	Albany
Wetland S Albany St	35a	16	20	13	0	10	5	64	71.36	Full Protection	Colonie
Wetland S Albany St	35b	16	20	13	0	10	5	64	29.49	Full Protection	Colonie
Wetland S Albany St	35c	16	20	13	0	10	5	64	34.62	Full Protection	Colonie
Wetland S Albany St	35d	16	20	13	0	10	5	64	121.31	Full Protection	Colonie
Wetland S Albany St	35e	16	20	13	0	10	5	64	30.52	Full Protection	Colonie
Wetland S Albany St	35f	16	20	13	0	10	5	64	7.11	Full Protection	Colonie
Wetland S Albany St	35g	16	20	13	0	10	5	64	60.00	Full Protection	Colonie
Rt 155 Corridor	36	8	16	13	20	0	0	57	35.21	Open Space	Albany
Cook Park	38	4	0	13	0	10	5	32	41.23	Open Space	Colonie
NE Wash Ave Ext/Rt 155	42	16	12	9	0	0	0	37	7.88	Full Protection	Albany
Btween Kings/Morris/Curry	43	12	20	16	0	5	0	53	54.66	Full Protection	Colonie
Btween Conrail/Morris/Kings	44a	8	20	16	0	5	0	49	96.73	Full Protection	Colonie
Btween Conrail/Morris/Kings	44b	8	16	13	0	0	0	37	7.63	Full Protection	Colonie
SW of Madison Ave Ext/Rt 155	45	4	16	0	0	0	5	25	0.89	Partial Protection	Albany
Ravine Corrider/N Willow St	46	0	16	9	0	10	5	40	64.70	Open Space	Guilderland

Table 9. Score Descriptions of Protection Areas (cont.)

		ENVIRONMENTAL RESOURCES						*See Figure 8 for area numbers listed below.*			
Area Location	Area No.	PPSO 4-20	Link 12-20	Buffer 6-16	Karner Blue 10-20	Water Resources 5-10	Hist/ Arch 5	Total Score	Appro Acres	Protection Recommend	Municipality
Rifle Range Rd Terminus	51a	20	20	16	0	10	5	71	43.02	Open Space	Colonie
Rifle Range Rd Terminus	51b	20	20	16	0	0	5	61	11.75	Open Space	Colonie
NW Morris Rd/Kings Rd	52a	8	20	13	0	10	5	56	120.89	Full Protection	Colonie
NW Morris Rd/Kings Rd south	52b	8	20	13	0	10	5	56	81.61	Full Protection	Colonie
NW Morris Rd/Kings Rd south	52c	8	16	13	0	10	5	60	18.61	Full Protection	Colonie
NW Morris Rd/Kings Rd south	52d	8	16	13	0	10	5	60	9.56	Full Protection	Colonie
SW Morris Rd/Kings Rd	53	4	20	16	20	10	0	70	114.35	Full Protection	Colonie
SW Morris/Curry Rd	54	4	16	9	0	0	0	29	229.98	Full Protection	Guilderland
Between Curry & Thruway (West)	55	4	16	9	0	10	5	44	149.32	Full Protection	Guilderland
W Rapp Rd S	57	4	20	16	0	0	5	45	17.36	Partial Protection	Guilderland
Morris Street	59	0	16	9	0	10	5	34	35.27	Partial Protection	Colonie
Brookview Drive	60	4	12	9	0	10	0	37	72.27	Partial Protection	Guilderland
S Blueberry Hill	61	20	0	16	0	0	0	36	11.28	Full Protection	Guilderland
N Prow & E Rapp Rd	62	20	20	16	0	0	5	61	6.72	Full Protection	Albany
Cordell Rd North	70	8	16	9	0	10	5	48	86.89	Full Protection	Colonie
Michael Drive North	71a	8	20	13	0	10	5	56	51.75	Full Protection	Colonie
Michael Drive South	71b	8	20	13	0	10	5	56	65.46	Full Protection	Colonie
Between Kings Rd & Curry Rd	72a	8	16	16	0	10	5	55	67.04	Full Protection	Colonie
Between Kings Rd & Curry Rd	72b	12	20	16	20	10	5	55	86.61	Full Protection	Colonie
Between Curry Rd & I-90	73	4	16	9	10	5	5	49	96.44	Full Protection	Guilderland
Apollo Drive	74	20	20	16	20	0	0	76	1.38	Full Protection	Colonie
Apollo Drive West	75	12	20	16	10	0	5	63	4.86	Full Protection	Colonie
Apollo Drive North	76	20	20	16	10	0	0	66	0.96	Full Protection	Colonie
E of Route 155 (North)	77	4	16	6	0	5	0	31	4.77	Full Protection	Colonie
S. Frontage Rd Terminus	78	4	20	16	20	0	0	60	6.24	Full Protection	Albany
Old State Rd West (North)	80	0	0	16	0	5	0	21	45.61	Open Space	Guilderland
Cemetery	81	8	0	9	0	0	5	22	43.69	Open Space	Guilderland
Old State Rd West (South)	82	20	20	16	0	5	5	66	2.85	Full Protection	Guilderland
Dennis Terrace	83	12	20	16	0	0	0	48	1.73	Full Protection	Colonie
Pine Lane South	84	20	20	16	20	0	0	76	1.46	Full Protection	Albany
Kings Rd East	86	12	20	16	0	0	0	48	1.65	Full Protection	Colonie
Apollo Dr.	87	8	16	16	0	0	0	40	1.40	Full Protection	Colonie
TOTAL									3,645.54 Acres		

