

Summary: Intervention & Options

Department /Agency: Defra, Welsh Assembly Government, Forestry Commission	Title: Impact Assessment on future management of risks from <i>Phytophthora ramorum</i> and <i>Phytophthora kernoviae</i>	
Stage: Consultation	Version: 2.7	Date: 5 June 2008
Related Publications: Publicity information on the pathogens, including pictures of symptoms is available at: www.defra.gov.uk/planth/pramorur.htm and www.defra.gov.uk/planth/pkernovii.htm The Central Science Laboratory/Forest Research data sheet for <i>P. ramorum</i> and Pest Risk Analysis for <i>P. kernoviae</i> can be found at: www.defra.gov.uk/planth/prasudd.pdf and www.defra.gov.uk/planth/prasforest.pdf A summary of key research findings and also Defra/Forestry Commission research reports are available at: www.defra.gov.uk/planth/pramorur.htm and www.defra.gov.uk/planth/pkernovii.htm		

Available to view or download at: <http://www.defra.gov.uk>

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What is the problem under consideration? Why is government intervention necessary?

Two fungus-like exotic pathogens of plants, *Phytophthora ramorum* and *Phytophthora kernoviae* which can kill trees have been detected in Great Britain. A policy of containment and eradication has been pursued since the pathogens were first identified (2002 *P. ramorum* and 2003 *P. kernoviae*). This policy is now being reviewed. Responsibility is shared between Central Government, landowners, and commercial plant and timber traders.

Government intervention is necessary because the market does not take into account the external environmental benefits that a higher level of plant health would ensure. Therefore the market may not provide enough plant health controls which can lead to major environmental loss.

What are the policy objectives and the intended effects?

To provide the best overall outcome for society given the current spread of and knowledge about the diseases, whilst considering their geographic spread in the wider environment and within the commercial plant trade; balancing both support for rural and horticultural businesses with the risks to woodland and other rural environments such as heathland, whilst evaluating the need to adopt a consistent approach across Great Britain.

What policy options have been considered? Please justify any preferred option.

1. Option 1 (Baseline option): cease any additional disease controls other than EU minimum statutory requirements necessary to prevent disease spread to other Member States.

2. Option 2: Increased activity with a view to reducing disease levels to epidemiologically insignificant levels.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

Option 1 would not involve a planned review date, reviews would be as part of normal Plant Health policy. Option 2 would be reviewed after five years of activity or earlier in the case of any significant change in either disease status.

Ministerial Sign-off For Consultation stage impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

.....Date:

Summary: Analysis & Evidence

Policy Option: 2	Description: Increased activity leading to containment and possible eradication
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COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' Costs are defined as those impacts where the losses/cost over the 20 year period are greater for Option 2 (i.e. policy intervention) than for the baseline (Option 1). Costs change over time as disease spreads in the baseline option and disease is brought under control in Option 2. Therefore it is difficult to define one-off and average annual costs and the present value (PV) of the costs over a period of 20 years is described below: Inspection costs to government PV of £3.8m, inspection costs to nursery and garden centre industry PV £500,000 and cost of diagnostic tests PV £2.0m all with higher costs in earlier years but savings in later years. Cost of rhododendron clearance of PV £4.3m.
	One-off (Transition) Yr		
	£		
	Average Annual Cost (excluding one-off)		
£		Total Cost (PV)	£ 10.5 million
Other key non-monetised costs by 'main affected groups' There will be impacts on visitor numbers to historic gardens under the baseline and Option 2. The impact has not been costed because it is difficult to assess under which option more visitors are lost and how many of the visitors will just visit other gardens which would represent a redistribution of revenue but no loss of revenue overall (however regional impacts may be substantial see special note regarding Cornwall Annex 7).			

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' Benefits are defined as those impacts where the losses/cost over the 20 year period are smaller for Option 2 (i.e. policy intervention) than for the baseline (Option 1). Continued exports of susceptible plants PV £800 k, reduced loss of social and environmental benefits of woodlands PV £9.4m, biodiversity benefit from rhododendron clearance PV £3.0m, reduced loss of ecosystem services of heathland PV £20,000. Cost savings of clearance and maintenance of historic gardens PV £9.3 million and cost savings of outbreak control in nurseries PV £1.8m.
	One-off Yrs		
	£		
	Average Annual Benefit (excluding one-off)		
£		Total Benefit (PV)	£ 24.4 million
Other key non-monetised benefits by 'main affected groups'			

Key Assumptions/Sensitivities/Risks The spread of the diseases and thus most of the costs and benefits are subject to a high level of uncertainty. Therefore sensitivity analysis was carried out. There is also the risk that the diseases cannot be fully brought under control even with increased activity.

Price Base Year 2007	Time Period Years 20	Net Benefit Range (NPV) £ 7 – 16 million	NET BENEFIT (NPV Best estimate) £ 13.9 million
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What is the geographic coverage of the policy/option?	Great Britain			
On what date will the policy be implemented?	1 April 2009			
Which organisation(s) will enforce the policy?	GB Plant health			
What is the total annual cost of enforcement for these organisations?	£			
Does enforcement comply with Hampton principles?	Yes			
Will implementation go beyond minimum EU requirements?	Yes			
What is the value of the proposed offsetting measure per year?	£ N/A			
What is the value of changes in greenhouse gas emissions?	£ Negligible			
Will the proposal have a significant impact on competition?	No			
Annual cost (£-£)/organisation (excluding one-off)	Micro	Small	Medium	Large
Are any of these organisations exempt?	Yes/No	Yes/No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)		(Increase - Decrease)	
Increase of	£	Decrease of	£
		Net Impact	£

Key: Annual costs and benefits: Constant Prices (Net) Present Value

Evidence Base (for summary sheets)

1. This impact assessment considers options for the way forward in developing a policy for the management of two fungus-like exotic pathogens of plants. First, background information on the diseases and on current policy is provided. Then, the issues for consideration are outlined before the two main options are described in more detail. A summary of the expected impacts of the policy options follows together with details of quantitative estimates of the policy impacts where this is possible. The impact assessment concludes with an indication of the uncertainties surrounding the estimates and the results of sensitivity analysis.

Background

2. Their scientific names are *Phytophthora ramorum* (*Pr*), first confirmed in Great Britain in May 2002, and *Phytophthora kernoviae* (*Pk*), first discovered in October 2003. Both are thought to have arrived in Great Britain within the last ten to twenty years and there is strong evidence that they can kill or seriously damage trees and shrubs, including mature beech trees. To date 86 trees have been infected with *Pr* and *Pk* (26 *Pr* and 60 *Pk*). The current policy towards the diseases is one of containment and eradication, on a precautionary basis whilst more evidence is gathered. However, after executing this policy since the first confirmations of each, both diseases are continuing to spread, albeit slowly and mainly in the southern and western parts of England and Wales. This review, which extends to England, Scotland and Wales, examines the historic and current situation and proposes options for management of the diseases in the future. Comments are sought on the options for future management and on any particular circumstances that may need further consideration.

3. Defra and the Forestry Commission share responsibility for managing the diseases in England. The Scottish Government and the Welsh Assembly Government share responsibility with the Forestry Commission in their respective areas. Defra is responsible for implementing policy in Wales under a concordat with the Assembly Government. This paper has been prepared jointly by Defra, the Forestry Commission and the Welsh Assembly Government Department for Rural Affairs and Heritage. Responses will be considered by the relevant devolved authority and the interdepartmental Programme Board first set up in 2003. The Programme Board includes officials from Defra, the Forestry Commission and the Devolved Administrations, except Northern Ireland. It is advised by a number of sub committees, including an Industry Liaison Group. The Scottish Government is consulting separately, their consultation paper can be found on their website at: www.scotland.gov.uk.

