Forestry Commission

Eight-toothed spruce bark beetle (*Ips typographus*) – contingency plan

Contingency plan for Ips typographus

1. Serious or significant pests require strategic-level plans, developed at a national level, describing the overall aim and high-level objectives to be achieved and the response strategy for either eradicating or containing an outbreak.

2. Following identification by the National Plant Health Risk Register, the Plant Health Risk Group (PHRG) has commissioned pest-specific contingency plans for those pests that pose the greatest risk and require stakeholder consultation. The Forestry Commission is also prioritising plans which require updating, including the plan for *Ips typographus*.

3. The purpose of pest-specific contingency plans is to ensure a rapid and effective response to an outbreak of the pest or disease described.

4. Contingency planning starts with the anticipation and assessment of potential threats, includes preparation and response, and finishes with recovery.

Anticipation

5. Researching sources of information and intelligence about the pest, including horizon scanning.

Assessment

6. Identifying concerns and the preparation of plans.

7. Setting outbreak objectives.

Preparation

8. Ensuring staff and stakeholders are familiar with the pest.

Response

9. Implementing the requirements to either contain or eradicate, including work to determine success.

Recovery

10. Identifying when the response strategy has been effective, or when the response is not considered feasible, cost effective or beneficial.

11. The Defra Contingency Plan for Plant Health in England (in draft) gives details of the teams and organisations involved in pest response in England, and their responsibilities and governance. It also describes how these teams and organisations work together in the event of an outbreak of a plant health pest.

The purpose of pest-specific contingency plans is to ensure a rapid and effective response to an outbreak of the pest or disease described. They are designed to help government agencies anticipate, assess, prepare, prevent, respond and recover from pest outbreaks.

Scope

This contingency plan was prepared by the Forestry Commission Plant Health Cross-Border team to be used at both country and national (GB or UK) levels. It should be used in England in conjunction with the Specific Incident Contingency Plan for Plant Health Pest and Disease Outbreaks (currently in draft) developed by Forestry Commission England's Forest Services division, which provides details of the level of response required and by whom, depending on the scenario. Forestry Commission Scotland and the Welsh Government will develop similar documents detailing their management of outbreaks. Where an outbreak becomes of GB-wide concern, the Chief Plant Health Officer will form an outbreak management team to co-ordinate the activities in the different countries.

This contingency plan falls into three main parts:

- official action following a presumptive diagnosis;
- official action following the conformation of an outbreak; and
- pest background information.

This plan will be updated following new information or changes in policy or contact details. (Last updated September 2015).

Objectives of this plan

- To raise awareness of the potential threat posed by *Ips typographus* in the event of a **new** outbreak being identified, and therefore ensure that stakeholders are aware of the signs and symptoms caused by infestation by this pest.
- To provide guidance on the steps to be taken whenever evidence of attack by *Ips typographus* are observed.

- To ensure that infestations of *Ips typographus* are managed promptly with the primary aim of eradicating pioneer populations of the beetle.
- To ensure that all relevant staff of the Forestry Commission, other government agencies and local authorities are conversant with the contents of this contingency plan so that effective and immediate action is implemented.
- To ensure that good communications are put in place so that all stakeholders (including relevant media) are kept fully informed of the scale of infestation, both at regional and, if desirable, national levels.

Anticipation & Assessment

1.1. *Ips typographus* (Linnaeus) (Coleoptera: Curculionidae, Scolytinae), commonly known as Eight-toothed spruce bark beetle, but also as the European spruce bark beetle, large spruce bark beetle and larger eight-toothed spruce bark beetle, is the most serious and destructive pest of spruce species in its Eurasian range.

1.2. Its native range includes Asia and Europe.

1.3. It is common throughout the entire native range of *Picea abies* (Norway spruce) in Europe, and also occurs in plantations in Western Europe, outside the natural range of the host.

1.4. Although mainly a secondary pest attacking weakened or felled trees, its main impacts are through population build-up and mass attack of living trees, which can result in extensive tree mortality. It is a significant quarantine pest risk in areas where spruce is native or planted, e.g. North America, the UK and Ireland, where it has the potential to cause extensive damage if introduced. (FAO 2009)

1.5. It is officially absent from the, although occasional interceptions of the pest have occurred at UK ports and timber-processing yards.

