

# **Massachusetts Southern Pine Beetle Response Plan – Protecting Pitch Pine Forests Through Active Restoration**



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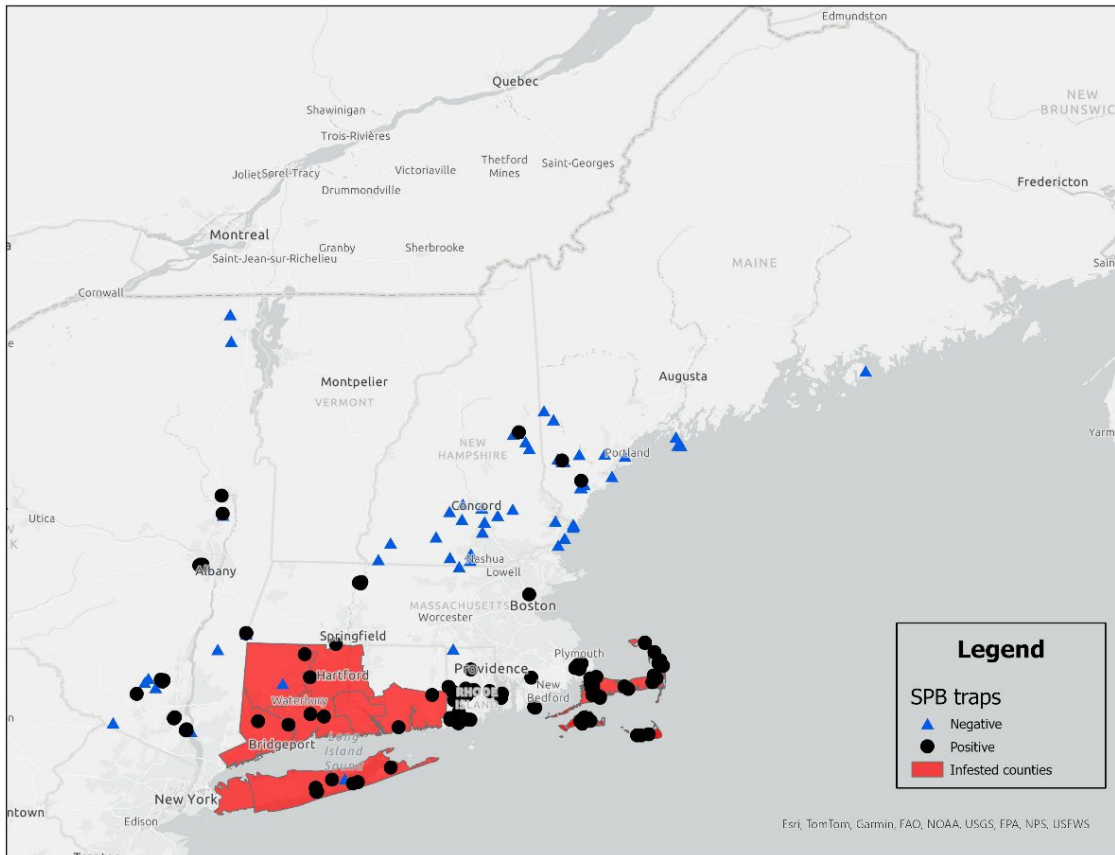
## Introduction

Southern pine beetle (SPB), *Dendroctonus frontalis* Zimmermann, is expanding its range to include portions of the northeastern U.S. (Figure 1). Southern pine beetle is a primary tree killer (i.e., attacks and kills healthy trees) and responsible for widespread tree losses throughout the southeastern U.S. In the early 2000s, SPB began causing significant forest damage in the New Jersey Pinelands that continued for two decades. Infestations in the Central Pine Barrens on Long Island, NY were detected in 2014, and considerable damage has occurred throughout the area since. Southern pine beetle infested trees were also located at multiple locations in Connecticut in 2015. The multi-generational SPB forms infestations (commonly referred to as “spots”) that expand during summer months and can quickly grow in dense stands of host trees from only a few trees to hundreds or thousands of trees in one summer. Within only a short period of time entire stands can be killed by SPB.

