Department for Environment, Food & Rural Affairs

Rapid Pest Risk Analysis (PRA) for:

Xylosandrus compactus

April 2025

Summary and conclusions of the rapid PRA

This rapid PRA shows:

Xylosandrus compactus, the black coffee twig borer or the black twig borer, is a widely distributed tropical/subtropical ambrosia beetle. This pest causes significant damage to many economically important crops in the tropics such as avocado, cocoa, coffee, and various ornamental species. Since the first European finding in Italy in 2011, *X. compactus* has since expanded its range and been detected in many other European countries attacking popular ornamentals. To date there have been two interceptions of *X. compactus* by APHA inspectors on imports entering the UK.

Risk of entry

The risk of pathways of entry were assessed as **likely for plants for planting, and unlikely for cut branches and plant parts, wood products, and wood packaging material, with low to medium confidence**. As *X. compactus* prefers twigs and small branches, the likelihood of association with live plants is high, and previous European introductions were thought to be from the live plant trade. The pathway of cut branches and plant parts is rated as unlikely due to the relatively low trade volume and the limited opportunity for transfer to the wider environment. Wood products and wood packaging material is also rated as an unlikely pathway as *X. compactus* is not known to regularly attack larger parts of the plant, like the trunk and large branches. Low to medium confidence is rated for these scores due to the lack of evidence that *X. compactus* may or may not move along these pathways.

Risk of establishment

As *X. compactus* is an ambrosia beetle, the larvae feed on the fungus growing within their natal tunnel (i.e. the tunnels bored into the plant by the female beetle and in which she lays her eggs) rather than the wood of the host, allowing a wider host range. Additionally, many plant species that are very prevalent in the PRA area are known hosts. However, the UK climate is likely to be a limiting factor for this species' establishment. Climate data indicates the majority of the UK is unsuitable for establishment, with only small parts of Wales and Southeast England allowing pest presence. Winter temperatures, in areas where the pest could establish, may cause significant mortality. **Outdoor establishment is rated as unlikely with high confidence.**

Xylosandrus compactus primarily attacks woody hosts and is therefore not expected to be a significant pest of protected cultivation in the UK. However, there are some cases where *X. compactus* could become established, such as glasshouses either for the growth of seedlings or botanical collections, and the protected cultivation of some woody ornamentals such as Bonsai, *Acer,* and *Camellia*. The combination of high temperatures and high humidity would be ideal for *X. compactus* development. The likelihood of establishment at these sites could be controlled by biosecurity procedures. **Under protection, establishment is rated as likely with medium confidence**.

Economic, environmental and social impact

Economic impacts have been rated as small with medium confidence. The majority of impacts caused by *X. compactus* is in the tropics and to crops such as coffee and cocoa. *Xylosandrus compactus* could attack a variety of woody plants that occur in the PRA area including apricot, cherry, pear and apple, but damage to these hosts to date appears to be limited. Impacts in the PRA area are likely to be limited to ornamentals in parks and gardens, as seen in European countries. Given the limited climate suitability, the development of *X. compactus* and damage to PRA hosts is expected to be small.

Environmental impacts have been rated as small with medium confidence. In its current range, *X. compactus* has caused limited environmental concern. Other than in Hawaii where some endangered, endemic species, that are already subjected to other stress, are being put under additional pressure by *X. compactus*.

Social impacts have been rated as small with high confidence. Currently, *X. compactus* appears to have little social impact. In Europe, attacks mostly result in aesthetic damage where small branches wilt and die, and no significant public concern has been reported.

Endangered area

This pest is not expected to cause an unacceptable level of economic damage where it could become established. Therefore, there is no endangered area.

Risk management options

Due to the pest's size and life strategy, if a population became established, containment and eradication would be difficult. In the case where *X. compactus* becomes a quarantine pest, continued exclusion is the preferred management option. However, this PRA concludes that *Xylosandrus compactus* does not meet the requirements of a quarantine pest and is not recommended for statutory action.

Many management options are currently being researched such as chemical and biocontrol, however, the most effective method is sanitation and pruning of infested trees. Due to the obvious symptoms of flagging, wilting and necrosis, infested branches can be pruned and destroyed to effectively limit the pest population. In addition, options such as improving tree health and restricting the movement of live plants are suggested.

Key uncertainties and topics that would benefit from further investigation

The primary uncertainty regarding this pest is its presence in the live plant trade. Many sources agree that the main cause of European outbreaks of *X. compactus* is from introduction via plants for planting. However, evidence is lacking and details regarding the introduction of *X. compactus* would be beneficial to assess likelihood of entry and possible mitigations.

Additionally, due to the pest's tropical and subtropical distribution it is believed that outdoor establishment in the UK is unlikely but there is the possibility of establishment under protection. No sources have identified *X. compactus* under protection such as glasshouses, botanical collections, etc. Yet, it appears a likely scenario when considering the ideal conditions these structures offer for pest development. More information is necessary to evaluate the potential risk to plants grown under protection.

Images of the pest

Photo 1. Adult female of *Xylosandrus compactus* (with 0.5 mm scale bar)	Photo 2. Section of affected twig showing a gallery within the pith
	
Pest and Diseases Image Library, Bugwood.org CC BY-NC	Hughes *et al.* (2015)

Is there a need for a detailed PRA or for a more detailed analysis of particular sections of the PRA? If yes, select the PRA area (UK or EPPO) and the PRA scheme (UK or EPPO) to be used.

From the information gathered on *Xylosandrus compactus*, this PRA has concluded that the risk of establishment and potential impacts to the UK are not high and therefore a more detailed PRA is not necessary.

No	✓				
Yes		PRA area: UK or EPPO		PRA scheme: UK or EPPO	

Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Pest populations are most likely to develop in protected structures such as heated glasshouses where either young or mature trees are grown. Due to highly polyphagous nature of the pest and its associated fungi, many plant species may be affected.

Depending on the size of populations, pest damage could be quite severe leading to wilting, dieback and potentially host mortality. However, proper biosecurity procedures at these sites should be sufficient to prevent pest entry. Also, there have been no reports of *X. compactus* being a pest of glasshouses or protected crops.

Outdoor establishment of *X. compactus* appears unlikely for most of the UK. Certain areas in Southwest England and Wales may meet the conditions for pest establishment but it is thought that populations would not be able to build to sufficient levels to cause significant damage, specifically due to a high overwintering mortality caused by colder winter temperatures. If *X. compactus* was able to become established in the wider environment, eradication would be difficult where the most effective control measure is removal of branches and felling.

As *X. compactus* is considered unlikely to establish in the UK and the potential impacts to the PRA area are rated as small, it does not meet the criteria to be a quarantine pest. Therefore, the UK’s Plant Health Risk Group does not recommend statutory action against this pest following the analysis presented in this PRA.

Yes Statutory action ☐	No Statutory action ☑

Stage 1: Initiation

1. What is the name of the pest?

Xylosandrus compactus (Eichhoff), common names: black twig borer; black coffee twig borer; shot-hole borer. Synonyms include: *Xyleborus compactus* (Eichhoff) and *Xyleborus morstatti* (Hagedorn)

2. What initiated this rapid PRA?

Xylosandrus compactus has been intercepted in the UK on two occasions. In February 2014 on mango (*Mangifera indica*) fruit from Kenya, and in May 2016 on bay laurel (*Laurus nobilis*) plants for planting from Italy (Further details provided in section 6). The subsequent risk register entry gave *X. compactus* a UK relative risk rating of 20 out of 125.

Recently, *X. compactus* has been reported in more European countries and was subsequently removed from the EPPO alert list. *Xylosandrus compactus* is no longer considered a non-European Scolytinae and therefore no longer subject to measures to prevent introduction. This PRA is to further investigate risk and consider whether specific UK measures for this pest are required.

