

Red Pine Insect and Disease Problems: A Summary

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General Guidelines For Red Pine Pest Management

Forest managers should consider potential pest problems in their forest management planning to prevent or reduce economic losses. Proper planning at the beginning of a red pine planting project will pay off throughout the life of the stand. Here are some general guidelines:

1. Plant on proper sites to maintain tree vigor. Highest productivity occurs on sandy to loamy soils with good moisture and drainage. Good site preparation before planting and periodic silvicultural treatments after planting are often required to maintain healthy trees.
2. Before seeding or planting, check to see what diseases or insects are prevalent in the area.
3. Survey plantations annually to detect pest problems early. Surveys should be included in the annual program of work and the procedures should be well developed before surveys are initiated.
4. Report pest problems immediately to your forest pest control personnel for evaluation.
5. Maintain a well-balanced diversity of species on land management units to temper disease or insect outbreaks. Large continuous stands of red pine of the same age are susceptible to severe pest outbreaks, so blocks of red pine should be of varying age classes and broken up with alternate species, preferably not pine.

Palmer and Jones (1983) have developed a useful pest management action plan that is summarized as follows:

- Plan ahead. The easiest and most cost-effective way to control pest outbreaks is to prevent pest outbreaks.
- Learn to identify major forest pests. It is important to be familiar with the common pests that affect the timber types managed.
- Conduct frequent surveys. Frequent surveys are needed to detect new pest outbreaks as early as possible. Historical records of past outbreaks are also important.
- Decide if control is necessary. The cost-benefit of control as it relates to management objectives needs to be evaluated before making a control decision.
- Choose controls. A successful pest management program will integrate all available genetic, legal, biological, cultural, and chemical controls.
- Evaluate control efforts. A follow-up evaluation is important to determine the success or failure of the chosen controls and to provide information for future decision making.

Site index is used to estimate productivity of the site, but the productivity of the stand depends not only on the site but how well it is used (Benzie, 1977). The potential for insect-caused losses and suppression costs must be considered to realistically estimate site productivity and investment returns.

Insects can reduce tree growth without causing noticeable injury. Symptoms may be over-looked by the untrained observer, or the stand may be visited after symptom development.

Following are two examples of insects influencing estimates of site productivity in Michigan:

1. Saratoga spittlebug impact was assessed in moderate and high risk red pine plantations. Several plantations were found with an under estimated site index due to unrecognized spittlebug injury. One forty-acre plantation had a few pockets of stunted, deformed and top killed trees, yet the planting as a whole appeared "normal". Within this planting, the average tree height on 30 acres was 6 feet in contrast to the remaining 10 acres where the trees averaged 12 feet. The soils in both areas were sampled with a 5-1/2 foot soil auger. There were no discernible differences in soil or topography between areas. However, moderate to high risk ground vegetation was prevalent on the 30 acre parcel, and low risk ground vegetation covered the 10 acre parcel. Upon closer examination Saratoga spittlebug scars further confirmed that spittlebug injury plus possible differences in ground cover competition were the primary causes of the growth differences.
2. Ten years after establishment, the growth of plantation red pine in white grub areas treated with Aldrin and untreated stands was compared. The SI_{50} based on projections from height measurements revealed trees in the grub infested areas averaged 5 to 9 units lower (e.g. SI_{50} values of 39-61 untreated vs. 46-70 treated area).

In these two examples, the potential productivity of the sites without spittlebug or grub injury should have been used to estimate site productivity and to evaluate the economics of control options.

The Habitat Classification System developed by Kotar and Coffman (1982) presents one method of determining potential productivity of a site for a variety of tree species suited to that site. The system presents a means of assessing site productivity without relying on tree growth as affected by pests and other factors.

Major Insect Problems of Red Pine

1. **Saratoga spittlebug** (*Aphrophora saratogensis* [Fitch]).

The Saratoga spittlebug causes growth loss, deformity and mortality of young plantation red pine in the Lake States. The spittlebug is a problem only when suitable alternate hosts (e.g. plants on the forest floor fed upon by spittlebug nymphs) are abundant. Of the numerous alternate hosts sweet-fern (*Comptonia peregrina* [L.] Coult) is the most important for population buildup. The abundance of sweet-fern relative to other ground cover plants is used to risk-rate red pine planting sites and young red pine stands.

