



**Report of a Pest Risk Analysis
for *Litylenchus crenatae*, cause of beech leaf disease**

PRA report prepared by Dominic Eyre (Defra, GB) and reviewed by the EPPO Panel on Phytosanitary Measures.



Beech leaf disease associated with *Litylenchus crenatae* on *Fagus grandifolia*. Courtesy: Matthew Borden, Bartlett Tree Research Laboratories & Arboretum (US) (EPPO Code: LITYCR)

PRA area: EPPO region in 2026-09.

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Based on this PRA report, *Litylenchus crenatae* was added to the EPPO A1 List of pests recommended for regulation as quarantine pests in 2026. Measures for plants for planting of *Fagus* spp. are recommended.

Introduction

The aim of this PRA report is to assess the status of *Litylenchus crenatae* as candidate for listing on the EPPO A1 and A2 Lists of pests recommended for regulation as quarantine pests. EPPO recommendations for regulation are normally made either on the basis of EPPO Pest Risk Analyses (PRAs) prepared by Expert Working Groups (EWGs) or PRAs developed by EPPO member countries for the EPPO region, or PRA reports based on national PRAs or EFSA PRAs. This PRA report is based upon a GB PRA (DEFRA, 2025), an Express PRA for Ireland (McGee, 2024) and additional references used to apply the national PRAs to the wider EPPO region. A Quickscan prepared by the Netherlands is also available (NVWA, 2020).

The probabilities of entry, establishment, spread, and potential impact have been established based on the GB PRA and adjusted by the Panel on Phytosanitary Measures for the EPPO region on a five-level scale (very low, low, moderate, high, very high) with a three-level scale of uncertainty (low, moderate, high).

The PRA report was presented to the meeting of the Panel on Phytosanitary Measures in October 2025 and March 2026; and to the Panel on Quarantine Pests for Forestry in November 2025. EPPO Working Party on Phytosanitary Regulations and EPPO Council agreed in 2026 that the pest should be added to the EPPO A1 List of pests recommended for regulation as quarantine pests.

Stage 1: Initiation

Reason for doing the PRA

Litylenchus crenatae is the causal agent of beech leaf disease. Beech leaf disease was first detected in North America in Lake County, Ohio (USA) in 2012. Since then it has been detected in several USA states and in Ontario (Canada) (see Figure 1). It has led to the death of many saplings and mature trees of American beech, *Fagus americana*. In addition, the European beech, *Fagus sylvatica* has become infected with *L. crenatae* in arboreta and nurseries in the US, demonstrating the risk to the EPPO region (DEFRA, 2025). *Litylenchus crenatae* was added to the EPPO Alert List in April 2019 and in 2022 an addendum to the EPPO commodity Standard for beech (PM 8/9; EPPO, 2018) was published, encouraging EPPO member states to review their phytosanitary measures for beech plants for planting. Simon Lloyd from Defra (GB), conducted a fact-finding visit to the outbreak areas of the USA in 2022 as part of the Jens-Georg Unger Plant Health Fellowship with the aim of drafting a GB PRA for *L. crenatae* which could form the basis of an EPPO recommendation for regulation as a quarantine pest.

Taxonomic position of the pest

Pest: *Litylenchus crenatae* Kanzaki, Ichihara, Aikawa, Ekino and Masuya, 2019

Phylum: Nematoda

Class: Chromadorea

Order: Rhabditida

Family: Anguinidae

Genus: *Litylenchus*

Species' scientific name: *Litylenchus crenatae*

English common name: There is no common name for the pest, but it is the causal agent of beech leaf disease

EPPO code: LITYCR

The original description of *Litylenchus crenatae* Kanzaki was from Hokkaido, Japan (Kanzaki *et al.*, 2019). However, (Carta *et al.*, 2020) observed differences in host range and female morphology between nematodes isolated from *F. grandifolia* in Ohio and those described by Kanzaki *et al.* (2019) from Japan. They named the North American subspecies *L. crenatae mccannii* and the Japanese subspecies *L. crenatae crenatae*. However, in two recent molecular studies, specimens from North America have been described with the species name rather than using the sub-species (Wolf *et al.*, 2025; Kantor & Subbotin, 2026). This indicates that there is some uncertainty about the validity of separating *L. crenatae* into two separate subspecies. Given this uncertainty, in this PRA report has been carried out for *L. crenatae* as a single biological entity rather than attempting to determine sub-species differences.

Stage 2: Pest Risk Assessment

2.1. Likelihood of introduction

2.1.1. Entry

2.1.1.1. Geographical distribution

Table 1: Distribution of <i>Litylenchus crenatae</i>	
North America	Canada Present, restricted distribution: Ontario USA Present, restricted distribution: Connecticut; Delaware; Maine; Maryland; Massachusetts; Michigan; New Hampshire; New Jersey; New York; Ohio; Pennsylvania; Rhode Island; Vermont; Virginia; West Virginia
Central America	-
South America	-
Europe	Absent (confirmed by survey): Netherlands, Romania, Slovenia and the United-Kingdom (Viaene <i>et al.</i> , 2024)
Africa	-
Asia	Japan: widely distributed (unpublished data from survey in 2024; Deriel, 2024)
Oceania	-



Figure 1. Area where beech leaf disease has been detected in North America as of December 2024 based on USDA Forest Service data (Source: <https://njaes.rutgers.edu/E376/>) with beech distribution data from (Little, 1971).

For an up to date pest distribution see EPPO Global Database (<https://gd.eppo.int/taxon/LITYMC/distribution>).

2.1.1.2. Host plant(s)

The major host in North America is *Fagus grandifolia*, but beech leaf disease symptoms have also been detected in some *Fagus* species introduced to North America (Table 2).