3. What is the PRA area?

The PRA area is the United Kingdom of Great Britain and Northern Ireland.

Stage 2: Risk Assessment

4. What is the pest's status in the plant health legislation, and in the lists of EPPO[1]?

The legislation for Great Britain is the assimilated Phytosanitary Conditions Regulation (EU) 2019/2072[2]. The legislation which applies to Northern Ireland is the EU legislation: 2019/2072 and 2016/2031[3].

[1] https://www.eppo.int/ACTIVITIES/quarantine_activities

[2] https://www.legislation.gov.uk/eur/2019/2072

[3] The latest consolidated version can be accessed on the left-hand side of https://eur-lex.europa.eu/eli/reg_impl/2019/2072/oj

Pest is not listed in GB legislation or the EU plant health legislation and is not recommended for regulation as a quarantine pest by EPPO. This pest was added to the EPPO Alert List in 2017. This list serves as a dynamic warning system which draws attention to particular pests that may present a risk to EPPO member countries. *Xylosandrus compactus* was subsequently removed in 2020, as no action was requested by EPPO member countries within the 3 years.

5. What is the pest's current geographical distribution?

Asia

Xylosandrus compactus is considered to be native to East Asia and has a tropical and subtropical distribution. Described in Japan in the 19th century, the exact area of origin for this species is unknown as it has spread to various parts of Asia, including multiple provinces of China, India, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, and Vietnam (EPPO, 2024).

Africa

This species was most likely introduced, accidentally, to Africa hundreds of years ago by traders and has spread to the majority of countries in the Afrotropical region (EPPO, 2024), summarised in Table 1.

Americas

Xylosandrus compactus was first reported in the Americas in Florida in 1941, causing damage to orchids (Orchidaceae) and avocado trees (*Persea americana*). There were later reports from Cuba in 1958, Mississippi (USA) in 1968, and Georgia (USA) in 1975 (CABI, 2022). This beetle has now spread within the USA but is restricted to the hot, humid, southern states. It is suggested that the populations from North America acted as a source for invasions in the Pacific Islands and South America (Urvois *et al.*, 2021b). *Xylosandrus compactus* was first recorded in Hawaii in 1964 on pink tecoma (*Tabebuia pentaphylla*) but was later found to attack 108 species of shrubs and trees from 44 families and is now found on all major islands near Hawaii (Greco & Wright, 2015). In 1979, *X. compactus* was found in Brazil on a variety of hosts, but it is suggested that it may have been present for a while before (Wood, 1980). From Brazil, the beetle was most likely introduced to Ecuador and Peru in the 1980s, although reported findings were only made in 1985 and 2010, respectively (Delgado & Couturier, 2010). Currently, no further reports have been made from South American countries.

Oceania

Several islands in Oceania have recorded *X. compactus* presence (Table 1), possibly due to spread from Asia. *Xylosandrus compactus* was believed to be present in New Zealand but Brockerhoff *et al.* (2003) and EPPO have called these records unreliable, and the pest is considered absent.

Europe

The first European finding of *Xylosandrus compactus* was in Italy in 2011, most likely introduced from international trade (Garonna *et al.*, 2012). Populations were later found on the Alpes-Maritimes coast near Nice, France in 2015. Followed by findings in Sicily (Italy) (Gugliuzzo *et al.*, 2019b), Greece (Spanou *et al.*, 2019), Monaco (Roques *et al.*, 2019), Spain and Balearic islands (Leza *et al.*, 2020), Corsica (France) (EPPO, 2024), Malta (NPPO of Malta, 2021), Türkiye (Hizal *et al.*, 2023), Slovenia (Hauptman *et al.*, 2024), Switzerland (Blaser *et al.*, 2024), Russia (Karpun *et al.*, 2024), Croatia (Pernek *et al.*, 2025), and Montenegro (Fiala *et al.*, 2025). In all these countries, the distribution of *X. compactus* is considered present but restricted. However, it is evident that *X. compactus* is increasing its geographical range within Europe.

Italy

In 2011, *X. compactus* was found in two parks on *Quercus ilex*, *Viburnum tinus*, *Fraxinus ornus* and *Celtis australis* displaying symptoms of withering on twigs and shoots with a small diameter (NPPO of Italy, 2011 – EPPO GD). This was followed by a severe outbreak of *Fusarium solani* (a common fungal associate of *X. compactus*) on *Q. ilex* (Bo*sso et al., 2012)*. In 2016, *X. compactus* was reported in the Circeo Promontory (a national park). The affected area was over 13 ha where a large number of evergreen species, such as *Q. ilex*, *V. tinus*, *Ruscus aculeatus*, *Pistacia lentiscus*, *Laurus nobilis* and *Ceratonia siliqua,* presented wilted branches and mortality of young plants (Vannini *et al.*, 2017). In 2019, *X. compactus* was also reported in Sicily, primarily on carob trees (*C. siliqua* L.) (Gugliuzzo *et al.*, 2019b).

France

In September 2016, *X. compactus* was discovered on several ornamentals e.g. *Q. ilex*, *L. nobilis*, *Phillyrea* sp., and *Arbutus unedo*, in the Provence-Alpes-Côte-d’Azur region (southern France). Damage to the plants was considered limited with only loss of aesthetic appearance. As a result, no phytosanitary measures were taken (NPPO of France, 2016 – EPPO GD). In 2019, *X. compactus* was then recorded as present along the southern coast, in the Var and Alpes-Maritimes departments. In subsequent trapping studies, 109 specimens were captured in three sites in southeastern France, including the Botanical Garden of Villa Thuret and the Garoupe Forest, along with the first reported finding in Corsica (Roques *et al.*, 2021).

Spain

In December 2019, one finding was made in Mallorca on a carob tree (*Ceratonia siliqua*). This tree was then drastically pruned and received two endotherapy (trunk injection) treatments with abamectin (Leza *et al.*, 2020). *Xylosandrus compactus* was then found in

2020 in two municipalities in the Cataluña region (mainland Spain). One finding was in a private garden on *Laurus nobilis* and the other on a farm on carob trees (*C. siliqua)* and hazelnut trees (*Corylus avellana*). Eradication measures were implemented including surveys to determine outbreak extent and affected twigs were pruned and destroyed. At the end of 2022, *X. compactus* was recorded in 25 municipalities in 6 regions of the provinces of Girona and Barcelona. In Catalonia, a total of 38 plant species from 30 genera have been reported as affected hosts, with the most reported being *L. nobilis* and *C. siliqua*, followed by *Cercis siliquastrum, Magnolia grandiflora* and *Arbutus unedo* (Riba-Flinch, 2023).

Table 1: Distribution of *Xylosandrus compactus*	
North America:	Mexico, United States: Alabama, Florida, Georgia, Hawaii, Illinois, Louisiana, Mississippi, North Carolina, Pennsylvania, South Carolina, Texas
Central America:	Cuba, Dominica, Guadeloupe, Guatemala, Martinque, Puerto Rico, Trinidad and Tobago, Virgin Islands
South America:	Brazil, Ecuador, Peru
Europe:	France, Greece, Italy, Malta, Monaco, Russia, Slovenia, Spain, Switzerland, Türkiye
Africa:	Benin, Cameroon, Central African Republic, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Nigeria, Réunion, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zimbabwe
Asia:	Cambodia, China, East Timor, India, Indonesia, Israel, Japan, Laos, Lebanon, Malaysia, Myanmar, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam
Oceania:	American Samoa, Fiji, Papua New Guinea, Samoa, Solomon Islands

6. Is the pest established or transient, or suspected to be established/transient in the UK/PRA area?

Xylosandrus compactus has been intercepted in the UK on two occasions. A single live adult on mango (*Mangifera indica*) was found on fruit from Kenya in February 2014, and a single dead adult was found associated with galleries in two bay laurel (*Laurus nobilis*) plants for planting from Italy in May 2016. No action was taken against the findings on the mango fruit. From the bay laurel consignment, two plants were immediately rejected due to trunk damage with numerous exit holes and wilting. After confirmation of *X. compactus*, the whole lot was destroyed as a precaution, and the other plants present were sprayed prior to movement. No further interceptions have been made by the Plant Health and Seed Inspectorate (PHSI) and *Xylosandrus compactus* is considered absent from the UK.

7. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK/PRA area?

Xylosandrus compactus is highly polyphagous, with records from 340 plant species from approximately 77 families (Hizal *et al.*, 2023). These mostly consist of broadleaved trees and shrubs, but also some monocots such as orchids (e.g. *Cattleya skinneri*), red ginger (*Alpinia purpurata),* and conifers (*Pinus* spp. and *Cupressus sempervirens*) (Chong *et al.*, 2009; Greco & Wright, 2015; SAMFIX, 2022). This is due to *X. compactus* being an ambrosia beetle, where larvae do not feed on the tree material but rather a fungus that grows on the tunnels created by the adult female. While it is technically the fungus that is polyphagous and feeds on the plants, the beetle and fungus cannot survive separately so this PRA will consider them together, and therefore the beetle is described as polyphagous.

The most significant host of *X. compactus* is coffee, especially *Coffea robusta* and *C. arabica*. Making this an important economic pest for many coffee-producing countries such as Brazil, Hawaii, India, and Uganda. Other important economic hosts include cacao (*Theobroma cacao*), tea (*Camelia sinensis*) and tropical and subtropical fruit trees such as avocado (*Persea americana*), macadamia (*Macadamia ternifolia*), lychee (*Litchi chinensis*), and mango (*Mangifera indica*) (Greco & Wright, 2015).

In Europe, Riba-Flinch *et al.* (2021) recorded 54 genera of forest, agricultural and ornamental plants affected by *X. compactus* in Italy and France. However, some species have been identified more during surveys. These are *Quercus ilex*, *Laurus nobilis*, *Ceratonia siliqua*, *Cercis siliquastrum*, and *Magnolia grandiflora*. While a pest of economically important crops in tropical regions, in Europe, hosts are chiefly ornamentals. Thus far, it appears that damage to these and other European plants is limited. There is also limited evidence of *X. compactus* having an impact on important European agricultural plants including fruit trees (such as *Malus*, *Pyrus*, and *Prunus*).

It is suggested that *X. compactus* may have hosts on which it is more reproductively successful, which could impact establishment and spread capabilities. A recent example of this is in a paper on ant biocontrol treatments which recorded *L. nobilis* having a higher reproductive success compared to *Castanea sativa*. Attacks on *L. nobilis* resulted in an average of 20.5 offspring per brood, compared to *C. sativa* with 7.1 (Giannetti *et al.*, 2022). Which supports the idea that some hosts are more suitable than others, but this area is not well-researched, and no clear definitions have been made.

Due to the wide host range reported for *X. compactus*, many known host plants are present in high numbers in the PRA area including forest trees such as *Acer* spp., *Alnus* spp., *Castanea* spp., *Fagus* spp., *Quercus* spp., and *Ulmus* spp., as well as ornamentals including *L. nobilis*, *Cornus sanguinea, Rhododendron* spp., *Prunus laurocerasus*, *Viburnum tinus*, and *Quercus ilex* (Hizal *et al.*, 2023). As *X. compactus* expands its range across Europe it is likely that new hosts will be reported, so any host list provided should be considered a 'snapshot' of the current situation.

8. Summary of pest biology and/or lifecycle

Females penetrate twigs and small branches (1-3 year-old twigs) up to a maximum diameter of 4 – 6 cm. Often preferring thin, smooth and slightly suberified (corky) bark of shrubs, young plants, or in the peripheral portion of the canopy of large plants (SAMFIX, 2022). However, infestations have also been reported on carob tree (*Ceratonia siliqua*) trunks and large branches that were over 80 cm and 30 cm in diameter, respectively (Gugliuzzo *et al.*, 2019b). Invasion is initiated by the female which digs a small, circular hole with a diameter of 0.7 – 0.8 mm, usually on the underside of the branch, where less exposed (ANSES, 2017). An entrance tunnel is constructed often to a depth of 1 – 3 cm into the wood. The tunnel system consists of a simple or bifurcated (forked) entrance tunnel, with a longitudinal chamber where a loose cluster of eggs is deposited (Browne, 1961). The tunnel is inoculated with ambrosia fungus carried by the female in a specialised structure called the mycangia. Eggs are often laid 7 – 8 days after the female begins her gallery as female oviposition occurs only after feeding on the fungus that becomes established within the gallery (Milbrath & Biazzo, 2024). The number of eggs laid normally varies from 2 to 16 (Hara & Beardsley, 1979), Entwistle (1972) found a mean of 12.3 offspring, but the number could occasionally exceed 60 (CABI, 2022).

Xylosandrus compactus displays arrhenotokous parthenogenesis, where fertilised eggs produce females and unfertilised eggs produce males. The ratio of females to males varies but is approximately 9:1. Broods of all males are rare. Development times discussed here are from the pest's tropical/subtropical range or under laboratory conditions and are unlikely to be similar in the PRA area. The egg stage lasts 4-5 days. The larvae hatch and begin feeding on the fungus growing on the tunnel walls. It is believed there are two larval instars, and larval development time is around 11 days. They then enter the pupal stage, which lasts 7 days (Hara & Beardsley, 1979). At 25°C, development time from egg to adult was approximately 28 days (Ngoan *et al.*, 1976). Once development is complete, mating occurs between siblings within the natal chamber. Females will then exit the host via the entrance hole (Hara & Beardsley, 1979). In Turkey, the adults are most active from mid-March to September, depending on local and seasonal climatic conditions (Hizal *et al.*, 2023). In favourable conditions, multiple overlapping generations in a year are possible. Three generations a year have been recorded in Northern Italy, and up to five have been recorded in Sicily (Gugliuzzo *et al.*, 2019a).

Adult females can live for around 42 to 58 days. After mating, females will only produce one brood (Hara & Beardsley, 1979). However, if a female cannot find a mate, she can lay a brood of unfertilised eggs, producing all males, and remain in the gallery while they develop. Once the offspring reach maturity the mother can mate with her offspring, produce another tunnel and lay a new brood containing females and males (Jordal *et al.*, 2001). Therefore, a single introduction of an adult female is enough to initiate an outbreak. This has not been studied specifically for *X. compactus*, but this mother-son mating has been reported from similar species (Norris, 1992; Andersen *et al.*, 2012).

Overwintering is by the female adults in the late-summer generation, where they remain in their tunnels. Adults may move to larger twigs before winter, as it would provide better protection, but this is not validated (Gugliuzzo *et al.*, 2020). In warmer climates, such as Uganda, the beetle does not overwinter and all life stages occur throughout the year (Egonyu, 2016).

Associated fungus

Xylosandrus compactus is an ambrosia beetle, characterized by inoculating their brooding chamber and tunnel with fungi. The *X. compactus* larvae feed on the mutualist fungus *Ambrosiella xylebori* Brader, rather than the actual wood of the host. This is a symbiotic relationship as the fungus is transported from one host to another by the beetle in the mycangia, and the beetle can attack a wide range of plants (Bateman *et al.*, 2016). Further information on associated fungi is available in section 15.