Since detection on Long Island, Massachusetts DCR has conducted trapping surveys across the state (Figure 1). SPB has been detected in trapping surveys at relatively low numbers since 2015, with dramatic escalation in numbers in 2023 and 2024. Fortunately, during early survey years no SPB infestations in trees were found in Massachusetts. Active SPB infestations were confirmed, however, for the first time in 2023 on Martha’s Vineyard and Nantucket where substantial damage resulted. An infestation closer to mainland Massachusetts, on Washburn Island, was found during the fall 2024. Multiple infestations were found in late 2025 on state properties on the Cape representing the first infestation detections on mainland Massachusetts.

Pitch pine is a common tree species in southeastern Massachusetts, usually occurring on sites characterized as dry, acidic, and nutrient poor. Across ownerships, approximately 100,000 acres of pitch pine dominated natural communities exist in Massachusetts (Nature Conservancy, undated). Two pitch pine forest types are recognized in Massachusetts. Pitch pine-scrub oak forests, the rarer of the two, contain a well-developed understory of several oak species and a relatively open canopy of pitch pine. Pitch pine-oak forest/woodland can have a more closed canopy and several species of oaks present in upper canopy layers.

The largest concentration of pitch pine stands occurs in the Bristol Lowland/Narragansett Lowland and Cape Cod and Islands ecoregions and includes forests in and around Myles Standish State Forest and Joint Base Cape Cod. Sporadic representation of this forest type is also found in other areas including the Connecticut River Valley. Ridgetop pitch pine-scrub oak natural communities occur in western portions of the state on ridgetops and steep mountain slopes. These habitats are critically imperiled (G1) globally and imperiled (S2) in the state. Pitch pine is also a common tree throughout urban and periurban landscapes of Massachusetts towns. Unfortunately, SPB represents a serious forest health threat to all these forests with ecological, recreational, and fire impact dimensions. These forests provide habitat for a diversity of rare plant and animal species, including many rare species of moths and butterflies.



**Figure 1.** Southern pine beetle detection trapping results from 2015 – 2025. Black dots represent traps where adult SPB have been captured.

Pitch pine has been the primary SPB host in the expanded region with attacks also found on white pine, red pine, Scots pine, Norway spruce, and hemlock. Spruce and hemlock are rarely attacked, and it is unknown if they are suitable reproductive hosts. White pine stands on Long Island have been attacked and suffered overstory tree losses between 37-55%. While white pine did produce viable brood, SPB was not as successful as in pitch pine (Dodds et al. 2024).

### **Opportunities for Stand and Ecosystem Restoration**

Southern pine beetle will be a challenge to manage in Massachusetts and has the potential to cause widespread tree mortality. However, it also provides the opportunity to improve resilience in pitch pine forests across the state. Many pitch pine stands are in poor condition requiring proactive forest management coupled with restoration treatments including prescribed fire to ensure their future. For example, pitch pine-scrub oak forests, often referred to as pine barrens, have become overstocked with conditions favoring shade tolerant tree species. This has resulted in stands where pitch pine only exists in the dominant canopy layer, with shade tolerant species slowly replacing them in the stand. Pitch pine regeneration is mostly absent in the understory of these stands. As SPB kills overstory pitch pine, future seed trees are lost, and any chance of

reinitiating pine regeneration becomes much more difficult. Restoring pitch pine to natural structural conditions ensures viable future regeneration, while also protecting overstory trees from SPB.

## **Tools Used for Managing SPB**

Unfortunately, SPB eradication is not possible and its presence in the region will be the new norm. An integrated approach with six components provides the best opportunity to reduce SPB-caused tree mortality, while maintaining pitch pine forest types, and reducing disruptions in important wildlife habitat and recreation areas in Massachusetts. These components are:

1. Public outreach
2. Assessing pitch pine conditions
3. Detection and monitoring efforts
4. Active forest management and ecosystem restoration
5. Targeted spot suppression/disruption
6. Post-outbreak restoration and monitoring

Integrated pest management methods have had success in the southeastern U.S. as well as recent efforts in northeastern pitch pine forests. The application of science-based strategies to improve the overall health of affected forests (e.g., stand thinning, invasive plant management, and return of fire) provides an opportunity for restoration of degraded forests while protecting them against damaging SPB infestations. Given the complex land ownership patterns and proximity to relatively populated urban environments, good communication and coordination with landowners, media, elected officials and others will also be important to maintain as plans proceed.