4. Responsibility for plant disease is shared between Central Government, landowners, and commercial plant and timber traders. Government intervention is necessary because the market does not take into account the external environmental benefits that a higher level of plant health ensures. Plant health services can be seen as a public good because the market does not provide enough of them and does not apply a global approach without Government intervention. Policing and enforcement of Plant Health legislation for all plants except trees is the responsibility of Defra's Plant Health and Seeds Inspectorate in England and Wales and for trees, the responsibility across Great Britain lies with the Forestry Commission. The enforcement arms of the Forestry Commission and Defra's Plant Health service are operating in a Hampton-compliant way.

5. Details of the history, the biology, and the spread within GB of the pathogens and measures taken to contain and eradicate the diseases are available in the consultation paper and its annexes.

6. The consultation, of which this Partial Impact Assessment forms part, aims to give individuals and groups the opportunity to comment on the proposals and to make government aware of particular circumstances that may need further consideration. Ministers will consider all responses to arrive at decisions on the future policy towards *P. ramorum* and *P. kernoviae*.

EU Measures

7. EU measures aim to eradicate *P. ramorum* from commercial ornamental plant production and to at least contain outbreaks in the wider environment. EU legislation requires Member States to take specific measures to stop the introduction of *P. ramorum* on imports, and also its spread within the Community. Those measures are due for review by the EU in 2008, after the report of an EU research project which is producing a European Pest Risk Analysis for the pathogen. The review of measures will be considered by the EC's Standing Committee on Plant Health, and the UK's line in those discussions will be informed by this consultation. The EU legislation is a constraint – we cannot unilaterally relax the measures on imports, or on movement of nursery stock, although there is flexibility available to Member States on management of outbreaks. In relation to *P. kernoviae* there are currently no specific EU measures, but like any Member State with a new disease problem, we have to report to the European Commission and the other Member States the measures which we are taking to prevent its spread and protect other countries. The European Commission may, if it deems it necessary for the purpose of protecting the rest of the Community, seek to introduce regulatory provisions by proposing measures to the Standing Committee on Plant Health for *P. kernoviae*. Under the same provisions in the EU Plant Health Directive, the UK (or, indeed, any other Member State) may request the European Commission to propose measures where they consider themselves to be at risk, and may take provisional measures unilaterally where they consider the immediate risk to be too great to delay.

8. The current EU control measures for *P. ramorum* applied to commercial nursery trade are: destruction of material within a 2m radius of infected plants and further monitoring of host plants within a 10m radius. These control measures, which have also been implemented for the 3 nursery findings of *P. kernoviae* in GB, have significantly reduced the spread of the diseases but have not stopped the spread completely. For *P. ramorum*, the control measures will be subject to an EU review later in 2008 and changes may be imposed and may include, for example, examination of alternative control measures e.g. destruction of all susceptible plants on infected nurseries, a ban on sale of all susceptible plants from infected premises for a defined quarantine period, etc..

9. An EU Food and Veterinary Office mission visited GB in April/May 2008. The report of the mission, which will be published at http://ec.europa.eu/food/fvo/ir_search_en.cfm, may make recommendations which might impact on future disease management policy.

Disease control and spread predictions

10. Research has shown that the eradication of rhododendron is the most effective control measure to reduce disease spread in the wider environment (woodland, gardens and parks). *Rhododendron ponticum* is the principal species of rhododendron growing in the wild in GB. Defra and the Forestry Commission have the authority under the Plant Health *Phytophthora ramorum* (England) Order 2004, the Plant Health *Phytophthora ramorum* (Wales) Order 2004 and the Plant Health (*Phytophthora ramorum*)(Forestry) Order 2004 to enforce the clearance of plants on infected sites.

11. It is difficult to try to predict the spread of any disease. The common model of disease spread is shown in Annex 1. This shows a lag phase, an exponential increase in infection followed by a slowing down or decline of infection levels. The length of the lag phase is uncertain and could be measured in months, years or decades. Evidence/expert knowledge suggests that for GB both *P. ramorum* and *P. kernoviae* are in the lag stage at present but that they are likely to move into the exponential phase in the near future. For *P. kernoviae* localised spread of up to 20 – 30 metres per year has been noted and on heavily infested sites spread of up to 6km has been noted. For certain sites in Cornwall *P. kernoviae* is believed to have reached the exponential phase. Both diseases have also spread over long distances, probably

on infected plants or soil on shoes and car tyres; although there is a possibility that weather events (storms) may also spread the diseases.

Control of *Rhododendron ponticum*

12. The Common Agricultural Policy Single Payment and Support Schemes (Cross-compliance) (England) Regulations 2005 require farmers to control the spread of *R. ponticum*. Failure to do so can result in deductions from certain payments received under the Common Agricultural Policy, including SPS. Defra and the Welsh Assembly Government have also recently consulted on proposals to add *R. ponticum* to schedule 9 of the Wildlife and Countryside Act 1981 (making it an offence to plant or cause it to grow in the wild); and on prohibiting its sale because it is an invasive non-native species. If approved, the decision to prohibit sale may influence the impact and costs to the nursery trade of applying either of the options proposed in this consultation. Respondents are invited to consider this aspect when preparing their response. Other measures such as further regulatory powers to tackle invasive non-native species would be considered as part of a legislative review under the GB Invasive Non-native Species Framework Strategy.

Timing

13. It is envisaged that the new policy will be in place for the beginning of the 2009/10 financial year. There is currently no financial provision to cover the cost of any new work identified as a result of this consultation. Any policy proposal recommended will be subject to the relevant financial mechanisms within departments and devolved administrations which may include consideration of opportunities to share costs with stakeholders.

Options

14. This consultation considers different options for dealing with the pathogens. It addresses a range of issues faced by the stakeholder groups, such as the commercial nursery trade, historic gardens, and landowners in the wider environment.

15. The options under consideration are:

- **Option 1:** Meet EU minimum requirements on control of *P. ramorum* and remove all controls against *P. kernoviae*, other than maintaining a ban on the movement of infected plants to other countries. Though not included in the cost benefit analysis, this option recognises that the minimum EU control levels of *P. ramorum* are under review and invites comments on where future levels should be set.
- **Option 2:** Increased activity, aimed at reducing the level of inoculum to epidemiologically insignificant levels; by removal of infected sporulating hosts in woodlands and the wider environment; combined with enhanced containment and eradication measures in infected gardens and nursery sites, as well as the identification and control of any new outbreaks.

Further options have been considered in the preparation of this consultation, options for controlling the spread of *R. ponticum* are being investigated as part of a legislative review under the GB Invasive Non-native Species Framework Strategy (see paragraph 12). The option of continuing containment and eradication activity whilst more evidence is gathered was explored (see paragraphs 73 – 75) but ruled out principally because the risk of the diseases moving into the exponential phase would greatly increase control costs and/or eliminate the possibility of undertaking option 2.

Expected impacts of the options under consideration

16. For each option, where possible, an attempt has been made to identify the impacts and to quantify the costs and benefits. The quantification is informed by scientific research to date and data available from experience in managing the diseases within GB and, for *P. ramorum*, in other countries. This document identifies the data sources; where evidence is weak or little evidence is available this has been highlighted. Evidence will continue to be collected as part of the consultation process. Paragraph 76 examines the evidence sources and the level of confidence in the data source. Unless otherwise stated the data and costs given are for Great Britain; specific data and costs for Scotland are defined in the separate Scottish Government consultation which can be found at www.scotland.gov.uk.