Table 2. Host plants infected with *Litylenchus crenatae* in North America and Japan, with notes on reported associations

Host species	North America	Japan
<i>Fagus crenata</i>		Present in several different areas of Japan, most commonly in the north-eastern part of Honshu (Kanzaki <i>et al.</i> , 2019)
<i>Fagus engleriana</i>	Symptoms at an arboretum in Ohio (Burke, Hoke, and Koch, 2020)	
<i>Fagus grandifolia</i>	Main host species in North America (Ewing <i>et al.</i> , 2019; Burke <i>et al.</i> , 2025)	

<i>Fagus orientalis</i>	Symptoms at an arboretum in Ohio (Ewing <i>et al.</i> , 2019)	
<i>Fagus sylvatica</i>	Symptoms at an arboretum in Ohio and a commercial nursery in Ohio (Ewing <i>et al.</i> , 2019)	

As reported in Kanzaki *et al.* (2019), Akimoto (2004) found leaf gall symptoms from some introduced tree species other than *Fagus*: *Alnus hirsuta*, *A. maximowiczii* and *Ostrya japonica*. However, the cause of the galls was not confirmed and so these will not be considered as hosts in this PRA report. Although *F. sylvatica* is considered to be a host of *L. crenatae*, its susceptibility relative to the susceptibility of *F. grandifolia* is not established.

2.1.1.3. Likely pathways of entry

Litylenchus crenatae has never been reported to be intercepted on internationally traded plants or plant products (DEFRA, 2025) and it is unknown how it reached North America.

The lifecycle of the pest has not been conclusively characterised. However, some aspects of the lifecycle have been studied and resolved in North America. It has been shown to overwinter in buds and detached leaves. *Litylenchus crenatae* is thought to have a similar lifecycle to other nematodes in the family Anguinidae. It is thought to develop from an egg, through multiple juvenile stages into an adult within a month (Kohl, 2011). Multiple life stages can be found in the same plant tissue. In Ontario, the numbers of *L. crenatae* per leaf has been found to increase from a few individuals in June to hundreds within leaves to August, followed by a decline in September and October when leaves start to senesce and temperatures drop below 10°C (Reed *et al.*, 2020).

The damage to trees is thought to start within leaf buds because leaves are already symptomatic when they break open in the spring (Vieira *et al.*, 2023). During the growing season, beech leaf disease symptoms include i) striped bands caused by the darkening of interveinal tissues and ii) crinkling of leaves in late season (Ewing *et al.*, 2019). However, when trees are dormant during the winter and are most likely to be traded, *L. crenatae* can be present in leaf buds with no external symptoms. Immature females have been found to be the main resistant and winter survival stage (Vieira *et al.*, 2023).

The most likely pathway/s of introduction identified was/were:

Pathway 1: Plants for planting (excluding seed, pollen and tissue culture). Pollen and tissue culture are both considered to be very unlikely pathways.

If *Fagus* spp. plants have been infested with *L. crenatae* in an exporting country, the plants could provide an effective pathway to introduce the pest into the EPPO region as the nematode can overwinter in buds. If plants were exported when dormant, the infestation will not be visible to officials issuing phytosanitary certificates or import inspectors in the EPPO region. The absence of symptomatic leaves may not be a reliable indication that *Fagus* spp. are not infested with *L. crenatae*. In surveys of woodlands in Ohio, Burke *et al.* (2025), *L. crenatae* DNA was detected in nine counties in 2021 whilst no symptoms of beech leaf disease had been observed in seven of these counties between 2021 and 2023. Once in the EPPO region, the nematode would need to be transferred from

the infested nursery plant into other plants. This seems to be very likely because pest spread has been found to be aided by wind and it may also be aided by passive vectors including birds and insects. No specific vectors have been discovered. Trade volume is expected to be the primary factor influencing the likelihood of entry through plants for planting.

The EU (EU 2018/2019¹), the United Kingdom (GB 2019/2072²), Guernsey, Jersey and Moldova (Aveskamp, pers. comm., 2025) prohibit the import of *Fagus* plants for planting from countries outside the EU, Switzerland and Liechtenstein; a risk assessment by an exporting country being required to apply for a derogation for export from that country into the EU. Naturally or artificially dwarfed plants are excluded from this prohibition and these provide the only possibility of bringing in infested plants into the EU and GB legally. Imports of dwarf beech bonsais from outside the EU into GB are rare with only six records since 2015, indicating that trade is minimal. During years 2021-2024, limited imports of *Fagus* plants for planting were reported into the EU (total of 24 phytosanitary certificates from all origins), including 19 from Japan into the Netherlands (*F. crenata*) and two from Japan into Spain (*F. crenata*) (TRACES, 2025). Imports into the Netherlands were checked and the company name relates to a bonsai tree trader (Aveskamp, pers. comm., 2025). Import of *Fagus* plants for planting into Israel is also prohibited (Annex 7 of PPIS, 2009), as well as from the USA into Jordan, and from countries not free from *Xylella fastidiosa* into Morocco (Aveskamp, pers. comm., 2025). However, it should be noted that several non-EU EPPO countries do not prohibit import of *Fagus* plants for planting e.g. countries of the Eurasian Economic Union (EAEU, 2016). Data for imports into other EPPO countries have not been obtained.

The likelihood of entry for EU countries, the United Kingdom, Guernsey, Jersey, Moldova and other countries that prohibit the import of *Fagus* plants for planting without a derogation and except bonsais is rated as **low** due to the presumed low volume of trade with **moderate uncertainty** given the absence of trade data.

The likelihood of entry for countries that do not prohibit the import of *Fagus* spp. plants for planting without a risk assessment is rated as **very high** with **high uncertainty** given the absence of trade data.

Other pathway/s of introduction identified of minor significance was/were:

Pathway 2: Cut branches

This pathway covers the commercially traded foliage of *Fagus* spp. from areas where *L. crenatae* occurs. In EPPO terminology, these are 'cut branches' as hosts are woody. However in common terminology, 'cut foliage' may also be used for woody branches.

