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Department of Environmental Conservation

NEW YORK STATE SOUTHERN PINE BEETLE MANAGEMENT PLAN

Division of Lands and Forests
Bureau of Invasive Species and Ecosystem Health

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Background

Southern pine beetles (SPB, *Dendroctonus frontalis* Zimmermann) were first found infesting trees on Long Island in October 2014. They have since been caught in traps as far north as the Albany Pine Bush Preserve, although infested trees have not been discovered in New York north of Long Island.

In the southeastern United States, SPB has been a destructive and costly forest pest. They produce several generations a year, and populations can grow rapidly depending on the availability and health of host trees, a lack of freezing temperatures, and the number of predators present. SPB communicate with each other using pheromones to locate host trees and attack them en masse. During outbreaks, these groups can consist of thousands of beetles which can overwhelm even a healthy tree's defenses, killing the tree in 2-4 months. Infestations, commonly referred to as "spots", can spread quickly when beetle populations are high, expanding from just a few trees to hundreds or thousands of trees in one summer. Tens of thousands of trees have already been killed on Long Island.

In New York State, pitch pine (*Pinus rigida* Mill.) is a preferred host of SPB, as well as a common tree found on Long Island. The Central Pine Barrens, an area of more than 100,000 acres co-dominated or dominated by pitch pine, is particularly at risk for extensive tree mortality (See Appendix A, Figure 1). SPB has also been found infesting eastern white pine (*Pinus strobus* L.), Japanese black pine (*Pinus thunbergii* Franco) and Norway spruce (*Picea abies* L.) on Long Island, although studies suggest they cannot complete their life cycle in these species.

Surveys have shown that SPB are abundant and found in many areas across Long Island. Eradicating the beetle is not possible so the New York State Department of Environmental Conservation (DEC) Division of Lands and Forests (DLF) is taking an integrated management approach, using tools such as targeted spot suppression and preventive stand thinning to manage SPB. These management tools have been used for decades in the south and are proven to reduce SPB populations and their impacts.

Southern Pine Beetle Response

The goals of DLF's Southern Pine Beetle Response Plan are to protect native habitats and rare ecosystems that have SPB-susceptible tree species, and to restore forest stands and ecosystems negatively impacted by SPB.

The strategies to address these goals are:

1. Detect and monitor SPB populations to determine their extent.
2. Manage forests to prevent or minimize SPB attacks to reduce tree mortality.
3. Work with land managers to restore stands and ecosystems negatively impacted by SPB.
4. Provide support to municipalities and not-for-profit organizations for SPB management activities that address public safety, reduce SPB populations, restore areas impacted by SPB, and protect susceptible ecosystems.

To effectively manage the response to SPB, an Incident Command System was established by DLF in Central Office to allow for communication between, and participation by, partner groups including DLF in Region 1; the Central Pine Barrens Commission; the US Fish and Wildlife Service; the National Park Service; the US Forest Service; Brookhaven National Laboratory; NYS Office of Parks, Recreation and Historic Preservation; Suffolk County; the Town of Brookhaven; the Town of Islip; and the Town of Southampton (See Appendix B, Figure 2).

Strategy 1 – Detect and Monitor SPB

SPB TRAPPING

DLF staff will use pheromone-baited SPB traps to detect new infestations. Early detection traps will be placed near uninfested susceptible host stands throughout the state from mid-April through August and will use a lure combination that includes (+)-endo-brevicomin (Sullivan and Mori 2009). Traps will be placed at least 40-50 feet from potential host trees to avoid initiating an infestation.

AERIAL DETECTION SURVEYS

DLF staff will conduct aerial surveys in planes throughout the year as follows:

- A general forest health aerial survey effort of all the state's forests is conducted every June/July, during which signs of forest pests and diseases are mapped throughout the state, including potential damage from SPB.
- SPB-specific survey flights will be conducted during the winter months over all areas known to be infested with SPB, to update infestation maps and adjust management priorities.
- More focused survey flights will be conducted in May, June, and August specifically over priority areas as management activities begin, to provide an updated snapshot of the current infestation conditions. The August aerial survey will also include new areas with confirmed SPB-trap catches to look for potentially infested trees.