Preparation

2.1. Not all countries recognise *Ips typographus* as a quarantine pest, mainly due to the fact that it is already present in large areas of Europe. It does, however, present a high risk to the islands of Great Britain and Ireland where *P. abies* does not naturally occur and where this and other *Picea* spp., especially *P. sitchensis* (Sitka spruce), have been widely planted. Based on the fact that the UK and Ireland have Protected Zone (PZ) status against this and other species of *Ips,* the requirement for imports of wood to be free from bark reduces the likelihood of spread to these islands. There is annual programme of PZ surveillance for *Ips typographus, I. amitinus and I. duplicatus* and in Great Britain 41 permanent study plots have been set up and surveys have been carried out since 1992. During 2014, the Forestry Commission looked to set up between 40 and

50 new plots from a list of 84 possible sites that had been identified through a risk based approach: i.e. were close to ports, processing sites etc. Additional funding came from Defra to set up and to monitor these plots. In the end, 38 new plots were established across GB. The likelihood of natural spread by flight from the European mainland is also low. This risk was recognised in recent discussions within EPPO, but too few countries were concerned for EPPO to add *Ips typographus* to its A2 list.

Response

Official Action Following a Presumptive Diagnosis

Communication

3.1. In England, a duty officer from FC England or the Animal & Plant Health Agency (APHA) will act as a point of contact for incidents, and it is their job to assign a response officer to incidents when they occur. Similar arrangements are expected to be in place in Scotland and Wales. The response officer investigates and reports back to the Defra contingency core group, which is an 'ad hoc' group put together in response to a notification, and which is usually chaired by the Chief Plant Health Officer. Country teams in Scotland and Wales will fully manage the outbreak in accordance with their own generic contingency plans, but will provide updates to the Defra contingency core group for information purposes and for Defra to report to the European Commission (EC).

3.2. The response officer will gather information including the location, likely origin, host or commodity, level of damage, extent of outbreak, and risk of spread. The composition of the contingency core group will depend upon the pest or disease in question, and will comprise plant health officials and specialists from the risk group. Based on the information fed back to it, the contingency core group in England will decide upon the alert status to be given (black, amber or red) to the outbreak, which will determine the level of response (see Appendix 2 for alert status table). In Scotland and Wales, the core contingency group can advise on alert status and the appropriate response. If required, the Contingency Core Group will request the relevant organisation/s to set up an incident management team to resolve the incident.

Holding consignments and movement / planting restrictions

3.3. Until further investigation no material shall leave the site and local operations will be halted until such time as the suspected case is either confirmed or classified as a false alarm.

Preliminary trace forward / trace backward

3.4. Depending upon the pathway of entry, tracing forwards and backwards to identify suspect material will be conducted to identify other potentially contaminated stock or sites. This will include suppliers, propagators and wholesalers where appropriate.

How to survey to determine whether there is an outbreak

3.5. An outbreak of *Ips typographus* will most likely be detected by specific surveys as part of the UK Protected Zone annual assessments, and by general surveillance using pheromone traps at ports and selected inland points. Detection might also occur during import inspection of host material. Follow-up inspections, either by APHA for non-woodland situations in England and Wales and Scottish Government in Scotland. Forestry Commission staff in England and Scotland will carry out follow up inspections for woodlands in England and Scotland and by Natural Resources Wales staff in for woodlands Wales , should gather information on:

- likely origin of the pest and, if a consignment of wood with bark is suspected to be at the origin of the outbreak, details of any other points of delivery of potential infested material;
- geographic location and ownership of the affected site, including any abiotic factors which might influence the outbreak, e.g. public access, susceptibility to windthrow, etc. Include maps if possible;
- hosts infested at the site (species, standing crop or felled trees, etc.);
- when and how the pest was detected and identified (including photographs of symptoms);
- level of pest incidence and, where appropriate, life stages present;
- extent and impact of damage;
- recent import or movement of host material into and out of the affected site;
- movement of people, products, equipment and vehicles, where appropriate; and

- likely biodiversity impacts of any control, including any duty of care obligations under the NERC (2006) Act.

3.6. Suspect beetles from infested material should be placed in plastic vials and sent immediately to Tree Health at Forest Research for diagnosis. The samples should be accompanied by information about the date of collection, location (address, postcode, GPS co-ordinates) and contact details of the person collecting the samples. The address is: Tree Health Diagnostic Advisory Service, Forest Research, Alice Holt Lodge, Farnham, Surrey, GU10 4LH.

Confirmation of a new outbreak

Official action following the confirmation of an outbreak

Communication

3.7. The incident controller sets up a management structure to facilitate incident management. The outbreak will determine the size and nature of the management structure. Identification of, and liaison with, key stakeholders is an essential part of this process.