Cut branches of *Fagus* spp. can be used in floral displays. Branches imported from countries where the pest is present could potentially be infected with *L. crenatae*. Cut branches is most likely to be traded when it is in leaf. Twigs with buds of some tree species, such as some *Salix* spp. that have furry catkins, are used in floral displays. It is, however, not known if *Fagus* spp. branches with buds and no leaves are used in floral displays. As discussed for plants for planting, there is evidence that *L.*

¹ Commission Implementing Regulation (EU) 2018/ 2019 - of 18 December 2018 - establishing a provisional list of high risk plants, plant products or other objects: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R2019>

² <https://www.legislation.gov.uk/eur/2019/2072> (link to latest consolidated version)

crenatae may be present in plants that are not exhibiting any symptoms (Burke *et al.*, 2025). Floral displays are most likely to be held indoors, but this is not always the case. If *L. crenatae* were present in dry floral displays, these are likely to be very low risk as a pathway because the low moisture levels would be expected to be very unsuitable for the survival of the pest. There is no indication in the published literature on this species that it can survive in dry debris, however, some other species in the Anguinidae, such as *Ditylenchus dipsaci* can survive in dry conditions in a process called anhydrobiosis (Wharton, 2015). If *L. crenatae* were present in a floral display kept in water then it might well still be alive when the display is disposed of.

The volume of imports of *Fagus* spp. cut branches into the United Kingdom from infested countries is likely to be very low or non-existent. There is only one record of an import of *Fagus* plant parts into the United Kingdom since 2021, and this was from Ireland which is free of *L. crenatae*. The Panel commented that cut branches of beech for decoration purposes would most likely be obtained locally i.e. directly within the EPPO region.

Some different options for disposal are:

- Sent to **landfill** – likely to be very low risk due the lack of pathway to growing plants,
- Sent to a **municipal composting** site – considered very low risk due to the high temperatures,
- Composted within a **closed container** –considered very low risk given the lack of pathway and temperature,
- Composted on an **open heap** – considered low risk: it is possible that nematodes could transfer from infested plant material to neighbouring *Fagus* spp. plants by wind dispersing nematodes in a film of water or plant debris or a passive vector.

Overall, the likelihood of entry is expected to be **very low** because i) the volume of traded plant material from infested countries is likely to be very low; ii) the low risk transfer from compost heaps to plants, but due to the lack of trade data, this conclusion has **high uncertainty**.

Other pathways briefly considered and judged to be very unlikely

Round wood or sawn wood with bark: Nematodes have been found on the bark of twigs (Vieira *et al.*, 2023), but this is less likely for wood products with bark if the wood has dried out. From 2015-2024 inclusive, imports into the EU of *Fagus* spp. wood in the rough [includes wood with and without bark] (CN 44039300 and 44039400) from the USA were reported in only 3 years, with a maximum annual volume of 30 270 Kg (see Table 3). No imports were recorded from Canada and Japan into the EU for the same time period (Eurostat, 2025). There are no records of imports into the United Kingdom from Canada, Japan or the USA for the same period although there have been imports from Hong Kong and China. Transfer of the nematode from wood products to living plants seems unlikely.

Table 3. Imports of *Fagus* spp. in the rough from United States into the European Union for years 2015-2024 [includes wood with and without bark] (CN 44039300 and 44039400) (Eurostat, 2025).

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Import by destination (Kg)	-	-	21 741 (into PT)	-	-	-	-	28 000 (into DK) 2 270 (into DE)	-	3 (into IR)
Total import (Kg)	0	0	21 741	0	0	0	0	30 270	-	3

Seeds: There is no published evidence that *L. crenatae* is associated with host seeds.

Hitchhiking: The widespread distribution of the pest in North America and large number visits by people from the EPPO region to North America means that it possible that the pest could be moved via footwear. However, the survival of the pest during transit and then transfer onto living plants in the EPPO region makes this very unlikely.

Natural spread: The possibility of *L. crenatae* being spread in bird faeces has been investigated (Parkinson *et al.*, 2025). DNA of the pest has been found in bird faeces and intact nematodes have been discovered, but as yet none have been confirmed as being alive. The lack of confirmation that *L. crenatae* can survive the bird gut and the time that it would take for birds to migrate from infested countries to the EPPO region means that pathway is considered to be very unlikely.

2.1.2. Potential establishment

2.1.2.1. Plant(s) at risk

The plants considered to be at risk are all *Fagus* species. Two *Fagus* species are found in the European part of the EPPO region: *F. sylvatica* and *F. orientalis*. The native range of these species in the EPPO region is shown in Figure 2.

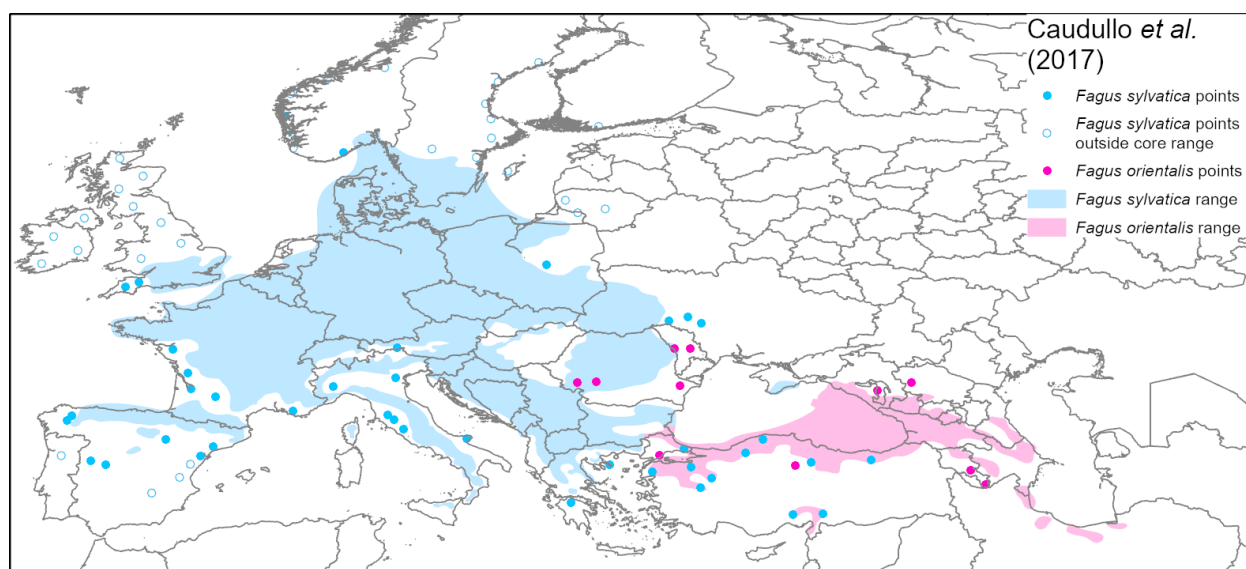


Figure 2. Distribution of *Fagus sylvatica* and *Fagus orientalis* in the EPPO region (Caudullo, Welk, and San-Miguel-Ayanz, 2017)