### **Public Outreach**

Public perception of pitch pine forest health is often misaligned with the natural structure and composition of forests prior to fire suppression and mesophication. To gain as much support as possible for forest management and restoration efforts, it is critical to clearly outline management objectives, explain treatment goals, methods, expected outcomes and treatment evaluations to elected officials, the public, landowners, NGOs, landscape professionals, regulatory agencies, etc. Consequently, a strong and coordinated outreach effort will need to be developed and delivered to various stakeholders. It will be important to explain the components of the SPB management plan during outreach efforts.

### **Assessing Pitch Pine Conditions**

A critical first step in developing responses to SPB is understanding conditions in pitch pine forests across landscapes. Stand-level maps that include even baseline forest inventory information can be helpful for prioritizing stands for treatment. If existing data is not available, quick forest surveys where at a minimum basal area is estimated can be helpful for determining the susceptibility of pitch pine forests and scheduling them for treatment and restoration. High-

hazard stands can also be prioritized for monitoring to detect any forming infestation early and schedule treatment if warranted.

## **Detection and Monitoring**

SPB detection and monitoring are important components of SPB management. These tools allow for the best assessment of SPB presence, extent, and severity of infestations across entire landscapes. Detection and monitoring efforts need to be consistently applied to catch new and growing infestations to allow for timely management activities. Tools used during detection and monitoring efforts include:

1. Aerial detection surveys (ADS). Generally conducted with fixed-wing aircraft at heights of at least 1000 ft. These surveys are conducted by Massachusetts DCR with results distributed to partner agencies. Surveys provide information on the location and size of possible SPB infestations. Suspicious areas mapped during ADS will be followed up with ground survey to confirm SPB presence and delimit the polygon on the ground.
2. Ground surveys. Ground surveys can serve two purposes. First, ground surveys follow aerial detection surveys to confirm or identify damaging agents and assess conditions within a mapped area. During this effort and if the mapped area is SPB-positive, ground surveys delimit the extent of the infestation and include estimates of emerged (i.e., vacated) and infested trees, including green infested trees not detectable during ADS. Infestation boundaries can be flagged to allow monitoring of spot growth during site revisits prior to any management activities. Ground surveys can also be used to observe signs of SPB attack on trees in high-risk forests.
3. Southern pine beetle trapping. Pheromone-baited traps can be used to detect SPB in new areas and monitor populations before tree mortality is found. Before arrival, traps can be deployed in high-risk areas, or unique habitats where there is a concern that SPB may become established. Following survey [protocols](#) is important to minimize risk to surrounding trees and ensuring consistent results. Fall trapping is now recommended for SPB detection surveys with traps deployed in mid-September and run until November.

## **Active Forest Management and Ecosystem Restoration**

High pitch pine basal area and stands growing on sandy soils are more susceptible to SPB in northeastern forests (Jamison et al. 2022). Important variables that have been associated with SPB susceptibility in the southeastern US include basal area, stem density, tree size, site quality, proportion of hosts, and growth rates (Coulson et al. 1974, Schowalter and Turchin 1993, Hedden 1978). Variables associated with overstocked conditions (i.e., high basal area, stem density) create environments conducive to pheromone stability, allowing for easier orientation to hosts by dispersing SPB. Overstocked stand conditions also provide short inter-tree distances that allow SPB to readily expand infestations. Perhaps most importantly, these characteristics also provide more stable environs for semiochemical signals used by SPB during tree attacks due to the closed canopy conditions. Unfortunately, these conditions are common in most of the pitch pine forests throughout MA.

Fortunately, stand conditions related to SPB hazard can be mitigated through silvicultural treatments that simultaneously reduce stand susceptibility to SPB and create conditions desired

for restoration of degraded pitch pine ecosystems. Preventative stand thinning reduces the likelihood of a SPB infestation becoming established in a stand or of large tree losses if tree attacks occur (Belanger 1980, Brown et al. 1987, Fettig et al. 2007 and references therein). Stand thinning should be emphasized across ownerships in Massachusetts because reduction in highly susceptible SPB habitat on the landscape will have the largest impact on beetle populations and subsequent tree and forest losses. Stand thinning results in more open stand conditions that disrupt SPB pheromone communication (Thistle et al. 2011), while also increasing resources for residual trees to resist infestations.

