RISK ASSESSMENT SUMMARY SHEET

Black Bamboo (*Phyllostachys nigra*)

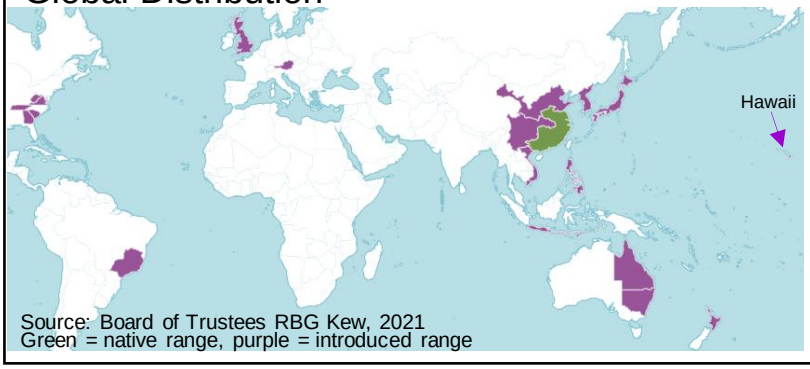
- An evergreen Bamboo growing up to 7.5 m tall at a fast rate; green at first becoming black-brown with maturity, has narrow-lanceolate leaves up to 12cm in length.
- Native to south central and south east China, with introduced ranges across the world.
- Present in GB for nearly 200 years.
- It is a widely available and highly popular ornamental.

Photograph: Georges Seguin, Wikimedia

History in GB

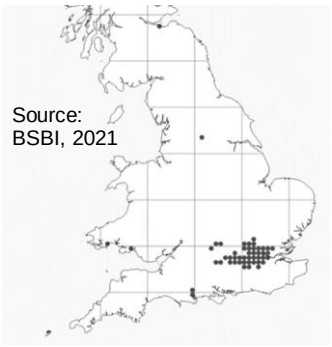
Introduced to GB around 1825. There are 282 records on the BSBI Distribution Database which are mostly limited to urban habitats. It is possible that many of these records are not from the wild and it may not be established (in the wild). However, there is an early record of it as "semi-naturalised" in Cardiff in 1994.

Global Distribution



Source: Board of Trustees RBG Kew, 2021
Green = native range, purple = introduced range

GB Distribution



Impacts

Environmental: (minor, medium confidence)

- Elsewhere in the world can form dense clumps excluding other vegetation (e.g. in Hawaii and Tanzania); however, none reported in GB.
- Potential to cause impacts depends largely on whether it will spread beyond gardens in GB as a 'running bamboo'.
- In general, impacts are thought likely to be localised in or near urban areas.

Economic: (minimal, medium confidence)

- None reported.
- Any economic costs are likely to be associated with structural damage and/or neighbour disputes but would be localised.

Societal: (minimal, high confidence)

- None reported.

Introduction pathway

Ornamental horticulture – widely available within GB.

Spread pathway

Natural: (minimal, medium confidence) – 'clump forming' in poor soils but become 'running bamboos' in fertile soil. Rhizomatous with potential to spread vegetatively.

Human: (minimal, high confidence) - soil contamination, dumping plant waste or deliberate planting in the wild. However, it is not expected to increase its spread by more than 0-10% in the next 5 years.

Summary

	Response	Confidence
Entry	VERY LIKELY	HIGH
Establishment	MODERATELY LIKELY	MEDIUM
Spread	VERY SLOW	MEDIUM
Impact	MINOR	MEDIUM
Overall risk	LOW	MEDIUM

RISK ASSESSMENT COVERING PAGE - ABOUT THE PROCESS

It is important that policy decisions and action within Great Britain are underpinned by evidence. At the same time it is not always possible to have complete scientific certainty before taking action. To determine the evidence base and manage uncertainty a process of risk analysis is used.

