Rapid assessment of the need for a detailed Pest Risk Analysis for *Phytophthora austrocedrae*

Disclaimer: This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist decisions on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.

STAGE 1: INITIATION

1. What is the name of the pest?
Phytophthora austrocedrae Gresl. & E.M. Hansen. First described as a new species by Greslebin and Hansen (2007).

Synonyms:
The pathogen is also named as *Phytophthora austrocedri* Gresl. & E.M. Hansen 2007 in Mycobank (http://www.mycobank.org/MycoTaxo.aspx?Link=T&Rec=530225).

Common names of the pest:
None.

Taxonomic position:
Kingdom - *Chromoalveolata*; Phylum *Heterokontophyta*; Class – *Oomycetes;*
Order – Peronosporales; Family – Pythiaceae; Genus – *Phytophthora*

Special notes on nomenclature or taxonomy:
Phytophthora austrocedrae is a recently described new species and the name '*austrocedrae*' refers to *Austrocedrus*, the genus of conifers first recorded as a host of this pathogen in Argentina.

P. austrocedrae is in clade 8 of the Cooke *et al*. (2000) molecular phylogeny of the *Phytophthora* genus, which includes *P. syringae* and *P. lateralis* (the latter is another pathogen of the Cupressaceae). It is a homothallic species characterized by semi-papillate sporangia, oogonia with amphigynous antheridia, and in culture has a very slow growth (1-2 mmd^{-}1 on V-8 agar at 17.5 ^{o}C which is the optimum temperature for growth).

Phylogenetic analysis of ITS rDNA sequence of *P. austrocedrae* indicates that *P. syringae* is its closest relative, a species known to be widespread in Europe and America.

2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC) and in the lists of EPPO?
P. austrocedrae is not listed in the EC Plant Health Directive.

P. austrocedrae is not on the EPPO Alert List or the EPPO Action List (http://www.eppo.org/QUARANTINE/quarantine.htm), although it was highlighted by the EPPO Reporting Service in 2009 (http://archives.eppo.org/EPPOReporting/2009/Rse-0901.pdf)

3. What is the reason for the rapid assessment?
This rapid assessment was initiated as a result of findings of *P. austrocedrae* in the UK by Forest Research scientists in 2011. Mainly juniper trees (*Juniperus communis*) have been found to be infected by *P. austrocedrae* in the UK, although other species have also been affected (see Section 5 and Table 2 for details of the various host records). The rapid assessment is to determine the status of the pathogen in the UK and whether or not a full PRA is required and to determine future action.

STAGE 2: RISK ASSESSMENT

4. What is the pest's present geographical distribution?
Prior to the recent findings in the UK, it had been established that *P. austrocedrae* is a causal agent of a disease known as ***mal de ciprés*** (MDC) which results in mortality of *Austrocedrus chilensis* (Cordlilleran or Chilian cypress) in forests of western Argentina (Patagonia). Affected forests include those in the southernmost extreme near Corcovado, Chubut, 43^{o} 43'S, to the northern extreme near Villa Pehuenia, Neuque´n, 38^{o} 54'S.

Phytophthora has long been suspected as the causal agent of MDC but this was not confirmed until 2007 (Greslebin *et al.* 2007). Details of the disease are described under 6.

In addition to isolations made from symptomatic root and bark tissue of *A. chilensis*, *P. austrocedrae* has also been recovered from forest soils (Greslebin and Hansen, 2010).

The current known distribution of *P. austrocedrae* is shown in Table 1.

Table 1. Distribution of *Phytophthora austrocedrae*

North America	No record
Central America	No record
South America	Patagonia, Argentina
Caribbean	No record
Europe	UK (England, Scotland, Wales)
Africa	No record
Asia	No record
Oceania	No record

5. Is the pest established or transient, or suspected to be established/transient in the UK? (Include information on interceptions and outbreaks)
Currently *P. austrocedrae* has been found at a limited number of locations in England, Scotland and Wales and assessments of potentially affected sites are underway to determine its status. The cool temperature requirements for growth (17.5 ^{o}C optimum temperature) by this pathogen may limit its distribution to cooler parts of the UK, and so far all records have been limited to western Britain.