Pure pitch pine and pitch pine-oak forests should be thinned to a residual basal area of at most 60 ft<sup>2</sup>/ac, and no higher than 80 ft<sup>2</sup>/ac if possible. Stands at or above 120 ft<sup>2</sup>/ac are particularly at risk to SPB infestation. A hazard model developed for northeastern pitch pine forests can be used to prioritize stands across larger landscapes (Jamison et al. 2022). Preventative silvicultural treatments can be conducted any time during the year, making scheduling outside of restrictions for wildlife protection or other factors irrelevant compared to growing season suppression activities.

Specific tools for reducing the risk of SPB establishment in forests include:

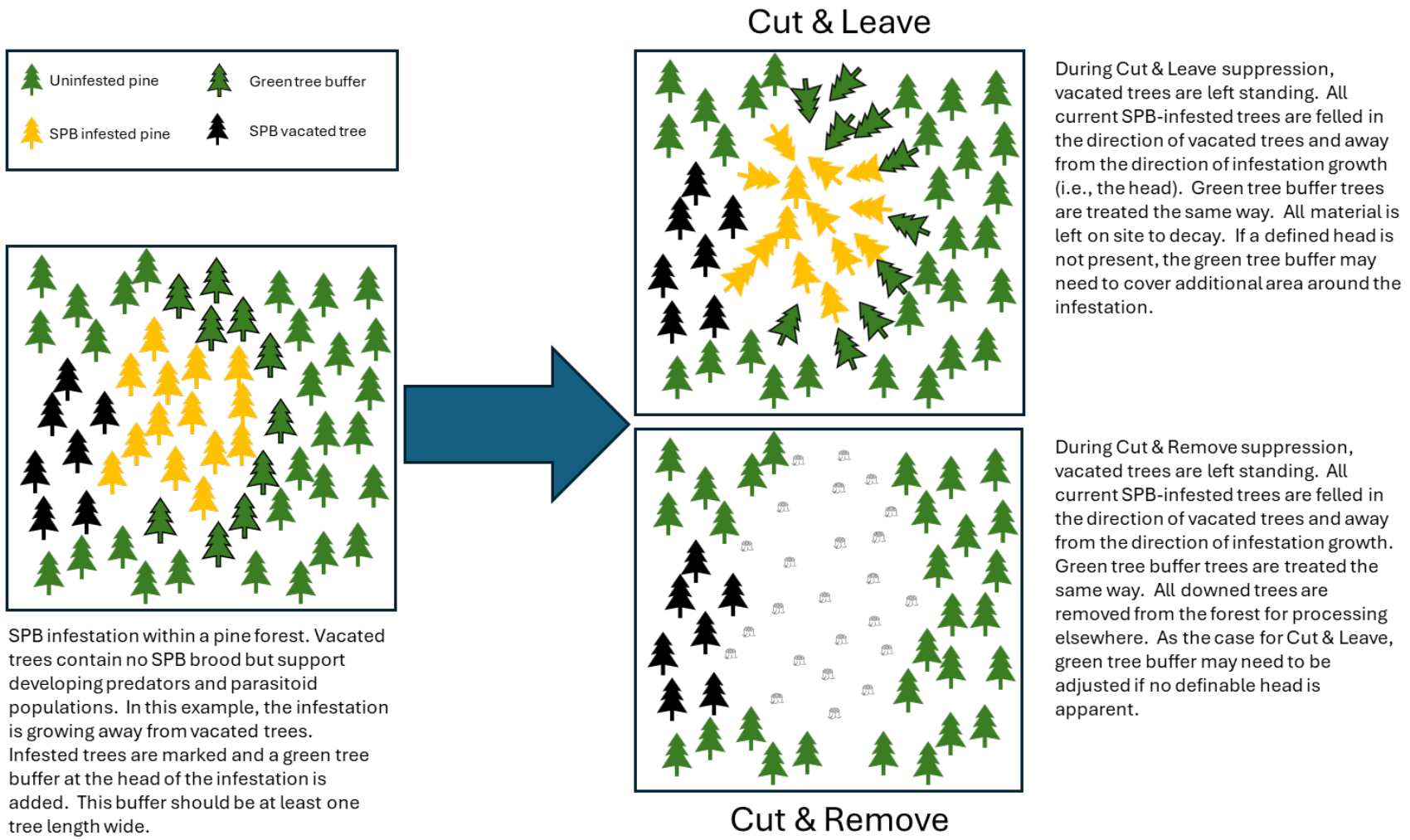
- a. Stand thinning. Several thinning approaches, or a combination of techniques, can be used in mature stands that are overstocked including low, crown, or mechanical. Target stands should have basal areas near or above 100 ft<sup>2</sup>/ac with the goal of reducing this to 60 ft<sup>2</sup>/ac or below. In stands where hardwoods have become established in intermediate and co-dominant crown classes, these trees should be prioritized for removal.
- b. Whole tree mastication. Mastication is conducted using a tractor or excavator that grinds, shreds, or chops tree material. This can be done in conjunction with stand thinning when there is no market for cut material, abundant fuels remain on site, or as the primary tool to reduce stocking. The size of the tree material dictates which machine is needed. The treated tree material left on site is often burned following mastication.
- c. Chipping and/or burning. Any silvicultural treatment will result in many cut trees that likely will not be commercially utilized. Chipping and/or burning can be used to reduce the amount of material left on site. Large amounts of dead wood left after treatments can provide habitat for other bark beetles (e.g., *Ips* spp.) that may in turn spill into living trees. Air curtain burners are an efficient way to reduce fuels after stand disturbance and could be used to reduce this material.
- d. Fire. The near-term fire hazard in treated stands may increase and fire considerations should be considered for all treatments, and also for areas with large amounts of standing dead wood. A prescribed fire plan could help reduce the amounts of downed materials over time, thus reducing the overall fire hazard of a stand.