Fagus sylvatica has a continuous distribution from southern Scandinavia in the north to Sicily in the south and from Spain in the west to northwest Turkey in the east. *Fagus sylvatica* has been widely planted outside the area shown as its native range in Figure 2, for example as a hedge plant. There are more than 1.3 million records of *Fagus sylvatica* on GBIF (2026), most of which are in Europe. The records indicate that the species has a continuous distribution across Britain and Ireland. *Fagus sylvatica* is commonly grown as a hedgerow plant in Europe to form boundaries around gardens. It is one of the most widespread and important broadleaved trees in Europe. High temperatures and

drought are limiting factors and there is likely to be a shift in distribution as a result of climate change (Durrant *et al.*, 2016). Dyderski *et al.* (2025) evaluated the impact of climate change on ten key European tree species by modelling current and future distribution using the Maxent model. *Fagus sylvatica* was rated as partially threatened by climate change, the middle category of the ratings.

Fagus orientalis is present in eastern Europe, Türkiye, and the Caucasus region. It is found in warmer and dryer sites than *F. sylvatica*. It is found at altitudes between 500 to 2000m and it prefers well drained, fertile soils. In common with *F. sylvatica* the southern end of its range is vulnerable to climate change (Yilmaz, 2010).

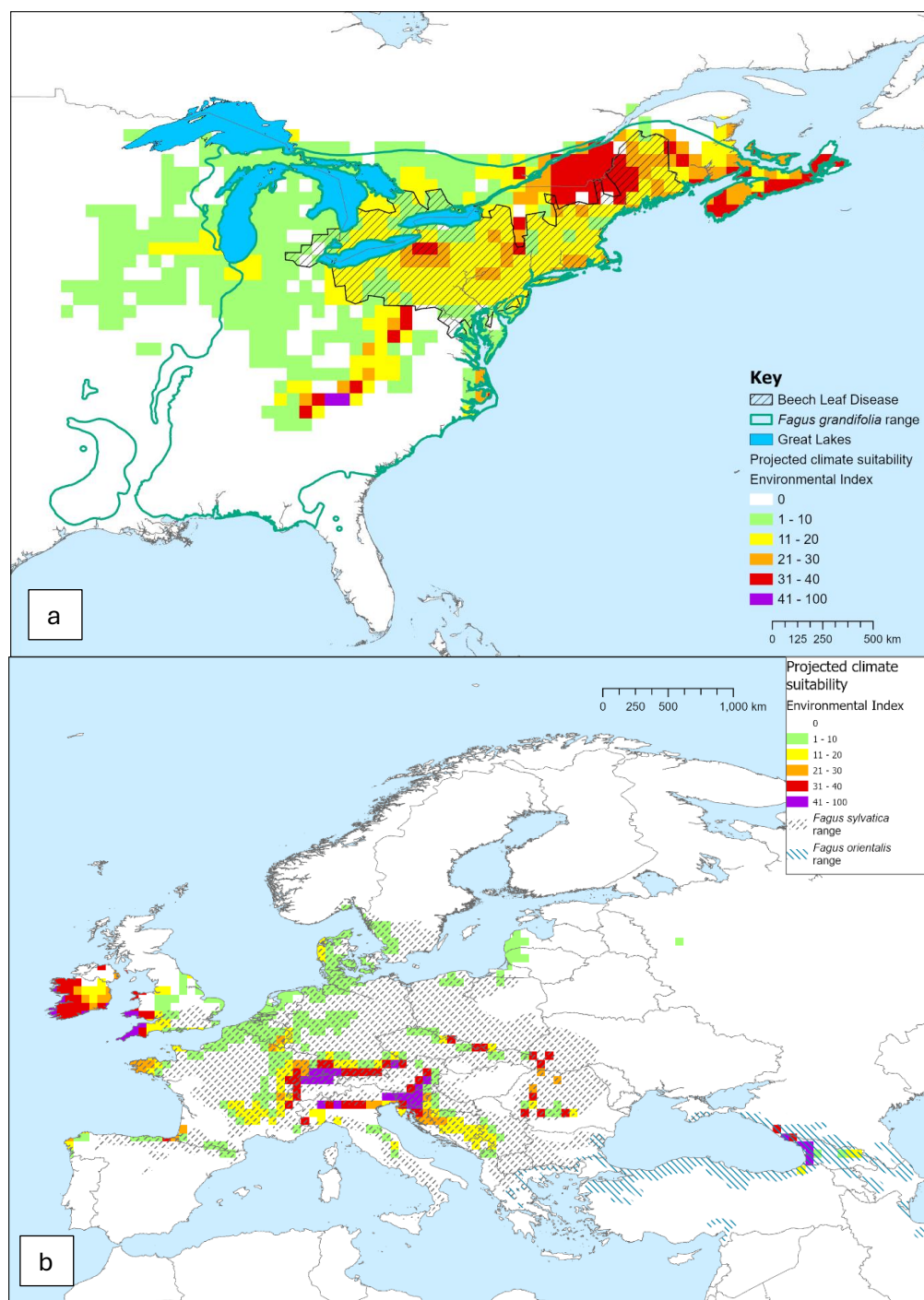
2.1.2.2. Climatic suitability

There is a lack of detailed information about the environmental conditions required for *L. crenatae* to complete its life cycle. In addition, the geographic distribution of beech leaf disease in North America is still expanding, therefore the limits of the current distribution there may not reflect fully its climatic limits. However, some understanding of the climatic tolerances and preference of *L. crenatae* can be deduced from scientific studies that have been conducted and from the climate in the area where *L. crenatae* is established.