D. Protection Priorities and Preserve Vision

Table 9 lists individual areas that were evaluated and their respective protection recommendations. This list was generated using the criteria set forth in the 2010 Management Plan. Based on the final scores (and in some cases, other important information about an area such as degree of threat), individual areas were identified for full protection, partial protection, or maintenance as open space. Full protection, as the name implies, is a recommendation that the undeveloped portion of an area be protected in its entirety. This recommendation is made in recognition of the fact that these areas often include multiple property owners and that various means of protection (e.g. purchase, management agreement, conservation easement) may be appropriate. Partial protection indicates that protection of some portion of an area is appropriate. The location and extent of protection necessary must be determined on a site-specific basis. However, in general it should be assumed that partial protection implies protection of at least 50 percent of an area so designated. Open space indicates that an area should essentially support an existing or proposed use that maintains its open space character.

Protection recommendations are strictly advisory in nature. These protection recommendations will guide the Commission, its members, and reviewing agencies in their protection and project review processes. As in previous plans, protection of any areas identified for full protection, partial protection, or maintenance as open space requires the participation of a willing seller and fair compensation. The Commission is committed to working with landowners in a cooperative fashion to explore a variety of options that achieve protection goals.

Areas Recommended For Full Protection

Areas receiving high scores, or containing especially important resources (e.g. Karner blues) were recommended for full protection. Areas designated for full protection are recommended for protection in their entirety using the greatest means of protection possible, including acquisition in fee, land exchanges/swaps, purchase of development rights, or a conservation easement. Acquisition in fee is the preferred manner of protecting areas that can be readily managed with fire. Land swaps allow for the protection of Pine Bush lands recommended for full protection, provide for a proposed development to occur on less sensitive areas outside the Pine Bush Protection Area, and at the same time conserve financial resources. For example, in May 2000, 46 acres of land on Rapp Road (former protection areas 13 and 14) were protected due to the support of the City of Albany and the State of New York. These lands were swapped in exchange for land provided by the State Office Campus for development of a proposed commercial office complex. Conservation easements or purchase of development rights may be appropriate and desirable in areas that are largely residential and/or agricultural, where the use of prescribed burning for management would be difficult. Where working farmlands are recommended for protection, the Commission is interested in working with the owners in a cooperative way to support and protect the continuation of farming. Areas designated for full protection should be identified as priorities for protection in the NYS State Open Space Conservation Plan. The rationale for recommending full protection of certain areas is presented below:

1. High priority areas for protection based on the occurrence of existing or restorable pitch pine-scrub oak communities (i.e. receiving scores of 12, 16, or 20) include areas 3, 17a-c, 20, 21a-b, 29, 29a, 30, 34, 35a-e, 42, 43, 44b, 51, 51a, 61, 62, 72b, 74-76, and 82-86. While the total area of these parcels is over 530 acres, some of the acreage supports community types that cannot or should not be restored to pitch pine-scrub oak (i.e. the plant communities in and along ravine corridors), and some of it would be inside 75-foot

wide buffer strips along Preserve boundaries. Thus the fire-manageable acreage within these parcels is significantly less than their total acreage.

2. Several areas support subpopulations of the federally listed Karner blue butterfly, including areas 20, 29, 29a-c, 36, 53, 72b, 74, 78, and 84. In addition certain areas– including areas 44, 54, 55, 73, 75, and 76–are appropriate locations for the establishment of new subpopulations of Karner blues to allow connection of isolated subpopulations with the Preserve. Because of the high level of threat to the Karner blue, full protection is recommended for all of the areas listed above.