Surveyors use tree color-change, as visible from the air, to identify potentially infested areas. As pine trees decline, needles fade from green to yellow, to red, and then brown. Surveyors map groups of yellow and red pine trees as potential SPB infestations.

GROUND SURVEYS

Suspect trees detected and mapped during aerial surveys need to be visited through ground surveys to determine whether the decline is from SPB attack. During ground surveys, surveyors can record a more accurate number of infested trees and acres, as well as the number of newly infested (stage 1), older infested (stage 2), and dead (stage 3) trees, and the direction of spot growth (i.e., active front, spot head). If the area is going to be targeted for management, surveyors will also mark trees to be removed.

Strategy 2 – Manage Forests to Prevent or Minimize SPB Attacks

DLF will concentrate efforts to prevent or minimize impacts from SPB infestations in large forested blocks and unique or rare ecosystems. Some of the areas designated as a high priority for management include the Central Pine Barrens Core Preservation Area on Long Island, several State Forests and Parks in the lower Hudson Valley, and other unique areas designated by the NYS Natural Heritage Program. Rare native ecosystems that will be targeted for protection and restoration include:

- Dwarf pine plains
- Dwarf pine ridges
- Maritime pitch pine dune woodland
- Pitch pine-scrub oak barrens
- Sandstone pavement barrens
- Pitch pine-oak-heath woodland
- Pitch pine-heath barrens

Management activities will not be conducted by DLF in urban settings, but support for municipalities to conduct management will be provided through the Southern Pine Beetle Community Recovery Grant Program (See Strategy 4).

Using a combination of targeted spot suppression and preventive thinning is necessary to successfully manage SPB. Each tool addresses a different aspect of SPB management, with spot suppression tackling current population levels while thinning addresses the susceptibility of forests to future attack.

SPOT SUPPRESSION

Infested trees and uninfested buffer trees will be cut during spot suppression to disrupt spot growth. Cutting infested trees has a negative effect on the developing SPB brood and the additional removal of uninfested trees to create a buffer disrupts the pheromone communication of surviving beetles due to the greater distance between trees. Buffer width may vary based on size of an infestation, but should be a minimum of 60 feet. Following spot suppression efforts, sites are monitored to determine whether additional cutting is necessary. The two common spot suppression techniques are:

Cut-and-leave

Infested and buffer trees are felled (cut down) such that they fall toward the center of an infestation and are left on site. The bark of felled trees is then cut or scored from the base of the tree to the top. The effects on brood survival depend on cut timing (Hodges and Thatcher 1976). In fall and winter suppression, scoring the bark exposes beetles to freezing temperatures and moisture while in the summer, it increases the beetles' exposure to predators.

Cut-and-remove

Infested and buffer trees are felled and removed from the site to be utilized as wood products or otherwise disposed of (e.g., landfill, burn pit, chipper, etc.). This tactic is more effective than cut-and-leave since the surviving beetles are being removed from the area with the infested trees, but it hasn't been feasible on Long Island due to a lack of local timber markets and tree removal resources.

Prioritization

When prioritizing spots for suppression, several factors are considered, including:

- The number of Stage 1 and Stage 2 trees present (Billings and Pase, 1979)
  - Spots with fewer than ten Stage 1 and Stage 2 trees are generally not targeted since it indicates SPB populations are low enough that trees are more likely able to withstand their attacks.
  - Suppression is most effective when all infested trees in a spot are cut within a two-week period.
- Whether spots fall within the Central Pine Barrens Core Preservation Area or other priority areas.
- How active the spot is, or what the rate of spread is.
- When comparing the number of Stage 1 to Stage 2 trees, a spot with a higher percentage of Stage 1 trees suggests SPB populations are growing quickly, so spot suppression activities would have a greater impact (See Appendix C, Figure 3).
- The number of tree cutters available and their experience.

SPB do not continue to attack trees once the trees are dead, so there is no benefit to cutting them down during suppression efforts unless they are a liability. Leaving the dead trees, however, provides habitat for SPB predators and other wildlife.