Reed *et al.* (2020) observed consistent numbers of nematodes within beech buds and detached leaves on the ground through the winter months in Ohio and Ontario, and the surveying period included a significant cold snap of -26°C on 2nd February 2019. As the nematode is likely to move through water films, and this may be essential to local spread within a host, and rainfall and humidity might be favourable factors in its establishment (Kohl, 2011). Goraya *et al.* (2024) monitored the dispersal of *L. crenatae* in the USA over a period of two months in the autumn of 2023 found that higher humidity, rainfall and wind speed were all found to be linked to higher dispersal rates of *L. crenatae*. This suggests that wetter and windier climates are likely to be more suitable for the spread of the pest.

The GB PRA includes a Climex model for *L. crenatae*. The initial model parameters were the default values for a temperate climate within Climex. The parameters were then adjusted iteratively to find the best fit to closely match the known distribution of beech leaf disease in North America, whilst minimising projections of suitability in the area where it has not been recorded yet. The distribution of the nematode in Japan was not included in this analysis because of the lack of georeferenced data. The values for cold stress (starting at -17°C) and the day degree total (1100 above base 7°C) were set based on the figures in the coolest locations that the pest has been recorded in North America, such as northern Maine. The southern and western limits of distribution are determined by dry stress and heat stress. The soil moisture parameters were set relatively high to reflect the scientific studies such as Goraya *et al.* (2024). The parameters for the model are listed in Table 4 of the GB PRA.

Projections based upon the Climex model are shown for North America and Europe in Figures 3a and 3b respectively. Figure 3a also shows the distribution of American beech, *F. grandifolia*, in North America, plus the known range of beech leaf disease (December 2024). In addition to the climate projections, Figure 3b shows the range of European beech, *F. sylvatica* in Europe and part of the range of oriental beech, *F. orientalis* in southern Europe and areas around the Black Sea.



Figures 3a and 3b. Projections of climatic suitability for *Litylenchus crenatae* based on a Climex model a) of eastern North America, b) of the United Kingdom and most of the EPPO region, using a 1981-2010 climatic data set. The EI (Environmental Index) is a measure of the likelihood of establishment (0 – very low; 100 – very high).

Areas marked by the coloured blocks in 3b are projected to be suitable for the establishment of *L. crenatae*. There is a lot of overlap with the area where *Fagus* is native in the EPPO region. The most

suitable areas are projected to be in western Ireland, south western Wales, south western England, areas to the north and south of the Alps, Slovenia, northern Croatia and the eastern Black Sea coast. The model suggests that water availability could be a limiting factor in parts of the range of *Fagus* in the EPPO region. However, the parameters in the model are based upon the current known distribution of beech leaf disease in North America. If the same methodology is used once the pest has reached its climatic limits in North America, then it is most likely that a larger area of the EPPO region would be projected to be suitable. The same model used to create the projections shown in figures 3a and 3b was used together with the +2 °C climate change function in Climex version 4. This indicates that the threat posed by *L. crenatae* is likely to increase in the EPPO region as the climate warms. This increase is particularly noticeable in northern Europe, especially Ireland, Scotland, Wales and northern England.

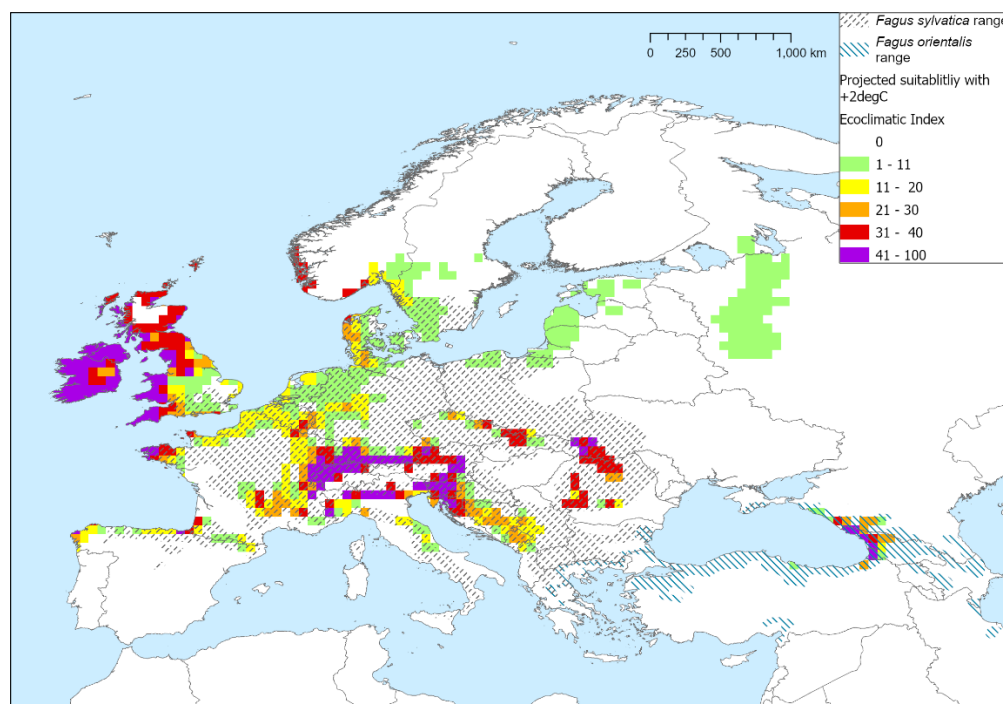


Figure 3c. Projections of climatic suitability for *Litylenchus crenatae* based on a Climex model for the United Kingdom and most of the EPPO region, using a 1981-2010 climatic data set together with the +2 °C climate change function in Climex version 4. The EI (Environmental Index) is a measure of the likelihood of establishment (0 – very low; 100 – very high).

