



Department
for Environment
Food & Rural Affairs

www.gov.uk/defra

Juniper: Management Guidelines

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Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

Contents

Document Scope	3
Introduction	5
Wider Environment	7
1.1 Existing Sites.....	7
1.2 Planting Juniper on New Sites	16
Ornamental plantings.....	18
2.1 Before planting	18
2.2 Biosecurity.....	18
2.3 Other susceptible hosts of environmental/commercial value.....	18
Trade	20
3.1 Awareness raising	20
3.2 Production of juniper under FRM.....	21
3.3 Plant and seed collection/plant maintenance for non-FRM.....	22
3.4 Reporting suspicious symptoms.....	22
Appendix 1: England.....	23
Appendix 2: Scotland	24
Appendix 3: Wales.....	25
Appendix 4: Useful links to websites, documents and organisations	26
Appendix 5: List of <i>P. austrocedri</i> -susceptible species (found +ve).....	29
Appendix 6: Description and ecological value (SNH).....	30

Document scope

Juniper is a declining species of ecological importance requiring ongoing conservation to maintain or improve populations. It is further threatened by the serious pathogen *Phytophthora austrocedri*, which requires measures to minimise its introduction and spread to unaffected areas, and to slow the spread at known infected sites.

Working in partnership, the Animal and Plant Health Agency (APHA), Forestry Commission, Forest Research, Natural Resources Wales, Natural England (NE), Science & Advice for Scottish Agriculture (SASA) and Scottish Natural Heritage (SNH) have developed these good-practice guidelines in support of juniper management.

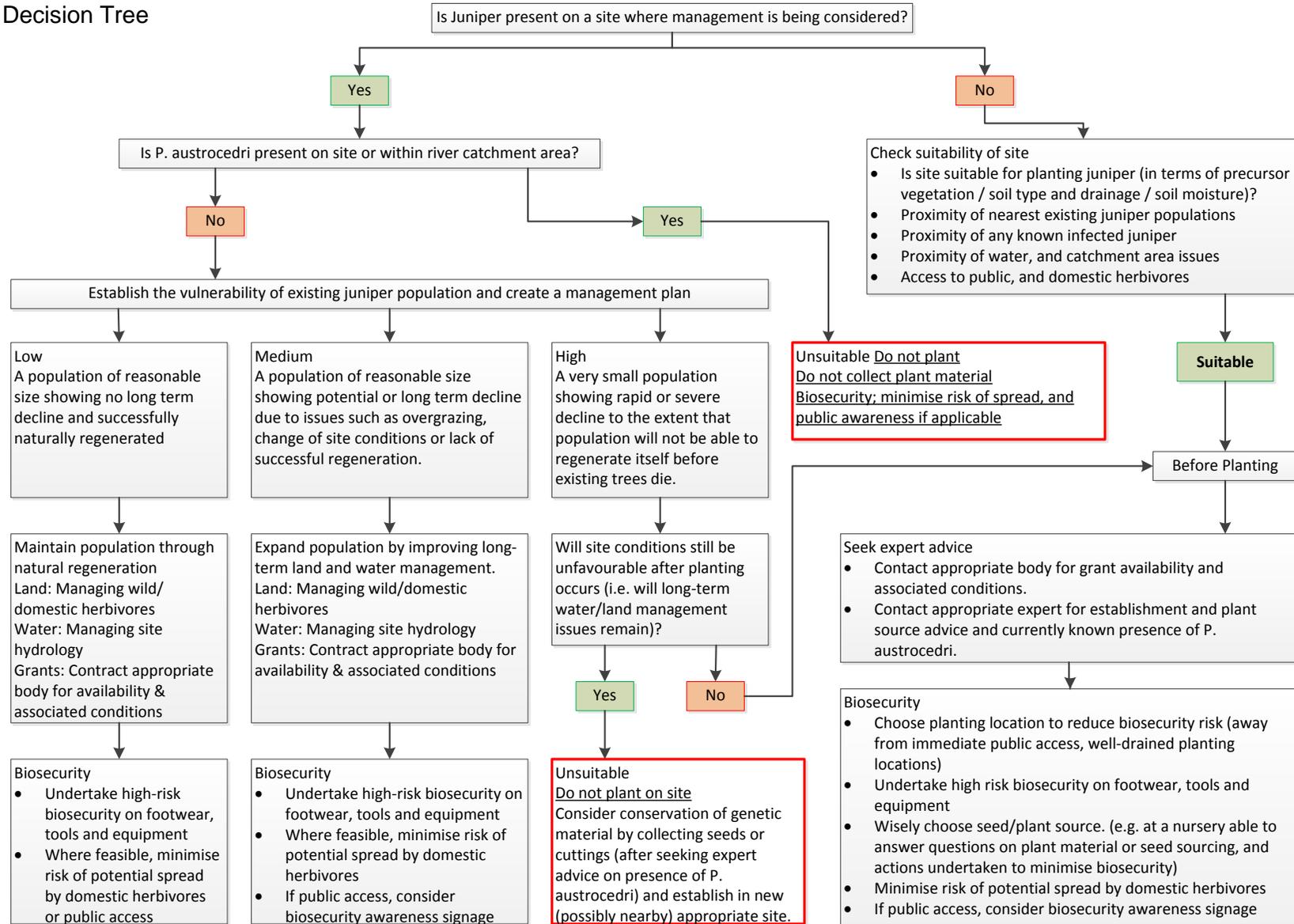
This document sets out a management approach for juniper across Great Britain, for encouraging its sustainability, identifying associated risks, and supporting land managers, conservation organisations and nursery trade in good practice. Juniper is an ecologically important species, and further information can be found in Appendix 6.

Where possible, existing populations of juniper should be managed to encourage the maintenance and expansion of the population through natural regeneration. Juniper should only be planted on sites which are suitable for it in terms of soil, precursor vegetation and site hydrology.

We have generated a decision tree on page 4 to help managers make informed decisions on the suitability of planting juniper on sites. This should be used to inform the decision about when planting is low-risk and suitable and where, given suitable changes in land and habitat management, juniper natural regeneration should be encouraged as a method of expanding and enhancing the population.

This includes biosecurity measures where *Phytophthora austrocedri*, is known or suspected to be present. Major responsibilities and tasks for implementing them are listed.