Assumptions

17. This paragraph sets out the types of impacts identified and which stakeholders may be affected. Later paragraphs examine the impacts under each option in more detail. The impact areas are:

- i) Government inspection staff costs: under each option some level of official inspection and control will be required. The cost of official inspection will vary depending on the option chosen and on the level of disease present. Cost data has been drawn from past and current experience with the policy of containment and eradication of these diseases. (Annex 2)
- ii) Rhododendron clearance costs: Clearance of *R. ponticum* has been shown to be the most effective control measure to reduce disease spread. Infected *R. ponticum* produces high levels of inoculum which can infect susceptible trees and plants. Clearance costs vary considerably from site to site depending on access and ease of disposal of cleared material. Significant clearance work has already taken place on a range of sites, these costs have been used to estimate the average cost of clearance of £8k/ hectare. (Annex 3)
- iii) Cost of diagnostic tests: Whenever an infection is suspected laboratory tests are required to confirm the presence of either pathogen. The number of tests required will vary with the level of inspection activity and the amount of disease present. The Central Science Laboratory and Forest Research who currently undertake the diagnostic tests on suspected infections have provided the costs of individual tests. These figures have been multiplied by estimates of inspection activity to provide a cost of diagnostics under each option. (Annex 4)
- iv) Costs to nursery and garden centre industry: There are a range of impacts which disease spread and control activities may have on the nursery and garden centre trades. These are:
 - a) Destruction of plants when a nursery or garden centre infection is identified: Official controls require destruction of plants within a 2m radius of any infected plants. Based on information provided by the Horticultural Trades Association (Annex 5), it has been estimated that the average value of plants within a 2m radius is £916 per infection. The number of infected plants found will vary with disease spread and the number of surveys undertaken.
 - b) Staff costs: nursery or garden centre managers will need to use staff time to manage diseases. For these two diseases which are controlled by official inspection, nursery and garden centre staff will need to spend additional time preparing for and dealing with the inspectors. The assumption is that on

average nursery and garden centre staff are present or involved for 50% of the inspector's on site time. The level of nursery and garden centre staff time will increase as disease levels rise.

- c) Loss of export market: if third countries lose confidence in GB's measures to control the spread of any disease they can restrict exports of susceptible plants from GB to their country. The estimated value of exports of susceptible species by the principal exporters is £355,000 per annum (currently principally rose plants). However, it has been assumed that some of the plants would get sold to the domestic market and that over time bilateral trading arrangements would be agreed with plant health authorities in third countries lessening the impact of any loss in export market.

- v) Costs to historic and public gardens: there is a range of costs involved with infection in historic and public gardens (Annex 6):
 - a) Infected plants and adjacent uninfected susceptible host plants are normally removed. This can mean the loss of significant or historic specimen plants. Clearance of infected and susceptible plants may lead to closure of some gardens or parks whilst replanting with non host species is undertaken, for some closure may be permanent if key feature plants have to be removed or the focus (such as spring flowering plants) have to be removed for disease management.

 - b) Removal of plants may change the appearance of gardens to an extent where the public are deterred from visiting. Loss of visitors has not been quantified in this impact assessment since data are not available and it is unclear how visitor numbers would change with each option. However there is generic information available about the importance of gardens to the economy in Cornwall. Information from the South West Tourism, Gardens of Cornwall project suggests that in 2001 the income of 45 gardens in Cornwall, which met the criteria for their study (out of a total of 163 gardens in the county), generated an income of £23.6m (50% from entrance fees and 50% from other income (refreshments, plant and gift sales)) and directly employed nearly 700 people. The gardens attracted over 2.8 million visitors, 75% of which came from outside the south west (including 8% from overseas). A loss of confidence in a garden's ability to manage its plant collection or its ability to protect visitors from carrying either disease away with them is likely to have a significant impact on visitor numbers and plant sales.

 - c) Gardens would need to manage their way through the diseases by moving to plantings of non-susceptible plants over a period of time. This would involve the loss of feature specimens of historic significance and in some instances may change the character of gardens substantially. The cost of such a transition, has not been included in the costs for this impact assessment but it is likely to run into some £millions. It is likely that this management process will be undertaken whatever option is chosen.

- vi) Loss of social and environmental benefits of woodlands: a range of tree species in GB are susceptible to *P. ramorum* and *P. kernoviae*. The most susceptible tree in British woodlands is beech. For the cost benefit analysis areas of beech woodland in high risk climatic areas have been mapped against acid soils (acid soils have been used as a proxy for the presence of *R. ponticum* (since mapping of the presence of *R. ponticum* is not sufficiently accurate at present)). This has identified an area of 40,000ha of highly susceptible woodland, which has been used in the calculations. It is possible that if the diseases spread or inoculum levels increase sufficiently other susceptible woodland areas may become infected. The annual value of the non-

market social and environmental benefits of British woodland has been estimated at £1.022 billion¹ [Kenneth G Willis et al 2003]; based on its recreational, landscape, biodiversity and carbon sequestration benefits. It should be noted that the aggregate landscape value in the study is likely to be an underestimate.

- vii) Loss of ecosystems services of heathland: GB has 89,000ha of lowland heath and 923,000ha of upland heath. *Vaccinium myrtillus* (bilberry) is native to heaths, moors and acidic woodlands and forms an integral component of native heathland. It is commonly found throughout the British Isles and can become locally dominant in England towards the southeast. *V. myrtillus* was identified as a susceptible species for both pathogens in laboratory experiments by the Central Science Laboratory in 2006. Other heathland species (have also been shown to be highly susceptible (*Vaccinium vitis-idaea* and *Arctostaphylos uva-ursi* to *P. kernoviae* with *Calluna vulgaris* being highly susceptible to *P. ramorum*). In December 2007 *V. myrtillus* was found infected with *P. kernoviae* in woodland in Cornwall as well as in February 2008 in open heathland, also in Cornwall. *P. ramorum* has not been found affecting heathland species to date. Spread of the diseases to native heathland could have significant impacts on heathland areas and biodiversity of heathland sites. The Government is committed to ensuring that 95% of heathland is in 'good' condition by 2010. *Phytophthora* infections would jeopardise meeting these targets on heathland (Annex 7). For the purposes of this cost benefit analysis the values used in the recent study by Eftec (2007) on valuing ecosystem services, for both woodland and heathland (lowland heath) have been used. These are:

Low £500/ha
Mid £2,000/ha
High £6,000/ha

- viii) Biodiversity benefit of rhododendron clearance: costs of rhododendron clearance have been included in the cost-benefit analysis. *R. ponticum* is an alien invasive species in GB. Rhododendron clearance has been shown to improve biodiversity. Though this is an incidental benefit it is a consequence of this policy and has been included as clearance of *R. ponticum* is funded in parts of the country because of the biodiversity benefits offered. Studies have shown that currently rhododendron clearance is under funded (see for example Dehnen-Schmutz *et al.* 2004). For this impact assessment it has been assumed that the value of the increase in biodiversity is equivalent to 70% of the cost of clearance. The woodland areas which would need to be cleared for disease control may not offer the best sites for clearance for biodiversity purposes, therefore it was assumed that the costs exceed the benefits as a conservative estimate.

Estimates of the impacts

18. This section outlines the major cost, benefit and risk components of each option. Where the costs are shown they are present values (PVs) calculated over a 20 year period. The present value makes future streams of benefits and costs with a different profile over time comparable by converting them into equivalent values today. This is done by assigning monetary values to benefits and costs and discounting these values using an appropriate discount rate. The net present value of the option can then be derived by subtracting the sum total of discounted costs from the sum total of discounted benefits.

¹ The woodland value of £1.023bn is in 2002 prices. We have not increased this value to 2008 prices given uncertainty over appropriate deflators for environmental values. Using the GDP deflator at market prices would increase this value by 14.7% by 2007/08 (2007/08 deflator in line with Pre-Budget Report 2007).

19. A discount rate of 3.5% was used in accordance with the guidance in the ‘Green Book, Appraisal and Evaluation in Central Government’. The impacts were estimated over a period of 20 years. This period was chosen because Option 2 considers increased activity to be taken over a period of 5 years to reduce the spread of the diseases and finally eradicate them with the aim of reducing costs in the future. Therefore, the length of time had to be considerably longer than 5 years to capture the expected benefits of government intervention. The lifespan of trees is significantly beyond twenty years, the possibilities of continued impacts of disease on trees beyond the 20 year period are not accounted for in this impact assessment.

20. As the main issue is the spread of disease over time and space, the impacts are expected to continue to change over the period. In order to make meaningful comparisons, present values are generally quoted. In the summary sheet as well as when comparing government intervention (that is Option 2) to the baseline (that is Option 1), costs were defined as those impacts where the losses/cost over the 20 year period are greater for Option 2 (i.e. policy intervention) than for the baseline (Option 1). Benefits are defined as those impacts where the losses/cost over the 20 year period are smaller for Option 2 (i.e. policy intervention) than for the baseline (Option 1).