3. Areas with high linkage value are generally recommended for full protection. This includes areas 17a-c, 21a-b, 22, 28, 29, 29b, 35a-g, 36, 45, 46, 52a-d, 53-55, 57, 62, 70, 71a-b, 72a-b, 73, 74-76, 77, 78, and 82-86. Destruction of these areas could: 1) prohibit species movement across major sections of the Preserve, 2) destroy the chance of maintaining existing or potential dispersal opportunities, and/or 3) have significant negative impacts on adjacent Karner blue butterfly subpopulations.

4. Areas with the highest buffer value are also generally recommended for full protection in recognition of the importance of these areas for effective management on existing Preserve lands.

5. Areas 35a-g are recommended for full protection by fee acquisition or a conservation easement due to the presence of a high quality wetland (the largest in the Pine Bush) and for watershed protection. Other areas with significant water resources are also worthy of full protection because of the amphibian species they support and the watershed protection functions they provide. It should be noted that these water resources are already afforded some protection under state and federal wetlands laws.

Areas Recommended for Partial Protection

As stated in the 2010 Management Plan, although full protection of all areas within the Pine Bush Protection and Project Review Area would be desirable, protection of an entire area may not always be necessary or feasible. For example, only a portion of an area may support an important resource or serve as a linkage or buffer. Similarly, a portion of an area may already be disturbed and the disturbed portion of the area might not contribute to any of the protection criteria. In these cases, partial protection of the area may be desirable, given appropriate and adequate mitigation measures. Protection of the area of importance to the Preserve could include acquisition in fee, conservation easement, management agreement, or set-asides. Similarly, mitigation could occur in a variety of ways such as mitigation fees, set-asides, or other mitigating activities.

The areas designated for partial protection in this plan were also recommended for partial protection in the 2010 Plan. These include:

1. Area 32 could be partially protected, provided the density and type of development that may occur does not preclude fire management within the Preserve and that ecological resources, such as wetlands and ravines, are adequately protected through the use of buffer areas. It is recommended that the continued use of this land for agricultural purposes be encouraged.

2. Areas with wetlands and ravines that are recommended for partial protection include areas 30, 31, 59, 60, and 80.

3. Partial development of areas 42 and 45 may be appropriate with proper mitigation such as set asides and mitigation fees. Area 42 scored relatively high utilizing the revised protection criteria/scores in the 2002 Plan. This is the result of high scores for the presence of pitch pine-scrub oak variants and buffer function, plus a moderate linkage score. However, the small size of this parcel and the occurrence of development on all sides (including the Thruway to the north and Route 155 to the west) essentially preclude its potential contribution to fire-manageable acreage within the Preserve. Consequently, partial protection is an appropriate recommendation for this parcel.

4. Area 60 is located near the western edge of the study area and provides a buffer that can reduce impacts from potential development. The area could be partially developed provided that the density and type of development does not preclude fire management within the Preserve and ecological resources such as wetlands and ravines are adequately protected.

5. Partial development of area 57 may be appropriate provided that proper set-asides are protected and native pine barren plantings are used for landscaping to ensure that the area can widen and protect the existing Karner blue butterfly linkage between the Crossgates Hill and Preserve lands to the east.

Areas Recommended to Remain as Open Space

Several areas near the Preserve provide public or private open space (i.e. Pine Haven Country Club, Cook Park, etc.). The only new areas added to this category are areas 46 and 81, which together make up approximately 140 acres. These areas include an open field protected through a set aside and temporary management agreement, a ravine, and a cemetery. Areas designated as open space serve as important buffers, linkages, and in some cases, support important remnant ecological resources that could easily be restored to pine barrens. Because these areas are important to the integrity of the Albany Pine Bush, it is recommended that they continue to be maintained as open space so that protection and management efforts in the Preserve are not compromised. Conservation easements or management agreements should be negotiated for these areas. If these areas are threatened by development in the future, acquisition by the Commission, in part or full, should be pursued.

1. Areas where it is recommended that conservation easements or management agreements with landowners be negotiated and/or open space be maintained include areas 20, 21a-d, 22, 24, 25, 28, 36, 46, and 51a. Should development of these sites be proposed, protection of these areas through acquisition should be considered. Of particular importance are areas 20, 21a-d, and 36 because they provide important linkages for Karner blue butterflies.

2. Areas 33b, 33d, and 38 represent existing public land that is not currently part of the Preserve. They are recommended for maintenance as open space and recreational lands.