Decision Tree



Introduction

Juniper (*Juniperus communis*) is a priority species for conservation which has experienced significant decline across Great Britain in recent decades. It is one of only three native conifers in Britain, the other two being Scots pine and yew. It is found predominantly within native woodland mosaics in Scotland, whilst in England and Wales it is more common on non-woodland, “moorland” sites.

Juniper belongs to the family *Cupressaceae*, with two varieties of *Juniperus communis* recognised: *var. communis* and *var. saxatilis*.

Because it is a succession species in the wider environment, management practices are key to its maintenance and long-term sustainability.

Juniper populations are also at risk from the introduction of a fungus-like organism, *Phytophthora austrocedri*, which has been identified as the causal agent of significant juniper dieback and death in wider-environment populations in Scotland and England. It has also been found killing mature Nootka cypress (*Callitropsis nootkatensis*) at a public park in Scotland, and young hedgerow Lawson cypress (*Chamaecyparis lawsoniana*), also in Scotland. DNA of *P. austrocedri* has been detected in diseased nursery plants of *Juniperus* spp., Lawson cypress and Leyland cypress (*Cupressocyparis leylandi*).

Experiences of managing the disease once introduced, together with a review of the factors needed for healthy sustainable juniper, inform the decision tree.

The document recommends that:

- where possible, developing and maximising advantageous site conditions for existing wild juniper populations’ growth should be the priority activity;
- juniper planting to re-invigorate wild populations should be undertaken only where the above is proving impossible, where guidance from appropriate authorities is sought, and where an assessment is made of likely risks with suitable mitigations put in place before any planting is undertaken; and
- good biosecurity practices and awareness should be encouraged and supported in the plant trade, thereby reducing risks of spread from the plant trade and plant movement.

Statutory action requirements / Defra consultation

Following the first findings on juniper in 2011, statutory action was taken both in trade findings of *P. austrocedri* (destruction), and in the wider environment (primarily containment). Further surveillance was then undertaken to determine the distribution of *P. austrocedri* on juniper.

Surveys conducted to date have identified findings on juniper at a large number of geographically separate, wider-environment sites, primarily across Scotland and northern England, but also at a site in southern England. Given the widespread nature and the number of findings so far, the UK plant health authorities decided to bring forward the review of the existing policy, with feedback on proposals invited through a consultation process. This was completed in December 2015. A revised Pest Risk Assessment (PRA) was also undertaken by Forest Research in June 2015. This is available at

<https://secure.fera.defra.gov.uk/phiw/riskRegister/downloadExternalPra.cfm?id=4058>

The Defra review and consultation concluded that:

- statutory action would continue on plants in trade and in nurseries in order to manage the risk of introducing the pathogen into new areas;
- government agencies would continue to work in collaboration with conservation organisations and other stakeholders to mitigate the risk and protect unaffected areas where possible;
- at known infected sites, government agencies would continue to work in collaboration with conservation organisations, land managers and other stakeholders to mitigate the risk of spread; and
 - no statutory action would be carried out in parks, gardens and the wider environment.

However, the option remains to take statutory action in the wider environment in response to exceptional circumstances, such as new scientific evidence, or specific risks to localised situations being found. Further information is available at:

<https://secure.fera.defra.gov.uk/phiw/riskRegister/viewPestRisks.cfm?cslref=27216> .

Known distribution of *P. austrocedri*

A map of known locations of confirmed cases of *P. austrocedri* infections is available at www.forestry.gov.uk/paustrocedri.

Wider environment

The basic guidance within this document is condensed and presented as a decision tree on page 4. This is not exhaustive of all situations where juniper might be chosen as a species to plant on a site, but is intended to enable the land manager to focus on the reasons for planting juniper on that location initially. If juniper is not already present on a site, various considerations, including the advisability of seeking expert guidance, are recommended to assess the suitability of the site conditions before any planting takes place.

Where a juniper population already exists, a management plan should be created to establish whether that population is vulnerable, and if so, to what extent.

If a stand is not vulnerable, the recommendations would be for continued good management practices, avoiding the introduction of new planting material, and enabling successful natural regeneration.

Where a stand is vulnerable, the recommendations would centre on whether long-term good land management practices could restore the site to being suitable for juniper to naturally regenerate. This review should be undertaken before considering planting new plant material.

Note that infection of juniper by *Phytophthora austrocedri* is causing significant dieback and mortality in some areas. In considering any site for management, the proximity of known or suspected *P. austrocedri*-positive sites, together with its relationship in the local water catchment to the infected site, should be ascertained before proceeding. It is recommended that no planting should take place within a water catchment (either upstream or downstream) where *P. austrocedri* is known to be present on juniper.

1.1 Existing sites

1.1.1 Vulnerability - definition and extra information

Establishing the vulnerability of an existing population of juniper is an essential element in the creation of a long-term site management plan. The following aspects should be considered when deciding whether a site is vulnerable, and whether the level of vulnerability is low or high.

Population size – This guidance is not advising a cut-off point above or below an arbitrary number of juniper bushes on a site where different action should be taken. Instead it is important to consider the health, age and distribution of the population as contributory evidence of the longevity of a juniper stand. A smaller population with a good proportion of female plants producing a reasonable crop of cones (berries), with evidence of successful natural regeneration, is less vulnerable than a large stand with no natural regeneration.

Natural regeneration – Overgrazing and other changes in site conditions can lead to a lack of naturally regenerating juniper. If this situation continues over a number of years, older bushes can die, leading to an overall population decline, with a reduction in age class and genetic diversity on site.

Site conditions – Changes in local land management might mean that groundwater levels are raised, or nitrification might occur, rendering a once-suitable site for juniper unsuitable. Grazing by herbivores can change from being beneficial to having an adverse effect, and can be caused by various factors, such as herbivore populations growing too large, or previously transient herbivore grazing becoming permanent.

Accumulation of factors and speed of change – If a stand is severely affected by one or several of these factors, there is a risk that the population might eventually become extinct, also affecting the flora and fauna that are dependent or co-dependent on the existence of juniper in that location.

Designated sites – Natural England, Scottish Natural Heritage or Natural Resources Wales might wish to make a site-by-site assessment of benefits and risks in relation to the conservation objectives of designated sites, e.g. for Sites of Special Scientific Interest (SSSIs) and Special Areas of Conservation (SACs). You must consult the relevant body if planting is on or close to a site designated for juniper.

In summary, these guidelines suggest that where an established site is found to be healthy, the most appropriate management is to continue to maintain the population through natural regeneration alone.