The Saratoga spittlebug can be managed by preventive, cultural, and chemical measures. Prevention involves restricting the planting of spittlebug-susceptible pines to only no-risk or low-risk areas. This may mean not planting an entire area or omitting just a few small islands or pockets where the important alternate hosts predominate. Not planting a small portion of an area may greatly enhance aesthetic and/or wildlife values in some regions. Cultural control implies reduction of the principal alternate hosts --especially sweet-fern. Deep plowing disrupts and buries sweet fern and usually curtails rapid regeneration. However, on sandy soils this procedure disrupts soil structure and water-holding capacity of the plowed soil layer. Shallow plowing or mowing stimulates growth of sweet fern and should be avoided unless repeated for 2 to 3 years -- the cost of which may be prohibitive. Chemical herbicides do not disturb the soil and provide what appears to be the most reasonable method of reducing ground vegetation. When applied properly, herbicides suppress sweet fern and blueberry providing long-term suppression.

2. **Red-headed pine sawfly** (*Neodiprion lecontei* [Fitch]).

The red-headed pine sawfly causes growth loss, deformity and mortality in young red and jack pine plantations. Stressed trees are more susceptible to attack and vulnerable to damage. Thus, factors which cause tree stress increase the risk of sawfly injury during peak periods of sawfly abundance.

The red-headed pine sawfly can be controlled in cultural and chemical means. High-risk sites are those with dense growths of bracken fern or sod, zones within 30 feet of hardwood edges, zones surrounding residual over-topping trees, high water tables, frost pockets, and areas where soils are excessively poor in nutrients or have very high or very low moisture holding capacity. Additionally,

sawflies often damage trees on plantation edge most severely. Thus, reducing the proportion of edge to plantation area lowers overall risk.

Cultural practices include any activity which hampers the sawfly population by improving the site or the tree's ability to use the site. These include suppressing bracken fern and other strong competitors for soil moisture and nutrients, and using seed sources, species and varieties which best match the site.

Chemical control is required when sawfly larvae become numerous. Pesticides are used on young larvae soon after emergence.

3. **White grubs** (*Phyllophaga* spp.)

White grubs kill pine seedlings and reduce the growth and vigor of damaged trees for many years. Old fields always represent a potential white grub problem - especially if heavily sodded. However, sites with only a light cover of grass and forbes with a high proportion of bare ground and lichens can also harbor very high grub populations. A plantation with 0.5 grub /ft.³ of soil will experience 16-34% seedling mortality by the second growing season after planting. Additional mortality may occur in the third year after planting.

All old field proposed planting sites should be surveyed before planting to assess the need for chemical suppression at the time of planting.

4. **Pine root collar weevil** (*Hylobius radialis* Buch).

The pine root collar weevil causes growth loss and tree mortality by injuring pine trees at the root collar just below ground level. Scotch and Austrian pine are the most severely damaged species followed by red and jack pine, and lastly white pine. Susceptible species four inches in diameter or less die after 3-4 years injury. Larger trees are killed if weakened enough to be susceptible to wind throw. In Kalkaska County, Michigan, pole size red pine (e.g. 7-9" d.b.h.) adjacent to 16-20 year old Scotch pine plantations are suffering significant losses from wind throw of weevil weakened trees. The growth impact has not been determined, yet almost every tree in these plantations has at least one weevil attack.

The pine root collar weevil is most severe on light soils. In such areas, red pine should not be inter-planted with or planted within 1/2 mile of Scotch or Austrian pine plantations. Weevil injury can be reduced by planting seedlings at the proper depth. Increasing planting depth as sometimes practiced on lighter soils increases weevil susceptibility.

5. **Pine engraver** (*Ips* spp.)

Pine engraver beetles occur naturally in most pine and spruce stands where they breed in recently dead or dying trees. Healthy trees resist beetle attacks by drowning the adults in pitch. Outbreaks occur during periods of drought which slow growth and reduce resin production. The beetles seek out, attack and kill drought-weakened trees and trees killed or stressed by insects, diseases, fire or logging.