3. With the ongoing expansion, the size of area 23 (the Albany landfill) will increase by 23 acres. As in 1996 and 2002, this area is recommended for maintenance as open space and

restoration with native pine barrens species, as required in the Part 360 permit for the latest expansion.

Vision for the Albany Pine Bush Preserve

Based on the protection recommendations described above, the proposed configuration of the Albany Pine Bush Preserve is presented in Figure 8. Table 10 provides acreage estimates for each type of protection category, existing Preserve lands, and fire-manageable pitch pine-scrub oak communities. It must be emphasized that protection of any of the areas identified for full protection, open space, or partial protection would require a willing seller, and the Commission is committed to working with willing landowners to protect the Pine Bush.

Table 10. Estimate of Existing and Potential Fire Manageable Acres in the 2010 Albany Pine Bush Study Area.[1]

		Existing Preserve			**Full Protection**			**Partial Protection**		
Community type	**Fire Potential**	Alb.	Col.	Guil.	Alb.	Col.	Guil.	Alb.	Col.	Guil.
PPSOB/T	100%	908	53	107	3	45	28	1	2	14
PPSOF	100%	288	121	244	10	108	96	2	2	13
AOPF	30%	59	46	71	5	87	42	1	10	46
SNHF	50%	46	47	43	3	102	43	1	5	18
SSHF	100%	271	187	345	14	233	242	3	39	122
Open Field	100%	9	16	16	2	42	32	0	2	13
Sub-total		1581	470	826	37	617	483	8	60	226
Total		2877			1137			294		

[1]Actual fire manageable acres are less than the total above because these calculations do not remove a 75 feet buffer around protected lands.

Table 11. Acreage of Existing Preserve Lands, Protection Recommendations, and Fire-Manageable Pitch Pine-Scrub Oak within Each Municipality.

Approximate Number Of Acres In Each Municipality					
Protection Recommendation	Colonie (Village & Town)	Guilderland	Albany	Total	Fire-manageable PPSO[1]
Existing Preserve	836	1,152	1,212	3,200	2,877
Full Protection	1,301	800	78	2,180	1,137
Sub-total	2,137	1,928	1,290	5,380	4,014
Open Space	340	326	211	877	**0**
Partial Protection	125	501	9	635	294

[1] Number of acres of fire-manageable pitch pine-scrub oak barrens was estimated using GIS natural community data and assumptions regarding restoration potential described in Gebauer, 1996.

Currently, the existing protected lands within the Preserve include approximately 3,300 acres. If protection goals for the areas identified for full protection (approximately 2,080 acres) are realized, the Preserve would consist of approximately 5,380 acres. In addition, approximately 877 acres exist that can be maintained as open space to further protect the Albany Pine Bush. This does not include portions of another approximately 635 acres recommended for partial protection.

Of the approximately 5,380 potentially protected acres (including Preserve and full protection) approximately 4,014 acres support existing or potentially restorable pitch pine-scrub oak barrens. This 2010 Management Plan recommended a Preserve of 5,380 acres, which was slightly higher than the 4,610 acres recommended for protection in the 2002 Management Plan. This reflected the Commission's inability to guarantee full protection for areas so designated; Commission experience indicating constraints on fire management are more significant than originally anticipated; and the results of ongoing research regarding the restoration potential of certain community types. Protection and maintenance of all areas proposed for full protection or maintenance as open space would also ensure the protection of all the remaining Karner blue butterfly subpopulations and their potential linkages to the core of the Preserve. It would maximize contiguity of the Preserve and provide a buffer area around significant parts of the Preserve.

Although protection of valuable ecological and cultural resources, linkages, and buffers will have been achieved, Figure 8 clearly shows that there are developed areas remaining that fragment portions of the landscape. The Commission should collaborate with these landowners and municipal agencies to plant native pine barrens vegetation, which may help these areas serve as a potential linkages to the Preserve. Opportunities for purchase and restoration of certain partially developed in-holdings should not be overlooked. This could include parcels that are small and currently developed but in the future could be potentially restored and included in the Preserve. Such actions can result in restoration of important communities and linkages, as evidenced by the Commission's successful Karner blue butterfly habitat restoration of a former paved parking lot on Apollo Drive. Additionally, the Commission should pursue smoke management easements

with residents and businesses in proximity of the Preserve to foster the opportunity for a cooperative approach to effective management.

Development and Conservation Design Guidelines for Partial Protection Areas

For partial protection areas, it is recommended that the Commission develop a set of development and conservation guidelines for use by project sponsors in preparing plans for development in the Pine Bush Project Review Area. These guidelines would be illustrative of the type of habitat conservation techniques that can best address the typical conditions found in the Pine Bush. The guidelines would be prepared in collaboration with each of the municipalities for potential adoption as part of subdivision and site plan review procedures.