Damage

The most common damage caused by *X. compactus* is wilting and death of twigs and shoots. The adult female bores into the host, excavating a brood gallery along the twig pith, injuring the vascular tissue and reducing structural (load) resistance. The female also inoculates the wood with its fungal associates, to act as a food source for its offspring. This fungus does not cause degradation of the woody structure but interferes with the vascular tissue (Riba-Flinch *et al.*, 2021). Other fungal pathogens may be introduced such as *Fusarium solani*, eventually leading to browning/necrosis of the cortical tissue, extending from the entrance hole to the end of the branch. Flagging of the branch occurs about 5 – 7 days after initial tunnelling, followed by wilting within weeks (EPPO, 2020). Other signs and symptoms include white frass and/or exudates around the entrance hole, cankers around attacked areas of larger twigs and branches, and hindered fruit production (Dixon *et al.*, 2003; Riba-Flinch *et al.*, 2021). Unlike other *Xylosandrus* species, frass expelled from the entrance holes of *X. compactus* are not compacted in noodles, and resembles sawdust (Dixon *et al.*, 2003).

9. What pathways provide opportunities for the pest to enter and transfer to a suitable host and what is the likelihood of entering the UK/PRA area?

Xylosandrus compactus reproduces by sibling mating or females' mating with offspring, and only females leave the larval galleries. Therefore, a viable population may be formed by the introduction of a single adult female. Adults are small (<2 mm long) and create small entry holes and tunnels, making them difficult to spot (Dixon *et al.*, 2003). However, after 1 to 2 weeks, infestations can become quite noticeable due to symptoms such as twig flagging/wilting and dieback which may aid in the detection of this insect. As adults will remain in their brood until maturity and sometimes overwinter in larval galleries, all life stages are likely to be present in infested material.

Plants for planting

While capable of flight and natural spread, it is believed that the first outbreak in Europe from Italy was due to international plant trade (Hizal *et al.*, 2023). Invasion history studied using genetic markers showed the European population derived from that single introduction in Italy (SAMFIX, 2022). The majority of papers suggest that subsequent outbreaks in Europe were through human-mediated spread via live plants (Riba-Flinch, 2023).

Evidence for this pathway is lacking. While there is a known association with seedlings and young trees, as well as ornamentals that experience significant volumes of trade e.g. *Laurus nobilis* and *Prunus laurocerasus*, there is little evidence of the pest moving via this pathway. All initial records in new areas come from surveys or sightings in parks and gardens, rather than interceptions or nursery outbreaks (EPPO, 2024). The only evidence available for the pest moving on this pathway is the UK interception on *Laurus nobilis* trees from Italy in 2016. No further interceptions have been recorded on Europhyt from the years 1993 to 2020, excluding the UK interception on Kenyan mangoes.

Xylosandrus compactus could be spread via this pathway easily. This pest is minute and would be very difficult to spot. It is highly polyphagous and could be present on potentially any woody host plants being imported. A single brood is likely to contain multiple females which can go on to produce more offspring. As entry holes are very small, identification of infected branches would be very difficult, until symptoms begin to show after 1 to 2 weeks.

However, spread via plants for planting may be limited for a few reasons. Firstly, once a plant has been attacked, it will become a more attractive target for other *Xylosandrus* adults and similar wood-boring beetles, as attractant volatiles related to plant stress and *F. solani* are released (Ranger *et al.*, 2016; Gugliuzzo *et al.*, 2021). Therefore, an initial attack can quickly lead to a severe infestation. Secondly, *X. compactus* prefers young plants and seedlings, where evidence of infestation would be more noticeable. Even in the case of limited attacks, symptoms often become visible within a few weeks, such as wilting, flagging, and desiccation. Rendering the plant unmarketable or unfit for trade.

Additionally, the number of woody plants for planting is significantly higher from the EU than the rest of the world. The European distribution of *X. compactus* is limited and is particularly associated with coastal areas of some countries. If spread into continental Europe continues and *X. compactus* becomes more prevalent, the likelihood of this pest being associated with plants for planting would increase. The main imports of concern are woody plants for planting from the Mediterranean, but these are already considered high risk due to other quarantine pests and diseases and are often prioritised for inspection.

Table 2. Mass of live trees, shrubs, and other live plants imported from the distribution of *Xylosandrus compactus* (Tonnes) (Commodity codes included: 06022010, 06022020, 06022030, 06022080, 06023000, 06024000, 06029041, 06029045, 06029045, 06029046, 06029048, 06029050, 06029070, 06029091). Source = HMRC

	Total Annual Mass (t)	
Year	**EU**	**Non-EU**
2019	5514.07	178.51
2020	3393.21	173.01
2021	6661.4	130.63
2022	22539.33	175.66
2023	21080.06	112.9

The pathway of plants for planting is rated as likely with low confidence. This is the most likely pathway as there is a strong association with plants and many believe the live plant trade is the primary cause of spread in Europe. However, due to the lack of evidence for movement on this pathway, there is significant uncertainty.

Plants for Planting	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	☑	Very likely	☐
Confidence	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑				

Cut foliage, branches and plant parts

Xylosandrus compactus has a known preference for 1–3-year-old twigs and small branches, with a maximum diameter of 4 – 6 cm, suggesting a strong possibility of association and entry via this pathway. *Xylosandrus crassiusculus* has been intercepted on cut foliage in the United States, even though it is primarily found in larger branches and trunks (DEFRA, 2015). If *X. crassiusculus* can move via this pathway, it is likely *X. compactus* could as well, but there is no definitive evidence to support this.

From Uktradeinfo.com, the trade volume of foliage, branches and other parts of plants from countries with pest presence in the last 5 years (2019-2024) is quite low and would suggest an unlikely rating. In the European continent the distribution of *X. compactus* is currently restricted with only certain parts of the Mediterranean having recorded presence, the volume of trade from the pest's current range would likely be smaller than the volume reported for countries with pest presence. Additionally, commodities such as woody branches cannot be separated from other cut parts of plants using commodity codes, and a proportion of this trade volume could be attributed to foliage and other plant parts that are not suitable as host material for *X. compactus*.

Table 3. Mass of foliage, branches and other plant parts from the distribution of *Xylosandrus compactus* (Tonnes) (Commodity codes included: 06042090 and 06049091). Source = HMRC

	Total annual mass (t)	
Year	**EU**	**Non-EU**
2019	37.975	541.942
2020	83.614	390.53
2021	123.477	565.349
2022	361.034	374.393
2023	276.535	387.535

Because of the intended use of the commodity, cut foliage and plant parts is a pathway that provides little opportunity for transfer to a new host, though material disposed of outside near suitable hosts could provide a transfer opportunity, such as cut plants parts disposed from importers or material used for outdoor decorations. **This pathway is rated as unlikely with medium confidence.**

Cut branches	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

Timber and other raw wood products

Xylosandrus compactus has a documented preference for small twigs and branches but has recently been shown to attack larger parts such as the trunk. This has been observed in Sicily in the trunks of carob trees (*C. siliqua*), as well as on the trunks of plane trees (*Platanus* sp.) in southeastern France (SAMFIX, 2022). The wood of these tree species is not often traded so likelihood of entry via infested wood appears small. This may change if *X. compactus* is found to attack the trunks of trees that are more widely grown for timber or other wood products.

There are various requirements laid out in Annex 7 of the assimilated Phytosanitary Conditions Regulation (EU) 2019/2072 for the UK and EU legislation: 2019/2072 for NI, regarding wood of some host species of *X. compactus* such as the removal of bark and appropriate treatments. Due to the pest’s large host range and distribution, this PRA will not go into detail on these measures. *Xylosandrus compactus* and other ambrosia beetles are not corticolous and tunnel relatively deep into the wood (recorded depths of 1-3 cm) so debarking of wood products alone might not be sufficient to mitigate association.

For some countries and tree species, there would be limited controls in place for the import of wood, especially for EU member states. Sawn hardwood and other wood products are primarily imported from European countries with no recorded presence or restricted presence of *X. compactus* such as Latvia, Estonia and France. Similarly, the majority of sawn softwood, is imported mostly from Sweden, Finland and Latvia (Forest Research, 2023). This means that the majority of imported timber is very unlikely to exposed to *X. compactus* and therefore unlikely to serve as a pathway for entry.