Surveillance

3.8. A delimiting survey should be set up as soon as possible after the first finding of *Ips typographus* to determine the geographical limits of the infested area, and to demarcate a regulated area. There are two elements to the delimiting survey:

- an intensive survey of all suitable host trees within at least a 1km radius of the first tree(s) found to be infested; and
- an inspection for obvious signs of damage in any forest blocks containing *Picea* spp. within 100km of the known infested site.

3.9. *Ips typographus* distribution can also be determined using pheromone traps during the flight period of May to October. These should be located in areas, such as windblown trees and freshly harvested trees, which would naturally attract the species. Host species showing signs of infestation, such as discolouration of the needles and small exit holes on the bark accompanied by frass, should be examined closely. Small areas of bark should be removed to look for galleries and immature life stages. It is essential

that any adults are identified to species level, especially because it is not possible to separate *Ips typographus* from the closely related *Ips cembrae* (which is present within GB) in the field.

Demarcated zones

3.10. A statutory regulated area should be established as soon as possible after the discovery of an outbreak of *Ips typographus*, to help minimise the spread of the pest within the infested area, and to prevent human-assisted transport to areas outside the infested area. An initial regulated area of at least 50km around the infested trees will need to be established, within which measures to prevent the movement of all potentially infested host material should be implemented. These measures should include a prohibition on the movement of untreated host material with bark present (including firewood, round and sawn wood, waste wood and wood chips with significant bark present, wood chips, waste wood and arboricultural arisings). Subsequently, the size of the regulated area might need to be increased, depending on the distribution of *Ips typographus.*

Tracing forwards/backwards

3.11. Depending upon the pathway of entry, tracing forwards and backwards to identify suspect material will be conducted to identify other potentially infested stock or sites.

Pest management procedures

3.12. The management programme should focus on monitoring and the phased removal of the worst affected host species, along with areas of windblown and newly dead trees, because these provide prime host material for *Ips typographus*.

3.13. Material which has been confirmed as infested shall be dealt with as follows:

a) infested material (usually wood with significant coverage of bark) will either be re-exported to the exporting country or will be burned or chipped;

b) standing infested trees should be felled and either debarked, chipped (to less than 3cm in any dimension) or burned on site, or moved under control to premises where the material can be processed immediately to remove and destroy the bark)

c) transportation of the material should be in a closed container during the expected flight period of the pest (March to late October, but this would need to be determined for UK conditions) . Outside the flight period, material can be moved in open containers.

d) If burning of large volumes of wood is needed in a woodland situation, advice should be sought from Forest Research on whether monitoring for *Rhizina inflate*, a fungus which can proliferate on post-fire sites, is required. However, because the risk is related only to the cambium layer, debarking and destruction of bark (by burning or chipping) is sufficient to reduce further spread.

Public outreach

3.14. It is crucial to have stakeholder and public support for the management programme and to help with general surveillance. Engaging the public and key stakeholders, such as neighbours and the forestry sector, will require the provision of timely, balanced and accurate information about monitoring and control. Information, subject to available budget and prevailing communications policy, can be made available through direct contact, site signage, leaflets and posters, trade and specialist media, newspapers, radio, TV, the internet and social media. Information should be targeted locally, especially within the infested and regulated areas and, if wider awareness is required, at a national level.

3.15. It is important to provide information on the location and size of the infested and regulated areas, statutory and voluntary responsibilities, rates of spread, management options, pathways and how the pest might have arrived and could be transported. The implications for British forestry and what people can do to help, especially in terms of monitoring, should be communicated. Managing this level of public and stakeholder engagement will require a central administration office capable of handling the expected numbers of enquiries, and able to provide general and specific information.

Review measures in the case of prolonged official action

3.16. If continuing action is required within the delimited area over a prolonged period, a review of the management programme should be undertaken regularly (e.g. annually) to determine the success and cost effectiveness of the measures in the longer term. This review will involve consultation with stakeholders and should include:

- evaluation of the effectiveness of current measures;
- evaluation of the economic impact and cost effectiveness of continuing existing measures;
- consideration of further measures to strengthen containment and eradication actions;
- consideration of statutory obligations and impact on import and export procedures;

- consideration of alternative approaches or the cessation of statutory action; and
- consideration of the impacts on biodiversity from control methods.

3.17. In situations where official action is no longer considered appropriate, stakeholders should be consulted and a timetable and mechanism agreed for the removal of official measures and for the dissemination of pest management information as appropriate.