Where a population is found to be vulnerable, but at a low level, the most appropriate management is to improve long-term land and water management to enable natural regeneration on the site to be successful once again.

Where a population is found to be highly vulnerable, but site conditions are in a state where juniper will eventually naturally regenerate again, management could include the introduction of new planted material, ideally making use of genetic material on the site.

If conditions are such that the site will **never revert to being suitable for juniper**, it is recommended that **planting is not attempted**. Instead, consideration should be given to establishing a population on a nearby suitable site (if possible) using approved [Forest Reproductive Material](#) (FRM) collected from that site.

For additional **country-specific guidelines** refer to Appendix 1 (England), Appendix 2 (Scotland) and Appendix 3 (Wales).

1.1.2 Land and water management

Consider the site hydrology, including water flows and drainage, because juniper prefers free draining, non-waterlogged conditions. Wet and waterlogged conditions also favour establishment and spread of *Phytophthora* spp., including *P. austrocedri*, with disease spread by zoospores swimming in water, on host plants, and through rain splash. Optimal site locations which reduce risks from *Phytophthora* are drier areas set above and well away from watercourses, spring lines and wetter parts of a site. Do not plant downstream or downslope of stands of plants known or suspected of being infected.

Also consider contacting appropriate authorities for the current availability of grant schemes which might support land improvement activities.

1.1.3 Managing wild and domestic herbivores

Juniper's decline in the uplands has been due to a combination of overgrazing, burning and afforestation of open sites, and other land use changes. Seedlings are particularly vulnerable to grazing by livestock and small mammals. Even when established, mature juniper bushes remain vulnerable to damage from rubbing by livestock and deer, and also to burning, which kills bushes.

In general, juniper management involves manipulating grazing and browsing levels. Restrict grazing at certain times of the year to maintain a balance between the native scrub and open areas. Light grazing with livestock (preferably cattle) in late summer and autumn, and none in the winter, allows for moderate scrub growth whilst maintaining open ground. This will benefit the associated wildlife, help protect soils, and store carbon.

In the uplands, overgrazing is mainly due to impacts from deer and sheep. Deer management might also be necessary to keep herbivore impacts within an acceptable level. Use the [woodland grazing toolbox](#) herbivore impact assessment method to assess whether this is required. Ideally, herbivore impacts should be assessed as no higher than 'low' according to the woodland grazing toolbox's herbivore impact assessment method. Sheep browsing can be addressed through stock fencing. However, managing wild deer browsing involves either reducing the local population to a level that will allow natural regeneration of juniper (about 1 deer/square kilometre) or deer fencing around the juniper.

The conditions which favour juniper regeneration are strongly related to grazing and disturbance levels. Although young seedlings are vulnerable to grazing, especially on intensively stocked land, the rank vegetation that results when no grazing takes place impedes regeneration by hindering the germination and establishment of young plants. In addition, if suitable grazing is unavailable or limited during the winter, livestock and wild mammals will browse juniper. Intensive winter stocking can also dislodge seedlings, making them more prone to drought and therefore more vulnerable to frost.

In general, conifers such as juniper are less able to survive browsing than are broadleaved trees because they store more of their nutrients in their leaves. Slow growth means that seedlings and saplings are more likely to be grazed to a standstill. Juniper is moderately palatable, and is preferred over birch, particularly in winter because it is evergreen.

The ideal conditions and actions for natural regeneration are:

- proximity to viable seed parents;
- patches of bare, lightly disturbed ground as a seed bed for germination;
- light summer grazing to reduce rank vegetation;
- protection from over-grazing and burning;
- when grown within a fenced area, the ground adjacent to fruiting bushes can be disturbed by removing vegetation by hand, or by the careful application of glyphosate in September.

These actions reduce competition from other species, providing the juniper with space to establish amongst other vegetation. Any seedlings should be protected against grazing for a couple of seasons; and

- shrub guards, which can be used around seedlings as protection from smaller browsing mammals.

Different regeneration microsite conditions are needed in different habitats. Different interventions or intensities of these appear to be required, depending on habitat type. Broadly, intense scarification or soil stripping is needed on calcareous grassland, while on dry heathlands light scarification is suitable. On upland acid grassland, cattle grazing and ground scarification do not reliably result in regeneration. Creation of favourable mossy regeneration microsites is unlikely following intervention, unless soil fertility is low. Land-use change, increased climate warming and pollution are pressures acting on *J. communis*, and might cause habitat loss and altered site conditions (e.g. soil fertility), making it difficult to create regeneration microsites at all *J. communis* sites. Other constraints on regeneration might operate (e.g. seed predation and low seed viability), and managers should assess population and site potential before undertaking management. (Broome et al, 2017)

1.1.4 Grants and appropriate bodies

Contact the appropriate country body to find out if there are any current grant schemes for which you might be eligible to apply.

In England, contact Natural England

W: www.gov.uk/government/organisations/natural-england/services-information

E: enquiries@naturalengland.org.uk

T: 0300 060 3900

In Wales, contact Natural Resources Wales / Cyfoeth Naturiol Cymru

<https://naturalresources.wales/?lang=en>

In Scotland, agri-environment support is available to manage juniper scrub through the Scottish Government's Rural Payments Scheme, with additional supporting guidance.

<https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/> (general enquiries)

<https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/managing-scrub-of-conservation-value> (juniper scheme)

Grants might also be available through Forestry Commission Scotland:

<http://scotland.forestry.gov.uk/supporting/grants-and-regulations>

1.1.5 Biosecurity - all sites

Biosecurity measures to protect an existing stand of juniper from the introduction of *P. austrocedri* must be pragmatic and feasible for each site. In some cases it might not be possible to implement any additional measures, but in others one or a combination of the suggestions below can be put in place.

Awareness signage – If a footpath, bridleway or track etc. passes close to or through a juniper stand, awareness information recommending that visitors keep to paths and undertake basic biosecurity after completing their walk could be effective.

Contractor and worker awareness – If workers might be entering or working near a stand of juniper (e.g. for fencing or drainage works) it is important that they are aware of the biosecurity risks of arriving on site with potentially contaminated equipment and machinery. Ensure all machinery and equipment is cleaned down thoroughly to remove all traces of soil and plant debris and disinfected before entering the site, and again before leaving it.

Herbivore management – If stock is being brought to a site, and they have come from an area where they might have grazed amongst juniper infected with *P. austrocedri*, where practicable, carry out a short period of “quarantine” in a field (away from the juniper site) to reduce the likelihood of contaminated soil or plant material being carried onto the juniper site.