The introduction of *X. compactus* via wood products could be considered likely given the volume of trade and the pest's large host range. However, there is no evidence of *X. compactus* moving via this pathway and there is a known preference for small twigs and branches, **this pathway is rated unlikely with medium confidence.**

Timber	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

Wood Packaging Material (WPM)

Large volumes of Wood Packaging Material (WPM) enter the UK from the current range of *X. compactus*. All WPM being traded internationally must be compliant with ISPM 15. This requires all WPM to be debarked and undergo heat treatment that achieves a minimum temperature of 56°C for 30 minutes or be treated with methyl bromide. Correct application of these measures should be effective in preventing *X. compactus* entering via this pathway. Either by physical removal of tunnels close to the surface or by killing individuals and associated fungi via treatment.

Non-compliant WPM could provide a pathway of entry for *X. compactus.* Members of the Scolytinae are commonly intercepted on non-compliant WPM. In the USA, 73% of Scolytinae interceptions were made on WPM and new introductions were strongly associated with WPM (Marini *et al.*, 2011). It is thought that similar species such as *X. germanus* are primarily spread by infested wood. In the USA, domestic untreated solid WPM and raw timber were suggested as the main source of spread (LaBonte *et al.*, 2005). However, *X. compactus* has not been intercepted or recorded on WPM, most likely due to the beetle's preference for small twigs and branches. Additionally, the hosts where attacks on the trunk have been recorded are carob (*C. siliqua*) and plane (*Platanus* sp.) which are not used for WPM.

While WPM experiences a high volume of trade, compliance with ISPM15 and the biology of *X. compactus* suggests a low likelihood of association between the pest and WPM suggests that entry via this pathway is **unlikely with medium confidence.**

Wood Packaging Material	Very unlikely ☐	Unlikely ☑	Moderately likely ☐	Likely ☐	Very likely ☐
Confidence	High Confidence ☐	Medium Confidence ☑	Low Confidence ☐		

10. If the pest needs a vector, is it present in the UK/PRA area?

Xylosandrus compactus is a free-living organism and does not require a vector.

11. How likely is the pest to establish outdoors or under protection in the UK/PRA area?

Given the wide host range of *X. compactus*, including plant genera widespread in the UK such as *Acer*, *Castanea*, *Quercus* and *Rhododendron*, host availability is unlikely to be a limiting factor. *Xylosandrus compactus* has been recorded from several plant species that grow in the UK, either as native/naturalised species such as *Castanea sativa* (sweet chestnut) and *Quercus robur* (English oak), or as popular ornamentals such as *Laurus nobilis* (bay laurel) and *Prunus laurocerasus* (cherry laurel) (Hizal *et al.*, 2023). Due to the ability of ambrosia beetles to infest trees with the use of associated fungi, even woody plant species not currently recorded as hosts could also be at risk.

Outdoors

Xylosandrus compactus has a known tropical and subtropical distribution, evidenced by its range in America where it is only found in hot humid states and similarly in Europe where only specific areas of the Mediterranean have recorded findings. A study conducted by Urvois *et al.* (2021a) looked at the potential impact of climate change on the geographical distribution of *X. compactus*. This paper uses Maximum entropy (MaxEnt) software for modelling species distributions. Additionally, this model was corrected for potentially expanding distributions by using presence-only models, which increases reliability. With the use of distribution data and recent historical climate variables (temperature and precipitation) from 1970 to 2000, current suitable areas were predicted, as shown in Figure 1. Over 50 models identify the southwest UK as being suitable for *X. compactus* presence. With other areas estimating a 0 – 25% potential presence. These areas appear to be modelled as suitable mostly based on precipitation, while temperature seems to play a less significant role. Additionally, this paper includes a map showing the standard deviation of habitat suitability for *X. compactus* under current climate conditions. The predicted suitable areas of the UK (southwest) have a high standard deviation, suggesting a lack of agreement or confidence between models. However, there is a low standard deviation for the east of the UK, suggesting agreement between models that these areas are unsuitable for pest presence. This paper indicates that establishment is possible in certain parts of the UK, specifically the southwest of England and southern Wales, but there is a significant degree of uncertainty.

From the findings in Europe, this model appears to be quite accurate, where the majority of findings have been reported from areas with high predicted presence. Although, the findings from Switzerland are concerning as predicted presence is smaller, with only a small patch of yellow to indicate 50% of models predicting presence. Further investigation reveals these findings were from the canton of Ticino, in the south of Switzerland, near the border of Italy. The climate of this area is described as mediterranean-influenced, where there is a local convergence of moist mediterranean air, resulting in hot and relatively humid summer seasons and mild winters which would be suitable for *X. compactus* development and establishment (Sheppard & Cape, 2013). The climate of this area of Switzerland is considered significantly different from the UK climate and does not explicitly indicate that establishment in the UK is likely.

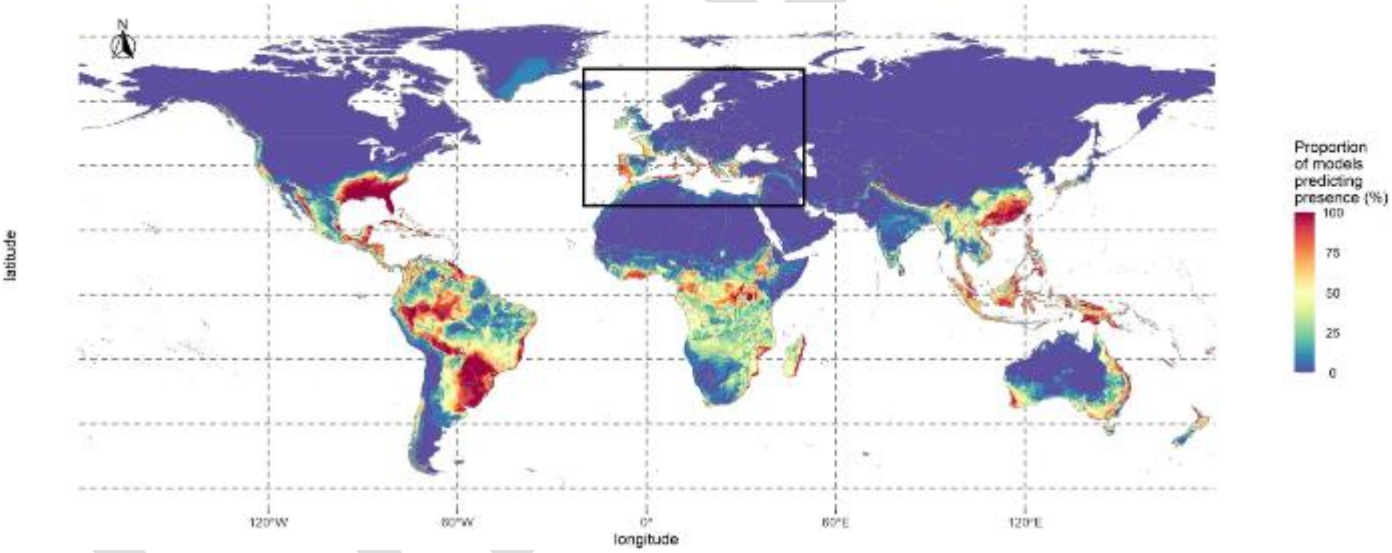

Figure 1. Map showing habitat suitability of Xylosandrus compactus under current climate conditions. Produced by Urvois et al. (2021a) CC BY 4.0

Limited studies have been conducted on the temperature requirements for the development of *X. compactus* in the natural environment. The UK experiences cooler summers compared to the current distribution so may limit the establishment potential. Under lab conditions, development from egg to adult took approximately 28 days at 25°C (Hara & Beardsley, 1979). However, applying this information to the UK environment is problematic and more research is needed to create a better estimation of development requirements and possible generations a year.