As mentioned previously, the Commission should prepare site analyses for the partial protection areas in advance of, or in concert with, development proposals. These plans will identify which resource elements/functions are priorities for protection in each protection area. The design guidelines would illustrate how to execute conservation-based development projects that protect the sensitive features/functions of a site. The benefit of this approach is that it ensures the Commission's goals are appropriately defined, in a physical sense, for the partial protection areas. Past practice has proven that it is much more prudent to identify the resources to be conserved first, rather than having to scramble to identify these in the face of a specific development proposal. The conservation and development guidelines could also become a topic for educational outreach by the Commission. Participants would include the municipal planning boards, the development community, and property owners.

Incentive Zoning and/or Transfer of Development Rights

In order to protect Pine Bush resources, incentives to place new development in other, less sensitive areas should be encouraged. Toward this end, the Commission should draft a generic local law for consideration and refinement by each of the municipalities to facilitate the transfer of development rights out of the Pine Bush to other less sensitive areas. In return for this transfer, the community may offer incentives, such as increased development flexibility and/or density, to encourage this activity.

E. Project Review Guidelines

The Albany Pine Bush Preserve Commission has nearly 30 years of experience and is a resource of state-of-the-art ecological and natural resource management information for Commission members and state and federal agencies. Because these agencies may not always have the biological/management expertise needed to evaluate potentially adverse environmental impacts of a particular project, they are encouraged to solicit Commission assistance as needed.

While the protection guidelines described above serve to guide protection actions that will be developed in cooperation with willing landowners, protection may not always be a preferred option. If a landowner is not willing to consider the benefits of a sale or donation, the Commission will make project review recommendations, in cooperation with the landowner and lead agency, before and during the project review process. This should ensure that a hard look is taken at a proposed project and that mutually agreeable solutions are designed to protect as much of the ecologically valuable areas as possible.

The following project review guidelines were developed as part of the 1996 Implementation Guidelines and have not been significantly changed in this updated Management Plan.

The Albany Pine Bush Protection and Project Review Areas

To ensure adequate review of development proposals for developed areas, Pine Bush Protection and Project Review Areas were identified in the 1996 Implementation Guidelines. The Albany Pine Bush Study Area, consisting of Preserve lands and protection areas satisfying one or more of the protection criteria, has been described previously.

Development proposals for any property within these areas should be carefully reviewed by the county, towns, city or village to ensure that development will not have a direct adverse impact on the Albany Pine Bush Preserve; will not hinder the ability of the Commission to manage the Preserve with prescribed fires or other means; and will not hinder attaining other goals of the Preserve and the Commission. Types and density of development, destruction of pine barrens habitat, and fragmenting existing/potential Preserve lands are especially important to consider.

Land acquisition and other forms of protection, should be considered for significant lands within the Study Area to assure the long-term viability of the Pine Bush ecosystem and the rare species and natural communities found there. The project review guidelines apply to all lands within the Study Area including Preserve land, open areas, and fully or partially developed sites.

Types of Projects

The Commission will comment on development projects that are before the city, towns, or village for various approvals or zoning changes. This includes approvals by planning and zoning boards, town boards, the Village Board of Trustees, Albany Common Council, and the Albany County Legislature. In addition, the Commission should be notified of projects requiring building permits that may result in significant alteration of natural and cultural resources in the Pine Bush.

The Commission will also provide comments on projects/plans initiated by entities that may not require review and approval by the county, towns, city or village. These entities include federal and state agencies (e.g., NYSDOT, NYSDEC, and NYSOPRHP), other public agencies, public utilities (e.g., National Grid), public authorities (e.g., NYS Thruway Authority, CDTA), planning and funding entities (e.g., CDTC, IDAs), and educational institutions (e.g., school districts, SUNY).

Project Notification

The Commission requests that the county, towns, city, village, DEC, OPRHP, Thruway Authority, CDTA, and other public agencies or authorities, upon receiving an application for project review and approval, forward information (concept plans, final plats, etc.) on the project to the Preserve's Conservation Director at the following address, in a timely manner:

Albany Pine Bush Preserve Commission
195 New Karner Road
Albany, NY 12205
(518) 456-0655

If the time for review of any project is less than three weeks, the Commission respectfully requests the contact person for the village, county, town, or city to immediately notify the Conservation Director by phone or e-mail.

