

# SUSTAINABLE MANAGEMENT OF SCOTS PINE IN THE NORTHERN PERIPHERY



## SILVICULTURAL GUIDANCE NOTE 6 - Diseases and pests of Scots pine

## Introduction

This Guidance Note is one of a series produced as part of the **Northern Periphery Programme** (NPP) “**Developing Scots Pine**” project. These Guidance Notes are aimed at improving the added value potential of the future Scots pine resource by encouraging growers to invest in economically effective and ecologically sustainable forest management, leading to the production of high quality timber. This guidance note aims to give an overview of the main pests, diseases and disorders that may hamper the establishment and maintenance of healthy and vigorous stands of Scots pine. It is important to note that some of these agents may respond to changes in local and regional climate patterns, and may increase in significance both locally and nationally in the future. Red-band needle blight and pine-tree lappet moth in particular are currently causing concern in this respect. It should also be noted that although these pests and diseases are rarely fatal, they may infect and attack simultaneously or sequentially with more serious consequences. The following are discussed:

<b>Fungal Diseases:</b>	Red band needle blight ( <i>Dothistroma septisporum</i> ) Needle cast ( <i>Lophodermium spp</i> ) Pine stem rust ( <i>Peridermium pinī</i> ) Root and butt rot ( <i>Heterobasidion annosum</i> ) Shoot dieback ( <i>Brunchorstia pinea</i> )
<b>Insect Pests:</b>	Pine-tree lappet moth ( <i>Dendrolinus pinī</i> ) Pine shoot moth ( <i>Rhyacionia buoliana</i> ) Pine sawfly ( <i>Neodiprion sertifer</i> ) Common pine-shoot beetle ( <i>Tomicus piniperda</i> )
<b>Abiotic Damage:</b>	Winter desiccation

**Please note:** The large pine weevil (*Hylobius abietis*) is considered to be more of a silvicultural problem and is described, along with Forest Research’s Management Support System in Guidance Note 3 – *Establishing Scots Pine Forests by Planting*.

## Fungal Diseases

### Red Band Needle Blight

**Red band needle blight (RBNB, *Dothistroma septosporum*) is believed to be the most significant current threat to plantation conifers in Britain. Infection leads to defoliation and decreased yield (roughly in proportion to the amount of crown lost). Severe infection can lead to premature mortality. There is currently no recommended treatment for infection in the UK. Planning for the planting of Scots pine must take account of the issues currently affecting nursery production and the supply of planting stock. The risks associated with the choice of planting stock must be assessed based on awareness of the presence and extent of RBNB in the locality.**



*Figure 1: Close-up of damage to foliage caused by RBNB (Note: Corsican pine used for illustration)*

RBNB is characterised by yellow and tan spots and bands on the needle which then turn red, followed by more general browning (from the tip down, Figure 1), usually starting in the lower crown and on older foliage. Infection is most apparent in June and July, prior to needle loss, after which only the current year's foliage will remain - giving a 'lion tail' appearance to a shoot (Figure 2).

In Britain RBNB is caused by the fungus *Dothistroma septosporum*, which is dispersed via atmospheric humidity (such as mists and moist winds) and movement of infected plant material. Although it has occurred sporadically since the 1950s, there has been a recent rapid increase in its prevalence. The disease has now been confirmed across much of the Highlands, and is also present in Fife, Dumfries and Galloway. The warmer spring months and increased spring and summer rainfall of recent years are likely to have optimised conditions for spore dispersal.



*Figure 2: Foliage damage caused by RBNB (Note: Corsican pine used for illustration)*

The fungus is also known to have two mating types and to reproduce sexually, so it is possible that its spread (between species and locations) may be associated with an increase in genetic diversity and adaptability.

RBNB is found on a range of conifers, but pines are the most common hosts with Corsican pine more affected than other species. Lodgepole pine has been affected, but to a much lesser extent. As planting of Corsican pine has been suspended by the Forestry Commission (FC) and is being discouraged through the grant system, the natural alternative species for many sites would be Scots pine. Scots pine was previously thought to have low susceptibility (perhaps as in Britain it is growing within its natural range). Although infection had been reported (mainly in areas adjacent to other heavily-infected other species) it had rarely caused any significant damage. However there is now evidence that Scots pine is more susceptible than initially thought and infection rates have recently been increasing.