The effect of temperature on overwintering mortality was investigated as part of a study on seasonal changes to population dynamics of *X. compactus* and its associated fungus in

Sicily. Twigs showing signs of infestation were examined and the number of eggs, larvae, pupae, live adults and dead adults present in galleries were recorded. A higher percentage of dead adults, from 20-40%, was recorded from December to February when the majority of days experienced daily minimum temperatures of below 10°C. Temperatures often varied from 5 to 10°C, with only a few days in December and February experienced temperatures below 5°C. The link between daily temperatures and the presence of dead adults is not extensively studied and is based on preliminary results (Gugliuzzo *et al.*, 2020). Winter temperatures in the UK regularly drop below 5°C, especially in the South-west of the UK, so we can assume that overwintering mortality rates would be higher and would potentially prevent establishment of *X. compactus* populations or severely limit populations levels.

It is evident that humidity plays an important role in beetle establishment. In a paper published by Delgado and Couturier (2010) involving an experimental protocol of replanting Swietenia macrophylla (mahogany) seedlings infested with *X. compactus* in the Peruvian Amazonia, it was discovered that after plants were delivered to a nursery, the number of insects decreased. It was suggested this was due to a decrease in humidity, from lower plant density, greater light, and better air circulation. Additionally, Hara and Beardsley (1979) measured a 50 to 60% relative humidity requirement for the development of *X. compactus*. Areas experiencing higher levels of precipitation and humidity would be most suitable for *X. compactus*. This developmental requirement for high relative humidity would explain why predicted presence is small for the south-eastern UK, including London. This area experiences higher temperatures and is often considered more suitable for non-native insects, but as the level of precipitation and humidity is lower, this area is considered less suitable for *X. compactus* development. This also supports the likelihood of establishment in southwest UK, which contains temperate rainforests that meet the ideal conditions for pest development.

Evidence provided in this section suggests that the PRA area climate is unsuitable and would either prevent establishment or severely impact pest population numbers. More research is required into this area, especially if *X. compactus* continues to expand its range into Europe. However, it appears *X. compactus* has reached its northernly range in Europe as recent findings have not extended outside the expected climate boundary modelled by Urvois *et al.* (2021a). Therefore, **outdoor establishment is rated as unlikely with medium confidence.**

Under protection

It is possible that a beetle population could establish where woody plants are being grown under protection, due to the higher temperatures, higher humidity and the relatively short development time of the pest. The hosts of *X. compactus* mostly consist of broadleaved trees and shrubs (woody plants), which are not generally grown under protection. Although some high-value ornamentals, such as *Acer* spp., *Azaelea* spp., *Camellia* spp., and Bonsai, are sometimes grown large-scale under protection. The number of businesses using such methods is unknown but there is a concern that such sites could act as 'hotspots' for pest presence and allow further spread and establishment to similar sites. However, if proper biosecurity methods are followed at these sites, damage from *X. compactus* on imported plants should be recognised during quarantine procedures and prevent entry. Additionally, further spread of *X. compactus* between sites should be limited as businesses are unlikely to trade with a business that is distributing infested, damaged plants.

As *Xylosandrus compactus* is known to attack seedlings and young plants there is the possibility that damage could be significant for plants in glasshouse cultivation, where seedlings are grown before being moved outdoors. There is limited data regarding the impact of *X. compactus* on plants grown under protection. The only example available is from Peru where *Swietenia macrophylla* seedlings were placed under protection, leading to a decrease in the beetle population, most likely from a decrease in humidity (Delgado & Couturier, 2010). This is not what is expected for the PRA area, where protected cultivation is expected to have a higher humidity compared to the wider environment. This could be an issue where infested plants are imported and grown on, allowing transfer to new hosts. Although, protection for most seedlings and young plants would consist of polytunnels, rather than heated glasshouses, so conditions for pest development and activity may not be ideal.

Glasshouses belonging to botanical collections, or visitor attractions such as butterfly farms or tropical cages in zoos, which mimic tropical conditions, would meet the requirements for establishment. However, no outbreaks of *X. compactus* in glasshouses have been reported from the pest's current distribution, including from the EPPO region. The use of quarantine procedures should also limit the risk of entry and establishment.

Establishment under protection is rated as likely with medium confidence. Heated glasshouses and other structures would provide better conditions, such as higher temperatures and humidity, and suitable hosts are not expected to be limited. Yet, the likelihood of entry to these protected areas is unknown but should be mitigated by quarantine procedures and monitoring from growers.

Outdoors	Very unlikely ☐	Unlikely ✓	Moderately likely ☐	Likely ☐	Very likely ☐
Confidence	High Confidence ✓	Medium Confidence ☐	Low Confidence ☐		
Under Protection	Very unlikely ☐	Unlikely ☐	Moderately likely ☐	Likely ✓	Very likely ☐
Confidence	High Confidence ☐	Medium Confidence ✓	Low Confidence ☐		

12. How quickly could the pest spread in the UK/PRA area?

Natural spread

Gugliuzzo *et al.* (2019a) studied the flight activity of *X. compactus* in Sicily and reported a spread of more than 8 km from the last infested site of the previous year. This suggests a relatively high flight capacity and rate of spread. However, this spread is unlikely in the PRA area. As this paper highlights the relationship between flight activity and temperature, where adults were only caught when maximum daily temperatures were higher than 20°C. This suggests spread would be limited in the UK to the summer months. **Natural spread is rated as moderate pace with medium confidence.**

With trade

In trade, *X. compactus* is most likely to be moved in infested plants via the live plant trade. This has been the suggested cause for all European outbreaks. *X. compactus* was first introduced to Italy in 2011 with subsequent outbreaks in the majority of countries in southern Europe (SAMFIX, 2022). The relatively rapid spread of *X. compactus* between 2019 to 2024 indicates spread via trade rather than natural spread, considering the majority of outbreaks being quite isolated. Therefore, **spread with trade is rated as quickly with medium confidence**.

Natural Spread	Very slowly	☐	Slowly	☐	Moderate pace	☑	Quickly	☐	Very quickly	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

With trade	Very slowly	☐	Slowly	☐	Moderate pace	☐	Quickly	☑	Very quickly	☐
Confidence	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐				

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

Xylosandrus compactus is considered a significant pest of multiple crops, primarily coffee, in tropical countries. By 2012 in Uganda, *X. compactus* had spread to 68% of Robusta coffee (*Coffea canephora*) farms, where 40% of coffee plants were infested and 8.6% of twigs were killed (Kagezi *et al.*, 2013). In Malaysia, infestation of coffee was reported as severe, with 20% branch losses, although damage to other hosts was quite minor (Anuar, 1986). *Xylosandrus compactus* damage to coffee production in Uganda was valued at US$40 million annually (Hizal *et al.*, 2023). Additionally, this beetle is also a pest of coffee in Cameroon, with reported losses of about 20% (Hizal *et al.*, 2023), and in India, with 21 to 23.5% losses on old and young coffee plants respectively (Ramesh, 1987). More recently, *X. compactus* has also been a particular pest of coffee in Hawaii in the Kona area (Greco & Wright, 2015). It is believed that the main crop loss is due to the infection by associated fungus (Anuar, 1986).