21. A cost benefit analysis has been completed which estimates the change in value of the impacts under the two options. Table 1 below compares the present values of the costs and benefits of the two options under consideration over the 20 year period.

22. The first column describes the impacts of the options; the second column shows the difference between the present values of the impacts of Option 2 and the baseline, Option 1. The values in the second column are the ones shown in the summary sheet at the front of the document.

23. The second and third columns show the underlying present values for the two options separately. This overview highlights the fact that the further spread of *P. ramorum* and *P. kernoviae* will lead to overall losses in GB. The policy options can influence where the main costs fall and the overall level of costs but they cannot prevent some losses.

Table 1 Comparison PVs of costs and benefits of Option 1 and 2¹

	Option 2 – Option 1	Option 1	Option 2
Costs	£s	£s	£s
Inspection costs to government	3,800,000	14,000,000	17,700,000
Rhododendron clearance	4,300,000	0	4,300,000
Diagnostic tests	2,000,000	3,700,000	5,700,000
Inspection costs to industry	500,000	1,700,000	2,200,000
Historic gardens lost visitors	n/a	n/a	n/a
Total costs	10,500,000	19,400,000	29,900,000
Benefits			
Cost of outbreak control to nurseries	1,800,000	-2,200,000	-400,000
Exports	800,000	-800,000	0
Social and environmental benefits of woodlands	9,400,000	-9,900,000	-400,000
Historic gardens clearance and maintenance costs	9,300,000	-13,700,000	-4,400,000
Ecosystems services of heathland ²	0	0	0

	Option 2 – Option 1	Option 1	Option 2
Benefit from rhododendron clearance	3,000,000	0	3,000,000
Total Benefits	24,400,000	-26,600,000	-2,300,000
Benefits minus costs	13,900,000	-46,000,000	-32,200,000

¹ Values might not add up due to rounding

² Values shown as zero due to rounding actual values are option 1 £20k, option 2 £0

Option 1: Meet EU minimum requirements on control of *P. ramorum* and remove all controls of *P. kernoviae*, other than maintaining a ban on the movement of infected plants to other countries.

24. This option recognises that the minimum EU control levels of *P. ramorum* are under review and invites comments on where future levels should be set.

25. Under this option, current officially-funded work which has already been commenced on clearing *R. ponticum* from infected woodland and garden sites would continue within existing budget limits. Clearance on new sites, either planned under the existing risk-based programme, or on any newly-identified infected sites, would not be started. Action would be taken to contain garden and wider environment outbreaks. Containment and eradication measures would continue at all infected commercial nurseries in accordance with current EU requirements.

26. The UK, like any other Member State has an obligation to comply with EU legislation regarding plant health controls. The current minimum level of controls is described in the EC Directive 2002/757/EC amended by 2007/201/EC. These require surveys of 'cultivated' plants and appropriate procedures aimed at eradicating *P. ramorum* if found and surveys of uncultivated/unmanaged plants and appropriate measures at least to contain *P. ramorum*, if found. The prescribed eradication methods for 'cultivated plants' is that all plants within a 2m radius of where the disease is found must be destroyed; those within a 10m radius and any others plant from the infected lot must be held for three months, during which two official inspections must take place. All plant debris within the 2m zone must be destroyed and the growing areas must be disinfected.

27. There is also a requirement on all Member States to take emergency action on 'unlisted' pests and diseases under Article 16 of the Plant Health Directive 2000/29/EC to prevent their spread to other Member States. For *P. kernoviae*, which is currently unlisted, no action would be taken at any site of new infection. At sites where clearance of sporulating hosts has already begun, the work would be completed using current financial provisions. There would, however, be a ban on the movement of plants from infected locations to other countries.

28. The costs of this option have been calculated using the current EU minimum levels of control. Should the EU Minimum levels change as a result of discussions at the European Commission this year then the costs may vary appropriately. When considering this option consultees are asked to comment on the minimum level of controls describe above. Are the levels appropriate?

Impacts of Option 1

29. The following impacts have been identified:

- Infection of trees is likely to continue to increase and reach the exponential phase. The total area of susceptible woodland in GB has been calculated as 40,000ha. (Beech woodland on acid soils). It is likely that over time all of this woodland with a rhododendron understorey would become infected.

- Increased levels of disease in nursery trade.
- Exports of susceptible plants to third countries may be banned.
- Trade of susceptible plants from all infected places of production to other Member States may be restricted.
- Diseased trees will pose a health and safety risk in parks, gardens and woodlands limiting access and possibly leading to closures.
- Native heathland species may become infected. Bilberry (*Vaccinium myrtillus*) has been confirmed infected with *P. kernoviae* in woodland and heathland areas. Further spread of either disease to native heathland could have significant impacts on heathland areas and biodiversity of heathland sites.
- Significant impact on the economy of historic gardens and wider tourist economy dependent on garden visitors. This is particularly so in the south west of England.
- Imposition of new EU controls to prevent spread of *P. kernoviae* within the Community, and to seek to eradicate it from infected sites.

Details of quantitative estimates of impacts of Option 1

Cost of government inspections

30. Inspection levels would be cut back to those prescribed under EU law. It has been estimated that the cost of these inspections to government would be £615,000 in the first year increasing by 5% each year as disease levels increase. The PV of these costs over 20 years would be £14m.

Rhododendron clearance

31. Under this option no new clearance would be required or funded to prevent disease spread.

Diagnostic tests

32. The cost of diagnostic tests under this regime and disease levels have been estimated by the Central Science Laboratory as £161,000 in the first year. These costs would increase as the diseases spread. The best estimate is that costs would increase by 5% each year leading to a PV of £3.8m.

Cost to nursery and garden centre industry

33. Infected plants are currently found as a result of 1% of surveys at nurseries and garden centres leading to ca. 27 interceptions per year. For this option it is likely that interception rates will rise over time as the diseases become more widespread. The average cost of destruction in the 2m radius is estimated at ca. £916 (see Annex 5). The value of plants destroyed in the 2m zone on nurseries would be in the region of £25,000 per year in year one. Plants held in quarantine in a 10m radius around an infected plant may miss their market and be sold at a discount or destroyed voluntarily. For the purposes of this calculation it has been estimated that on average 5% of the value of the plants in the 10m quarantine zone will be lost, giving an annual cost of plants lost on nurseries of £54,000 per year increasing as disease level rise to £163,000 from year four onwards. This gives a PV of £2.2m over the 20 years.

34. There is also a cost to nurseries and garden centres in providing staff to liaise with inspectors and take the remedial activity suggested or prescribed as a result of inspection. It has been estimated that nursery staff time will be roughly half of the time that inspectors are on site. This option would see activity at nurseries and garden centres increase as disease levels increased, the cost to industry would therefore increase over time, to a maximum of £204,000 per year after 20 years. The NPV would be £1.7m.

35. Loss of export market: if third countries lose confidence in GB's measures to control the spread of any disease they can restrict export of susceptible plants from GB to their country. The estimated value of exports of susceptible species by the principal exporters is £355,000 per annum (principally rose plants). However, it has been assumed that some of the plants would get sold to the domestic market and that over time bilateral trading arrangements would be agreed with plant health authorities in third countries lessening the impact of any loss in export market. A loss of 50% of the market value for the first five years has been assumed. After that transition to non-susceptible plants would be made or new markets would be found. The total value of exports lost would equate to £800,000.

36. Costs used here are average costs based on conservative estimates, it is recognised that losses to individual businesses may be greater or lower than the averages used.

37. Information from the Horticultural Trades Association indicates that growers may choose not to produce susceptible host plants if disease levels reach a certain point, reducing the risk of disease spread and nursery disease management. Landscape architects are, however, prone to continue to specify susceptible plants; the demand is likely to be met from non-GB suppliers. Due to lack of information on how and when such a transition might take place, this aspect has not been included in the quantification of the costs.