Two other methods were used to evaluate areas in the EPPO region suitable for *L. crenatae* in the GB PRA. Firstly, average annual day degrees over 7°C (to match the projected development threshold in the Climex model) were compared between the area where beech leaf disease is recorded in North America and the EPPO region. A very close overlap was noted. Secondly, three metrics (a Climex model for soil moisture, degree days above base 5 °C and mean temperature of the coolest quarter of the year) were used to describe the distribution of *F. grandifolia* in North America and the results were projected to the EPPO region. This methodology was used to investigate where it could be

suitable for *L. crenatae* in the EPPO region if the pest is able to spread to the whole range of *F. grandifolia* in North America. The results show a wider area of the range of *Fagus* in the EPPO region as being suitable for the pest than Figure 3b.

Ireland was rated as most likely to have a suitable climate for the pest in the Irish PRA on the basis of the ability of the pest to survive in northern climates and the overlap in Köppen-Geiger zones between the known beech leaf disease area in North America and the PRA area.

2.1.2.3. Other characteristics for establishment

None known.

2.1.2.4. Areas and likelihood of potential establishment

Projections of where *L. crenatae* could establish are shown in the overlap between the native range of *Fagus* species in Figure 2 and the areas shown as climatically suitable in Figure 3b. In some of the areas shown as climatically suitable for the pest in Ireland and northern Britain, but outside the native range of *Fagus*, *Fagus* is planted in woodland and also in parks and gardens, therefore they could also be at threat from this pest. The uncertainties on host suitability are described 2.1.1.2 and the limitations of the climate analysis are described in 2.1.2.2. It should also be noted that the analyses are based upon a pest range that is still expanding in North America and there is a lack of laboratory data on temperature tolerances therefore exact areas where the pest could establish are subject to uncertainty.

Based on the host information and climatic analyses in 2.1.2, the likelihood that *L. crenatae* would be able to establish outdoors in at least part of the range of *Fagus* in the EPPO region is **very high**, with a **moderate** uncertainty (same rating as in the GB PRA).

Fagus plants for planting may be produced under protected conditions for nursery production and early stage of production e.g. to control watering, temperature and to get uniform, marketable plant sizes (EFSA, 2023). It may also be used for research and breeding purposes. In the GB PRA the likelihood of *L. crenatae* establishing in protected conditions in the United Kingdom is rated as very unlikely (the lowest on a 5 point scale) and in the Irish PRA the likelihood is rated as low (the lowest on a 3 point scale). Uncertainty for the ratings is medium (for the United Kingdom) and low (for Ireland). For, the EPPO region, the likelihood is rated at **very low** with **moderate uncertainty** with the uncertainty relating to lack of detailed information about the biology of the pest and the lack of information about the production of *Fagus* plants in protected conditions in the EPPO region.

2.1.3. Magnitude of spread

The mechanisms of the population spread of *L. crenatae* are not fully understood in terms of their magnitude, but the rapid expansion of the area where beech leaf disease has been recorded in North America is indicative of very rapid spread being possible. Research suggests a few mechanisms of natural spread:

- windborne spread of nematodes in films of water (Carta *et al.*, 2020; Vieira *et al.*, 2023) and with plant debris. Goraya *et al.* (2024) demonstrated that higher wind speeds correlated with increased spread of the pest.
- spread on passive invertebrate vectors such as spider mites which can be blown for many miles (Carta *et al.*, 2020).
- spread by birds either within their plumage or eaten and then excreted in faeces, although the ability of *L. crenatae* to survive within bird guts has not been confirmed (Parkinson *et al.*, 2025).

Human mediated spread is also very likely by the trade in infested plants for planting or the movement of plant parts as described in the pathway section 2.1.1.3. Plants for planting could facilitate spread over hundreds or thousands of kilometres.

Figure 4 shows the increasing area of the known distribution of beech leaf disease in North America between 2012-2024. From the site where it was first detected, it has now been found approximately 900 km to the north, 1600 km east, 600 km south and 400 km west.

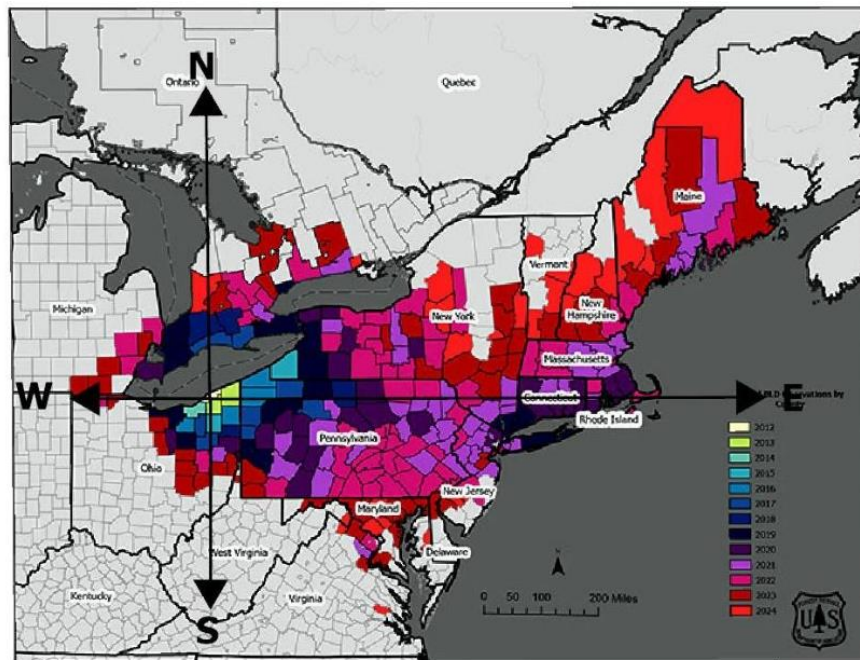


Figure 4. Known distribution of beech leaf disease in North America in 2012-2024. Courtesy of USDA Forest Service (Source: <https://njaes.rutgers.edu/E376/>).