PREVENTIVE THINNING

Preventive thinning has been extensively researched and used as a strategy to manage SPB in the southeastern United States and in the New Jersey Pine Barrens. Before the beetle arrives, crowded forests can be thinned to reduce competition between trees for nutrients and sunlight, making them healthier and more resistant to attack. Thinning also allows more air circulation within the forest which helps disperse the pheromones that SPB use to communicate, making it harder for them to attack trees en masse (Belanger 1980, Brown et al. 1987, Fettig et al. 2007, Thistle et al. 2011 and references

therein). A statewide susceptibility map was created to identify areas where thinning would help prevent SPB outbreaks should the beetle continue to move through the state (Appendix D, Figure 4). The current focus for SPB preventive thinning is uninfested forests within the Central Pine Barrens Core Preservation Area on Long Island.

To prioritize areas for thinning, susceptible forest stands will be inventoried and analyzed. Data collected will include type (species), number, and diameter of trees. This data is used to estimate competition factors such as stand basal area (amount of area occupied by tree stems), stand density index (based on number of trees and tree diameters in an area), and quadratic mean diameter (estimate for average tree diameter), which will be used to rank the forests on their susceptibility to SPB attack. Stands with basal areas ≥120 ft^2/acre and/or densities >700 trees/acre are considered the most susceptible and will be targeted first.

Thinning prescriptions (cutting plans) will be developed to outline how each stand will be thinned, how the thinning will affect the overall management goals of the property, and if there will be any impacts on unique ecosystems and endangered species. Ideally, forest stands should have a basal area of <80-100 ft^2/acre and or ≤450 trees/acre to have the best chance of resisting SPB. Commercial harvests will be used, where feasible, to accomplish preventive thinning goals. In areas such as Long Island, where there isn't a robust timber industry, DLF may need to pay to have the thinning completed.

Strategy 3 – Work with Land Managers to Restore Ecosystems

DLF is encouraging land managers to use forest management plans to help them identify what actions need to be taken to restore stands impacted by SPB. DLF staff are available to provide recommendations on how to assess impacted stands and define goals for restoration. Goals may include, but are not limited to, reestablishing pine species killed by SPB; controlling competing vegetation and invasive species; and ensuring pine stands don't become overly dense as they regrow, inviting another outbreak of SPB. While the loss of canopy in impacted areas may benefit some stands with the increased sunlight reaching the forest floor, others will need restoration activities such as replanting and vegetation management to reach desired conditions. Management plans will need to include monitoring appropriate to the outlined goals (e.g., recording vegetation composition and structure, monitoring pine tree regeneration, invasive species detection and management, etc.).

Pitch pine seeds will be collected from impacted areas to preserve the local genetics. The NYS Tree Nursery in Saratoga Springs will grow seedlings from this stock and make them available to DLF staff, landowners and partner groups for restoration efforts. Seed from additional native species may be collect in the future as the need arises.

Strategy 4 – Provide Support to Municipalities and Not-for-profit Agencies for SPB Management

DLF developed the Southern Pine Beetle Community Recovery Grants Program to support communities by providing funding to: remove dead trees that pose a danger to public safety, conduct spot suppression, conduct preventive thinning, conduct prescribed burns, and replant in impacted areas. This grant program compliments DLF's efforts to manage SPB by supporting partner efforts in areas not targeted by DLF's direct management. Grants are available to municipalities, municipal corporations, soil and water conservation districts, school districts and community colleges that have a public ownership interest in the property or are acting on behalf of a public property owner. Awards range from $25,000 to $75,000, and have a match requirement of 25% of the grant amount requested.

Other Considerations

SPB IN NON-PRIORITY AREAS

Municipalities, landowners, and others that wish to manage SPB in areas outside of DLF's priority areas, should follow these recommendations:

- Remove infested trees as quickly as possible to prevent the beetle from spreading to nearby uninfested host trees.
  - Infested trees will die within the next 2-4 months, so removing these trees may also help prevent future hazard trees.
- Trees killed by SPB no longer harbor the beetle and do not contribute to the spread of an infestation. However, landowners, parks, highway departments and others should remove dead trees that are a hazard to people, structures, public roads, utilities, etc. Infested trees should not be moved to a different area during the summer without plans for bark removal, or immediate disposal or destruction.
- Homeowners are advised to contact an arborist as soon as infested trees are found to discuss removal options.