Contact Persons

Each member of the Commission will provide to the Executive Director the name of the person(s) (and their phone numbers/e-mails) responsible for referring projects to the Commission. The contact person for all project reviews by the Commission is the Conservation Director.

The Conservation Director, after consultation with the Executive Director and the Technical Advisory Committee, is responsible for forwarding comments on behalf of the Commission.

Members and staff of the Commission and members of the Commission's Technical Advisory Committee should contact the Conservation Director on any project that they become aware of which may affect the Pine Bush ecosystem. Such projects are not limited to those undergoing municipal review.

Project Review Area

Within the Study Area (see Figure 8) contact persons will use the following guidelines for project referral:

1. Planning and Zoning Board Projects. The contact person(s) for the village, county, towns, and city will notify the Conservation Director of all projects proposed within the Study Area. For such projects, information on the project, location, environmental impacts, and alternatives will be forwarded as soon as available to the Conservation Director.

2. Building Permit Projects. The contact person(s) will notify the Conservation Director of all projects within the Project Review Area.

3. Municipal Projects. The contact person(s) will notify the Conservation Director of any projects proposed by any of the departments within the village, county, towns, and city that will take place within the Study Area. These projects may include actions such as spraying for insect control, policies regarding salting of roads, maintenance of utility rights-of-way, or other similar actions.

4. Other Projects. Upon learning of projects occurring within the Project Review Area under the jurisdiction of federal or state agencies, public utilities, public authorities, planning and funding entities, or educational institutions, the contact person(s) will notify the Conservation Director of such projects and sources of information.

Project Review Implementation

Coordination between the Commission and its members has proven to be effective in assuring adequate and coordinated review of applications for development since adoption of the 1996 Implementation Guidelines. Technical Advisory Committee members typically meet on a monthly basis to assure that projects are reviewed adequately and promptly. The Commission has established and will maintain the following project review procedure with local Planning, Zoning, and municipal boards and other permitting authorities:

1. All applications for SEQR Type I actions within the Protection Area should contain enough information to allow the Commission to make a recommendation as to whether the project may have significant impacts on the Pine Bush. For SEQR unlisted actions, municipal contacts should consult with the Conservation Director regarding the type and extent of environmental information needed.

2. For projects that could have a significant impact, the lead agency should give serious consideration that an environmental impact statement (EIS) be prepared pursuant to SEQR. Such an EIS need not be encyclopedic, but must address substantive issues and concerns identified through a scoping process by the public and involved and interested agencies, including the Commission. In addition, municipalities are encouraged to ask applicants to meet with the Technical Advisory Committee and/or the Conservation Director to assure that Commission comments are incorporated early on in the review process.

3. The Conservation Director and the Technical Advisory Committee will review and comment on applications for proposed development projects that come before municipalities, NYSDEC, or other permitting authorities. The Conservation Director's comments will be forwarded to the Executive Director prior to being finalized. After comments are finalized, the Conservation Director will submit comments to the reviewing agency on behalf of the Commission. Members of the Technical Advisory Committee should serve as liaisons between the Commission and the reviewing agency to foster prompt and appropriate communication regarding proposed developments.

4. The Commission continues to recommend that the towns of Colonie and Guilderland, the City of Albany, NYSDEC, and OPRHP consider designating the Protection Area as a Critical Environmental Area (CEA). Such designation has no impact on actions that would previously have been designated as Type I or Type II pursuant to SEQR. Such designation would ensure that "unlisted" actions within the Protection Area receive appropriate and careful review to determine if they would have an significant impact on the Pine Bush Preserve.

5. The specific recommendations for acquisition and other forms of protection in this section of the Preserve Management Plan require cooperation between the Commission and its members to assure proper mitigation, especially where development of an area is to take place. Where development is proposed for areas where full protection or open space is proposed, municipalities are encouraged to suggest that the applicant meet with the Commission as early as possible.

6. Where an irreversible loss of lands that contain existing or restorable pitch pine-scrub oak; linkages between protected lands; buffer areas; or significant cultural and natural resources cannot be avoided, permitting authorities should require mitigation. If this takes the form of fees, they would be charged for each acre of land lost to development and would be equivalent to the average purchase price of lands acquired as part of the Preserve, as calculated by the Commission based on the most recent acquisitions or based on a recent appraisal of fair market value or assessed value. If fees are used as mitigation, such fees are not a substitute for the acquisition of land needed to create and maintain an ecologically viable Preserve. Mitigation funds will be placed in an account and dedicated for acquisition and protection of the Albany Pine Bush Preserve.