Where an infection has been identified in a nursery (or garden centre), the movement of any young pines (*i.e.* those intended for resale or planting) is now controlled. Until spring 2011, the following interim measures are in place to prevent further spread of the infection within Scotland:

- *Any pines in specific nursery beds with confirmed infection must be destroyed (on-site).*
- *Any pine stock within 550m of a known infected bed may be transferred, under licence, for planting within Scotland (only).*
- *Only stock beyond 550m of a known infected bed may be traded as normal.*

In spring 2011 the current status of the disease will be re-evaluated by Forest Research, particularly with regard to diversification of the genotypes and geographical spread. The interim controls will then be reviewed and up to date information will be available through the **Forestry Commission website**. Note that the import of live pine from any non-European country is now prohibited.

For Corsican pine, thinning regimes are now recommended that favour reduced humidity beneath the canopy. In Scots pine, higher planting densities and a greater degree of selection at thinning are required to produce high quality timber, so the yield models specific to Scots pine should still be maintained. For further information, see the FC Research Note **Red Band Needle Blight of Conifers in Britain** (Brown & Webber, 2008) and the FC Red **Band Needle Blight Website**.

### **Lophodermium needle cast**

**An air-borne fungal infection, *Lophodermium* is the most common and potentially serious needle disease of Scots pine. It leads to discolouration, and loss of foliage, with associated reduction in shoot growth and shoot mortality in severe cases. Infection may be caused by either *Lophodermium seditiosum* or by *Lophodermium sulcigena*.**

(Note: *Lophodermium*, pine-shoot beetle, and *Brunchorstia* can affect a tree simultaneously.)

### ***Lophodermium seditiosum***

Symptoms vary in seasonal appearance – in some years the disease may be evident as a mottled yellowing to the current season's foliage during the autumn months, but in others infection is not noticeable until late winter or spring when reddish or purple-brown blotches will appear. Discolouration may affect all or parts of a needle (Figure 5) and be more on one side than the other. In partially affected needles the tips remain green, which may prove a useful indicator when diagnosing. Shoots may be fully



Figure 3: Young Scots pine needles infected by *Lophodermium*

or partially affected (Figure 3), leading to widespread browning (Figure 4) then defoliation in late winter or spring. Lower crown areas are often worst affected. Some younger crops may become completely defoliated. The windward side of trees may be worse affected on exposed sites, so infection may be mistaken for wind-blast.



Figure 4: Browning caused in mature Scots pine by *Lophodermium*

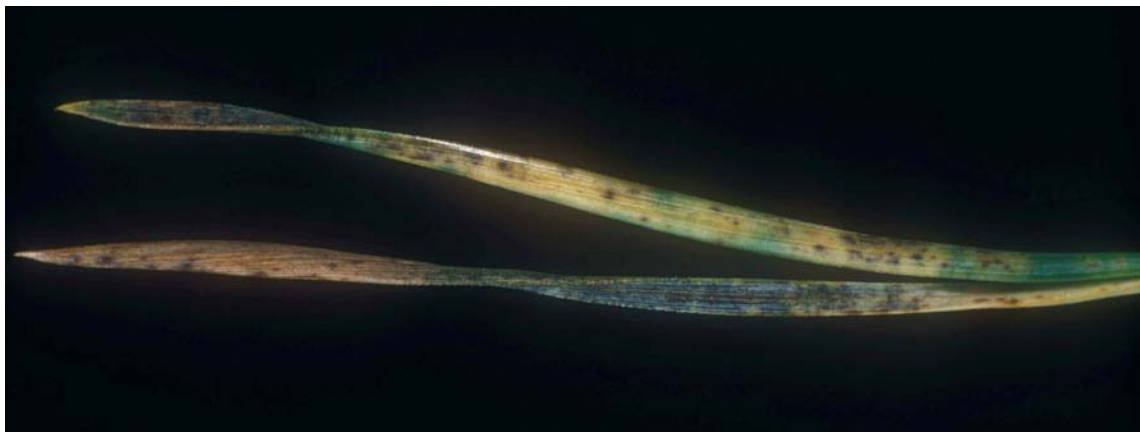


Figure 5: Close-up of pine needle (heavily) infected by *Lophodermium*

### ***Lophodermium sulcigena***

More usually associated with Corsican pine, *L. sulcigena* may also affect (younger) Scots pine with symptoms similar to *L. seditiosum*. In contrast to *L. seditiosum*, typically only a few individuals or small groups will show signs of infection. Infection is apparent during late summer or autumn as purple or pinkish-brown discolouration of the current year's foliage, particularly following a wet summer. During early infection, any strongly discoloured needles will stay green at the tip or the base (or both). Later they will become entirely grey-brown, but usually keep a mottled appearance. Sometimes only one needle of a pair will be affected. Badly infected trees may have quite a striking purple appearance.