USE OF INSECTICIDES

In some cases, individual trees can be protected with preventive insecticide treatments such as bark sprays containing permethrin or bifenthrin, or trunk injections of emamectin benzoate (Tree-äge, available for commercial applicators only), prior to SPB attack. Application of these insecticides are time consuming as they must be done one tree at a time, they take weeks to disperse through the tree and become effective, and even if they defend against the beetle they do not protect trees from the blue-stain fungi introduced by bark beetles. For these reasons they are not practical to use at a landscape-level and therefore will not be used by DLF to manage SPB. The choice of whether to treat a tree or not should be made on a case-by-case basis. Additional management recommendations for nursery and landscape professionals and homeowners may be provided through Cornell Cooperative Extension of Suffolk County and trade groups.

VERBENONE

Verbenone is a type of pheromone emitted by SPB, and other bark beetles, that scientists have been able to synthesize in the laboratory. The pheromone sends a signal to other beetles that a tree it is almost dead and therefore no longer a good host causing them to avoid that tree and look elsewhere. Although some studies have shown verbenone to be successful in dispersing SPB, overall it has produced mixed results and it is not fully confirmed that verbenone can protect individual pines against SPB attack (Strom and Clarke, 2011). This may be because SPB attack behavior is not only affected by verbenone but also by the number and sexes of beetles in an area, the amount and timing of pitch response by the host tree, and other factors. Until the research becomes more definitive, DLF will not incorporate verbenone use into the management strategies.

PITCH PINE FIRE HAZARD

SPB infestations will result in a rapid increase in standing dead wood and/or an increase in downed coarse woody debris in pitch pine and pitch pine-oak forests. It is currently unknown what effect the increase of dead woody material will have on fire hazard, but in other bark beetle systems an increase in fire hazard has not generally been recorded (Harvey et al. 2014). Local fire response organizations will be notified of the areas containing potential fuels from pitch pine mortality in their jurisdictions. Fire mitigation measures by local fire agencies, such as wood removal or chipping, or otherwise clearing a fuel-free buffer zone around suppression areas should be considered when feasible. In areas where they are applied, thinning and prescribed burning may reduce available fuels for wildfires and serve as fire mitigation.

OUTREACH

To adequately explain management goals, methods, and expected outcomes of the SPB response to elected officials, landowners, environmental groups, landscape professionals, regulatory agencies and others, an outreach unit has been included as part of the overall incident command system. Materials including factsheets, annual reports, billboards, signs, and webpages will be developed as needed to raise awareness and understanding of SPB management.

In cooperation with the United States Forest Service, DLF has created a Demonstration Forest in the Rocky Point Pine Barrens State Forest, which will be used to show how thinning increases tree health and reduces susceptibility to SPB attack. Prescribed burns will also be conducted in some of these stands to show the added benefits of restoring fire to these fire adapted ecosystems.

RESEARCH

SPB research is and will continue to be conducted to guide management decisions in New York. Several agencies and educational institutions including DLF, US Forest Service, Cornell University, Dartmouth College, and Southern Illinois University are working together on Long Island to:

- Examine the factors that may affect expansion rates in infested stands such as forest basal area, tree density and the number of State 1 and Stage 2 trees.
- Record winter temperatures and their effects on SPB mortality.
- Determine the time lapse between infestation and when symptoms begin to show through color change in needles.
- Calculate roadside tree density in the Core Preservation Area to anticipate roadway impacts from hazard trees.
- Monitor regeneration in impacted stands to determine the response to the loss of pitch pines, and if the forests are naturally re-growing.
- Collect data on the age and size of trees cut during suppression efforts to provide a snapshot of what is being lost and evaluate the potential long-term impacts.