Risk analysis comprises three component parts: risk assessment (determining the severity and likelihood of a hazard occurring); risk management (the practicalities of reducing the risk); and risk communication (interpreting the results of the analysis and explaining them clearly). This tool relates to risk assessment only. The Non-native Species Secretariat manages the risk analysis process on behalf of the Programme Board for Non-native Species. During this process risk assessments are:

- Commissioned using a consistent template to ensure the full range of issues is addressed and maintain comparable quality of risk and confidence scoring supported by appropriate evidence.
- Drafted by an independent expert in the species and peer reviewed by a different expert.
- Approved by the NNRAF (an independent risk analysis panel) only when they are satisfied the assessment is fit-for-purpose.
- Approved by the Programme Board for Non-native Species.
- Placed on the GB Non-native Species Secretariat (NNSS) website for a three month period of public comment.
- Finalised by the risk assessor to the satisfaction of the NNRAF and Programme Board if necessary.

Common misconceptions about risk assessments

The risk assessments:

- Consider only the risks (i.e. the chance and severity of a hazard occurring) posed by a species. They do not consider the practicalities, impacts or other issues relating to the management of the species. They also only consider only the negative impacts of the species, they do not consider any positive effects. They therefore cannot on their own be used to determine what, if any, management response should be undertaken.
- Are advisory and therefore part of the suite of information on which policy decisions are based.
- Are not final and absolute. They are an assessment based on the evidence available at that time. Substantive new scientific evidence may prompt a re-evaluation of the risks and/or a change of policy.

Period for comment

Once placed on the NNSS website, risk assessments are open for stakeholders to provide comment on the scientific evidence which underpins them for three months. Relevant comments are collated by the NNSS and sent to the risk assessor for them to consider and, if necessary, amend the risk assessment. Where significant comments are received the NNRAF will determine whether the final risk assessment suitably takes into account the comments provided.

To find out more: published risk assessments and more information can be found at http://www.nonnativespecies.org/index.cfm?pageid=143

GB NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

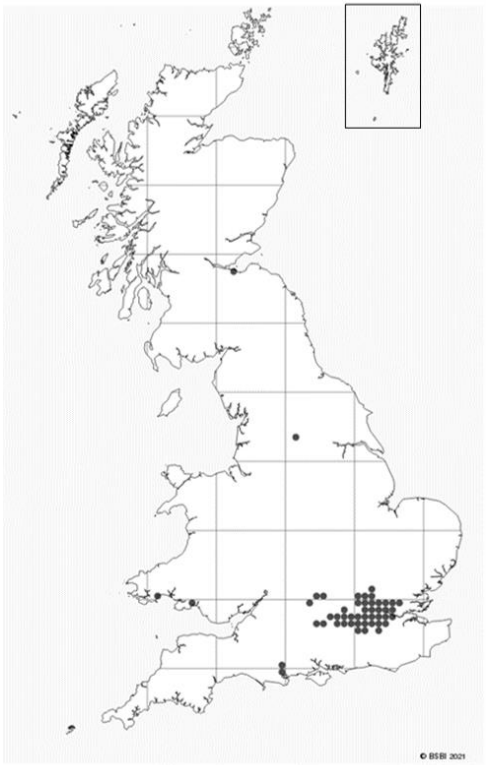
Name of organism: *Phyllostachys nigra*, black bamboo
Author: Tomos Jones, University of Reading
Risk Assessment Area: Great Britain
Version: Draft 1 (Feb 21), Peer review (Apr 21), NNRAP 1 (Mar 21), Draft 2 (Jun 21), NNRAF 2 (Jul 21), Draft 3 (Jul 21)
Signed off by NNRAF: July 2021
Approved by Programme Board: January 2023
Placed on NNSS website: January 2024

What is the principal reason for performing the Risk Assessment?

This species was identified as a potential threat by horizon scanning in 2020 and therefore prioritised for risk assessment.

SECTION A – Organism Information	
Stage 1. Organism Information	**RESPONSE AND COMMENT**
1. Identify the organism. Is it clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	Yes *Phyllostachys nigra* (Lodd. ex Lindl.) Munro Common name: Black bamboo, Black Japanese bamboo Synonym: *Bambusa nigra* Lodd. ex Lindl. The Flora of China (2006) and The Plant List (2013) list many synonyms for *P. nigra*, which is often true for ornamental bamboos, and Clayton et al. (2002) lists 77 synonyms. There are named cultivars, such as 'Boryana', 'Han-chiku' (Lord, 1994), 'Hale', 'Henonis' AGM[1], 'Megurochiku' as well as *P. nigra* f. *puncata* (Brickell, 2008; Cubey, 2018). [1]Award of Garden Merit (AGM) is discussed in section 1.22. It is worth noting that bamboos can be difficult to identify (e.g. Canavan et al., 2020).
2. If not a single taxonomic entity, can it be redefined? (if necessary use the response box to re-define the organism and carry on)	There is inconsistency in the taxonomic rank for *P. nigra* 'Henonis' with both *P.* f. *henonis* and *P.* var. *henonis* used. In this report, the rank adopted within the respective citation is used and thus will not be consistent.
3. Does a relevant earlier risk assessment exist? (give details of any previous risk assessment)	No
4. If there is an earlier risk assessment is it still entirely valid, or only partly valid?	NA