Site management – if activities need to take place within or close to juniper populations, try to organise work so that the juniper area is visited first, reducing the chance of transferring contaminated soil or plant material to the site. Equipment and machinery should be cleaned again (where practicable) of accumulated mud before returning to the juniper. If possible, avoid multiple site visits in the same day, and if this is not possible, visit clean sites first.

Fencing and path management – In some cases juniper could be enclosed to prevent access by herbivores and the public. When planning long-term site management, it might also be feasible in some cases to redirect public footpaths away from juniper populations, or to block informal paths.

1.1.6 Plant and seed collection

1.1.6.1 Forest Reproductive Material (FRM)

If juniper plants or seed are intended for marketing as [Forest Reproductive Material](#), a collector can voluntarily register with the Forestry Commission as a supplier under the Voluntary Scheme for the Certification of Native Trees and Shrubs. There is no legal requirement to do this, because juniper is not a species which is controlled for forestry purposes under the FRM regulations. The voluntary scheme allows collectors to certify their native seed or cuttings through the Forestry Commission without charge. The procedures for the scheme are exactly the same as those for the species which are controlled for forestry purposes.

The scheme provides a system for the identification and control of seeds, cuttings and planting stock used for forestry purposes in Great Britain. This is defined as “woodland planting of any description for any forestry purpose, including timber production; forests and woodlands for tourist,

recreational, sporting, educational or amenity purposes; and the conservation and enhancement of the forest and woodland environment”.

Its purpose is to ensure that planting stock is traceable through the collection and production process to a registered source of basic material (e.g. trees from which the seed is collected or cuttings taken). This allows those who buy FRM to have sufficient information about the material being bought, such as its provenance and origin.

The actions required of seed collectors and tree suppliers are to [register](#) with the Forestry Commission as an FRM supplier, to notify the Commission of their intention to collect seed or cuttings at least 14 days beforehand, and then to apply to the Commission for certification within nine months of the collection.

1.1.6.2 Seed collection guidelines

Given the value of juniper, and that infection might not be visible in the earlier stages, it is advisable to implement appropriate biosecurity precautions at **all** sites of collection. It is also advisable to contact relevant plant and tree health authorities to ascertain whether there is known infection in the area.

- Before collection, decide how many berries are needed and stick to this, to reduce the chance of collecting juniper berries at random.
- Check juniper plants for suspicious symptoms before collecting berries, and avoid any plants showing potential symptoms of *P. austrocedri*.
- Only collect ripe purple/black berries, and leave the green berries to the following year.
- Collecting berries from juniper sources not known to be infected is the safest plant health choice.
- At collection time, apply standard biosecurity, preferably cleaning down footwear and tools before and after collection, because people might well be visiting or have visited other juniper stands. <https://www.forestry.gov.uk/forestry/inf-d-9fjd2d>
- Collect from juniper plants away from suspected or known infected areas or plants.
- Collect juniper berries from a minimum of 1m above or from the soil surface, and from “drier” areas or raised areas within the site.
- Minimise the amount of foliage and brash included in the collections. Where possible, avoid stripping branches to obtain berries/cones, and prevent needles or small branches being transported off the site.
- Keep collected lots separate and labelled.
- Keep records of lots or batches collected from each site sampled, so that subsequent plants grown from collected juniper berries can be identified and traced forwards and backwards.

- If seed is being used to raise juniper plants, conduct close surveillance of the progeny.
- DNA of *P. austrocedri* has been detected in the flesh of juniper berries, and on seed. During seed extraction it is therefore recommended that berry flesh is soaked in a 10% domestic bleach solution before discarding. Seed should be air dried at room temperature before storage or scarification.

1.1.7 Protecting genetic resources

A long-term research goal is to look at the genetic diversity of juniper, and the potential for natural, heritable resistance to *P. austrocedri*. This, it is hoped, will inform greater understanding and future management.

1.1.8 Before planting – evidence and advice

Before planting, seek expert advice and review, and satisfy yourself that all other options have been explored, and that risks through planting have been identified.

1.1.9 Planting in woodland

It is a condition of some native woodland planting schemes that grant payment will apply only if plants are supplied with documentation to show that they have been produced under the Voluntary Scheme for the Certification of Native Trees and Shrubs. (See section 1.6.) The purpose of the scheme is to ensure that planting stock is traceable through the collection and production process to a registered source (e.g. trees from which the seed is collected or cuttings have been taken), and that the plants have been derived from parent material from a region of provenance close to the planting site.

When the Forestry Commission is notified about an intention to collect seed or cuttings it can check whether *P. austrocedri* is known to be present at the collection site. If the disease is known to be present, the collections from these infected sites will not be certified through the voluntary scheme. This allows those who buy FRM with suppliers' documentation to be confident about the health of, and the information about, the material being sold, such as its provenance and origin. For further information see [Forestry Commission Practice Note 8 'Using local stock for planting native trees and shrubs'](#).

Further information about FRM is available at www.forestry.gov.uk/frm .

1.1.10 Sites where *P. austrocedri* is present or suspected

Symptoms

These include foliar dieback, and stem and collar lesions. When roots and stem bases are infected the foliage initially appears a lighter colour, then it becomes bronzed, and branches or entire bushes die. Removing the outer bark around stem lesions will expose the inner, darker staining.

Physical or environmental conditions can also result in browning of foliage, but there will be no associated lesions. For further information visit www.forestry.gov.uk/paustrocedri .

Juniper populations in the wider environment affected by *P. austrocedri* have been identified in the Lake District, Yorkshire Dales, Wiltshire and many sites in Scotland, with infected ornamental juniper identified in locations across Britain, including a number of nurseries.



Infected juniper showing foliage turning bronze.

Reporting

It is important to be vigilant for early symptoms which might indicate infection, and to report to and seek advice from the following authorities.