Criteria for declaring / change of policy

3.18. Policy changes should be considered in the light of:

- changes in the geographic distribution of *Ips typographus;*
- new or updated research information on the pest species range and lifecycle; and
- identification of new pathways.

Evaluation and review of the contingency plan and potential changes of policy

3.19. Regular reviews of the plan must take account of:

- any new legislative measures, or amendments to measures, introduced to reduce the risk of introduction;
- changes in the geographical distribution of *Ips typographus;*
- assessment of whether eradication is still feasible, or whether long-term management and containment measures should be implemented;
- new or updated research information on the host species and the life cycle of *Ips typographus; and*
- Any new pathways identified.

The plan should only be modified if significant new information is presented which affects the approach to the management of an outbreak.

Recovery - Pest freedom after management

4.1. A site can be deemed as free from an outbreak if, after three years of monitoring, there are no indications of beetle presence.

Appendix 1: Factsheet for *Ips typographus*

Identity of organism and quarantine status

Species name: *Ips typographus* (Linnaeus, 1758) (Coleoptera: Scolytidae)

Synonyms: *Ips japonicus* Niisima, 1909; *Bostrichus octodentatus* Paykull, 1800

Common names: Eight-toothed spruce bark beetle, European spruce bark beetle, large spruce bark beetle

UK risk rating: Unmitigated 100/125 Mitigated 40/125

EU status: Widespread

UK status: Absent, UK has protected zone status

Hosts

Ips typographus prefers weakened or freshly dead trees of the following conifer species: *Picea* spp., including *P. abies* (the main host in Europe), *P. orientalis*, *P. yezoensis* (Northern Asia), *P. sitchensis* (plantations in France); *Pinus* spp.; and *Abies* spp. Large concentrations of this pest can overwhelm the defences of healthy host trees.

Life history

Spring flight occurs when the air temperature rises to about 20°C (Annila, 1969; Bakke *et al*., 1977a). Depending on latitude and altitude, this usually occurs from April to June in different parts of its range. After a period of dispersal flight (Botterweg, 1982), the beetles search for suitable breeding material, on which males make initial or 'pioneer' attacks. Volatile substances from the host tree guide the beetles to areas containing breeding materials. Once the males have bored initial, nuptial chambers, they emit an aggregation pheromone to attract female beetles.

The major components of the aggregation pheromone released by the boring male are (S)-cis-verbenol and 2-methyl-3-buten-2-ol. Ipsdienol, which is shared by most *Ips* spp., also occurs, but seems to play a minor role (Bakke *et al*., 1977b; Birgersson *et al*., 1984; Schlyter *et al*., 1987). Once the male has attracted one or more females, it emits chemicals that act to inhibit further attacks. These are verbenol and ipsenol (Bakke, 1981). They are released after the females have entered the gallery, and seem to regulate gallery density and cause the shift to boring in new bark areas or in neighbouring trees. During non-outbreak periods, the beetles breed in wind-felled trees, slash and logs. During outbreaks the beetles kill healthy trees (Schwerdtfeger, 1955; Thalenhorst, 1958; Svihra, 1973). There are two reasons for this

ability. The beetle has an effective aggregation pheromone, and also carries spores of several blue-stain fungi which germinate and affect the phloem and cambium, and play an active role in killing the tree. (Christiansen & Horntvedt, 1983)

Parent beetles might leave successfully attacked host trees after a short period to produce a second, sister brood in other trees. Parents re-emerge sooner when gallery density is high (Anderbrant, 1986). Whereas only one annual generation is produced at high altitude and latitude, the species usually has two generations in the lowlands of central Europe, and even three generations per year at warmer sites. The flight for the second generation usually takes place in July and August. In northern areas, beetles of the new generation emerge from July to October, depending on time of brood establishment, microclimate and weather. In central Europe emergence of the second generation can take place as late as November.

The beetles usually hibernate in the adult stage, mainly in the forest litter, close to the tree where they developed. They can also overwinter under the bark of the host tree. Larvae and pupae have supercooling points of -13 and -17°C respectively, while adults can tolerate winter temperatures close to -30°C (Annila, 1969).

Identification

Figure 1 – Larvae of Ips typographus. Source M. Lurc, University of Ljubljana

Figure 2 – Pupae of Ips typographus. Source M. Lurc, University of Ljubljana.