Control of *Lophodermium* is limited to prevention of any further spore production. Note that the fungus may fruit abundantly on recently dead or recently felled trees and branches, thus leading to larger local outbreaks. Minimising the amount of this material on site may reduce any further spread of the disease.

### Pine stem rust

Pine stem rust is caused by the fungus *Peridermium pini*, most commonly associated with Scots pine in the north-east of Scotland.



Figure 6: Close-up of bark lesions and resin bleed on infected pine



Figure 7: Heavy resin-bleed from canker-affected area on main stem



Figure 8: Crown die-back due to girdling of main stem by cankers

*Peridermium* infects young shoots causing bark lesions (Figure 6) and small swollen cankers which persist and can lead to distorted and girdled branches (Figure 7&10). During May or June, yellow or orange pustules will be produced surrounding a canker or infected area - like erect scales in appearance (Figure 9), on live bark only. After these die and rot they will leave 'crater'-like depressions, visible as roughened bark where infection is extensive.



Figure 9: Pustules on infected bark



Figure 10: Cross-section of partially affected stem

Infection typically spreads along shoots and branches from tips downwards. When this reaches the main stem it may girdle and kill the tree above that point, first visible as a thinning crown (Figure 8). Girdling may be visible as a rope-like swelling around the main stem. There is no recommended treatment for *Peridermium*, although in affected stands efforts are generally made to remove infected trees during thinning.

### ***Heterobasidion annosum***

***Heterobasidion annosum* (formerly *Fomes annosus*) is a pathogenic fungus that can kill roots and decay heartwood in most conifers, but which is most commonly associated with pine plantations (where it can lead to significant economic losses).**

Infection is usually via airborne spores which germinate on freshly-cut stumps. The fungus then grows downward and will spread to and between other live trees via root contacts. Subsequent thinning and clear-felling may increase its prevalence within a plantation as more fresh stumps are created. Early infection will cause staining and degrade in the timber, but as this advances the wood will begin to decay (Figure 12), and this may extend for many metres up the stem. Severe infection can lead to mortality at any age. Infection may be visible externally in live trees through the appearance of fruiting bodies around the base of the tree (Figure 11).



*Figure 11: Fruiting bodies of Heterobasidion annosum visible at the base of a young Scots pine tree*



*Figure 12: Decay caused by Fomes butt rot in Scots pine*

The vulnerability of a stand to *Heterobasidion* is largely affected by soil type and climate, and also by its management history. Warmer, well-drained sites are higher risk: peaty, colder sites in high rainfall areas are lower risk. There will be a greater risk of infection on sites with a history of growing pine or other vulnerable conifers, and those where thinning or clear-felling in the past has been undertaken without any stump treatment (or stump treatment done poorly or late). Sites with mineral soils and those above pH6 are most at risk.

Once established in a stand, control of *Heterobasidion* is difficult or impossible. It is possible however to exclude it from healthy sites by chemical or biological control methods. Control is expensive and needs to be determined on a risk basis, but it is likely to be required on all pine sites except those on peaty, cold and very wet conditions. Stump-treatment has traditionally been done by dosing freshly-cut pine stumps with 37% urea in solution (stained blue to indicate treatment). For pines only, PG Suspension, a biological agent (non-chemical) is also available to control *Heterobasidion*. Freshly-cut stumps are treated in a

similar manner to urea application. The active ingredient is a wood-rotting fungus (*Phlebiopsis gigantea*), but one which only attacks dead material. This prevents infection by Heterobasidion by out-competing it for resources in the stump. PG Suspension is manufactured and supplied by Forest Research. When planting on a site with known infection where the removal of infected stumps or trees is not possible, care should be taken to avoid root contact between newly planted trees and infected stumps or trees. For more information on control techniques, see Forest Research's **Control of Root & Butt Rot** internet pages and **PG Suspension Information Note**.

### Shoot dieback

**Shoot damage due to *Brunchorstia pinea*, a disease caused by the *Gremmeniella abietina* fungus (a.k.a. Scleroderris canker) may cause severe and extensive die-back and mortality in Scots pine plantations, and is considered to be a serious disease. Infection may remain at low levels and then increase rapidly under favourable climatic conditions.**

The fungus attacks shoots produced in the previous growing season. This leads to browning and then loss of the corresponding foliage, forming a gap between the current season's and that from two years previous. Infection usually starts in the lower crown area, typically in 15 to 35-year old crops and on poorer / upland sites.

For diagnosis, needle discolouration and loss is always associated with necrotic bark supporting it and discolouration always spreads from the base to the tip of the needle (though this is only visible early in the growing season).