In England and Wales - the Plant Health & Seeds Inspectorate (PHSI) of Apha

E: planthealth.info@apha.gsi.gov.uk

T: 01904 405138

W: www.gov.uk/government/organisations/animal-and-plant-health-agency/about/access-and-opening

In Scotland – the Scottish Government’s Horticulture & Marketing Unit (part of SASA)

E: hort.marketing@gov.scot

W: www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

Suspected infections in woodland anywhere in Great Britain can be reported using the Forestry Commission’s Tree Alert disease reporting tool.

www.forestry.gov.uk/treealert

Biosecurity

Given the importance of native juniper, actions to minimise the spread of *P. austrocedri* (and other potential pests and diseases) is a key factor. Although no statutory actions are now required in the non-trade situation, following the biosecurity recommendations set out in sections 1 and 2 of this document will assist in reducing the risk of spread. In addition:

- erect information signs explaining what is happening and why, and how the public can help;
- keep dogs under close control or on a short lead in the infected area;
- continue to prohibit the removal of juniper plant material and soil from the infected area unless safe disposal of material is achieved by double-bagging (or placing it in enclosed containers) and transporting it the minimum distance for licensed incineration or non-hazardous landfill at permitted facilities;
- leave infected juniper bushes in situ if possible, or cut them off at ground level to minimise soil erosion and disturbance. The cut juniper material can then be burned in a controlled manner. This should be in a controlled open fire in situ (subject to not creating a nuisance and not burning more than 10 tonnes of plant material in a 24-hour period);
- do not compost infected plants;
- for juniper bushes with recent infection, ring barking at ground level can help reduce soil inoculum levels by killing the host juniper bush more quickly than natural disease progression can;
- assess the healthy and diseased juniper bush locations and create a cordon sanitaire, taking into account the topography and hydrology to limit movement between plants by ground water;
- consider carrying out destructive actions on the leading edge of the infection to help protect healthy plants, and then work towards infected plants; and
- follow best practice biosecurity guidance each time a visit is made.

Further information on biosecurity measures can be found at:

www.forestry.gov.uk/forestry/inf-d-8zjmq4 (general);

www.forestry.gov.uk/forestry/beeh-9z9dbr (biosecurity e-learning module);

www.nonnativespecies.org/elearning/ (biosecurity e-learning module); and

www.forestry.gov.uk/england-keepitclean .

1.1.11 Plant health and site management plans

It is recommended that a plant health management plan (PHMP) is drafted, or a specific section on plant health incorporated into any existing or proposed site management plan. This enables site plant health risks, and risks from site activities, to be identified, and mitigations put in place, particularly when *P. austrocedri* infection is suspected or confirmed at the location. Plant health authorities will be able to assist in this process.

1.12 Implementation of guidelines across countries

Refer to Appendices 1, 2 and 3 for additional country-specific guidelines.

1.2 Planting juniper on new sites

1.2.1 Checking site suitability

Refer to the decision tree on page 4, and also consider the points raised in section 1.1 of this document.

1.2.2 Before planting - seeking expert advice

Contact relevant authorities to discuss, and to ensure inclusion of, country-specific and local requirements.

1.2.3 Biosecurity

Biosecurity measures to protect a newly established stand of juniper from *P. austrocedri* might be easier to implement on a new

site, because contributing factors can be taken into consideration before planting takes place. Consideration should be given to the points below.

Plant sourcing – *P. austrocedri* is occasionally found during routine inspections of nurseries on ornamental *Juniperus* spp., along with some other species. A nursery which grows specifically for the forestry market, and which grows all of its stock on site, is less likely to accidentally transfer exotic *Phytophthora* spp. than a nursery which frequently imports ornamental stock. In addition, it should be possible to question a forestry nursery to ascertain where the FRM used to grow juniper was collected. Our scientific understanding of how *P. austrocedri* is transferred is still not complete, and scientists from Forest Research have detected *P. austrocedri* DNA on the surface of berries/cones. Therefore this guidance currently recommends great caution in the choice of nursery, and using FRM which was obtained from an area of juniper known to be uninfected. Where possible a nursery can hold over juniper plants for an additional year to see whether they develop any symptoms.

Audit trail, recording and monitoring – Keep records of plant supplier, lots or batches, and places and dates they are planted; assess establishment rates and consider planting individual batches separately; and monitor regularly as appropriate.

Fencing and path management – If footpaths already exist on site, it is logical to not plant juniper close to locations with public or regular foot traffic. Footpaths which are waterlogged or very muddy could be managed and improved by relocation to drier areas, or by the addition of drainage, membrane and scalplings. If juniper is planted within fenced enclosures to protect plants from future grazing pressure, ensure there is a buffer of at least several metres between the fence and the planted juniper to allow space for natural regeneration, and to prevent stock from getting too close to the plants.

Site hydrology – *Phytophthora* spp. are water-borne, and their zoospores swim to host plants. Therefore the optimal site location to prevent a potential *Phytophthora* attack would be on drier

areas set above and well away from watercourses and wetter parts of a site. Do not plant downstream or downslope from known or suspected infected stands of plants.

Contractor and worker awareness – If workers might be entering or carrying out activities near a newly established stand of juniper (e.g. for fencing and drainage works) it is important that they are aware of the biosecurity risks of arriving on site with potentially contaminated equipment and machinery. Ensure all machinery and equipment is cleaned down thoroughly to remove all traces of soil and plant debris before entering the site and at least cleaned again before leaving it, then disinfected again before the next use.

Herbivore management – If stock is being brought to a site from an area where they might have grazed amongst juniper infected with *P. austrocedri*, where practicable hold them for a short period of “quarantine” in a field to reduce the likelihood of contaminated soil or plant material being carried onto the juniper site.

Site management – If activities need to take place within or close to juniper populations, try to organise work so that the area is visited first, reducing the chance of transferring contaminated soil or plant material to the site, and then clean equipment and machinery (where practicable) of accumulated mud before returning to the juniper. If possible, avoid multiple site visits in the same day, but if this is not possible, visit clean sites first, then infected sites.

Ornamental plantings

2.1 Before planting

Consider site conditions (e.g. ensuring well drained soils), plant provenance and an appropriate quarantine period, and be aware of other susceptible species which might facilitate cross-introduction to juniper. Refer also to the decision tree on page 4, and consider points raised in section 1.1.

2.2 Biosecurity

A number of factors should be considered:

Plant sourcing – *P. austrocedri* is occasionally found during routine inspections of trade premises, on *Juniperus communis* and on ornamental *Juniperus* spp., along with some other known host species listed in Appendix 5. A nursery which grows all of its stock in situ might be less likely to accidentally import exotic *Phytophthora* spp. than a nursery which frequently imports ornamental stock (whether directly from abroad or from other UK nurseries). Our scientific understanding of the host range of *P. austrocedri* is incomplete. Therefore at this time this guidance currently recommends great caution with choice of nursery, and purchasers should establish provenance and information about nursery practices. (See list in section 3.) It is also good practice to avoid introduction of known *P. austrocedri* host species directly into an ornamental bed, but to retain them in quarantine for a whole growing season to allow an opportunity for symptoms to appear should the planting material be infected.