X. MANAGEMENT PLAN IMPLEMENTATION

A. Introduction

The Albany Pine Bush Preserve Commission must continue to maintain financial support to successfully accomplish its mission of managing and protecting the Albany Pine Bush. This includes operating and capital expenses associated with the Albany Pine Bush Preserve and Discovery Center. Additional financial support will be necessary to meet the goals identified in the Protection section of this document. Funding and in-kind support during the first years of the Commission came from various Commission member agencies and the New York Legislature. In addition, the City of Albany provided mitigation fees associated with operation of the landfill. To date, over $35 million has been invested in the Albany Pine Bush. Current funding sources include: the New York State Environmental Protection Fund, a Discovery Center endowment from TrustCo Bank, mitigation fees, grants from public and private agencies, program fees, lease revenue, and private donations.

The fiscal projection for the next five years is based on recent growth and found in Table 12 below. The Commission estimates that the funding needed to achieve an ecologically viable Preserve, to support public recreational opportunities, and to operate the Discovery Center and its associated educational and public programs is approximately $3 million per year. To achieve all the land acquisition and protection goals identified in this Plan will require an investment of an additional $25 to $30 million.

B. Operations

The New York State Legislature recognizes the importance and value of management of the Preserve and Discovery Center by allocating an annual appropriation from the Environmental Protection Fund. This is the Commission's primary source of funding which is supplemented by the additional funding described above. Although the Commission's allocation is a permanent line item in the Environmental Protection Fund, it is important for the Commission to continue to work closely with the Legislature and Governor's office in the future, as the State of New York is one of several critical funding sources.

The Commission's operating budget has focused on habitat protection, ecological restoration and management, education, outreach and communications, the Discovery Center and appropriate recreational uses. Specific costs associated with these activities include operating the Discovery Center facility and programs, and contracting for outside services in support of habitat restoration efforts. The Commission projects that the Management Plan will cost approximately $3 million per year to implement. To meet this projection, the Commission will need to maintain and/or expand public and private support, including the State of New York, federal agencies, private foundations, corporations and individuals.

Key elements of the Commission's fiscal projection include the following:

1) Maintain fiscally responsible operations, balanced budgets, clear priorities and an adequate reserve.

2) Maintain transparency and accountability for operations and expenses including reporting and annual audits as required by the NYS Public Authorities Law and government accounting principles.

3) Work with Commission members and strategic partners to continue their support, and build the Commission's constituency

4) Incorporate volunteers to meet the goals of the Management Plan.

5) Ensure investments are managed according to the approved Investment Policy Statement.

6) Work with private and corporate strategic partners to expand and diversify the Commission's funding sources.

7) Continue to provide education programs, Discovery Center room rentals and gift shop merchandise as service and source of additional revenue.

Table 12 shows a fiscal projection for 2016/2017 to 2020/2021. It should be noted that absent the additional costs for inflation and increased costs of materials and services, the Commission's fiscal projection does not include significant increases over existing levels of spending. Fundraising, grants and other support, will need to increase in order to meet the intent of the 1988 legislation as realized through implementation of the 2017 Management Plan Update.

C. Land Protection/Acquisition

Estimates of the cost to achieve the land acquisition/protection goals outlined in this Plan range from $25 to $30 million. Several potential funding sources exist, including, but not limited to, the Environmental Protection Fund, U.S. Fish and Wildlife Service and other federal agencies and programs (Land and Water Conservation Fund, Conservation and Reinvestment Act, and transportation funds), local governments, private foundations, individuals, corporations, and mitigation fees.

The State of New York is in the process of updating the New York State Open Space Conservation Plan (NYSDEC and NYSOPRHP, 2009) in which projects in the Albany Pine Bush have been identified as a regional priority. The Albany Pine Bush was listed by the legislature as a priority area eligible for funding under the Environmental Protection Fund in 1994, and became a permanent line item for fiscal year 2001. It is critical that the Commission and its supporters work with the Governor's office and the Legislature for continuation of Environmental Protection Fund support of priority acquisitions in the Pine Bush.

Mitigation funds associated with development projects that impact the natural resources of the Albany Pine Bush are placed in Commission accounts dedicated to the acquisition and management of Pine Bush lands. Such fees are not considered a substitute for the protection of lands needed to create and maintain an ecologically viable Preserve. However, they can and should be applied toward land/resource protection priorities.

To support land acquisition, the Commission will continue to investigate private and government funding on the State and local levels. The Pine Bush represents a unique opportunity for a wide range of private funding sources to sponsor a high profile model project.