Studies of management alternatives and options in this non-timber product setting would also be beneficial. DLF will continue to engage the research and academic community to formulate the most effective and efficient response to SPB.

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Appendix A

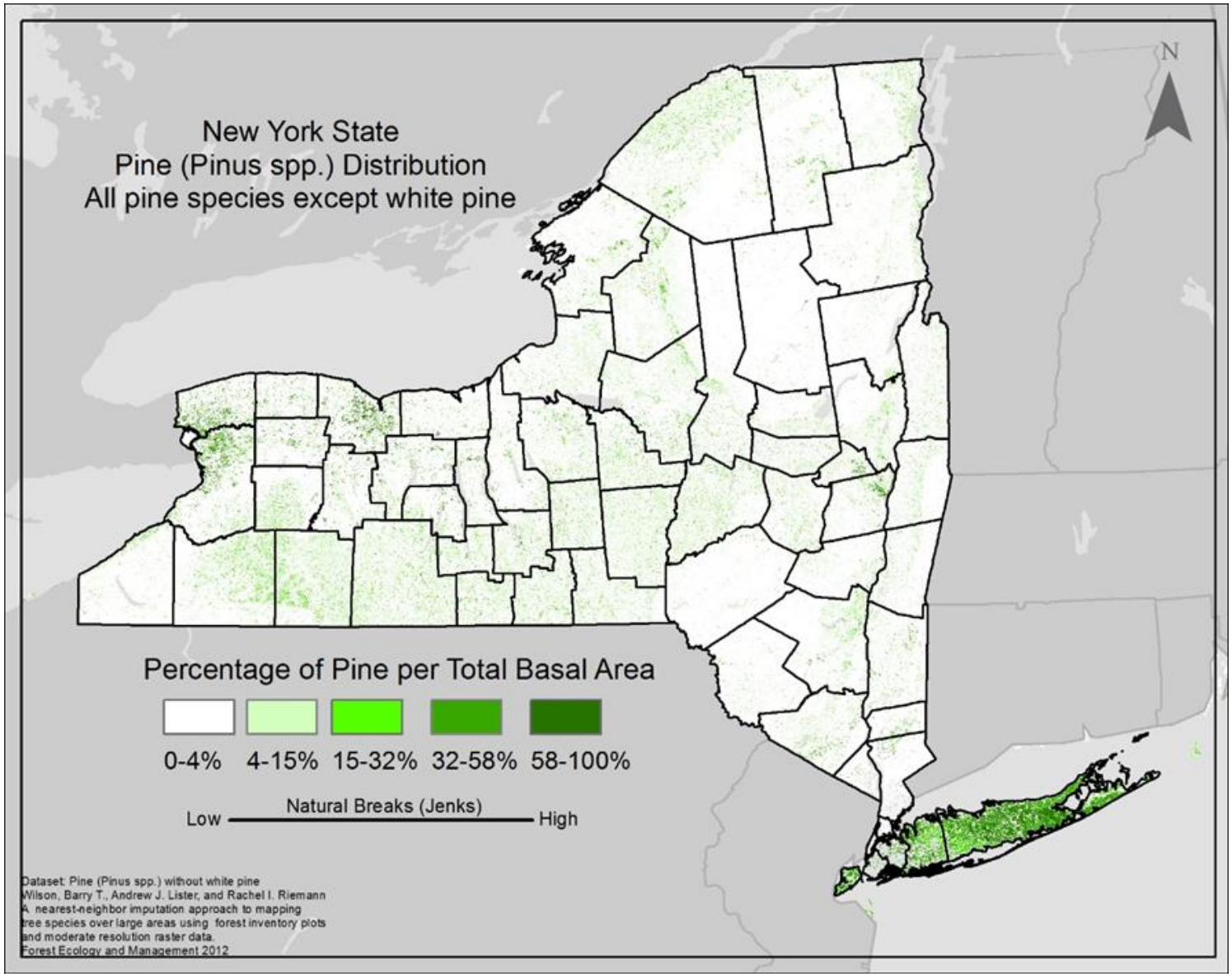

Figure 1. New York State distribution of susceptible pine species including pitch pine, red pine, Scots pine, Austrian pine, shortleaf pine, and Virginia pine. White pine and Norway spruce were not included due to higher resistance to SPB attack.