Cost to Historic and Public Gardens

38. This option is likely to have the largest impact on historic and public gardens. Continued spread of both diseases in the wider environment is likely to increase the number of infected gardens across GB. Over a twenty year period it has been assumed that all gardens would become infected; the cost of clearance of infected and susceptible plants over that period has been estimated at increasing from £375,000 per year to over £1.9m per year. Leading to a PV of £13.7m.

39. Loss of visitor numbers have not been assessed as part of the cost benefit analysis as it is difficult to assess under which option more visitors will be lost.

Cost to wider environment

Loss of social and environmental benefits of woodlands

40. Forest Research considers that it would take about 5 -10 years for all woodlands where *R. ponticum* is present in Cornwall to become infected with *P. kernoviae* if no controls were in place. Based on this information and information about current spread of the diseases, a best estimate of the spread rate has been derived. The best estimate used is a 31% annual increase of the area of woodland infected. It has been estimated that in total 40,000ha of woodland is at significant risk from infection with *P. ramorum* and *P. kernoviae*. The 40,000ha were taken to be the maximum area of woodlands to become infected with the pathogens. However, without controls it is likely that *P. ramorum* and *P. kernoviae* will become widespread, not only in highly susceptible woodlands but also in ornamental plantings in parks and gardens in the west of Britain, and probably sporadic elsewhere although most of these infections may only affect leaves and shoots. Disease Spread Model information is available at Annex 1 and specific responses on disease spread from Forest Research can be found at Annex 2.

41. Diseased trees, which may fall, pose a health and safety risk. There may be additional costs due to park and woodland closures prior to felling. The cost of felling of trees can range from very little (tens of pounds) to several thousand pounds dependent on operational circumstances.

42. When woodlands get infected with *P. ramorum* and/or *P. kernoviae*, ecosystem service benefits will be reduced but not all will be lost. Estimates from the Forestry Commission suggest that severely damaged beech woodland would lose between 50% and 70% of their annual biodiversity and recreational benefits. However, when woodlands first get infected, the losses will be a lot smaller and it will take some time till the beech woodland will be severely damaged. For recreational benefits, there is also the possibility that people will go to non-infected woodlands. These factors would suggest on average a lower proportion than 50% to 70% would be lost. For this exercise, a value of 25% was used as the best estimate. For landscape and carbon sequestration benefits, the best estimate is that 10% of annual landscape and carbon sequestration benefits will be lost when woodlands get infected. By the end of the 20-year period the annual reduction in benefits would be £2.6m (which equates to a PV of £1.4m for year 20) and a PV over the period of £9.4m but this value is subject to a lot of uncertainty.

Loss of ecosystems services of heathland

43. GB has 89,000ha of lowland heath and 923,000ha of upland heath. The annual ecosystem value of native (lowland) heathland has been valued between £500 and £6,000 per hectare. Using the lowest figure the cost if all heathland were infected or lost would be £506m. As for woodlands, it has been assumed that infected heathland would lose 10% of its ecosystem services if heathland were infected or a loss of £50 per hectare per year. The 10% assumption is subject to a large degree of uncertainty. Data on the rate of spread of either disease in heathland is unavailable, therefore for the purposes of this impact assessment similar spread rates to those used for woodland have been used. Applying a spread rate of 31% (i.e. each year there will be 31% more infected than the previous year) the PV of lost ecosystem services of heathland over 20 years would be £20,000.

Biodiversity benefit of rhododendron clearance

44. No clearances and therefore no benefit of clearance of alien invasive species.

Admin Burden

45. The total cost of the administrative burden (i.e. beyond what is required in the normal course of business) falling on industry as a result of existing measures against *P. ramorum* and *P. kernoviae* (e.g. the need to maintain records to demonstrate that susceptible materials imported into England from the USA are accompanied by a phytosanitary certificate) has been estimated as negligible, at around £70 (seventy) per year. It is thought that the removal of the existing Management Zone under this option and the need to seek authorisation for the movement of susceptible material out of the zone would reduce the cost of that administrative burden by the negligible sum of £13 (thirteen) per year.

Questions regarding Option 1

1. Under Option 1 clearance of infected *R. ponticum*, for *P. ramorum* and *P. kernoviae* control, would cease. What implications for the wider environment do you perceive from this policy?
2. The current level of EU minimum controls is due to be reviewed by EC Standing Committee on Plant Health. What do you think are appropriate levels of controls for *P. ramorum* and *P. kernoviae* both on nurseries and in the wider environment? How should these levels be reflected in EU law?
3. Would Option 1 pose any other impacts which are not considered in the Impact Assessment? If so what are they and how might they be addressed?
4. This option identifies that trade in host material may be affected, how would a ban on exports and limits to other trade of host material impact on British Horticulture?

Option 2: Increased activity, aimed at reducing the level of inoculum to epidemiologically insignificant levels; by removal of infected sporulating hosts in woodlands and the wider environment; combined with enhanced containment and eradication measures in infected gardens and nursery sites, as well as the identification and control of any new outbreaks

46. An increase of activity with the aim of eradicating sporulating host plants (principally *R. ponticum*) from known infected sites, coupled with a national surveillance programme to identify and control all new outbreaks. Containment and eradication measures in infected gardens would be enhanced. An enhanced regime of checks and controls on commercial plant trade would be applied.

47. For *P. kernoviae*, due to the limited geographic spread of the disease within the south west of England, South Wales and recently Scotland, it is estimated that a 2 – 3 year campaign could reduce the inoculum levels to epidemiologically insignificant levels within existing known woodland and wider environment sites and significantly reduce the potential risk of future spread to other countries.

48. For *P. ramorum*, which has wider geographical spread within GB, is more widely present in the nursery trade, and is reported in other Member States, possible eradication in woodland and wider environment sites within GB might be achieved over a longer time period. The exact timeframe is difficult to predict. However, the assumption is that it may take decades rather than years.

49. To facilitate this option it may be necessary to re assess the use of Disease Management Zones (DMZ). There is currently a DMZ in part of Cornwall which controls the movement of susceptible plants out of the zone. Consideration will be given to the closure of or extension of the existing DMZ or possibly the creation of new DMZs.

50. A review of progress would be built in after 5 years to measure whether the increased activity was having the desired impact.

51. If eradication is successful this option also introduces the possibility of establishing within GB a 'Protected Zone' against *P. ramorum* under EU law. 'Protected Zone' status allows Member States in which a disease which is established within the Community but is not endemic within that Member State to impose certain restrictions on trade from other Member

States. Protected Zone' status is agreed at EU level through the Standing Committee on Plant Health.

Impacts

52. The following impacts have been identified:

- Infection and death of trees will reduce as targeted clearance of *R. ponticum* takes place.
- Levels of disease in nurseries and garden centres will reduce as tighter controls and more frequent surveys take place. However, since *P. ramorum* is present in international trade it is unlikely that the occurrence of the disease in the nursery trade will be completely eliminated.
- Exports of susceptible plants to third countries continue.
- Trade of susceptible plants with other Member States continue.
- Further spread of *P. kernoviae* to native heathland could be avoided. Lower levels of inoculum in the environment will reduce the likelihood of spread into new areas.
- The impact on the economy of historic gardens and wider tourist economy dependent on garden visitors will reduce over time. The number of gardens which become infected in the longer term will diminish. However in the short term there may be significant impact on infected gardens which are required to remove all infected or susceptible host material.

Details of quantitative estimates of impacts

Cost of government inspections

53. PHSI have estimated that this level of activity would require a total of 38.5 staff (28 more than in Option 1) and Forestry Commission have estimated that they would require a total of 3 staff (2 more than Option 1) for the first five years after which the staffing requirement would halve as disease levels dropped. Woodland surveys would continue to be carried out using existing resources.

54. Government staff costs would be £2.27m per year for the first 5 years after which the staffing levels would halve, then staff costs would diminish over the next five years as disease levels dropped. From year 10 onwards a lower cost equivalent to the initial annual cost of the EU minimum option (£615,000) would be applied. Using these assumptions the NPV of staff costs for Option 2 would be £17.7m.