In the event there is no money to acquire lands from willing sellers, the intent of ECL Article 46 and the NYS Open Space Conservation Plan may be stalled. However, there is a strong tradition of shared funding of land protection, and millions of dollars have been invested in the Albany

Pine Bush to date. With willing sellers and the needed additional investment, the Preserve can be completed.

D. Capital Improvements

The Commission has goals that include accommodating responsible public use and providing improved informational, educational and constituent-based services. The development of the Discovery Center is the most significant capital improvement to date. Future capital improvements include modifications, replacement and continued development of Discovery Center exhibits, improved trails and associated trailheads, parking and signage. These capital improvements are included in the contractual line of the fiscal projection and will provide opportunities for enhanced public awareness of and appreciation for the Pine Bush Preserve.

E. Conclusion

The Albany Pine Bush represents an opportunity for a broad partnership of public and private funding sources to join together and preserve a unique ecosystem. A partnership can share operating, protection and capital expenses to establish and manage a viable Preserve that will provide millions of people with open space, recreation and education benefits for the future. As in the past, strong support from the State of New York, the member agencies, municipalities and organizations of the Commission and other public and private partners will be critical.

Table 12. Management Plan Implementation: Fiscal and Personnel Projection

I. Five-Year Fiscal Projection

REVENUE	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Gov't Grants & Contracts	2,625,000	2,525,000	2,525,000	2,525,000	2,525,000
Mitigation Fees	380,000	380,000	380,000	380,000	0
Lease Revenue	173,000	176,000	180,000	183,000	186,000
Dues & Contributions	69,500	67,500	67,500	67,500	67,500
Other Revenue	20,500	21,500	22,500	23,500	24,500
TOTAL REVENUE	3,268,000	3,170,000	3,175,000	3,179,000	2,803,000
EXPENSE					
Personnel & Fringe	1,721,000	1,850,000	1,930,000	2,007,000	2,100,000
Travel & Training	72,000	73,500	74,000	75,000	70,000
Contractual	980,000	730,000	642,000	648,000	300,000
Communications	115,000	120,000	120,000	100,000	70,000
Occupancy	80,000	85,000	87,000	88,000	88,000
Supplies & Equipment	210,000	215,000	220,000	160,000	80,000
Other Expenses	85,000	90,000	95,000	95,000	90,000
TOTAL EXPENSES	3,263,000	3,163,500	3,168,000	3,173,000	2,798,000
NET GAIN (LOSS)	5,000	6,500	7,000	6,000	5,000

II. Personnel Projection

Permanent staff	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Executive Director	1	1	1	1	1
Finance/Administration	2	2	2	2	2
Science & Stewardship	6	6	6	6	6
Communications/Community Engagement	2	2	2	2	2
Discovery Center/Education	7	7	7	7	7
Total FTE	18	18	18	18	18
Part-time Staff	5	5	5	5	5

Seasonal staff and interns	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Seasonal (3-9 months)	14	14	14	14	14
Interns	6	6	6	6	6
Total	20	20	20	20	20

XI. ENVIRONMENTAL IMPACTS

The proposed action is the adoption and implementation of the 2017 Management Plan Update. This is considered a Type II Action under SEQR617.5(c)20 and therefore does not require the completion of an Environmental Assessment Form (EAF)..

Each of the previous Commission Management Plans (1993, 2002, and 2010 Management Plans, and 1996 Implementation Guidelines) included an EIS that described the potential environmental impacts associated with Plan implementation. These earlier Plans were determined not to have any significant adverse environmental impacts and to have many beneficial impacts to the Preserve, in particular its significant natural resources. The Commission adopted each Plan upon the completion of the SEQR process. Consequently, the impacts of Preserve protection and management, as proposed in the previous plans, have already been addressed. See the 2010 Management Plan/FEIS, including Findings Statement, at: www.albanypinebush.org/commission/management-plan. Any changes from the 2010 Plan in this 2017 Plan Update are considered neither significant nor adverse.

Consistent with NYS ECL Article 46-0111(3), a public hearing was held at 7pm on October 18, 2016 to allow the Commission to present the Plan Update and give the public the opportunity to ask questions and provide comments. Two additional public meetings were held at the Crossings of Colonie and the Guilderland Public Library on November 2 and 3, 2016 respectively. Public comment was accepted until November 25, 2017. Two individuals submitted comments that were subsequently incorporated into the Management Plan Update.

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XIII. APPENDICES

See updated Appendix E attached and 2010 Management Plan and FEIS at www.albanypinebush.org/commission/management-plan.

FIGURES

Figures