In March 2011, during surveys of *Chamaecyparis* for *P. lateralis*, dieback and mortality was noticed on three *C. lawsoniana* and two *C. nootkatensis* trees in a public park in East Renfrewshire, Scotland. *P. austrocedrae* was confirmed as the cause of a basal stem/root lesion causing dieback on a single mature specimen of *C. nootkatensis*

http://archives.eppo.org/EPPOReporting/2011/Rse-1106.pdf In the same region but at a separate site, *P. austrocedrae* was isolated from an aerial bark lesion (i.e. a lesion not connected to a root infection) on the stem of a recently planted sapling of *C. lawsoniana*.

In July and November 2011, more than 100 juniper trees (*Juniperus communis*) showing symptoms of crown decline consistent with lower stem and root necrosis were observed on a heathland site at Upper Teesdale, northern England. When examined in detail by FR scientists, infection by *P. austrocedrae* was confirmed on six trees from different locations on the site through both isolation and molecular diagnosis; samples comprised root and stem phloem lesions. Molecular diagnosis was based on Phytophthora specific ITS rDNA and CoxII sequences amplified from symptomatic tissue; these sequences matched 99% with those of two *P. austrocedrae* isolates from Patagonia deposited in Genbank (Accession numbers DQ995184, DQ995184) thereby confirming identity (Green unpublished data).

Subsequent enquiry revealed that *P. austrocedrae* had previously been diagnosed associated with symptomatic juniper plants by the Royal Horticultural Society Advisory Service (Wisley); once from a garden in mid Glamorgan (Denton *et al*., 2009) and twice during nursery surveys (B. Henricot, personal communication). Diagnosis was based solely on the amplification of Phytophthora specific ITS rDNA sequences from symptomatic tissue and matching these sequences with those of *P. austrocedrae* deposited in Genbank. Detailed records of the affected nursery plants (eg plant size, tissues affected, symptoms, dates of findings and location of affected plants) are not currently available but it is thought that the garden finding was in 2009 and the nursery findings in 2010.

Following on from those 2011 confirmed findings, further juniper sites with similar disease symptoms to those observed at Upper Teesdale have since been examined and *P.austrocedrae* again confirmed present on symptomatic junipers in 2012. These sites are Glen Artney Juniper Wood (a Special Area of Conservation in Perthshire) and Haweswater (an RSPB owned site in Cumbria), with both sites confirmed by Forest Research, the latter only through molecular diagnosis. At all of these sites dieback and mortality of junipers was frequent with root and lower stem necrosis evident. Detailed study at Glen Artney suggests that infections are initiated in the roots and extend into the bases of stems. Analysis of roots taken from some of the juniper with dieback have revealed episodes of bark killing on roots that can be dated to 2002, 1999 and even back to the late 1980s (Broome *et al*., 2008). At the Haweswater site it also appears that a growing number of affected junipers has been apparent since 2006 (Keith Jones, personal communication). In addition, Fera has confirmed the presence of *P. austrocedrae* at number of other juniper sites in northern England including the Haweswater site and two nurseries. Details of the Fera findings are shown in Table 2 below.

Table 2. Fera findings of *P. austrocedrae* on Juniper in the UK in 2012

Date of finding	**March 2012**	**April 2012**	**April 2012**	**April 2012**	**April 2012**	**May 2012**
Location	Devon	Cumbria	Cumbria	Cumbria	Cumbria	Cumbria
Area affected	Single plant	14.5 ha site	40 ha site	70 ha site	>70 plants	13 plants
Situation	Private garden	Natural environment	Natural environment	Natural environment	Nursery	Nursery

6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?
Natural hosts are listed in Table 3 but Koch's' Postulates have only been completed for *Austrocedrus chilensis* and *Juniperus communis* (Greslebin and Hansen, 2010; Green *et al.*, 2012). All the natural hosts known come from family Cupressaceae, and are described in Table 3.