Several other crops are also affected by *X. compactus*, such as cocoa (*Theobroma cacao*), tea (*Camelia sinensis*), fruit trees (e.g. *Macadamisa ternifolia*, *Litchi chinesis*, *Persea americana*), and forest trees (e.g. *Castanea*, *Swietenia*) (Hizal *et al.*, 2023). However, data on the impacts of these commodities is lacking so cannot be discussed in detail, but it appears that *X. compactus* has a significant economic impact on many tropical crops. Attacks from *X. compactus* can cause different types of damage depending on the host and its life stage. In mahogany (*Swietenia macrophylla*) seedlings in Peru, slight damage led to seedling breaking but eventually new sprouts were produced. Yet when damage was severe, seedlings would die, with a mortality rate of 38% (Delgado & Couturier, 2010). In shrubs and hedges, there is reduced plant growth due to the destruction of twigs and shoots on the crowns and mortality in cases of heavy and repeated infestations. In larger trees, symptoms are often reddening of crowns and subsequent peripheral desiccation (SAMFIX, 2022). Although, *X. compactus* has caused mortality in well-established, large trees in Hawaii (Nelson & Davis, 1972).

In Europe, damage caused by *X. compactus* appears to be mostly limited to ornamentals. According to the SAMFIX project, significant damage has been recorded with increasing frequency in Italy, France, and Spain, where forests, plant nurseries and urban greenery are being damaged within a few weeks of attack. Economic damage has also been recorded in tourist resorts in infested hedges and trees in the Lombardy and Veneto areas. The majority of this is aesthetic damage from the twig death and the drying of canopies, resulting in increased costs to garden and park management. However, no figures for management have been quantified so estimation of impact is problematic.

Environmental impacts are difficult to assess. The environmental impacts in the pest's current range are limited. During an outbreak of *X. compactus* in the Circeo National Park (Central Italy) serious damage including wilting, reddening of crowns and decline was recorded, primarily on holm oak (*Quercus ilex*). The ecological impact from this outbreak has not been measured but appears small. In Hawaii, *X. compactus* has been reported to attack several rare and threatened native trees, such as *Colubrina oppositifolia* and *Caesalphinia kavaiensis*, which are currently under stress from other factors (Pennacchio *et al.*, 2012). Creating an additional threat to these species' survival. Loss of these tree species could have significant environmental impacts. In the pest's current range, damage to forest tree species is significant but actual environmental impact appears to be small.

Additionally, social impacts are hard to estimate. The majority of findings in Europe have been on urban greenery, amenity trees or private gardens. Continued attack from *X. compactus* resulting in aesthetic damage (wilting, drying, crown dieback) could cause public concern. In certain areas such as resorts in Lombardy and Veneto, damage caused by *X. compactus* could have an impact on tourism (SAMFIX, 2022), although no figures are available. In Naples (Italy), significant dieback to apical shoots has been seen on *Magnolia grandiflora* and was described as conspicuous and had an overall visual impact to the parklands (C. Malumphy, personal communication, April 22, 2025). There is a lack of research in the public reaction to this damage. The social impacts for *X. compactus* are currently not thought to be significant, as there are no reported changes to local activities, and are rated as small. Although, it is important to note social impacts are often under reported in research papers, especially in the case where the pest is seen primarily in parks and private gardens and recorded impacts may not reflect the aesthetic damage and subsequent concern from the public.

Impacts in the current range are rated as large, with high confidence, due to the pest's economic impacts on different agricultural crops, especially coffee production.

Impacts	Very small	☐	Small	☐	Medium	☐	Large	✓	Very large	☐
Confidence	High Confidence	✓	Medium Confidence	☐	Low Confidence	☐				

14. What is the pest's potential to cause economic, environmental and social impacts in the UK/PRA area?

The UK climate is expected to severely limit the impacts of *X. compactus*. Should the pest be introduced it is likely only small populations would become established in parts of Wales and southwest England, and adults would be active only during the warmest parts of the year.

Economic

The majority of impacts caused by *X. compactus* in its current distribution is to crops such as coffee and cocoa in tropical countries. Other economically important crops that have experienced damage include fruit trees such as *Macadamia*, *Litchi*, and avocado (Hizal *et al.*, 2023). While these crops are not grown in the UK, the wide host range of *X. compactus* means fruit trees in the UK are potentially at risk. Several commonly grown fruit species have been identified as susceptible in Spain. Including apricot (*Prunus armeniaca*), cherry (*P. avium*), and pear (*Pyrus communis*) (Riba-Flinch, 2023). Additionally, *X. compactus* has also been recorded on plants in the genera of *Malus* and *Rubus* (Hara & Beardsley, 1979), suggesting that the infestation of commercially grown apple and berry species is possible. It is difficult to estimate the impact on fruit trees and shrubs in the UK as the extent of damage for these species has not been researched. In the current range of *X. compactus*, the impact on fruit trees appears small, where limited information is available and it is not highlighted as a significant issue, especially compared to coffee production.

In the PRA area, the main cause of economic impact is expected to be damage to ornamentals and urban greenery. If outbreaks of *X. compactus* behave similarly to those in Europe, damage to popular ornamentals such as *Laurus nobilis* and *Prunus laurocerasus* in private gardens and hedging, and native/naturalised species such as *Castanea* and

Quercus in parks and urban areas may occur in some parts. This may cause increased costs for garden and park management (SAMFIX, 2022) but establishment is unlikely in the wider environment due to limited climate suitability. High-value ornamentals grown under protection could be at risk of serious damage due to more suitable conditions for beetle development. It is thought that general monitoring and biosecurity procedures for such sites would help limit the risk of entry and damage.

Economic impact is rated as small with medium confidence.

Environmental

Due to the pest's wide host range and ability to attack healthy, non-stressed plants, there is a risk that the establishment of this pest could lead to infestations of various woody plant species important to the UK ecosystem. From the reports of mortality in both young plants and well-established trees (Nelson & Davis, 1972), there is a concern of damage to the UK environment. Multiple forest tree species in the UK have been reported as hosts, for example, *Quercus robur,* but the most common symptom for mature hosts is crown dieback. The mortality of well-established trees is not reported for many species, aside from the cases in Hawaii where trees are already stressed from other factors. Mortality of mature trees appears unlikely, but crown dieback and loss of twigs/branches would reduce photosynthetic ability and reduce the vigour of trees. Stressed trees would also be more susceptible to attack, especially from other insect pests and the fungal associates introduced by *X. compactus* (e.g. *Fusarium solani*).

There is limited evidence of this pest being a significant environmental concern in it’s current distribution. Impacts have been recorded mostly for agriculture or urban greenery, rather than native woodlands. **Environmental impact is rated as small with medium confidence.**

Social

Social impacts may occur when trees and hedging in private gardens and public spaces are infested, leading to aesthetic damage and public concern. However, for older trees, this damage would be limited, and only attacks on younger plants and seedlings are likely to result in mortality. There is currently no evidence of public concern as a result of outbreaks in Europe. **Social impacts are rated as small with medium confidence.**

Economic Impacts	Very small ☐	Small ☑	Medium ☐	Large ☐	Very large ☐
Confidence	High Confidence ☐	Medium Confidence ☑	Low Confidence ☐		
Environ - mental Impacts	Very small ☐	Small ☑	Medium ☐	Large ☐	Very large ☐

Confidence	High Confidence ☐	Medium Confidence ☑	Low Confidence ☐		
Social Impacts	Very small ☐	Small ☑	Medium ☐	Large ☐	Very large ☐
Confidence	High Confidence ☐	Medium Confidence ☑	Low Confidence ☐		

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

The primary symbiont is considered to be *Ambrosiella xylebori* Brader. *Ambrosiella xylebori* is considered a true mutualist, supplying the diet for the larvae and being transported in a specialized structure called the mycangia. *Xylosandrus compactus* and *A. xylebori* are considered symbionts as they are always present together, as the beetle requires the fungus as a food source, and the fungus relies on the beetle for transport to new hosts (Bateman *et al.*, 2016). *Ambrosiella xylebori* may obstruct the flow of water and nutrients through the xylem but is not thought to be a phytopathogen.