It is worth noting that provenance is thought to influence susceptibility to damage, and that native pinewoods are unaffected. When planting in an area where the disease is known to be present this factor should be considered with regard to choice of planting stock in discussion with the supplier.

## Insect pests

### Pine-Tree Lappet Moth

**The pine-tree lappet is now believed to be a significant economic and ecological threat to forestry and woodlands in the north-east of Scotland and further afield if allowed to spread. Feeding larvae of the species cause defoliation. Climate changes may favour an increase in its rate of spread. There are no currently approved methods of control.**

Pine-tree lappet (*Dendrolimus pini*) is a large moth with a wingspan of 60-80 mm (Figure 13). Males are greyish or reddish-brown with a jagged-edged band across the wing and a small white spot in the middle. Scots pine is the preferred host, but other commercial conifers can be affected. The moth is native to eastern Europe, Russia and



Figure 13: Adult male pine-tree lappet moth

Asia and has, until recently, only been an occasional visitor to southern England.

It was previously thought to be entirely absent in Scotland, but male moths began to appear near Inverness in increasing numbers between 2004 and 2009.

The caterpillar (Figure 14) feeds on needles causing damage (Figure 15) and eventually defoliation. Continental populations can increase rapidly following hot summers and dry winters, leading to severe attacks over very large areas of woodland and lasting for up to seven or eight years. This can leave trees more susceptible to other fungal infections, bark beetles and wood-boring insects and can lead to decline and mortality.



*Figure 14: Pine-tree lappet larvae feeding on Scots pine needles*



*Figure 15: Close-up of needle damage caused by feeding pine-tree lappet larvae*

Through trapping and monitoring, Forest Research (FR) has now confirmed that a breeding population has been present (*i.e.* both sexes, plus caterpillars present) since at least 2008. Genetic diversity is limited, indicating that the species is introduced rather than being a native that has always existed at very low levels.

FR is actively surveying and monitoring to determine the full extent and spread of the species, and the Forestry Commission (FC) has set up an Outbreak Management Team and published a **Pest Risk Assessment** and a **Contingency Plan for Outbreaks**. Woodland owners in the 'at risk' areas around Inverness are now subject to a Statutory Notice under the Plant Health (Forestry) Order, which requires

the de-barking and inspection of any conifer timber felled between March and November and compulsory notification of its destination to FC Scotland prior to its movement.

For further information, please see the FC's **Pest Alert Note, Frequently Asked Questions** and the current **Pine Tree Lappet** internet pages. If you believe you have sighted or captured this moth then you should report this to the FC on 0131 314 6156 with a description and a grid reference and photograph if possible.

### **Pine Shoot Moth**

**Pine shoot moth larvae can cause significant damage to leading shoots in young plantations, leading to stem deformities.**

The pine shoot moth (*Rhyacionia buoliana*) is silver-coloured with orange or reddish-brown markings with a wingspan of 16-24mm (Figure 16). Larvae are dark reddish or purple-brown. Though widespread in England and Wales it is currently limited in Scotland to the western border areas and Dumfriesshire.



Figure 16: *Adult pine shoot moth*



The larvae will burrow or *mine* into the base of Scots pine needles, feeding and over-wintering in the lateral buds and shoots and destroying their interior and resulting in the deformation or mortality of leading shoots. Terminal and/or lateral buds will also fail to flush on infected shoots.

Where a leading shoot survives it will usually be bent (Figure 17), and multiple leaders will form where they do not – either way resulting in significant stem deformities. Young plantations are the most vulnerable to this type of damage, and are more commonly affected.

Figure 17: *Shoot damage caused by larvae of the pine shoot moth*

Infestation is visible in spring and autumn, as spun silk 'tents' and resin appears between buds and at the bases of affected shoots (Figure 18). The larvae may be visible in these areas.

Adults usually fly during June, July and August (but are mostly nocturnal). There are no currently approved or recommended chemical control methods.

### **Pine Sawfly**

**Larvae of the pine sawfly can cause significant damage to foliage and cause shoot die-back, leading to reductions in tree growth rates.**

Pine sawfly (*Neodiprion sertifer*) larvae resemble caterpillars, are 18-24mm long when fully-grown, have distinct black heads with greyish-green bodies, and have lighter stripes down their backs and sides (Figure 19). Larvae emerge in April and May, initially feeding only on needle



*Figure 19: Pine sawfly larvae feeding*

surfaces causing them to turn brown, wilt, and eventually take on a 'straw'-like appearance. Older larvae feed gregariously, sometimes several individuals on the same needle. Feeding proceeds from the tip to the base of a needle, and is limited to old (*i.e.* not current season) foliage, resulting in a 'lion's tail' appearance (Figure 20). Feeding groups tend to eat all of the older foliage on a single branch before moving on to another, and then to another tree if necessary. Where defoliation has occurred, only the needle sheaths may remain. Otherwise where younger emerging foliage has been attacked there may be tufts of reduced and straw-like needles. The bark on newer shoots may also be eaten. As a result, the shoots may be deformed or die back: trees are rarely killed but heavy infestations may remove all but the current season's needles resulting in reduced height and diameter growth. There are no currently approved or recommended chemical control methods.