5. Where is the organism native?	South central and southeast China including Guizhou and southern Hunan (Plants of the World Online, 2021)
6. What is the global distribution of the organism (excluding the risk assessment area)?	According to Plants of the World Online (2021) it is introduced in: Austria, southeast Brazil, north central China, Hawaii, Japan, Jawa, Korea, Lesser Sunda Island, Nansei-shoto, Australia (New South Wales and Queensland), New Zealand (north island), Philippines, Seychelles, Tibet, Vietnam, and the USA (Georgia, South Carolina, Tennessee Virginia, West Virginia). Although it is not listed in the Flora of North America (n.d.) it is found in Alabama (newly recorded in 2013), Georgia, Mississippi, and Tennessee (Diamond, 2013). In New Zealand, *P. nigra* var. *henonis* is listed as naturalised since 1993 and *P. nigra* var. *nigra* since 1991 (New Zealand Plant Conservation Network, n.d.). In Europe, it is considered a casual in France and Austria (van Valkenburg et al., 2014).

7. What is the distribution of the organism in the risk assessment area?	Introduced to GB as an ornamental around 1825 (Bean, 1976). There are 282 records on the BSBI Distribution Database (BSBI, 2021) which are mostly limited to urban habitats. It is possible that many of these records are not from the wild, and the fact that *P. nigra* is not listed in Stace (2010; 2019) nor Stace & Crawley (2015) suggests that it is not established (in the wild) in GB. It is possible however, there is an early record of it in Ryves et al. (1996:6) as "semi-naturalised" in Cardiff (1994) but at the time there were no other naturalised records. 
8. Is the organism known to be invasive (i.e. to threaten organisms, habitats or ecosystems) anywhere in the world?	Listed in the Invasive Species Compendium (CABI, 2019a) but not as an invasive species. It is not listed in the Global Invasive Species Database (GISD, 2021) nor on the current or past EPPO Alert Lists (EPPO, 2020). Not listed in Weber (2003). In Hawaii there is a record of it dominating early successional habitats following fire (Tunison et al., 2002; Space & Imada, 2004). It is also considered a priority species for exclusion from Kiribati (Space & Imada, 2004).

	It is considered invasive in Tanzania where it escapes from gardens (BioNET-EAFRINET, 2011) and a 'weed' (i.e. invasive) in New South Wales, Australia (Department of Primary Industries, 2020) where it falls under the Biosecurity Act 2015. *P. aurea* and *P. aureosulcata* are considered highly invasive (CABI, 2019b; CABI, 2020).
9. Describe any known socio-economic benefits of the organism in the risk assessment area.	It is a popular and widely available ornamental (Cubey, 2018).

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into the risk assessment area. Not to be confused with spread, the movement of an organism within the risk assessment area.
- For organisms which are already present in the risk assessment area, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry.

QUESTION	RESPONSE	CONFIDENCE	COMMENT
1.1. How many active pathways are relevant to the potential entry of this organism? (If there are no active pathways or potential future pathways respond N/A and move to the Establishment section)	very few	very high	The only known introduction pathway is ornamental horticulture.
1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways. For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).	Ornamental and horticulture		
Pathway name:	Ornamental and horticulture (considered as one but see Pergl et al. (2020) for distinction).		
1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?	intentional	very high	