Appendix B

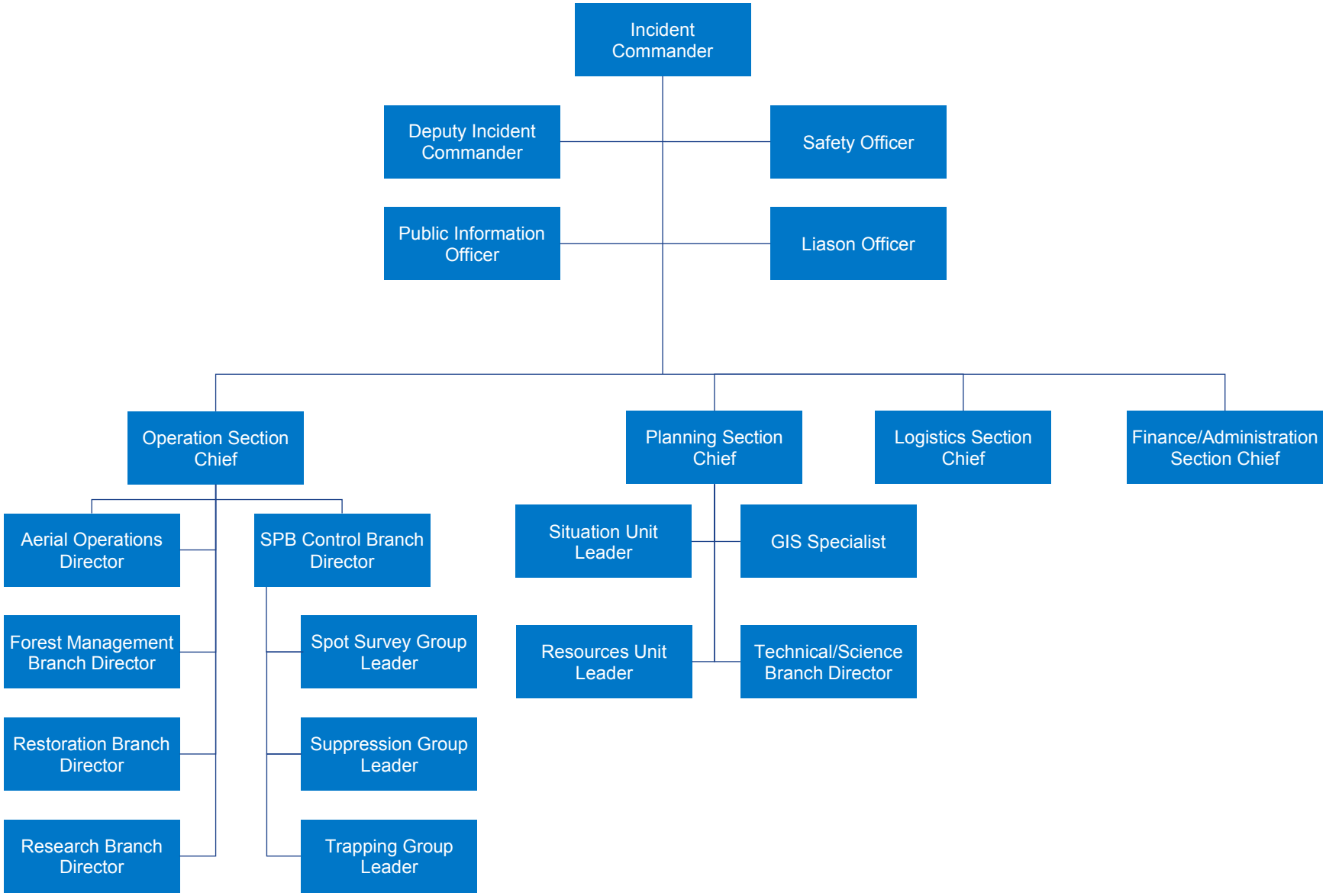

Figure 2. Generalized incident command structure for the SPB response.