Figure 3 and 4 – Adult *I. typogrpahus*. Source M. Lurc, University of Ljubljana

Figure 5 – Typical radial larval gallery of *Ips typographus*. Source L. Nagelisein, Département de la Santé des Forêts, Ministère de l'Agriculture, France**Distribution of the organism**

Ips typographus is native to Europe, being found throughout the natural range of *Picea abies*. It is also found throughout Northern Asia. It is absent from the Islands of Great Britain and Ireland, although it has occasionally been intercepted at British ports. In 1995, for example, 149 beetles were captured in pheromone traps deployed in 20 port areas. In 1997 approximately 30 adult *Ips typographus* were captured over 10 days at the Shotton Paper Mill in Clwyd. This mill processed spruce from British forests, so the beetles could have been of British origin. However, it is possible that they came from low-grade spruce used as wood packaging for machinery transported to the surrounding industrial area. Follow-up surveys in forests around the mill, and from forests throughout Britain that supplied the mill in the four-weeks before the trap captures, failed to detect the beetle. However, along with further finds at ports, it confirmed that the beetle frequently enters this country in host material with bark. The impact on the UK's spruce forests could be devastating if this pest were to become established in this country.

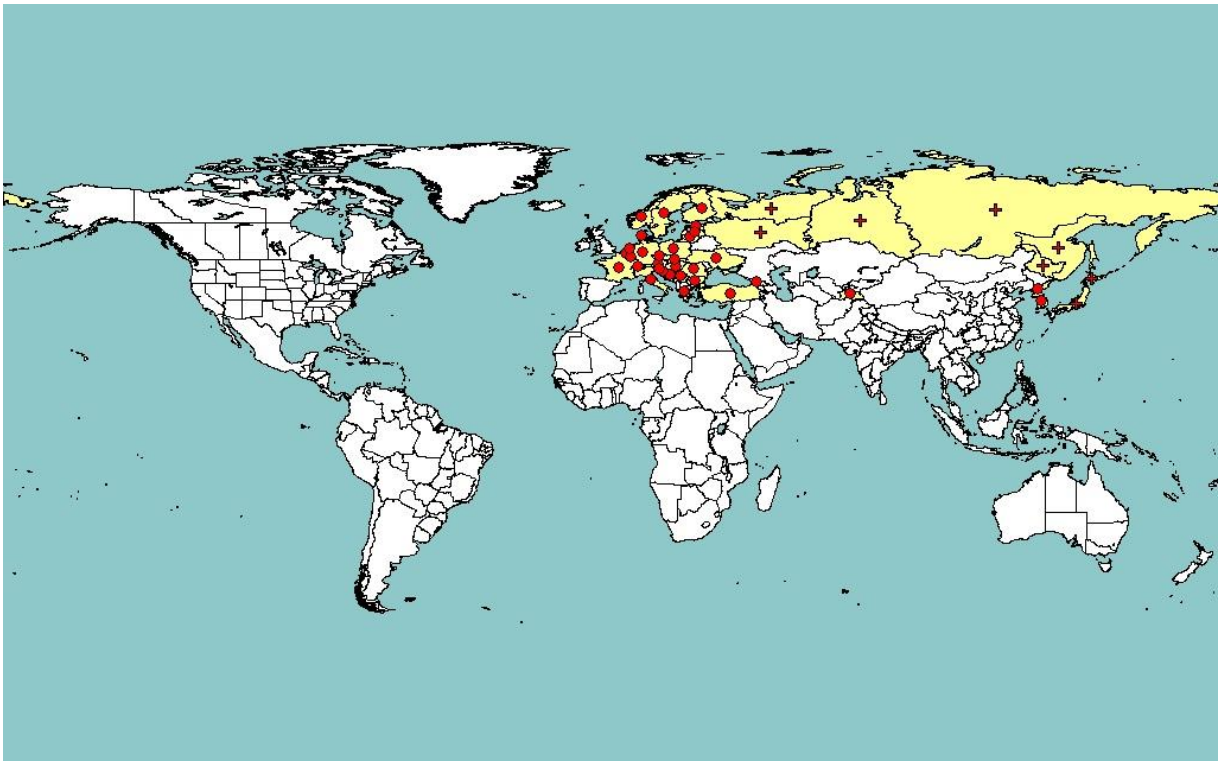

Figure 6 - Distribution map of *Ips typographus*. The circles represent national records) and the crosses represent sub-national records of its presence. (EPPO PQR database)