Table 3. Natural hosts of *Phytophthora austrocedrae*

Host		**Family**	**Symptom/ location of detection**	**Location**	**Date sampled**	**Reference**
Scientific name	Common name					
Austrocedrus chilensis	Chilean cedar	Cupressaceae	Root, basal lesions, decline	Western Argentina	2007	Greslebin *et al*., 2007
Callitropsis (syn *Chamaecyparis*) *nootkatensis*	Nootka cypress	Cupressaceae	Basal stem/root lesion	West Scotland	2011	S. Green, FR record
Chamaecyparis lawsoniana	Lawson's cypress	Cupressaceae	Aerial phloem lesion	West Scotland	2011	S. Green, FR record
Juniperus communis	Common juniper	Cupressaceae	Basal stem/root lesion	Northern England	2011	S. Green, FR record
Juniperus sp	Juniper	Cupressaceae	Unknown	Wales	*c.* 2009	Denton *et al*., 2010
Juniperus sp	Juniper	Cupressaceae	Unknown	Nursery, Unknown	2010	B. Henricot, pers comm

Austrocedrus chilensis (Cordilleran or Chilean cypress) is an endemic tree in the Cupressaceae found in southern Argentina and Chile. It forms pure and mixed stands with *Nothofagus* spp. and as a conifer of southern Argentina has a distribution covering approximately 160,000 hectares. Within this area *P. austrocedrae* has been found to cause the disease known as *mal de ciprés* (MDC) which starts in the root system of affected trees. Symptoms include lesions with resinous exudate on the basal stem, as well as necrotic lesions on root collar and roots of *Austrocedrus chilensis.* High levels of mortality are associated with MDC; some trees die very rapidly, in others progressive defoliation leads to death after several years (Greslebin and Hansen, 2010).

In the UK economically and/or environmentally important hosts with natural susceptibility to *P. austrocedrae* are present and comprise:

- *C. lawsoniana* (Lawson's cypress) which although not an important forestry species in the UK is planted in amenity situations and is a valued ornamental species. In combination with Leyland cypress (*Cupressocyparis leylandii*) both are considered important conifers in the UK ornamental nursery plant trade and account for a '*significant portion*' of the £29 million garden centre sales (including imports) of conifers each year (Woodhall and Sansford, 2006).

- *C. nootkatensis* is occasionally planted as an ornamental tree in the UK, but hybrids of this species and the Monterey cypress (*Cupressus macrocarpa* (syn *Callitropsis macrocarpa*) Leyland cypress (*Cupressocyparis leylandii*), is a fast-growing species which is much planted for hedges and screens and again an important conifer in the UK ornamental nursery plant trade.

- *Juniperus communis* (common juniper) is a component of semi-natural upland woodlands as well as upland and lowland heathlands, forming an important component of a range of semi-natural vegetation types (Broome, 2003). There are two subspecies: dwarf juniper (*J. communis* subsp. *nana*) and tree juniper (*J. communis* subsp. *communis*). It is one of Britain's three native conifer species and is a long-lived shrub/tree which provides structural permanence on sites where it is established. It is also an important food plant for many invertebrates and birds.

The distribution of common juniper in the British Isles is shown below; it occurs on a variety of soil types, both acid and alkaline, including brown earths, gleyed soils, iron pans and some peaty soils. It is a priority species in the UK Biodiversity Action Plan (Anon., 2007) due to a decline in distribution and general lack of population viability and regeneration.

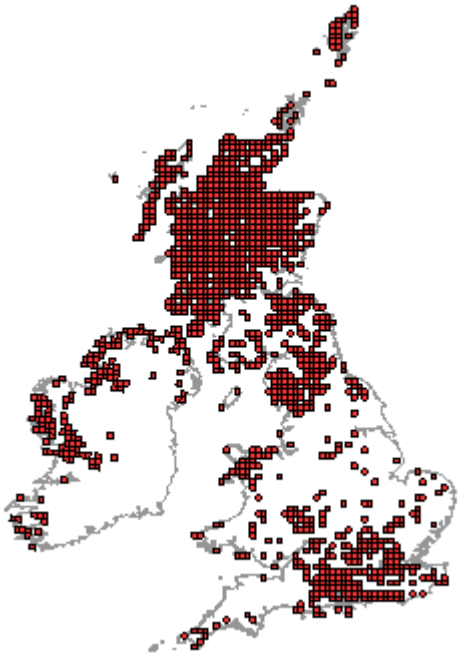

Figure 1: Red squares indicates presence of *Juniperus communis* in 10km squares over the British Isles (Figure taken from the National Biodiversity Network - http://data.nbn.org.uk/gridMap/gridMap.jsp#topOfMap)