Rhododendron clearance

55. For this option all known infected *R. ponticum* in woodlands would be cleared. Currently this would involve a five-year clearance programme of 310ha. of *P. kernoviae* infected *R. ponticum* principally in Cornwall and 112ha of *P. ramorum* infected *R. ponticum* at sites throughout GB, principally in England and Wales, followed by clearance of any newly identified infected sites in the following years. Assumptions about clearance costs and areas to be cleared can be seen at Annex 4.

56. Clearance would cost: £750,000 per year for the first five years. After which the cost will diminish in line with lower infection rates giving a PV clearance cost years of £4.3m.

Diagnostic tests

57. Whenever an infection is suspected a laboratory test is required to confirm the presence of both pathogens. The cost of diagnostics under this regime has been estimated by the Central Science Laboratory as £779,000 per year for the first five years after which the cost will halve then diminish as levels of disease reduce to an level equivalent to the EU minimum surveillance level (£161,000) from year 10 onwards. Using these assumptions diagnostic costs for Option 2 would have a PV of £5.7m.

Cost to nursery and garden centre industry

58. For this option it is assumed that increased inspection activity will initially detect more infection in nurseries and garden centres; but that there would be a rapid decline in infection levels down to 25% of current interception rates. Infected plants are currently found as a result of 1% of surveys at nurseries and garden centres, the increased level of surveys under this option would therefore equate to c54 interceptions per year in the first year, diminish over time as disease levels reduce. The average cost of destruction in the 2m radius is estimated at ca. £916. The value of plants destroyed within the 2m zone on all nurseries would be in the region of £100,000 per year in year 1. Plants held in quarantine in a ten metre radius around an infected plant may miss their market and be sold at a discount or destroyed. For the purposes of this calculation it has been estimated that on average 5% of the plants in the 10m quarantine zone will be lost, giving an annual cost of £108,000 per year in year 1 diminishing to a cost of £13,600 from year 11 onwards. The PV for 20 years would be £0.4m for Option two.

59. There is also a cost to nurseries and garden centres in providing staff to liaise with inspectors and take the remedial activity suggested or prescribed as a result of inspection. It has been estimated that nursery staff time will be roughly half of the time that inspectors are on site. This option would see activity at nurseries and garden centre increase initially to a cost of £284,000 per year then diminish to £77,000 from year ten onwards. The PV would be £2.2m. There will be no impact on exports under this option.

Cost to Historic and Public Gardens

60. It has been assumed that costs to historic and public gardens are high in years 1 – 5 then diminish to zero in year nine once infections have been cleared in gardens and infection in the wider environment is significantly reduced. Infected gardens will be compelled to clear susceptible host plants within a prescribed term (0 – 5 yrs). This could lead to high costs and possibly closure of some gardens whilst new plantings take place. Clearance will be subject to local management and production of individual action plans drafted on a case- by-case basis. From existing case studies an average clearance cost of £15,000 per garden has been estimated, it has been assumed that initially there will be 50 gardens undertaking clearance per year for the first five years (total cost £750,000 per year). After which the costs will diminish to zero in year nine once gardens are no longer infected. The NPV cost to is estimated to be £4.4m.

61. A loss of visitors due to the closure of gardens or the change in a garden's character due to removal of susceptible species could impact on local economies.

Cost to wider environment

62. In calculating the following costs it has been assumed that the measures are effective.

Loss of social and environmental benefits of woodlands

63. Because of the control measure introduced as part of this option the loss of trees and possible restricted access to some woodlands due to *P. ramorum* and *P. kernoviae* infection will be lower. The value of the non-market social and environmental benefits of British woodland

has been estimated at £1.022 billion per year; based on its recreational, landscape, biodiversity and carbon sequestration benefits. Under this option it has been assumed that no further trees become infected and therefore the cost of the loss of the loss of social and environmental benefits of woodlands remains at current levels of £16,000 per year. This would give PV of lost trees of £400,000.

Loss of ecosystems services of heathland

64. This options assumes no further infection of native heathland.

Biodiversity benefit of rhododendron clearance

65. The consequential biodiversity benefit from rhododendron clearance over 20 years is estimated at £3m PV.

Additional risk

66. The assessments outlined above are based on current knowledge of the diseases. Experience with disease control so far, suggest that the measures under Option 2 should be effective in eradicating the diseases. However, there is some risk that the measures may fail and disease continues to spread, either because the disease spread estimates are poor, disease outbreaks occur in new geographic areas or control measures are ineffective. If this is the case further more costly intervention may be required over a longer period combined with a manifestation of the impacts identified in Option 1.

Administrative Burden

67. The total cost of the administrative burden (i.e. beyond what is required in the normal course of business) falling on industry as a result of existing measures against *P. ramorum* and *P.kernoviae* (e.g. the need to maintain records to demonstrate that susceptible materials imported into the UK from the USA are accompanied by a phytosanitary certificate) has been estimated at around £70 per year. It is thought that there would be no change in that administrative burden resulting from this option.

Questions regarding Option 2

5. Option 2 will involve enforced clearance of *R. ponticum* from gardens and woodland where infection is found.
 - a. Should enforced clearance of infected sporulating hosts be applied in all cases?
 - b. Should infected plants of historic significance be regarded differently from other sporulating hosts? If so how?
6. Option 2 offers the opportunity to reduce inoculum levels to epidemiologically insignificant levels. How do you perceive the risk that the diseases may continue to spread regardless of increased activity?
7. Are the measures described under Option 2 sufficient to reduce the disease inoculum to epidemiologically insignificant levels? Would you suggest any alternative or additional measures?
8. Would Option 2 pose any other impacts which are not considered in the Impact Assessment? If so what are they and how might they be addressed?

Comparison of the impacts of options 1 and 2 (net values) by sector

68. The present value 20 year cost of both options is fairly similar £35.3m Option 1 against £34.7m Option 2. However, the costs of option 1 are incurred at the beginning of the period and diminish over time. This section identifies how the cost used in the impact assessment calculations may impact on different stakeholder sectors.

69. Nurseries and garden centres

- **Outbreak control:** Disease control activities under Option 2 reduce the number of interceptions in nurseries and garden centres leading to a £1.8m saving in the value of destroyed plants over Option 1.
- **Inspection cost to industry:** The higher level of inspection under Option 2 means that option 1 offers a time saving to the industry equivalent to £500,000 through less management of official inspection.
- **Maintenance of export market to third countries:** Under Option 1 the loss of export market is valued at £800,000 PV whereas under option two there is no cost as export markets are maintained.
- Maintenance of trade with other Member States (not valued at present).

70. Historic and public gardens

- **Clearance and maintenance costs:** Option 1 assumes continued infection of additional historic gardens and re infection of previously eradicated sites leading to £13.7m cost as opposed to £4.4m under Option 2 which assumes no new infection of gardens after 10 years of activity.
- **Visitor numbers and tourism benefits:** Not currently valued. However Option 2 offers a lower likelihood that further historic gardens will be infected thus minimising the costs of reduced visitor numbers due to closure or clearance work in future years but possibly at the expense of lower visitor numbers while the measures under Option 2 are carried out. The net effect is uncertain.

71. Wider environment

- **Biodiversity:** Option 2 offers an increase in biodiversity on heathlands and in woodlands where *R. ponticum* is cleared. Rhododendron clearance has been shown to improve biodiversity, for this impact assessment it has been assumed that the value of the increase in biodiversity is equivalent to 70% of the cost of clearance (this is based on the fact that clearance of *R. ponticum* is funded in parts of the country because of the biodiversity benefits offered; however the woodland areas which would need to be cleared for disease control may not offer the best sites for clearance for biodiversity purposes). Therefore the consequential biodiversity benefit from clearance over 20 years is estimated at £3m NPV.
- **Heathland infection:** Option 2 provides a reduction in the number of heathland plants infected, increasing governments' ability to achieve biodiversity and heathland condition targets. The benefit of the lower heathland loss under Option 2 has been estimated to be £20,000.
- **Tree infection:** Option 2 offers a significant reduction in the number of trees which may become infected and die leading to a consequent loss of amenity value to woodland. Option 1 assumes 40,000 ha of woodland will be infected over 20 years; whereas this

option assumes no further loss of trees over the current known infected woodland. The difference in the recreational, landscape, biodiversity and carbon sequestration benefits between Option 1 and 2 are estimated to be in the region of £9.4m NPV over 20 years.