### **Infestation Suppression/Disruption in Infested Stands**

There are two common techniques used to disrupt SPB infestations: (1) Cut-and-leave and (2) Cut-and-remove. Both methods are designed to disrupt pheromone communication and cause

the infestation to collapse. Cut-and-remove has the added benefit of removing beetle populations from an area, but local markets for the cut trees are necessary for this material. Consequently, most suppression activities involve cut-and-leave tactics. Trees already vacated by SPB are not included in suppression/disruption cuts and can provide valuable wildlife habitat as well as host beneficial insects in the near term. However, vacated trees should be removed if they pose a risk to public safety or planned prescribed fire activities. Both suppression methods also involve removing a green-tree buffer around the active infestation. In the southeastern US, this buffer is generally around the front of the infestation where active tree attacks are underway. In the northeast, defined fronts are rarer and infestations often expand equally around the perimeter. Consequently, the green tree buffer often includes more trees in the northeast. The buffer is important because it creates a gap between any freshly attacked trees that may emanate pheromones and living, uninfested pines. Buffer width may vary based on size of an infestation, but should be a minimum of 60 ft.

1. Cut-and-leave. Cut-and-leave involves directionally felling currently infested and buffer trees toward the center of an infestation to disrupt SPB spot infestation growth (Figure 2). Trees are generally left on the ground at a site. Cut-and-leave followed by chipping or mastication can help reduce the long-term fire hazard in a stand. Cut-and-leave is not appropriate for all situations, and is most effective at controlling smaller spots (< 100 infested trees) (Clarke and Nowak, 2009). When cut-and-leave is used for suppression, it is important to consider the at-risk forest in the surrounding areas. If there are other active infestations near the targeted infestation, every effort should be taken to also suppress those spots at the same time.
2. Cut-and-remove. Cut-and-remove is a suppression tactic whereby all infested and buffer trees are felled and then removed from the site to be utilized as wood products or otherwise disposed (e.g., landfill, burn pit, chipper, etc.). Because beetles are removed from the infested area along with any pheromone signals, this tactic is very effective. However, cut-and-remove relies on the presence of local timber markets. It may be possible for cut trees to be disposed of through local agreements with municipalities that have grinders or chippers at an accessible location. A surrogate would be to cut infested trees and then chip trees or to use an air curtain incinerator on site to reduce fuel loads.
3. Do nothing. Based on landscape prioritization, potential for negative impacts to rare species in some areas, or other management concerns or local decisions, many SPB infestations will not be actively managed or undergo suppression activities. Limited resources may also be a factor. The decision to do nothing should be justified on a case-by-case basis; documentation of the decision and continued long-term monitoring of pitch pine response (and potential monitoring for other species) can provide information on the relative success of various actions versus no action alternatives.