7. If the pest needs a vector, is it present in the UK?
P. austrocedrae does not require a vector for dispersal.

8. What are the pathways on which the pest is likely to move and how likely is the pest to enter the UK?
A major pathway on which *P. austrocedrae* is likely to move (by analogy with other *Phytophthora* spp.) is on 'plants for planting' of known natural hosts (i.e. *Austrocedrus chilensis*) from countries where *P. austrocedrae* is known to occur. To date it has not been reported from countries other than Argentina, although there is some evidence to suggest that the pathogen is not native to Argentina based on the near clonal nature of the *P. austrocedrae* from this region (E.M. Hansen, personal communication) suggesting an unknown centre of origin.

In addition to *A. chilensis*, host plants such as those within the family Cupressaceae may represent pathways for entry, but as no susceptibility tests have been undertaken to

determine the potential host range of *P. austrocedrae* beyond testing *A. chilensis* and *J. communis*, such pathways cannot be evaluated further at present.

There are no specific phytosanitary requirements for *P. austrocedrae* in the EC Plant Health Directive (Anon., 2000) that would directly influence further entry of the pathogen into the UK or movement within the UK. Moreover, plants in the genera *Chamaecyparis* and *Juniperus* are prohibited entry into the EU from third countries (Annex IIIA, EC Plant Health Directive: Anon., 2000) unless a derogation is in place to allow import as, for example, occurs with *Chamaecyparis* and *Juniperus* bonsai plants genera from Korea.

Any imports of *A. chiliense* could therefore pose a threat as well as any currently unknown hosts that are not subject to import controls. *Phytophthora austrocedrae* also has the potential to be moved in soil from infected sites to other at risk areas, based on evidence from Greslebin and Hansen (2010) who detected *P. austrocedrae* in the soil of forests where infected trees were located. However, the entry of soil from third countries is also prohibited entry into the EU (Annex IIIA, EC Plant Health Directive: Anon., 2000)

As the pest has already entered the UK, further entry is likely.

	Very unlikely		Unlikely		Moderately likely		Likely		Very likely	
Host plants for planting:								X		

9. How likely is the pest to establish outdoors or under protection in the UK?
Based upon the records of findings of *P. austrocedrae* listed under 5, the pest is already established outdoors in some parts of the UK (notably north west England and western Scotland). Uncertainty remains about the extent to which the pathogen is established in Wales and south west England although there have been findings (see Table 2 and 3). Establishment under protection is less likely because *P. austrocedrae* is not known to affect protected crops, although it has been found to infect nursery plants: Greslebin and Hansen (2010) showed that saplings and seedlings could be readily infected and killed by *P. austrocedrae*, and findings have been made in nursery plants.

The pathogen's growth range of 10 to 20ºC (Greslebin *et al*., 2007) indicates that the organism could survive in a UK climate. As vegetative growth of the pathogen is inhibited above 25ºC (and possibly between 20-25ºC), higher summer temperatures in the UK could limit the ability of *P. austrocedrae* to complete its life cycle although the production of oospores by this homothallic species could potentially allow persistence and survival under non-optimal conditions. Suitable humidity and/or moisture conditions for sporulation and zoospore production are also likely to occur in the UK, as closely related *Phytophthora* species including *P. syringae* sporulate readily under UK conditions or under conditions similar to those present in parts of the UK.

In Argentina it is reported that MDC is associated with certain site conditions, notably high soil moisture and poor drainage (Baccalá *et al*., 1998; Filip and Rosso, 1999; La Manna and Rajchenberg, 2004). Such conditions may also predispose certain sites in the UK, making any susceptible plant species that are present more vulnerable to colonisation by *P. austrocedrae.* In this context, the Glen Artney site has also suffered increased site wetness over the past two decades, both through increased rainfall and neglected drainage systems, both of which could encourage attack by Phytophthoras (Broome *et al.,* 2008) although it does not preclude other factors from playing a causal role. Overall the potential for further establishment in the natural environment is considered likely.