(If intentional, only answer questions 1.4, 1.9, 1.10, 1.11)			
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year? Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.	very likely	very high	It is listed as widely available in the RHS *Plant Finder* (Cubey, 2018) which means it is available from more than 30 nurseries and 54 suppliers currently listed online (RHS, 2021a). It is listed in Taylor et al. (2021) as one of six bamboos most commonly favoured by gardeners and landscapers. It is possible that it has become more widely available, perhaps because of increasing popularity, because only 11 suppliers are listed in the RHS *Plant Finder* in 1994 (Lord, 1994).
1.9. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very likely	high	Considered 'very likely' because of transfer by human means. This could be due to 'dumping' of plants in the wild, or because of soil contamination (Taylor et al., 2021). Transfer by natural means such as spreading from gardens would be considered 'likely' (see section 2.1.). Bamboos including *Phyllostachys* spp. are known to have entered the wild from this pathway.
1.10. Estimate the overall likelihood of entry into the risk assessment area based on this pathway?	very likely	high	Likelihood of entry into risk assessment area by natural means considered to be 'likely' (see comments in section 1.11.)
End of pathway assessment, repeat as necessary.			
1.11. Estimate the overall likelihood of entry into the risk assessment area based on all pathways (comment on the key issues that lead to this conclusion).	very likely	high	Despite uncertainty on the status of current records in GB (see section A.7.), it has entered the wild in Europe, being considered a casual in France and Austria (van Valkenburg et al., 2014). There is also considerable propagule pressure because of its popularity as an ornamental.

PROBABILITY OF ESTABLISHMENT

Important instructions:

- For organisms which are already well established in the risk assessment area, only complete questions 1.15, 1.21 and 1.28 then move onto the spread section. If uncertain, check with the Non-native Species Secretariat.

QUESTION	RESPONSE	CONFIDENCE	COMMENT
1.12. How likely is it that the organism will be able to establish in the risk assessment area based on the similarity between climatic conditions in the risk assessment area and the organism's current distribution?	moderately likely	medium	Climatic similarity between the native and introduced ranges of *P. nigra* is based on the Köppen-Geiger climate classification of Beck et al. (2018). The climate in its native range is mostly classified as Cfa (temperate, no dry season, hot summer) or Cwa (temperate, dry winter, hot summer). Its introduced range given in Plants of the World Online (2021) suggests a wide climatic tolerance, including other temperate climates such as Cfb (temperate, no dry season, warm summer) - as GB - on the north island of New Zealand. Also, tropical climates in east Asia. It is also fully hardy meaning that it can withstand temperatures down to -15°C (Brickell, 2008). The climate in most of GB is currently classified as Cfb (Beck et al., 2018) so does not match its native range and perhaps not optimal. France has the same climate classification (Beck et al., 2018) where it is only considered a casual (van Valkenburg et al., 2014). According to Bamboo Identification (2021), *Phyllostachys* spp. grow best with a "hot summer and cold winter to rest". For this reason, they rarely thrive in coastal northern Europe (including GB). Despite its wide climatic tolerance, temperature seems to be limiting factors for it to thrive (growing vigorously, spreading). Also, *Phyllostachys* spp. apparently need plenty of sun to thrive, although personal observations would suggest otherwise (at least for *P. aurea*).

			For example, *P. nigra* is considered invasive in New South Wales (Department of Primary Industries, 2020) and based on records in the Atlas of Living Australia (2021), it is mostly found near Sydney where it might be establishing beyond gardens. Sydney has a Cfa climate classification (Beck et al., 2018) meaning it has hot summers (compared to warm summers in GB). Bamboos have a gregarious flowering pattern (i.e. regardless of environmental or climatic factors) but also sporadic flowering which is determined by environmental factors (see section 2.1.).
1.13. How likely is it that the organism will be able to establish in the risk assessment area based on the similarity between other abiotic conditions in the risk assessment area and the organism's current distribution?	likely	medium	Does not seem to have specific abiotic requirements, beyond preferring fertile, humus-rich soil which is moist but well-drained (RHS, 2021a).
1.14. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in the risk assessment area? Subnote: gardens are not considered protected conditions	very unlikely	low	It could establish in protected conditions such as glasshouses, but it is only known to be grown in gardens where it does not need any particular maintenance (e.g. protection from frost). Confidence is low because it might be grown in protected conditions *sensu stricto* such as zoos.
1.15. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in the risk assessment area?	widespread	high	In its native range, it is found in open forests on slopes and in valleys (Flora of China, 2006). In Tanzania, it is found in riparian habitats, disturbed sites such as waste areas and roadsides, and in urban habitats (BioNET-EAFRINET, 2011).
1.16. If the organism requires another species for critical stages in its life cycle	NA	high	Bamboos are wind pollinated (e.g. CABI, 2020).