Site hydrology – *Phytophthora* spp. are water-borne, and their zoospores swim to host plants. Therefore optimal site location to prevent a potential *Phytophthora* attack would be on drier areas set above and well away from watercourses and wetter parts of a site. Do not plant downstream/downslope from known or suspected infected stands of plants.

Contractor and worker awareness – If gardeners or arboriculture workers might be working on site, it is important that they are aware of the biosecurity risks of arriving or leaving site with potentially contaminated equipment and footwear and carry the necessary equipment to undertake everyday biosecurity precautions.

2.3 Other susceptible hosts of environmental/commercial value

Lawson cypress (*Chamaecyparis lawsoniana*), which is planted in amenity situations, is an important conifer in the UK ornamental nursery plant trade. It is also planted as a minor forest species, and this role could increase in response to future climate change and resilience planning.

Nootka cypress is occasionally planted as an ornamental tree in the UK.

Leyland cypress (*Cupressocyparis leylandii*), hybrids of Nootka cypress, and the Monterey cypress (*Cupressus macrocarpa*; syn. *Callitropsis macrocarpa*) are fast-growing and much-planted for hedges and screens. This makes them important elements of conifer production in the UK ornamental nursery plant trade.

Creeping juniper (*Juniperus horizontalis*) is a low-growing shrub native to northern North America. Numerous cultivars of this species are grown as ornamental plants in gardens across the UK, and they are commonly found in the nursery plant trade.

Trade

3.1 Awareness raising

Juniper plants can be found moving in trade, for ornamental plantings, landscape plantings and, potentially, for habitat creation and supplementary planting. This section is aimed at people who are collecting juniper berries or growing juniper for sale. It might also be useful for land managers who are growing their own stock, and also for those ordering juniper plants, so that they can ask the supplying nursery for information about the plants and how they have been grown. The gin industry also sources berries which offer local provenance, and the biosecurity measures relating to collection should also be noted. (Refer to 1.6.2.)

It is worth noting that symptoms of *P. austrocedri* infection can take some time to develop, and that once introduced into a wider-environment site the disease is unlikely to be eradicated. Therefore for those growing juniper for sale, land managers growing their own stock, or clients wishing to purchase stock, the following measures are recommended.

- Familiarise yourself with *P. austrocedri* symptoms on juniper and other host species (see 1.10 and Appendix 5.)
- If sourcing plants from other nurseries or the European Union, consider requiring freedom from fungicide treatment for a minimum of six weeks before delivery. Fungicides mask infection, which might become evident at a later date.
- Isolate new batches for several weeks, and keep different batches separate and labelled with full supplier details.
- Grow batches in one location and do not mix or bulk batches at any time. (This avoids cross-contamination if a batch is infected.)
- Ensure full traceability by keeping records of origin and provenance of seeds and cuttings, planting sites, growing media, inspection and testing history, and any fungicide and pesticide treatments.
- Minimise the risk of cross-infection by keeping juniper separate from other susceptible hosts being traded (see appendix 5) such as Lawson cypress, Leylandii and Nootka cypress.
- Keep third-country plant imports and junipers from EU countries separate from UK-provenance juniper plants.
- Grow plants in drier conditions on hard standing areas; use trickle irrigation; minimise water splash; and don't allow plants to stand in pools of water.
- Ensure plants are well spaced to allow the air to circulate.
- Avoid using re-circulated water on juniper plants.

- Use new compost, do not re-use compost, and do not use soil which might already be contaminated.
- Conduct regular inspections for symptomatic plants.
- Before propagation from stock, consider testing plants and seed for *P. austrocedri*.
www.fera.co.uk/crop-health/popular-services/crop-testing-1.html
- Weed out weak plants and destroy, and do not compost.

P. austrocedri is notifiable, and statutory action is taken on traded plants on confirmation of a positive finding. Any suspect symptoms in trade must be reported to:

- England and Wales – the Plant Health & Seeds Inspectorate (of Apha)
E: plant.health@apha.gsi.gov.uk
T: 01904 405138
- Scotland - Scottish Government's Horticulture & Marketing Unit (part of SASA)
E: hort.marketing@gov.scot
W: www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

3.2 Production of juniper under FRM regulations

It is a condition of some native woodland planting schemes that grant payment will apply only if plants are supplied with documentation to show that they have been produced under the Voluntary Scheme for the Certification of Native Trees and Shrubs. (See section 1.6.) The purpose of the scheme is to ensure that planting stock is traceable through the collection and production process to a registered source (e.g. trees from which the seed is collected or cuttings have been taken).

When the Forestry Commission is notified about an intention to collect seed or cuttings it can check whether *P. austrocedri* is known to be present at the collection site. If the disease is known to be present, collections from these infected sites will not be certified through the voluntary scheme. This allows those who buy FRM to have sufficient confidence in the health and the information about the material being bought, such as its provenance and origin.

Growers can specify seed or cuttings which have been certified through the voluntary scheme. This is an advisable precaution to avoid the disease being unintentionally introduced into nurseries and then onto planting sites. In the unlikely event that problems do arise with certified material it would then be possible to trace material back to its origin, and to then to follow up by tracing forwards to any other consignments of seed or cuttings which might also have become contaminated.

Growers who wish to market juniper plants as FRM can voluntarily register with the Forestry Commission as a [supplier](#) under the Voluntary Scheme for the Certification of Native Trees and Shrubs. There is no legal requirement to do this, because juniper is not a species which is controlled for forestry purposes under the regulations. The voluntary scheme allows collectors to certify their native seed or cuttings through the Forestry Commission without charge. The procedures for the scheme are exactly the same as those for the species which are controlled for forestry purposes.

Suppliers' documents must be issued whenever marketing takes place at any stage in the production of planting stock, and not just when the original collector markets seed or cuttings.

3.3 Plant and seed collection, and plant maintenance for non-FRM

If collecting seed for propagation, see guidelines and information in section 1.6.2.

If collecting plant cuttings for propagation, be aware of the risks from *P. austrocedri*. See section 1.6.2.

Follow good-practice guidelines for raising and maintaining nursery stock, and consider separating juniper from other susceptible host species to reduce risk of introduction and spread. (See section 3.1.)