*Xylosandrus compact*us also has various fungal associates, where the beetle and fungus are often found together but do not rely on each other for survival. The fungal taxa most consistently associated with *X. compactus* is *Fusarium*, including members of the *Fusarium Solani* Species Complex (FSSC) (Bosso *et al.*, 2012; Bateman *et al.*, 2016; Vannini *et al.*, 2017). *Fusarium* spp. are thought to be stable associates, involved in the necrosis development of twigs/branches, and often found on the external surfaces of the beetle, specifically the abdomen, and possibly inside the gut. *Fusarium* association is thought to be less consistent than *A. xylebori* (Bateman et al., 2016). It is suggested this association with *Fusarium* spp. allows *X. compactus* to attack live/healthy trees (Hara & Beardsley, 1979). Although, *Fusarium* spp. are also associated with other *Xylosandrus* spp. such as *X. germanus* (Pastirčáková *et al.*, 2024) and *X. morigerus* (Carreras-Villaseñor et al., 2022), which prefer weakened, unhealthy trees as hosts.

This beetle is often associated with a variety of fungi. Morales-Rodríguez *et al.* (2021) identified 60 different fungal species associated to *X. compactus* in Italy. It is suggested that the mycobiome of ambrosia beetles may be altered by the invaded environment allowing exotic beetle species to acquire native fungi. After introduction, it can be assumed that different fungal species will become associated, and less adapted fungi would decrease over generations, allowing more well-adapted species to become stable associates leading to a greater pathogenicity of the beetle for native hosts (Rassati *et al.*, 2019).

16. What is the area endangered by the pest?

This pest is not expected to cause an unacceptable level of economic damage where it could become established. Therefore, there is no endangered area.

Stage 3: Pest Risk Management

17. What are the risk management options for the UK/PRA area?

Exclusion

For countries where *X. compactus* is likely to establish, the preferred risk management option is exclusion of the pest, as any established populations are likely to be difficult to detect early and allow eradication. Due to this beetle's preference for infesting twigs and small branches of live woody plants, phytosanitary measures to limit the risk of association are difficult. Current measures include requiring a phytosanitary certificate and plant health inspections at the border. Suggested additional measures could include the requirement of plants originating from a pest-free area. However, as there is a low risk of pest establishment and potential impacts are rated as small, actions for continued exclusion from the PRA area are deemed unnecessary.

Eradication and containment

While establishment has been rated as unlikely, if a population did become established, eradication would be complicated by the pest's broad host range and its cryptic nature.

It is unknown if eradication methods are currently being pursued for *X. compactus* in European countries such as France, Italy, and Spain. It has been noted in an ANSES (French NPPO) opinion request that no curative plant health measures can be proposed currently, and preventative control measures based on the destruction of infested plants is recommended. Previously there have been successful eradication protocols carried out. In Spain, after the first report of *X. compactus* on *Ceratonia siliqua*, the infested tree was drastically pruned and two trunk injection treatments with abamectin were performed (EPPO, 2024). An outbreak of *X. crassiusculus* in Oregon was eradicated with the use of ground sprays of all trees and shrubs with a pesticide containing permethrin (DEFRA, 2015). In both cases, the beetle populations were small and eradication is thought to be very difficult if the population is not detected early and becomes large.

While chemical control has been used for these outbreaks, the effectiveness of insecticides and fungicides for *X. compactus* is questionable. Chemical control is best performed as a preventative measure, due to females and developing stages being protected while inside the galleries. Contact pesticides cannot penetrate deep enough to the brood galleries and infestation affects water flow through the xylem vessels so systemic products are not transported to the entirety of the plant (SAMFIX, 2022). Chemical control has to be timed carefully so application is done at the same time as emergence and adult flight (Ranger *et al.*, 2016). Additionally, treatments could only be performed in confined and easily accessible environments (nurseries, private gardens) by spraying the under-foliage of small plants, shrubs and hedges. Large-scale spraying of trees is believed to be unsuitable (SAMFIX, 2022). Additionally, chemical approval differs between countries, therefore any mention of products in this PRA does not mean they are authorised for use in the UK.

Various bioinsecticides and synthetic insecticides have been tested on *X. compactus*, under laboratory conditions, with some promising results (Gugliuzzo *et al.*, 2023). During field tests, the organophosphate pesticide, chlorpyrifos, caused >80% mortality of all *X. compactus* stages infesting twigs of flowering dogwood in Florida (Mangold *et al.*, 1977). However, other insecticides have shown limited effectiveness against *X. compactus* in the field (Gugliuzzo *et al.*, 2021).

A more effective method to reduce *X. compactus* populations is sanitation. As the pest prefers small twigs and branches, felling of the entire tree is not necessary and pruning of infested limbs would be sufficient in reducing population levels. In countries where *X. compactus* experiences several generations a year, timing can be difficult as pruning must take place during the immature stages. However, where the pest is expected to overwinter, adult females remain inside their tunnels. This would provide plenty of time to carry out pruning/felling and reduce physiological damage. In the case of severely infested plants, felling is recommended as pruning becomes expensive and difficult to implement, and the physiological and aesthetic damage could outweigh the damage caused by the beetle. For hedges and urban greenery compromised by *X. compactus* attacks, total or partial replacement with multiple different plant species not known to be attacked by *X. compactus* is recommended (SAMFIX, 2022).

While the pest is capable of natural spread up to 8 km per breeding season in Italy there is no data for natural spread in the PRA area, but cool UK summers may limit potential spread (Gugliuzzo *et al.*, 2019a). It is suggested that plant trade is the primary source of new outbreaks. Therefore, the spread of the pest could be reduced by preventing the movement of planting material from a delimited area around known outbreaks.

Non-statutory controls

Management strategies for *Xylosandrus* beetles often discuss the need to maintain plant health and avoid significant stress, as most *Xylosandrus* species will only attack stressed/dying plants. This includes maintaining plants in vegetative conditions, avoiding trauma or excessive damage to foliage and roots, and avoiding water stress (drought/flooding) (Gugliuzzo *et al.*, 2021). It is also important to continually monitor the health of trees and hedges and provide proper irrigation, targeted fertilisation, and soil aeration to improve health (SAMFIX, 2022). However, *X. compactus* is an exception as it will colonise healthy and stressed plants. The influence of plant quality or stress has not been fully studied.

Other management strategies and prospects include:

- Lures and traps with the use of ethanol and plant volatiles e.g. α-pinene, α-copaene and quercivorol (Burbano *et al.*, 2012; Leza *et al.*, 2020; SAMFIX, 2022).
- Trap trees and ethanol-baited tree bolts (Gugliuzzo *et al.*, 2021).
- Push-pull strategies with traps and repellents, such as verbenone (Gugliuzzo *et al.*, 2021).
- Microbial control. Various fungi and bacteria are currently being studied for control of both *X. compactus* and their fungal mutualists (Balakrishnan *et al.*, 1994; Gugliuzzo *et al.*, 2021)
- Biocontrol with use of predatory beetles (Sreedharan *et al.*, 1992) (Greco, 2010) or parasitoids (Gugliuzzo *et al.*, 2021).

The use of traps, lures and push-pull strategies are not species specific but could be used for monitoring or to control populations of ambrosia beetles in general. Additionally, these management strategies are still being developed and may be unsuitable for application in the UK. Currently, the most appropriate management option for *X. compactus* infestations is proper sanitation and pruning of infested limbs.

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This publication is available via the UK Plant Health Information portal https://planthealthportal.defra.gov.uk/

This PRA has been undertaken following IPPC International Standards for Phytosanitary Measures (ISPMs 2 and 11) and it provides technical evidence relating to the risk assessment and risk management of this pest.

This PRA has been undertaken taking into account the environmental principles laid out in the Environment Act 2021. Of particular relevance are:

The prevention principle, which means that any policy on action taken, or not taken should aim to prevent environmental harm.

The precautionary principle, which assists the decision-making process where there is a lack of scientific certainty.

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