	Very unlikely	Unlikely	Moderately likely	Likely	Very likely
Outdoors:				X	
Under protection:		X			

10. How quickly could the pest spread in the UK?

It is not known when *P. austrocedrae* entered the UK; but the first fully documented record including isolation of the pathogen was in 2011 with some earlier findings (*ca*. 2009) based on molecular identification only. As it has now been found in ten separate locations in the natural environment in Britain this suggests that it has already been distributed to several geographically discrete locations. Natural spread is likely to be slow (via movement in water and soil, and possibly via animal and/or human activity). The potential for aerial sporulation and dispersal is unknown, but *P. austrocedrae* has been isolated from an aerial stem lesion on *C. lawsoniana* in Scotland, raising the possibility of aerial dispersal although *P. austrocedrae* has not been reported to cause aerial infections on *A. chilensis* in Patagonia.

Distribution via planting stock is currently unknown, but *P. austrocedrae* has been detected in nursery plants (B. Henricot, personal communication; Fera records, 2012) and if this is widespread the pathogen could be spread quickly through the movement of infected planting material. Some of the records (a recently planted *C. lawsoniana* and findings on *Juniperus* sp. in nurseries; see Tables 2 and 3) indicate that planting material has been found to be infected and potentially could be a pathway.

If established in nurseries, there is significant potential for the pathogen to spread into the wider environment possibly via plant trade possibly causing tree death amongst plantings of Lawson's cypress (*C. lawsoniana*) or other species within the Cupressaceae including juniper.

Many sites with juniper are also highly significant in terms of their environmental and biodiversity value (Broome, 2003; McBride, 2007). Interest in the expansion and re-introduction of juniper because of its decline over the past 25 years on many sites has resulted in programmes of enrichment via planting (Broome, 2003; Broome *et al*., 2008; Graham, 2007; McBride, 2005). This also raises the potential for spread to various different types of sites where juniper is a component, with infested plants acting as a pathway for movement of *P. austrocedrae.*

	Very slowly	Slowly	Moderately	Quickly	Very quickly
Natural spread:		X			
In trade:				X	

11. What is the area endangered by the pest?

Climatically-favourable areas where the known hosts occur include woodlands, gardens, parklands and heathlands. Geographically the west of the UK is likely to be more favourable than the east because of milder, wetter conditions, but not necessarily exclusively so; distribution will also depend upon the presence of natural hosts and suitable soil conditions. Areas of juniper (*J. communis*) in natural habitats such as semi-natural upland woodlands as well as upland and lowland heathlands with non-alkaline soils could be particularly at risk. The distribution of juniper is shown in Figure 1. Widespread dieback of junipers on some of the sites (eg Upper Teesdale and Glen Artney), suggests that the pathogen can be associated with intense damage on a local scale (15-70 ha) in favourable areas. Sites with high soil moisture and poor drainage are likely to be at increased risk based on observations

made in Argentina (Baccalá *et al*., 1998; Filip and Rosso, 1999; La Manna and Rajchenberg, 2004).

Presence of waterways is likely to favour pathogen spread. Human/large mammal activity may also assist in the introduction and spread, by affecting soil structure and possibly making roots more susceptible to infection through compaction and/or damage, as well as by movement of soil contaminated with pathogen spores.

12. What is the pest's economic, environmental or social impact within its existing distribution?

Currently, the economic, environmental and social impact of *P. austrocedrae* in Argentina is limited as its existing distribution is relatively narrow and the environmental impact is largely unquantified.

In Patagonia (western Argentina) mortality associated with MDC (mal de ciprés) has been noted throughout the natural range of *A. chilensis*, with symptomatic trees recorded in the majority of sites that have been evaluated (43 out of 47 sites scattered across 140,000 ha of forest: southern extreme 43^{o} 43'S, to the northern extreme 38^{o} 54'S). *Austrocedrus chilensis* is valued for its ecological function, the quality of wood and its scenic importance (Greslebin and Hansen, 2010) although these value of these various functions and losses due to MDC have not been quantified.