Appendix C

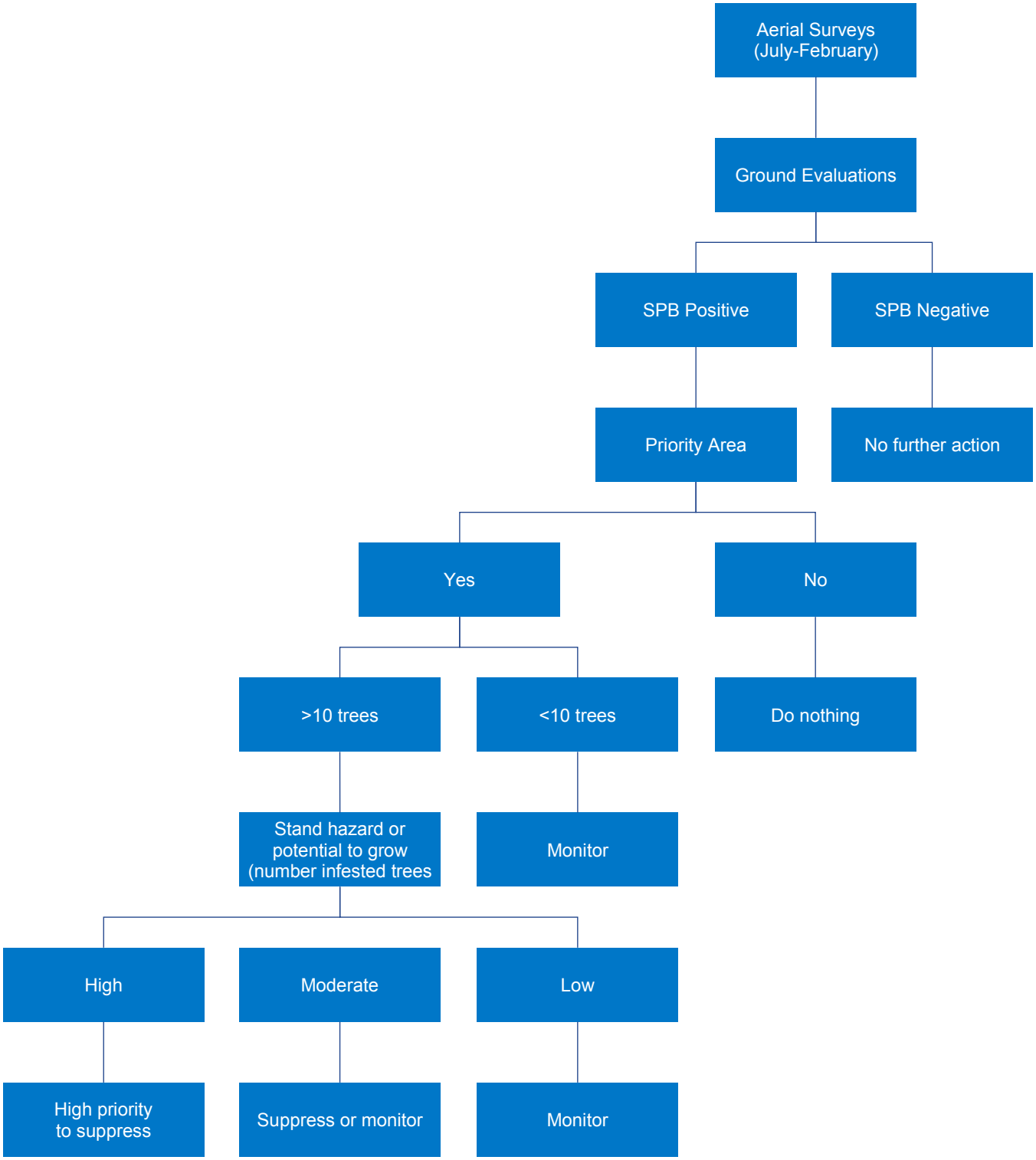

Figure 3. Flowchart for prioritizing areas for suppression efforts.