Outbreaks can be prevented or reduced by maintaining vigorous trees and by promptly removing beetle breeding material. Suggested practices include:

1. Select species best suited to the site.
2. Reduce competition among trees by thinning when needed.
3. Avoid mechanical injury to uncut residual trees in a stand.
4. Promptly remove, destroy or chemically treat infested material.
5. Remove stacked pulp sticks or saw logs within 2 weeks of cutting in summer.
6. If possible, avoid harvesting and thinning operations in or near pine stands during dry years.
7. Harvesting and thinning operations in pine stands should be conducted during late summer or early fall (August 1 to November 1). Slash and logging debris cut during this period will not be suitable breeding material the following spring.
8. Scatter slash as much as possible to aid drying and breakdown of the material. Avoid piling fresh slash next to standing trees.

Other Insect Problems

There are a number of other red pine insect problems which cause little growth loss or stem deformity. Following are three additional insect problems which merit mentioning. Management of these problems is less well understood, yet they should be monitored by virtue of their potential to damage red pine.

The **European pine shoot moth**, *Rhyacionia buoliana* (Schiff), can cause serious damage in red and scotch pine plantations in the north-central and northeastern United States. Shoot moth larvae feed on the tree's terminal bud causing a severe crook in the stem or bushy tops if all buds in a cluster are killed. Trees more than 15 feet tall are rarely attacked. One approach to control the shoot moth is to prune all lower branches which occur below the snow line as soon as the tree is large enough. The shoot moth over-winters in buds and most larvae in buds above the snow line are killed by subzero temperatures. Wisconsin has delimited red pine shoot moth hazard zones within which pruning lower whorls or chemical sprays are recommended if planting red pine.

The **red pine shoot moth**, *Dioryctria resinosella* Mutuura, has caused significant damage to plantation red pine in the lake states in recent years. New shoots are destroyed in July causing height and growth loss, and main stem deformity. Trees of all ages have been attacked, but the most severe damage occurs in 20-40 year old plantations growing on sandy soils. Hazard zones where red pine is not recommended for planting have been delineated in Wisconsin. No direct controls for the red pine shoot moth are available. Thinning in these areas removes the worse stems. Shoot moth may shorten the optimum economical rotation age for red pine by significantly retarding tree growth.

A **needle mining midge**, *Contarinia baeri* (Prell), received much attention in 1982-84 in Michigan and Wisconsin. This needle midge attacks scotch and red pine in July. One to several larvae feed at the base of the current year's needles causing the needles of red pine to bend at the fascicle sheath. The needles of both pines display needle browning from the fascicle sheath outward. This might be confused with symptoms of scleroderris, but appears in July and August, not in June. With heavily infested trees, all the new growth is lost, making the top of the tree where new needles are concentrated seem more heavily attacked.

The following general references can be used to further describe the insect problems presented above and/or to learn of other insect related problems on red pine.

1. Insects of Eastern Forests. 1985. U.S.D.A. Forest Service, Misc. Publ. No. 1426. 608 pp.
2. Wilson, Louis F. 1977. A Guide to Insect Injury of Conifers in the Lake States. U.S.D.A. Forest Service, Agricultural Handbook No. 501. 218 pp.
3. Rose, A.H. and Lindquist, O.H. 1973. Insects of Eastern Pines. Dept. of the Environment, Canadian Forest Service, Pubi. 1313, 127 pp.

Major Disease Problems of Red Pine

1. **Lophodermiurn needlecast** caused by the fungus, Lophodermiurn seditiosum.

This fungus is of primary importance in nurseries throughout the Lake States where it defoliates and often kills many nursery seedlings. The fungus can be transported on nursery stock to field locations where symptoms develop. The browning of infected trees after spring field planting has been confused with storage or handling problems or problems that originate in the field. Seedlings that survive in the field normally do not suffer major damage in later years.

2. **Pine needle rust** caused by the fungus, Coleosporium asterum.

Needle rust is most prevalent on young trees up to sapling size throughout the Lake States. The disease does not usually seriously damage trees. But in high hazard sites, where abundant goldenrod and aster can serve as the alternate host for the rust, the foliage is often killed. This causes reduced tree growth and unsightly foliage. Needle rust, when combined with insects or other agents that attack current-year shoots, can kill small trees.

3. **Diplodia shoot blight and canker** caused by the fungus, Diplodia pinea.

Diplodia causes shoot blight and stem canker of red pine in plantations, windbreaks, and ornamental plantings throughout the Lake States. The fungus usually attacks trees stressed by one or more of the following factors: poor site, drought, hail damage, snow damage, mechanical wounds, and insect activity. Diplodia kills trees by killing the new foliage year after year or by initiating girdling stem cankers on stressed or injured trees.