3.4 Reporting suspicious symptoms

If a quarantine pest or disease is suspected, or there are concerns about symptoms observed, you must contact your plant health authority. Refer to 3.1 for details.

Appendix 1: England

In England, management and prioritisation of juniper on wider-environment sites is undertaken on a site-by-site basis. Please contact the responsible body for further information and advice.

Natural England

W: www.gov.uk/government/organisations/natural-england

E: enquiries@naturalengland.org.uk

T: 0300 060 3900

NB: if a quarantine pest or disease is suspected in any situation, please contact

The Plant Health & Seeds Inspectorate (PHSI) of Apha

T: 01904 405138

E: planthealth.info@apha.gsi.gov.uk

W: www.gov.uk/government/organisations/animal-and-plant-health-agency

Suspected infections in woodland can be reported to the Forestry Commission with its Tree Alert on-line disease reporting tool at www.forestry.gov.uk/trealert . Note that a clear, well lit, close-up photograph of the symptoms is required for Tree Alert reports.

Appendix 2: Scotland

Planting zones approach

In Scotland the management and prioritisation of juniper sites is undertaken on a zoning basis. Please contact the responsible body for further information and advice.

The main situation where juniper is planted is to conserve and expand wild populations of juniper through:

- woodland creation or management schemes carried out by Forest Enterprise Scotland* on the National Forest Estate (NFE**), or by other woodland owners supported by grants;
- planting on moorland or in woodland areas which are not supported by grants; and
- planting in mitigation of developments such as wind farms.

The juniper programme published by Forestry Commission Scotland sets out a strategy based on three zones, which includes advice on the use of planting. Further information can be found at

[www.forestry.gov.uk/pdf/juniper-planting-guidance.pdf/\\$file/juniper-planting-guidance.pdf](http://www.forestry.gov.uk/pdf/juniper-planting-guidance.pdf/$file/juniper-planting-guidance.pdf)

*The land management division of Forestry Commission Scotland

**The land managed by Forest Enterprise Scotland.

Reporting

NB: if a quarantine pest or disease is suspected in trade (e.g. in nurseries or garden centres) or in parks, gardens and similar, please contact the Scottish Government's Horticulture & Marketing Unit (part of SASA).

E: hort.marketing@gov.scot

W: www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

Suspected infections in woodland can be reported to the Forestry Commission with its Tree Alert on-line disease reporting tool at www.forestry.gov.uk/treealert. Note that a clear, well lit, close-up photograph of the symptoms is required for Tree Alert reports.

Appendix 3: Wales

In Wales, management and prioritisation of juniper on wider-environment sites is undertaken on a site-by-site basis. Please contact the responsible body for further information and advice.

Natural Resources Wales

<https://naturalresources.wales/treehealth>

treehealth@cyfoethnaturiolcymru.gov.uk

NB: if a quarantine pest or disease is suspected in any situation, please contact

The Plant Health & Seeds Inspectorate (PHSI) of Apha.

T: 01904 405138

E: planthealth.info@apha.gsi.gov.uk

W: www.gov.uk/government/organisations/animal-and-plant-health-agency

Additional information

A survey of wider-environment juniper sites carried out by Natural Resources Wales in 2014-15 did not detect any sites with *P. austrocedri*.

Inspection of juniper in trade, ornamentals and wider environment continues to be carried out by the PHSI.

Wales is also home to the *Juniper communis* sub-species *nana*, an important component of montane heaths.

Any findings of, and responses to, *P. austrocedri* in the wider environment will be considered on a case-by-case basis.

Appendix 4: Useful links

Rapid PRA *P. austrocedri*

<https://secure.fera.defra.gov.uk/phiw/riskRegister/viewPestRisks.cfm?cslref=27216>

Symptoms guidance

www.forestry.gov.uk/paustrocedrae

Biosecurity guidance

<http://www.forestry.gov.uk/biosecurity>

www.forestry.gov.uk/forestry/bee-h-9z9dbr (e-learning)

www.nonnativespecies.org/elearning/

Government Plant Health Information Portal

<https://planthealthportal.defra.gov.uk/>

Competent authorities and advisory organisations

APHA Plant Health & Seeds Inspectorate (PHSI)
Room 10GA02/04
The National Agri-food Innovation Campus
Sand Hutton
York YO41 1LZ

T: 01904 405 138

E: planthealth.info@apha.gsi.gov.uk

Forestry Commission England
620 Bristol Business Park
Coldharbour Lane
Bristol BS16 1EJ

T: 0300 067 4000

E: fe.England@forestry.gsi.gov.uk

Forestry Commission Scotland
Silvan House
231 Corstorphine Road
Edinburgh EH12 7AT

T: 0300 067 6156

E: fcscotland@forestry.gsi.gov.uk

Forestry Commission Cross-Border Plant Health Service
Silvan House
231 Corstorphine Road
Edinburgh EH 12 7AT

T: 0300 067 5155
E: plant.health@forestry.gsi.gov.uk

Forest Research in England
Alice Holt Lodge
Farnham
Surrey GU10 4LH

T: 0300 067 5600
E: research.info@forestry.gsi.gov.uk

Forest Research in Scotland
Northern Research Station
Roslin
Midlothian EH25 9SY

T: 0300 067 5900
E: research.info@forestry.gsi.gov.uk

Forest Research in Wales
Thoday Building
Deiniol Road
BANGOR
Gwynedd LL57 2UW

T: 0300 067 5774
E: FRiW@forestry.gsi.gov.uk

Natural England (Enquiries)
County Hall, Spetchley Road
Worcester
WR5 2NP

T: 0300 060 3900
E: enquiries@naturalengland.org.uk

Natural Resources Wales / Cyfoeth Naturiol Cymru
c/o Customer Care Centre
Ty Cambria
29 Newport Rd
Cardiff CF24 0TP

T: 0300 065 3000
E: enquiries@naturalresourceswales.gov.uk

Scottish Government Horticulture & Marketing Unit
Science & Advice for Scottish Agriculture (SASA)
Roddinglaw Road,
Edinburgh EH12 9FJ

T: 0131 244 8935

E: hort.marketing@gov.scot

www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

Scottish Natural Heritage (SNH)
Great Glen House
Leachkin Road
Inverness
IV3 8NW

T: 01463 725000

E: enquiries@snh.gov.uk

Appendix 5: List of *P. austrocedri*-susceptible species (found +ve)

(* indicates Koch's postulates completed)

**Austrocedrus chilensis*

**Callitropsis (syn Chamaecyparis) nootkatensis*

Chamaecyparis lawsoniana

Cupressocyparis leylandii

**Juniperus communis*

Juniperus horizontalis

Juniperus x media

Juniperus squamata

Juniperus chinensis

**Juniperus communis ssp. Nana*

Juniperus communis ssp. Communis

Juniperus communis ssp. Alpine

Libocedrus chilensis

Appendix 6: Description and ecological value (SNH)

Common juniper (*Juniperus communis*) description and ecological value

Common juniper (*Juniperus communis* L.) is a conifer with a variable habit and complex taxonomy, belonging to the family *Cupressaceae*, and ranging from low-spreading shrubs to upright trees.