- **Rhododendron clearance:** Option 1 assumes no clearance of *R. ponticum* whereas Option 2 will clear all known infected *R. ponticum* and any newly-infected sites. *R. ponticum* is a non indigenous invasive weed within GB, clearance is currently funded through grant aid. Clearance for control of *P. ramorum* or *P. kernoviae* would contribute positively to the management of *R. ponticum*. Leading to a PV benefit of £3m under Option 2.

72. Government and shared cost activities

- **Government inspection:** The inspection costs to government are greater under Option 2 (£17.7m) than option 1 (£14m). The costs of Option 2 are significant at the start of the 20 year period, but diminish to an estimated £600,000 from year ten onwards. Whereas the costs of Option 1 start the 20 year period at £600,000 and increase year on year to £1.6m in year 20.
- **Rhododendron clearance:** Option 1 has no cost for clearance whereas Option 2 estimates a cost of £4.3m clearance over the 20 years.
- **Diagnostic tests:** Due to the higher level of inspection carried out under option 2 the cost of diagnostics for this option are £2m greater than for Option 1. However, as with inspection costs the diagnostic costs for Option 2 diminish to £200,000 from year 10 onwards, whereas the costs for Option 1 increase steadily over the period to £0.4m in year 20.

Generic Questions

9. Which of the proposed options do you favour? Please give your reasons for your preference, if possible explaining why you do not favour the alternatives.
10. Please explain whether you think that separate policy approaches should be adopted for each disease or should the same policy be applied to both?
11. Should measures continue to be taken to prevent these pathogens moving on nursery stock within GB/EU?

Additional option

73. A third option was explored as part of the development of these consultation papers. The option offered a 'medium term programme of funded clearance of sporulating hosts, focussed on containment and eradication at sites which pose the greatest risk of disease spread; combined with a continued targeted approach to monitoring and continued controls on commercial trade with a view to containing the spread of diseases whilst further evidence is gathered prior to further decision on long-term action.'

74. The interdepartmental Programme Board and its science subgroup identified what further evidence might be gathered during an extended containment and eradication period of 2 years.

- Further information about those trees and heathlands which are potentially at risk could be gathered through better mapping of species distribution and their host associations. The current assumptions about susceptible host trees are based on the incidence of beech woodland, in high risk climatic areas and on acid soils; beech trees in mixed woodlands are not accounted for and should be considered. Acidic soils have also been used as a proxy for the presence of *R. ponticum* since the mapping of *R. ponticum* is not currently available at a satisfactory resolution. Other tree species are also at risk other than beech (especially other Fagaceae) and these might also be mapped in a risk-based way in relation to climate and rhododendron.
- There is also scope to better understand risks to *Vaccinium myrtillus* (and other heathland species) in the wider environment setting, through more comprehensive epidemiological studies, including field-based studies of any existing or further outbreaks; current data on heathland species is limited and based on laboratory tests and the recent finding of *P. kernoviae* in heathland alone.
- Further monitoring of infected, but untreated, woodlands may give a better indication of the number of trees that may eventually become infected and die in areas of differing disease pressure. However, two years may not be sufficient time for significant tree death to become fully apparent.

75. This additional data may prove useful in refining the evidence base. However, it is unclear whether the additional data will significantly improve the information on which Ministers' can make choices on further policy options. Further evidence will most likely serve to narrow the range of parameters used in the sensitivity analysis. The option has now been discounted as a result of scientific peer review of the evidence and pre-consultation with an Industry Liaison Group who have been contributing to the disease management process. The main reason for discounting the additional option was the view that the risk of the diseases moving into the exponential phase which would greatly increase control costs or eliminate the possibility of undertaking option 2.

Question regarding additional information

12. What additional evidence would improve the ability to make a balanced long-term decision?

Confidence and sensitivity

76. The level of confidence in each of the criterion used in the cost benefit analysis varies depending on the availability of evidence. The confidence column in the table 2 below rates the level of confidence from 1 where confidence in the data is low to 5 where confidence is high. The following three columns give details of the assumptions that have been made in calculating the cost benefit. The final column shows the sensitivity of the cost benefit to changes in each criterion. Where the sensitivity score is low a change to the assumptions about that criterion produce only a small change to the overall NPV total for the model. Where the sensitivity score is high changes in that criterion have a large impact on the NPV total.

Table 2 to show level of confidence in each variable used in cost benefit analysis and the sensitivity of the model to changes in each variable.

Impact	Confidence	Data/assumption	Growth factor assumptions	Comment	Sensitivity impact
Inspections of commercial nurseries	5	Inspectors based on field data, industry time on assumption	Option 1: 5% pa Option 2: Constant for 5 years, then halves in Y6 and then to Option 1		
Diagnostics	5	Estimates from PHSI	As above		
Historic gardens clearance	3	Cost per outbreak from case studies	Assumed 10% growth on Option 1	Limited supporting evidence for 10% growth (but believed to be a conservative estimate)	High
Change in historic gardens visitor nos.	3	NA	Not really an economic issue but will have distributional effects (i.e. a problem for Cornwall gardens but a possible bonus to others)	Difficult to assess but little difference between options as susceptible species either die or are cleared	
Commercial nursery costs	3	Examples for value of plants in 2m zone from Horticultural Trades Association. Number of outbreaks estimates by PHD.	Option 1: affected nurseries increase from 27 to 54 to 81 and then flat. Option 2: double to 54 in Y1, decline to 7 per annum as still risk through trade	Range in number of affected nurseries could be included in sensitivity	
Rhodo clearance	4	Average cost estimated at £8k p ha (based on range of costs of completed clearance work)	Option 1 – no clearance Option 2: Fixed amount cleared per annum	Range of clearance costs could be included in sensitivity	
Export restriction	4	Value of susceptible exports (roses)	Option 1: Assumes 5 yr transition to find new markets.		
Woodlands	2	Ecosystem values based on FC 2003 study - best currently available. Amount lost due to PrPk assumed 10% of annual value	Rate of spread based on Forest Research's best guess for period for Cornwall to be fully infected = rate of spread between 14% and 55%	No supporting evidence for assumed proportion of value lost	High – rate of spread Medium - % of value lost
Heathlands	1	Values based on Eftec study (2007). Assumes 10% of value lost Starting value of 1 ha infected	Rate of spread same as for woodland	Potentially a problem if starting area of infection much larger. Range of initial infested area could be modelled	Medium Rate of spread could be high if higher initial infected area value
Rhodo clearance benefits	3	Dehnen-Schmutz <i>et al.</i> 2004 suggest some value from clearance. Assume 70% of clearance cost			Low

Confidence: 5 = highest, 1 = lowest

Notes on sensitivities: The overall sensitivity of a forecast to an assumption is a combination of two factors:

- the **model sensitivity** of the forecast to the assumption
 - the assumption's uncertainty
- The high-medium-low ranking here reflects the relative importance of those parameters modelled with ranges to the net present value forecast. Therefore, areas of most concern relate to those impacts with low confidence in the data and high sensitivity impact – highlighted in red.

77. Where a criterion scores low on confidence and high on sensitivity consultees should use that information to balance their judgement on the validity of the outputs of the costs and benefits for a particular option.