4. **Sirococcus shoot blight** caused by the fungus, Sirococcus strobilinus.

In the United States, Sirococcus shoot blight has become increasingly important since the early 1970's. When favorable conditions for infection have occurred, tree and shoot death have risen steadily in several local areas in the northern part of the Lake States. Tree mortality in some Wisconsin red pine plantations, for example, increased from 19 to 67 percent from 1972 to 1976. Small seedlings and saplings growing under or near infected overstory trees are commonly killed by multiple infections. Trees not killed often become misshapen. Lower branches are often killed on pole-sized or larger trees as a result of multiple infections.

Management Guidelines:

The best control is to avoid two-story or uneven-age stands in northern areas where Sirococcus is a potentially serious problem.

- Remove infected overstory and understory trees (or infected shoots if understory trees are small enough). The removal of infected overstory trees removes a major inoculum source and the shade infection.
- Do not plant red pine seedlings under or adjacent to infected trees. A minimum buffer zone should be twice the width of the height of the infected trees. This buffer zone can be left unplanted or it can be managed for deciduous species or immune or resistant conifers, such as white spruce, black spruce, balsam fir, or larch. As a precaution, newly established red pine plantations should be checked 5 years after planting to make sure the fungus has not spread into the plantations. If the fungus is present, carry out appropriate control measures that will insure that major inoculum sources are eliminated.
- Remove small pockets of infection in an otherwise healthy plantation by cutting infected overstory and understory trees. This procedure will minimize Sirococcus damage to the remaining healthy stand.
- Do not leave scattered, infected, overstory red pine during logging in Sirococcus hazard areas, particularly if the site is to be replanted to red pine. If such trees are not removed they will serve as an inoculum source that will infect the next crop of trees.

5. **Scleroderris canker** caused by the fungus, Gremmeniella abietina

Scleroderris canker has killed many trees in conifer plantations and forest nurseries in the northern areas of the Lake States. The fungus can be transported on nursery stock to field locations where symptoms and new pockets of infection develop. Two strains of the fungus are known in North America. The North American strain, present in scattered locations in the northern Lake States and Northeastern States, attacks young trees but does little damage to trees taller than 2 m (7 feet). The second strain, called the European strain, has been found in several New England States

where it has killed many trees of all ages in red pine plantations.

Management Guidelines:

- Choose red pine planting sites where Scleroderris canker is not present.
- If the planting site is in a Scleroderris canker hazard area, select a species for planting that is immune or has a low susceptibility. Hard pines are highly susceptible, but spruces, cedars, firs, and larches are more resistant to infection.
- Avoid geographic depressions, such as frost pockets, where the disease is most damaging.
- Select planting stock from a nursery outside of the range of Scleroderris canker or from a nursery that has an effective fungicide control program.
- In high-value stands, prune lower branches on infected and healthy trees.

6. **Armillaria shoestring root rot** caused by the fungus, Armillaria mella.

This fungus is common throughout the Lake States on trees under stress and trees growing in cutover hardwood stands. It causes a decay, seldom extending more than a few feet above ground, and it kills roots and kills trees by girdling at the root collar.

7. **Physiological needle droop** of red pine.

Young trees growing in low areas, on droughty soils, with heavy competition, or with J rooting are periodically severely affected in the north-central to northern Lake States area. Damage is greatest on the shoots towards the tops of the seedlings, but lower branches can also be affected. If many buds are damaged, very small seedlings may die. Surviving trees may have some growth loss and stem deformity.

Biology:

Physiological needle droop is caused by an abiotic disease. Trees usually under 2 m (7 feet) tall are affected in July and August on sites that have limited water availability on hot, sunny, and windy days when transpiration is rapid. It only takes a few hours for needle tissue under the sheath to collapse due to lack of sufficient water. The needles droop and die, but they remain green for awhile. They gradually fade to brown over winter and are retained into the next summer. Usually the buds remain alive and will expand, but most of the buds will die on severely damaged shoots. The remaining live buds will develop and the tree will develop a bushy appearance.

Management Guidelines

- Avoid planting red pine on droughty sites.
- Plant carefully to avoid J-rooting.
- Control weed competition.