	Very small		Small		Medium		Large		Unquantified	
Economic:				X						
Environmental:										X
Social:										X

13. What is the pest's potential to cause economic, environmental or social impacts in the UK?

Although the impact of the pest in the UK is currently limited, environmental and social impacts could be significant and even large if *P. austrocedrae* becomes widespread and damaging on juniper sites. Common juniper is already recognised as important and generally vulnerable (Anon., 2007). Over the past 25 years its extent and condition has declined considerably, especially on upland sites (McBride, 2005), where its importance is tied in with nature conservation and game management. Juniper is also a key food plant for a wide range of invertebrates and birds and has a unique and specialised group of associated insects, fungi and lichens. Its decline has already been attributed to overgrazing, burning, afforestation and other land use changes. A further contributing factor in this decline such as the root pathogen *P. austrocedrae* could be highly significant to the survival of this species in Britain.

	Very small		Small		Medium		Large		Very large	
Economic:				X						
Environmental:								X		
Social:						X				

14. What is the pest's potential as a vector of plant pathogens?

P. austrocedrae is a plant pathogen with no capacity to act as a vector of other pathogens.

STAGE 3: PEST RISK MANAGEMENT

15. What are the risk management options for the UK? (Consider exclusion, eradication, containment and non-statutory controls; under protection and/or outdoors)

Action for keeping the pest out of the UK (exclusion and/or eradication)
The impact of *P. austrocedrae* on juniper is judged to be relatively recent (over the past decade) so the pest in likely to be a non-native species. Current records suggest that *P. austrocedrae* has already entered the UK and now has a limited distribution in the wider environment. The origins of the pest (introduced or endemic) are unknown. Greslebin and Hansen (2010) comment that although it is widespread in Patagonia the geographical origin of *P. austrocedrae* is uncertain and may not be native to this area. If so, other pathways for entry into the UK may exist but are currently unknown.

As the pest already has a limited distribution in the UK exclusion can only apply to current or new pathways. Although there are no specific phytosanitary requirements for *P. austrocedrae* in the EC Plant Health Directive (Anon., 2000), plants in the genera *Chamaecyparis* and *Juniperus* are prohibited entry into the EU from third countries (Annex IIIA, EC Plant Health Directive: Anon., 2000). The exception to this when a derogation is in place to allow imports of known host genera (*Chamaecyparis* and *Juniperus*) so a further option would be to review the risk that such pathways could pose in relation to *P. austrocedrae.*

Eradication of the pest from some of the infected sites in the natural environment is likely to pose extreme difficulties. Most of the juniper sites are known to be vulnerable (see UK Biodiversity Action Plan; Anon., 2007) and eradication efforts could undermined by the environmental damage that could be caused especially as the *P. austrocedrae* can be present in soil as well as infected plant parts.

Options for control and/or containment
P. austrocedrae is present in the UK although the extent of its distribution is unclear.

Controls under nursery conditions
These could include:

- Inspections and testing in nurseries to prevent any dissemination via nursery plants focussed on known hosts in the genera *Chamaecyparis* and *Juniperus*; possibly also wider inspection and testing of plants within the Cupressaceae. Nursery inspections are now being undertaken by Fera PHSI (England and Wales) and SGHMU (Scotland) and at least two findings have been made in England.
- Intensive inspections in relation to juniper plants under propagation in nurseries destined for planting to repopulate/ enrich declining sites.
- Eradication of any *P. austrocedrae* outbreaks in a nursery setting following methods already in place for other *Phytophthora* pathogens (*P. ramorum*, *P. kernoviae*) where statutory measures are required.

Controls under non-nursery conditions and the natural environment

- Greater use of rejuvenation of juniper through natural regeneration to avoid bringing new plants from nurseries on site.
- Management of at risk and infected sites to prevent water logging and poor drainage. These conditions are thought to increase the likelihood of disease caused by *P. austrocedrae* developing.
- Limited access to already known infected sites or those deemed high risk (because of site conditions or proximity to known sites), to prevent accidental introduction or spread of *P. austrocedrae* by contaminated machinery/footwear.