*Figure 18: Silk 'tent' spun by larvae of the pine shoot moth*

Feeding groups tend to eat all of the older foliage on a single branch before moving on to another, and then to another tree if necessary. Where defoliation has occurred, only the needle sheaths may remain. Otherwise where younger emerging



*Figure 20: Damage caused by pine sawfly larvae feeding*

### Common Pine Shoot Beetle

The adult pine shoot beetle feeds internally in pine shoots, causing foliar damage and shoot-death which may reduce growth rates and affect timber quality.

The pine shoot beetle (*Tomicus piniperda*, a.k.a. *Myelophilus piniperda* or *Dermestes piniperda*) is common and widespread in Scotland. Adults (Figure 21) are 3-5mm long and are dark brown or blackish in colour. In summer and autumn, it feeds by boring up the core of current-year pine shoots (Figure 22), causing browning later in the year and eventual shoot-death.



Figure 21: Adult Pine-shoot beetle (much expanded)



Figure 22: Pine-shoot beetle feeding (exposed for photo)

Attack is not usually fatal, but may lead to poor form / timber quality and reduced growth rates. Trees showing signs of attack will usually have been weakened by other pests or by climatic factors. Otherwise healthy trees are rarely significantly affected.

Affected shoots will have a visible tunnel through the centre, which may have exuded resin. These shoots eventually break and fall (so it may be possible to diagnose from lying dead material). In badly-affected trees, entry holes (Figure 23) which may also be indicated by exuded resin will be visible from June onward. Emergence holes (approx. 1.5mm diameter) will be visible from June onwards in areas of thicker bark. Breeding galleries may be visible under removed bark. More adults are attracted to a tree by the smell of the exuded resin, rather than by the pheromones of those already present.

There are no approved or recommended chemical control methods, but maintaining a tidy site may control populations (breeding takes place in recently dead bark and cut logs), as may de-barking or minimising time that logs and felled / dead trees stay on site. Adults may attack live main stems for breeding, usually unsuccessfully, but any damage will be more dangerous where trees are already stressed by drought, *Lophodermium* or *Brunchorstia*.



Figure 23: Pine-shoot beetle feeding (exposed for photo)

## Abiotic Damage

### Winter Desiccation (Wind-blast or Scorch)

Individual trees and plantation edges may suffer from the effects of winter (and maritime) winds in exposed locations and sites.

Although more common in lodgepole pine, foliage desiccation will also sometimes affect Scots pine. It is usually visible in winter or early spring as foliage turns a dull green, then olive green, bronze, tan and finally red-brown. Foliage desiccation will often lead to affected shoots not flushing (or flushing but not extending) and then dying back by late summer. It can be distinguished from other causes of damage as typically only exposed areas are affected and, unlike *Brunchorstia* damage there may still be live bark immediately beneath affected foliage. Discolouration spreads from the tip downwards to the base of the needle.

### Summary: Types of damage and the likely associated disease or pest

Symptom	Likely Cause(s)
Needle discolouration, defoliation.	Red band needle blight ( <i>Dothistroma septisporum</i> )
Needle discolouration/damage.	Needle cast ( <i>Lophodermium</i> spp)
Shoot reduction/die-back.	
Stem rust. Shoot/crown die-back.	Pine stem rust ( <i>Peridermium pini</i> )
Fungal fruiting bodies at base of tree, root/butt rot.	Root and butt rot ( <i>Heterobasidion annosum</i> )
Needle loss, shoot die-back.	Shoot dieback ( <i>Brunchorstia pinea</i> )
Needle damage, defoliation.	Pine-tree lappet moth ( <i>Dendrolinus pini</i> )
Shoot deformities, shoot die-back.	Pine shoot moth ( <i>Rhyacionia buoliana</i> )
Needle damage, shoot die-back.	Pine sawfly ( <i>Neodiprion sertifer</i> )
Needle damage, shoot die-back.	Common pine-shoot beetle ( <i>Tomicus piniperda</i> )
Seasonal crown discolouration.	Winter desiccation

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**For further information about the “Developing Scots Pine” project, visit: [www.pineinfo.eu](http://www.pineinfo.eu)**

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