Recent taxonomic changes have recognised that there are currently two varieties in Britain: *var. communis* and *var. saxatilis*, which replace three sub-species: *communis*, *nana*, and *hemisphaerica* (Farjon and Filer, 2013; Farjon, 2015).

- *Juniperus communis* L. *var. communis*
= *J. communis* ssp. *communis* (synonym)
= *J. communis* ssp. *hemisphaerica* (Jacq. & C. Presl)(synonym)
- *Juniperus communis* L. *var. saxatilis* Pall.
= *J. communis* ssp. *nana* (Willd.) Syme (synonym)
= *J. communis* var. *nana* (Willd.) Baumg. (synonym)

Further information is available at

http://www.plantlife.org.uk/application/files/7614/8958/6210/JUNIPER_DOSSIER_13_2_17_CS.pdf .

Common juniper is a native component of the British flora, but has a transglobal distribution in the north temperate and sub-Arctic zones (More & White). It is found on basic and acidic soils in a wide range of habitats, including chalk downland, heather moorland, oceanic heaths, rocky slopes and in *Betula*, *Quercus* and *Pinus* woods. Continuous grazing by sheep prohibits regeneration, and this, combined with the reduced seed viability of older plants, limits the opportunities for natural regeneration.

In Britain it has an important dependent specialist species fauna. It is a UK BAP species, and in England an S41 priority species. It has its own insect fauna.

Bushes grow in a patchy cover with some more open areas and others where the bushes form a virtually impenetrable thicket (Rodwell). It is a main component of the National Vegetation Community (NVC) W19 *Juniperus communis* ssp. – *Oxalis acetosella* woodland, and appears in others. It is the main upland scrub species, and hence probably important for breeding birds in the uplands, and it is an important part of the upland plant community. In the lowlands, the grassland communities which support juniper are frequently species-rich themselves.

Juniper bushes are either male or female. Female bushes have small, blue-black or green berries (which, strictly, are cones or 'galbuli'). Male bushes produce minute flower cones in spring, with abundant pollen. Berries ripen 2-3 years after pollination. They fall to the ground, where they might

be eaten by birds and mammals, which then disperse the seeds. In the lowlands, migrant thrushes such as fieldfare, redwing and mistle thrush are particularly responsible. Seedlings are slow growing and take 4-9 years to reach sexual maturity. Juniper can also spread locally by layering (a means of vegetative reproduction) (Plantlife).

Juniper berries and shoots provide a food source for birds and mammals. The plant supports more than 50 insects, such as the juniper shield bug, juniper aphid and juniper carpet moth. Studies show that the larger the population of juniper, the greater the diversity of insect species it supports. More than 40 species of fungi are either entirely or partially dependent on juniper, and its stems and branches can support a range of lichens and bryophytes.

The rare and critically endangered ssp. *hemisphaerica* (*Juniperus communis* L. var. *communis*), although reportedly also found on mountains in southern Europe, might well prove to be unique to Cornwall, and only survives as a tiny population on one small area.

The BSBI 'A Vascular Plant Red List for England' lists juniper at 'least concern' (LC) in England and 'near threatened' (NT) in Great Britain.

GB Red List status	Taxon	England Red List status	Threat criteria	% AOO decline	% EOO decline	Number of locations	Population estimate	European edge of range?	England endemic?	England near endemic?
LC	<i>Juniperus communis</i>	NT	A2c AOO and EOO trend	20	24					
LC	<i>Juniperus communis</i> subsp. <i>communis</i>	NT								
CR	<i>Juniperus communis</i> subsp. <i>hemisphaerica</i>	CR	D			1	13			
LC	<i>Juniperus communis</i> subsp. <i>nana</i>	DD								

A Vascular Plant Red List for England

International responsibility?	Proportion (%) of GB hermits in England	Native archaeophyte	Comments
			Assumed NT as species.

Juniper has declined across Britain in recent years: in the lowlands, surviving populations have shown declines in abundance of up to 84%, many colonies having dwindled to such an extent that they are functionally extinct (Wilkins and Duckworth 2011). Juniper is declining across most of its geographic area in England: its stronghold was Cumbria until *Phytophthora austrocedri* became established.

The importance of juniper in Europe is acknowledged by its listing in Annexe 1 of the European Habitats Directive (H5130 *Juniperus communis* formations on heaths or calcareous grasslands).

http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

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Appendix 1 – list of invertebrates associated with juniper: from Biological Records Centre NBN.

Invertebrate order	Invertebrate family	Invertebrate subfamily	invertebrate
Diptera	Cecidomyiidae		<i>Oligotrophus gemmarum</i> Rubsaaen
Diptera	Cecidomyiidae		<i>Oligotrophus juniperinus</i> (L.)
Diptera	Cecidomyiidae		<i>Oligotrophus panteli</i> Kieffer
Diptera	Cecidomyiidae		<i>Shmidtella gemmarum</i> Rubsaaen
Hemiptera (Sternorrhyncha- scales)	Pseudococcidae		<i>Planococcus vovae</i> (Nasonov)

Hemiptera (Sternorrhyncha- aphids)	Lachnidae		<i>Cinara juniper</i> (Degeer)
Hymenoptera (wasps)	Torymidae		<i>Megastigmus bipunctatus</i> (Swederus)
Lepidoptera (macro- moths)	Geometridae	Larentiinae	<i>Eupithecia intricate</i> (Zetterstedt) ssp. <i>Hibernica</i> Mere
Lepidoptera (macro- moths)		Larentiinea	<i>Eupithecia pusillata</i> (Denis & Schiffermuller)
Lepidoptera (macro- moths)		Larentiinea	<i>Thera cognate</i> (Thunberg)
			<i>Aethes rutilana</i> (Hubner)