Damage, impact and controls

Ips typographus is one of the most destructive species of the genus *Ips*, and probably the most serious pest on spruce in Europe. There are records of outbreaks dating from the eighteenth century. The losses that occurred during some of these outbreaks, in millions of

cubic metres of wood, were as follows (Wellenstein, 1954; Schwerdtfeger, 1955; Worrell, 1983; Christiansen & Bakke, 1988):

Germany	1857-1862	4.0
Germany	1868-1875	4.0
Germany	1917-1923	1.5
Germany	1940-1941	1.0
Germany	1944-1948	30.0
Sweden	1976-1979	2.0
Norway	1970-1981	5.0

Outbreaks have also occurred in Italy (Lozzia, 1993), Poland, Czech Republic (Pfeffer & Skuhravy, 1995) and on Hokkaido Island, Japan , (Inouye & Yamaguchi, 1955).

Although *Ips typographus* is the most damaging of all the European *Ips* spp., and the one which is frequently reported to behave as a primary mass-attack pest, it is nevertheless most often a secondary pest, attacking and breeding in trees which are already stressed for other reasons (Schwenke, 1996), or damaged by storms (Forster, 1993).

The needles of attacked conifers turn yellow-green to reddish-brown, and eventually drop within a few weeks.

Figures 7 and 8 – Discolouration of needles following infestation by *Ips typographus*. Source: B. Forster, Swiss Federal Institute for Forest, Snow and Landscape Research, and L. Nagelisein, Département de la Santé des Forêts. Ministère de l'Agriculture, France

Other signs of infestation include red-brown frass in bark crevices, the presence of round exit holes, and small pitch tubes extruding from the bark. (Kimoto and Duthie-Holt, 2006)

Figures 9 and 10 – Bark frass and exit holes. Sources: D. Lupastearn, University of Suceava, and Landesforstpräsidium Sachsen Archive.

Woodpecker damage might also be evident. *Ips typographus* carries blue-stain fungi, which hasten the death of trees, discolour the wood, and can result in loss of timber grade and value. Distinctive larval galleries will be evident upon removal of bark, radiating out at right angles from the central chamber, and becoming wider as the larvae grow.

Main pathways

Adult *Ips typographus* beetles can fly up to 4km in search of suitable host material, and can also be transported by abiotic factors such as wind. Dispersal over longer distances depends on transportation under the bark of logs. It is one of the most commonly detected pests travelling on solid wood packaging. They do not usually attack trees under 15 years old, because such trees do not provide suitable breeding material.

Import controls

Although not considered to be a quarantine pest by EPPO, it poses a serious risk to the UK and Ireland, where *Picea abies* does not naturally occur, but where this and other *Picea* species are widely planted. Although EPPO considers the risk of spread to these islands as low, both the UK and Ireland have Protected Zones enabling them to impose phytosanitary measures, which are mainly based on requiring absence of bark on any imported host woody material. For the UK, these require:

- that plant material other than fruit or seeds of *Picea, Abies, Larix and Pseudotsuga* species from non-EU countries is prohibited entry into the UK unless it is bark-free and has undergone heat treatment or some other appropriate treatment;

- conifer wood shall be bark-free; or

- that it shall be accompanied by an official statement (plant passport) confirming that

- (a) it originates from an area known to be free from *Ips typographus*; or

- (b) in the case of:

    - wood, that it has been kiln dried to below 20% moisture content, and a mark of 'Kiln Dried' or 'KD' has been put on the wood or its packaging; and

-

    - in the case of isolated bark, that it has been subjected to an appropriate treatment against bark beetles.

See the Forestry Commission's plant health pages on Timber and wood import and export for more information.

Appendix 2 – Alert status table.

ALERT	STATUS	COMMAND LEVEL
White	Plant pest or disease with potential for limited geographical spread	Instigation of incident management plan involving operational command at appropriate level, and implementation of Standard Operating Procedures or scientific advice where applicable
Black	Significant plant pest or disease with potential for limited geographical spread	Instigation of incident management plan, usually involving joint tactical and operational command at appropriate level. Implementation of plant pest/disease-specific response plans where applicable
Amber	Serious plant pest or disease with potential for relatively slow, but extensive, spread leading to host death and/or major economic, food security or environmental impacts	Instigation of incident management plan, usually involving joint strategic and tactical command, and plant pest/disease-specific response plans where applicable
Red	Serious or catastrophic plant pest or disease with potential for rapid and extensive geographical spread leading to host death and/or major economic, food security or environmental impacts	Instigation of incident management plan involving strategic, tactical and operational command, and implementation of plant pest/disease-specific response plans where applicable

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