Appendix D

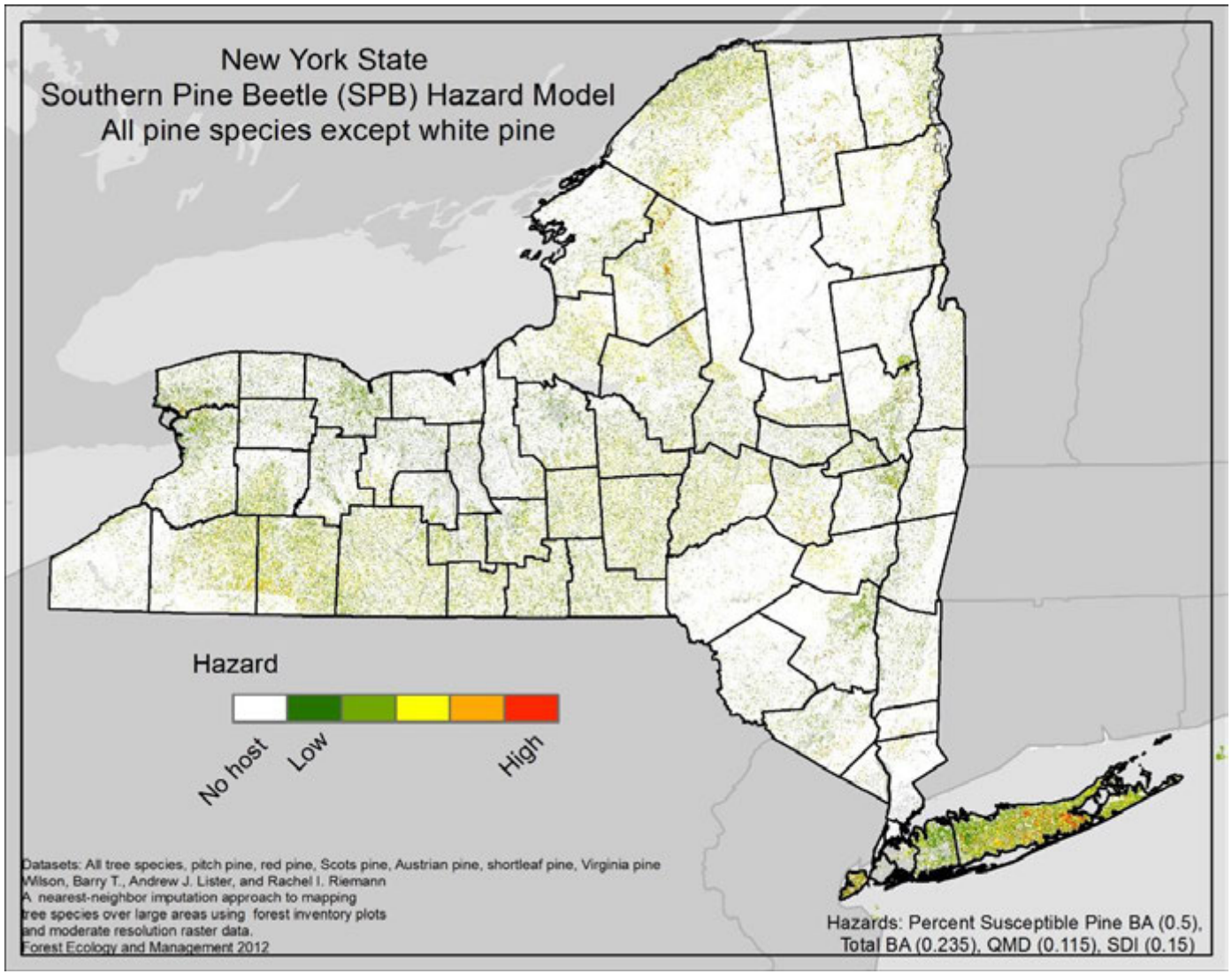

Figure 1. SPB hazard based on competition factors and distributions of susceptible pine species including pitch pine, red pine, Scots pine, Austrian pine, shortleaf pine, Japanese red pine, and Virginia pine.

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