- Removal of infected trees including the root system may be effective on sites where the disease is limited to a small area, or a single tree. However, on sensitive sites such as Upper Teesdale or Glen Artney where disease appears widespread, the disruption and damage caused by removal of entire trees including root systems could be counterproductive and lead to further spread over the site as well as root damage to non-symptomatic trees which could increase the likelihood of infection.

16. Summary and conclusion of rapid assessment

This rapid assessment shows that *P. austrocedrae* is established in certain parts of the PRA area.

Risk of further entry is: Likely

Risk of further establishment is: High

Rate of spread is likely to occur: Quickly (in plant trade); Slowly (via natural spread)

Economic impact is expected to be:

Small, in relation to the plant trade providing the pest does not spread in the plant trade thereby increasing the potential to cause damage to ornamental plants. However, costs based on environmental and social impacts are currently unquantified but potentially significant based on the high biodiversity and environmental value of some juniper sites.

Endangered area:

Limited, but in some cases these may be sites with high biodiversity values that are already vulnerable. The importance of juniper is recognised and it has been assigned its own species action plan in the UK Biodiversity Action Plan process (Anon., 2007).

Risk management:

Practices are available to manage the risk (see 15) which are based on managing other Phytophthora pathogens (both statutory and non-statutory) but would require evaluation to measure their effectiveness in relation to *P. austrocedrae*.

17. Is there a need for a more detailed PRA?

Yes [x] No [ ]

If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used.

PRA area: UK or EU? [UK] PRA scheme: UK or EPPO? [UK]

However, a more detailed PRA is only likely to be useful if more evidence is available on:

- the host range of *P. austrocedrae*, and relative susceptibility of known/potential hosts;
- improved understanding of the distribution of the pest in the UK, which may show that it is widespread but has remained undetected until now because of the difficulty of detecting and diagnosing this pathogen;
- more understanding of the life cycle of the pathogen (as suggested by Greslebin and Hansen, 2010), and the potential for aerial dispersal;

- possibly also genetic comparisons between *P. austrocedrae* populations from Argentina and those from the UK to determine if any differences exist, which could suggest the origins and pathways for entry of this pathogen;
- potential environmental and social costs through loss of plant species susceptible to *P. austrocedrae* with associated impacts on vulnerable habitats and other plant/animal species.
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18. Given the information assembled within the timescale required, is statutory action considered appropriate/justified?

Currently, a precautionary approach is being taken at two affected sites (Upper Teesdale and Glen Artney) with action being taken to contain the outbreak and prevent spread. Action has also been taken to eradicate outbreaks where single plant or nursery plants are infected. It is acknowledged that taking action on some of the infected sites in the natural environment poses difficulties, and containment efforts could have the potential to cause environmental damage through disturbance especially as *P. austrocedrae* can be present in soil as well as in infected plant parts.

The need for statutory action should be considered in relation to information about the distribution of the pest. So far, reports suggest that *P. austrocedrae* has a limited distribution but is established in the natural environment in two clusters of outbreaks in north-west England and western Scotland. Other reports are of single plants affected, or relate to infected plants in nurseries which have been destroyed. Therefore, two options can be considered in relation to this pest.

(a) no statutory action based on the findings that *P. austrocedrae* is already established in the UK, albeit with a limited distribution;
(b) statutory action to pursue containment, pending further information about the distribution of the organism. On this basis, statutory action (eradication or containment) could be considered as justified in the context of:

- Eradication measures applied to outbreaks affecting nursery plants, which otherwise could act as a pathway for spread of the pest. Without action this pathway could be especially damaging in the case of plants destined for enrichment or regeneration of juniper sites, as the latter are highly significant in terms of their environmental and biodiversity value (Broome, 2003; McBride, 2007).
- Eradication measures applied to outbreaks of a limited nature, with one or a few plants affected, particularly in parts of the PRA area where established outbreaks do yet appear to be present.
- Containment measures applied to outbreaks affecting highly sensitive sites or environmentally high value sites, where containment could limit opportunities for spread both within and between sites, and through out the wider PRA area.

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