**Figure 2.** Depiction of two methods for SPB spot suppression/disruption.

## Post-Outbreak Restoration and Monitoring

Post-suppression [monitoring](#) of stands should be conducted following treatments. Treated areas should be revisited two to four weeks after cutting has ceased to survey for any remaining SPB-infested trees. Any trees found to be attacked should be cut immediately and then the stand should be revisited in two to four weeks to again search for missed trees.

## Southern Pine Beetle Management in Urban Settings

Managing SPB in urban environs will involve removal of SPB infested or killed trees, hazard tree mitigation, and preventative treatments (i.e., pesticides).

1. Emerged trees. Although killed trees (foliage brown or fallen off) do not pose a threat to healthy trees nearby because SPB has already vacated these trees, landowners, parks, highway departments, and others may need to consider risks such trees pose to people, structures, public roads, utilities, etc. Standing dead trees can pose a serious hazard in urban situations and should be targeted for quick removal
2. Infested trees. Trees that are infested at the time of survey should be removed as quickly as possible. Currently infested trees pose a risk to nearby uninfested host trees during the growing season, so quick response is warranted. Homeowners should be advised to contact a consulting arborist if necessary.
3. Uninfested trees. It is unclear the extent to which non-forest landscape and nursery trees are at risk of infestation. Those near active infestations are likely to be more prone to attack, but some landscape trees not known to be adjacent to such active infestations have also been attacked. Trees can be protected from attack with preventative insecticide bark sprays containing permethrin or bifenthrin and labeled for such use. Products available and approved for use in Massachusetts for both commercial (nursery and landscape) and non-commercial (use by homeowners on their private property) situations have been identified. These include abamectin, bifenthrin, emamectin benzoate, and permethrin. The choice of whether to treat or not should be made on a case-by-case basis with concerns for possible impacts from off-target drift of bark spray applications.

## Fire Hazard

The presence of SPB in pitch pine and pitch pine-oak forests will result in a rapid increase in standing dead wood and/or an increase in coarse woody debris through suppression activities. It is unknown at this time 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). However, other stand level effects can be seen following death of the overstory that may increase the fire danger. For example, in pitch pine stands with scrub oak in the understory, dieback of the overstory increases scrub oak fuel loads and allow for more rapid drying. This results in higher likelihood of a fire ignition and potential extreme fire behavior from the increased scrub oak fuel load with control (smoldering, smoke) being exasperated by

downed and standing dead wood. Fire fighter safety can also be compromised due to the presence of large numbers of snags.

Until a better understanding of fire risk in SPB-infested and treated stands exists, fire management should be a component of any treated stand and stands where no SPB suppression/management efforts are undertaken. This could include notifying local fire response organizations of the increase in potential fuel in their jurisdictions supported by a broader approach that might include mapping and modeling fire hazard over the management landscape. Fuel loads and estimates of the duration of concern should be documented. Fire mitigation measures, such as wood removal, mastication, or chipping, or otherwise clearing a fuel free buffer zone around suppression areas should be considered when feasible.

## **Summary**

Southern pine beetle is now an important component of forest management and restoration plans for pitch pine forests in Massachusetts. Fortunately, techniques used for restoration efforts in pitch pine forests and pest management practices to reduce the impact of SPB parallel one another allowing for additive benefits of these approaches. An integrated approach that considers building resilience in pitch pine forests through silvicultural treatments to lower stand basal area and long-term restoration efforts, combined with detection/monitoring and suppression efforts for SPB provides the best approach to reducing the impact of this beetle in new environments. Aerial detection flights and follow-up ground surveys provide important information to allow for informed suppression decisions while proactive forest management across Massachusetts high-hazard forests reduces optimal SPB habitat.

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