If *L. crenatae* was introduced into the EPPO region, the rate of spread would be influenced by the density and continuity of the host distribution. Some of the areas within the known distribution of beech leaf disease in the USA, have high densities of beech (Busby & Canham, 2011). For example, New York State is 62% forested and the most common forest type (accounting for 55% of the forest) is mixed forest of maple / beech / birch (Division of lands and forests, 2025). Figure 3 of the GB PRA shows the distribution of *F. sylvatica* across the EPPO region. This shows that in some areas such as western Germany, south-western Germany and northern Switzerland, *F. sylvatica* is present in most 1 km x 1 km grid squares, whereas in other areas such as northern France, the host distribution is more dispersed. Further analysis would be required to directly compare host density in the beech

leaf disease distribution area in North America and the EPPO region, but some areas of the EPPO region, the host distribution appears to be suitable for a high rate of spread.

Wind speed could be another determinant of the rate of spread were the pest introduced into the EPPO region. A map showing the average windspeed at 10 m spatial resolution is indicative of the average wind speed in much of Europe to be similar to that in the area where beech leaf disease has been recorded in North America, although some parts of Europe such as Ireland, most of Britain, the Netherlands and Denmark have higher average (for 2008-2017) wind speeds (<https://globalwindatlas.info/en/>). An analysis of wind speed at the relevant times of year for pest spread would be needed to be more conclusive about the possible influence of wind speed on the rate of pest spread in the EPPO region.

In the GB PRA, the predicted rate of spread for the United Kingdom is very quickly (scale of 5) with high confidence, and in the Irish PRA it is high (scale of 3) with low confidence.

For the EPPO regions the magnitude of spread is rated as **very high** with **moderate uncertainty** (Suitable climates may not be as continuous as in the USA, host density will affect the magnitude of spread).

2.2. Potential Impact

2.2.1. Symptoms and nature of the damage

During the growing season, beech leaf disease symptoms include i) striped bands caused by the darkening of interveinal tissues and ii) crinkling of leaves in late season (Ewing *et al.*, 2019). Both types of symptoms can be present on the same branch. There is usually no progression of symptoms during the growing season suggesting that the damage is done at the bud stage (Fearer *et al.*, 2022). In severe and late stage infections, necrotic tissues develop and the leaves will drop earlier than October (Volk, Hausman, and Martin, 2019). This early leaf drop is unusual because beech normally hold on to dead leaves until the following spring. As symptoms progress, buds are aborted from infected trees which leads to thinner canopies in succeeding years. Pogacnik and Macy (2016) reported severe decline of saplings 1 to 2 years after symptom expression. Fearer *et al.* (2022) said that there is elevated mortality of saplings when beech leaf disease has been present for several years and mortality of mature trees has occurred when it has been present for 6-8 years.

In the absence of a confirmed requirement for other microorganisms being required for symptom development, the GB PRA considers *L. crenatae* as the sole causative agent.

Impact within the current area of distribution

Beech leaf disease has become pervasive in forests surrounding Lake Erie in the USA and Ontario. In the Great Lakes area of North America beech leaf disease symptoms are more widespread than those of beech bark disease caused by *Cryptococcus fagisuga*, *Neonectria faginata* and *N. ditissima*. Beech bark disease had dramatically altered the composition and structure of stands containing *F. grandifolia* (Reed *et al.*, 2022). In Ohio, ~ 30% of beech trees in long-term plots have died since 2014. The mortality began in 2016 and was recorded up to 2023 (Shepherd *et al.*, 2025). Annual mortality in unaffected beech trees in the US was previously estimated at approximately 1.5% (McWilliams *et al.*, 2005) cited by Shepherd *et al.* (2025). Growth rates in beech trees have also been slower since the introduction of BLD (Shepherd *et al.*, 2025). This marks a significant shift in beech tree population dynamics in US forests since its introduction. Beech leaf disease is affecting *F. grandifolia* of all size

classes and it is expected that *F. grandifolia* will be replaced by sugar maple (*Acer saccharum*) leading to environmental impacts in terms of conservation, sustainability, resilience and ecosystem services (Reed *et al.*, 2022).

In contrast to the USA and Canada, Japan shows no major economic or environmental impacts from the nematode. Surveys indicate it is widespread there, affecting Japanese beech with similar leaf symptoms as in American beech, but without significant tree decline or mortality, suggesting a long-term coexistence (DEFRA, 2025).

Potential impact within the EPPO region

Beech is one of the most important and widespread broadleaved trees in Europe (Durrant *et al.*, 2016). *Fagus* accounts for 11.9% of the growing stock in European forests, which is the highest of all the broadleaved species (Korhonen & Stahl, 2020).

Economic impact

Fagus sylvatica wood has around 250 recorded uses. Its water resistance and strength make it a valuable species for boatbuilding, flooring, stairs, furniture, plywood, panels and veneering. It can also be coppiced to produce firewood (Durrant *et al.*, 2016). *Fagus* spp. forests are important for their ability to catch groundwater and reduce the risk of flooding making them a favoured species for water catchment areas (Wühlisch & Muhs, 2011). Pest damage to *Fagus* spp. could have highly significant economic impacts due to its value as a timber species, the role it plays in reducing flood risk and the cost of removing infested trees. If *L. crenatae* became established in the EPPO region, a similar economic impact as observed in North America would be expected.

Environmental impact

Fagus sylvatica is the most shade tolerant species in its range. The large quantity of leaf litter produced by *F. sylvatica* aids soil conservation (Durrant *et al.*, 2016). In the absence of *Pinus sylvestris* and *Picea abies* which have been widely planted outside of their native range, *F. sylvatica* along with *Quercus* spp. would naturally dominate large areas of European forests (Lindner *et al.*, 2025). The leaf litter under beech trees provides a very suitable habitat for some rare plants such as bird's-nest orchid (*Neottia nidus-avis*) and the red helleborine (*Cephalanthera rubra*) as well various fungi including *Cantharellus* and *Agaricus* species (Royal Botanic Gardens Kew, 2025). Beech forests in central Europe tend to have lower biodiversity than *Quercus* forests (Wühlisch & Muhs, 2011). If *L. crenatae* were introduced into Europe and had a similar impact on *F. sylvatica* and *F. orientalis* as it is having on *F. grandifolia* in the Great Lakes region of North America, then it could reduce forest diversity and increase the vulnerability of the forests to other pests.