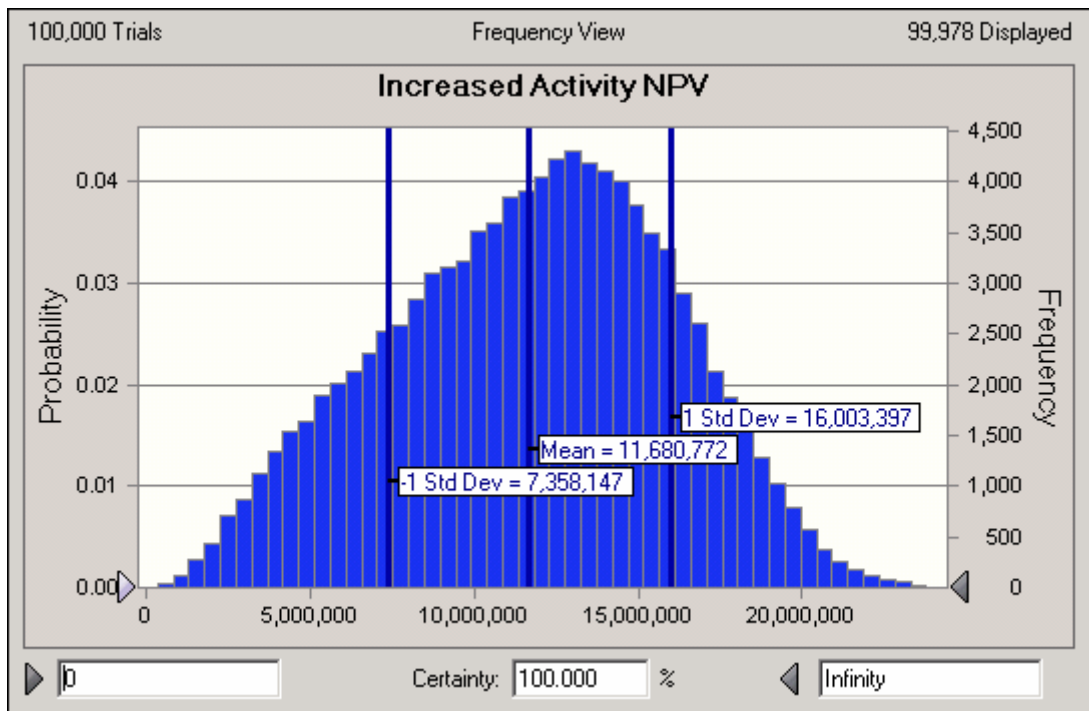
78. Table 3 Parameters used in sensitivity analysis

Variable	Single point value	Values for sensitivity
Cost increase to historic gardens	10% per annum	Minimum 5%, Likeliest 10%, Maximum 10%
Value of trees – proportion of ecosystem service lost	Recreation – 25%	Minimum 15%, Likeliest 25%, Maximum 35%
	Biodiversity – 25%	Minimum 15%, Likeliest 25%, Maximum 35%
	Landscape – 10%	Minimum 1%, Likeliest 10%, Maximum 15%
	Carbon sequestration – 10%	Minimum 1%, Likeliest 10%, Maximum 15%
Value of heathland	£500 per hectare lost	Low £500 = 80%, Medium £2,000 = 10%, High £6,000 = 10%
Proportion of heathland lost	10%	Minimum 5%, Likeliest 10%, Maximum 15%
Rate of spread	31%	Minimum 21%, Likeliest 31%, Maximum 41%
Value of rhododendron clearance	70% of clearance cost	Minimum 65%, Likeliest 70%, Maximum 125%

79. Table 3 above shows those model variables that were subject to the sensitivity modelling. The first column names the variable and the second column shows the single point estimate used for that variable in the model. The third column shows how each variable was allowed to vary within the sensitivity analysis. For all of the variables (apart from the value of heathland) this meant specifying minimum, maximum, and most likely values.

80. This Monte Carlo analysis involved running the model 100,000 times, each time taking a figure for each of these variables from the ranges above with numbers around the “likeliest” figure being used more often. The value of heathland used research that provided three values for such land type. The sensitivity used the lowest value for heathland for 80% of the 100,000 model runs and 10% each for the medium and high values.

81. The result of the 100,000 runs produces a histogram of outcomes of net present value. The chart below shows the NPV for the increased activity option. It shows the additional value provided by Option 2 over Option 1.



What is important to note is that the histogram does not cross zero on the x-axis (horizontal). This means that for all the sensitivities described in the above table, if all of the most benign of the impacts were to occur at the same time, Option 2 is still preferred to Option 1.

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	<i>Results in Evidence Base?</i>	<i>Results annexed?</i>
Competition Assessment	No	No
Small Firms Impact Test	Yes	No
Legal Aid	No	No
Sustainable Development	No	No
Carbon Assessment	No	No
Other Environment	Yes	No
Health Impact Assessment	No	No
Race Equality	No	No
Disability Equality	No	No
Gender Equality	No	No
Human Rights	No	No
Rural Proofing	Yes	No

Competition Assessment

82. Not applicable at this stage. It is thought unlikely that any of the options outlined above would directly limit the number or range of suppliers. There could possibly be indirect effects, through an increase in costs of some suppliers relative to others (e.g. nurseries with outbreaks), but it is unlikely the effect would be significant. The Horticultural Trades Association, which represents over 2,500 garden centres and other garden retail businesses, landscapers, growers and suppliers to the garden trade, has commented that growers continue to have a problem in getting over to landscape designers the implications of disease, and if a particular nursery opts out of supplying host material such as *Viburnum tinus* they are perceived as somehow being totally unprofessional as it is available in other UK and EU catalogues.

Small Firms Impact Test

83. We have been actively engaged in informal discussions with the Horticultural Trades Association, the National Farmers Union, the Royal Horticultural Society, the Confederation of Forest Industries (UK) Ltd. and individual nurserymen through the *Phytophthora* Industry Liaison Group. No indication of any significant impact on small businesses was identified from any of the three options set out above. We will gather further detailed data about likely impacts on small businesses as part of the consultation process.

84. Environmental Impact Test

1. Will the policy lead to a change in the emissions of greenhouse gasses?
No – some burning of *R. ponticum* may be necessary in the short term however the

emissions would be negligible and offset by new vegetation growing in its place.

2. Will the policy option be vulnerable to predicted effects of climate change?
Disease development and spread for both pathogens is favoured by mild and wet climates; areas most at risk are in the west of GB. Climate change may alter disease spread and development and change the areas at risk.
3. Will the policy option lead to a change in the financial costs or the environmental and health impacts of waste management?
No
4. Will the policy option impact significantly on air quality?
No
5. Will the policy option involve any material change to the appearance of the landscape or townscape?
Clearance of *R. ponticum* under option 2 would remove a non native invasive weed from infected woodlands opening the woodland understorey and benefiting biodiversity and indigenous species. Under option 1, the potential significant loss of trees may change the landscape through the loss of heathland and by changing the composition of mixed woodlands, removing woodland or access to woodland.
6. Will the proposal change
 - 1) the level of water pollution? – No
 - 2) levels of abstraction of water? – No
 - 3) exposure to flood risk? – No
7. Will the policy option disturb or enhance habitat or wildlife?
The clearance of *R. ponticum* would contribute to enhanced habitats as *R. ponticum* is considered to be an invasive non-native weed species in GB. *R. ponticum* will normally become very dominant, forming a dense impenetrable barrier which shades out all other vegetation. It has limited value for shelter and game cover and its removal can have significant beneficial effects on biodiversity and wildlife, and on the appearance of woodland, allowing trees and other vegetation to re-colonise which has beneficial consequences for wildlife. Under option 1 the potential increased loss of trees and heathland could have a significant negative impact on habitat and wildlife.
8. Will the policy option affect the number of people exposed to noise or the level to which they're exposed?
No.

Rural Proofing

85. Each of the options identified above will impact particularly to a greater or lesser extent on rural communities and businesses. We will seek to minimise the negative impact wherever possible. For example, rural communities, particularly in Cornwall, are dependent on historic gardens for employment and maintenance of the tourism industry at certain times of the year. In order to ease the impact on historic gardens of the enhanced eradication and containment measures under Option 2 the work could be managed over a longer time period (e.g. 5-6 years). This could allow gardens the opportunity to remain open and establish new plantings as part of a planned programme. This could, however, pose risks of the disease(s) spreading to surrounding areas which may already have been subject to earlier eradication or containment action if strict biosecurity measures are not maintained.