Social impact

Fagus trees are considered an important element of European culture. The names of numerous regions and towns in Europe can be traced to their association with *Fagus* (UNESCO, 2025). *Fagus* is associated with femininity and is often considered the queen of British trees and in Celtic mythology, *Fagus* was the god of beech trees (Woodland Trust, 2025). *Fagus* is widely used as a hedging plant and also planted in parks and gardens (Royal Botanic Gardens Kew, 2025). If *Fagus* hedges or urban trees were lost, this would mean a loss of the benefits they bring to the public in terms of their aesthetic value and role in reducing pollution, noise and providing privacy.

Overall, in the EPPO region, magnitude of impact in the area of potential establishment is expected to be **very high** with **moderate** uncertainty which relates to the limited information available about impacts on species other than *F. grandifolia*.

2.2.2. Conclusions

Some of the main uncertainties:

- Whether the pest should be considered a single species or as more than one sub-species
- The distribution in Asia
- The relative susceptibility of *F. sylvatica*, *F. orientalis* and *F. grandifolia*
- The means of spread
- The climatic tolerances of the pest
- The potential role of microorganisms detected alongside *L. crenatae* in symptom development

L. crenatae meets all the criteria to be recommended by EPPO for regulation as a quarantine pest. In particular, this nematode is absent from the EPPO region and could enter, establish, spread and cause impact to *Fagus* trees. Phytosanitary risk management measures are recommended to reduce the risk.

Stage 3: Pest Risk Management

3.1. Pathways Identification

Fagus spp. plants for planting (except seeds, tissue culture and pollen). Considering the many *Fagus* species reported as host plants, difficulty to recognize the particular species at import, and possible hybridization between species, risk management measures are recommended for all *Fagus* species.

Considering the very low risk of entry with cut branches (see 2.1.1.3) and that such material would most likely be obtained locally in the EPPO region, no risk management measures were recommended for *Fagus* cut branches. However, considering uncertainty, in particular the lack of knowledge on spread mechanisms, the Panel considered that a higher level of protection can be achieved by regulating the cut branches pathway. These measures could be developed based on the measures for plants for planting.

Pathways studied in the pest risk management

The most likely pathway identified for the introduction of *L. crenatae* is:

- Plants for planting (except seeds, tissue culture and pollen)

3.2. Identification of Potential Measures

Table 4. Potential measures and justification for the pathways identified.

Pathways	Measures identified for the exporting country
Plants for planting of <i>Fagus</i> spp. (except seeds, tissue culture and pollen; but including dwarfed plants for planting)	Pest free area (PFA) for <i>L. crenatae</i> (ISPM 4, ISPM 29) (see requirements below) and Stored in conditions to prevent infestation prior to export and transported closed, to prevent infestation OR Pest-free place/site¹ of production for <i>L. crenatae</i> established according to EPPO Standard PM 5/8 <i>Guidelines on the phytosanitary measure 'Plants grown under physical isolation'</i> (EPPO, 2016)² and Stored in conditions to prevent infestation prior to export and transported closed, to prevent infestation OR Import under post-entry quarantine (in the framework of a bilateral agreement)
Cut branches of <i>Fagus</i> spp.	No measures recommended. However, measures on cut branches could be developed if a higher level of protection is desired. These measures could be developed based on the measures for plants for planting.

¹: The choice between PFPP and PFPS is a decision to be taken by the NPPO based on the operational capacities of the producers and biological elements.

²: In the context of *L. crenatae*, pending clarification of spread mechanisms, spread by soil, water and air should be covered (see Table 1 of EPPO, 2016)

Requirements for establishing a PFA (applicable in all countries where the pest is not already widespread):

- To establish and maintain the PFA for *L. crenatae* (ISPM 4, IPPC, 2024; ISPM 29; IPPC, 2017), a general surveillance in the area prior to establishment of the PFA and continued every year may be sufficient.
- In specific cases, specific surveillance should also be carried out in a zone between the PFA and known infestation area to demonstrate pest freedom. The detection surveys to establish and maintain the PFA should be targeted for *L. crenatae*, and should be based on appropriate combination of visual examination of foliage and testing of asymptomatic buds (surveys only based on symptom expression underestimate the pest distribution). Although no minimum distance could be recommended for the buffer zone around the PFA because of lack of

information on spread mechanisms, it should be noted that in the USA, spread was reported to be over about 320 km during a 7-year period (Fig 4 of the GB PRA).

- Because host plants may not express symptoms for at least 1 year after infection (upper limit of the time period not known), and to allow pest population to build up, surveillance should be carried out in *Fagus* forests and growing areas for multiple growing seasons.
- There should be restrictions on the movement of host material in particular host plant parts (originating from areas where the pest is known to be present) into the PFA, and into the area surrounding the PFA, especially the area between the PFA and the closest area of known infestation.
- Systematic public outreach efforts should be made to raise awareness of easily recognisable foliage symptoms.

Additional risk management options considered but not retained

Heat treatment was considered but not retained in absence of specific data for *L. crenatae*.

Uncertainties in the management

- Distance of natural spread
- Time variability for symptom expression

Containment and eradication

If *L. crenatae* becomes established in the EPPO region and the population is detected quickly, eradication by the removal of host plants might be possible. However, it seems unlikely that the pest would be detected quickly enough to make eradication feasible. The pest might be able to persist in fallen leaves which could be blown towards hosts trees or hedgerows, tens or hundreds of metres away from infested trees. Some plant protection products have been tested for controlling beech leaf disease in North America with some success, but their use in the EPPO region may be prevented by the need to get approval for their use and the lack of an appropriate means of applying the products.

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