then how likely is the organism to become associated with such species in the risk assessment area?			
1.17. How likely is it that establishment will occur despite competition from existing species in the risk assessment area?	moderately likely	medium	Bamboos are strong competitors especially when reaching mature height because of the shade they create and the accumulation of leaf litter (Taylor et al., 2021). Establishment potential is probably limited by climatic favourability rather than biotic competition.
1.18. How likely is it that establishment will occur despite predators, parasites or pathogens already present in the risk assessment area?	very likely	medium	It is not known whether this species has natural enemies, and whether these are present in GB. For bamboos in general, there are "few, if any, native predators or diseases that might offer natural control" (Taylor et al., 2021). As an ornamental, it is considered generally disease free (RHS, 2021a).
1.19. How likely is the organism to establish despite existing management practices in the risk assessment area?	moderately likely	high	No known existing management practices in the risk assessment area. But it is likely to require management in cultivation (e.g. in gardens) especially if growing as a 'running bamboo' (see section 2.1.) because they spread beyond cultivation (Canavon et al., 2020).
1.20. How likely are management practices in the risk assessment area to facilitate establishment?	likely	high	There are no known existing management practices in the risk assessment area specifically for *P. nigra* but soil contamination (with fragments) could facilitate establishment.
1.21. How likely is it that biological properties of the organism would allow it to survive eradication campaigns in the risk assessment area?	moderately likely	medium	*P. nigra* is known to grow as a 'running' bamboo (see section 2.1.). It is also possible for the plant to grow from fragments of rhizomes, which may also be dispersed in soil and dumped garden material (BioNET-EAFRINET, 2011; Department of Primary Industries, 2020).
1.22. How likely are the biological characteristics of the organism to facilitate its establishment?	moderately likely	medium	Individuals probably have a long life-cycle (Bean, 1976). It is possible that more vigorous clones have become available recently. Vigour allows for quicker propagation which is cost effective for nurseries.

1.23. How likely is the capacity to spread of the organism to facilitate its establishment?	unlikely	medium	It rarely flowers and spreads mainly vegetatively (BioNET-EAFRINET, 2011). Any spread is more likely to be by human means. See section 2.1. and 2.2. for further comments on spread.
1.24. How likely is the adaptability of the organism to facilitate its establishment?	likely	high	Its current global distribution would suggest that it has considerable adaptability, being found in temperate and tropical climates (Beck et al., 2018; Plants of the World Online, 2021).
1.25. How likely is it that the organism could establish despite low genetic diversity in the founder population?	moderately likely	medium	It is not known how much genetic diversity there is within the horticultural stock of *P. nigra* in GB but there are several cultivars available (Brickell, 2008; Cubey, 2018).
1.26. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in the risk assessment area? (If possible, specify the instances in the comments box.)	moderately likely	low	It is considered a casual in France (mostly having the same climate classification as GB of Cfb) (van Valkenburg et al., 2014) which implies that it has not yet established. However, it has probably established in New South Wales (near Sydney) (Atlas of Living Australia, 2021) and it is considered invasive in Hawaii (Tunison et al., 2002; Space & Imada, 2004), which does include areas of Cfb climate classification (Beck et al., 2018).
1.27. If the organism does not establish, then how likely is it that transient populations will continue to occur? Subnote: Red-eared Terrapin, a species which cannot re-produce in the risk assessment area but is established because of continual release, is an example of a transient species.	very likely	high	It is a widely available ornamental (Cubey 2014; 2018), and therefore will almost certainly have a transient population within gardens as a source of possible establishment.
1.28. Estimate the overall likelihood of establishment (mention any key issues in the comment box).	moderately likely	medium	It has been introduced into cultivation in GB since around 1825 (Bean, 1976). It is widely available (Cubey, 2018) and possibly increased in popularity in recent years. This suggests considerable number of plants in gardens within GB as a source of potential establishment.

			It would be considered ‘likely’ or ‘very likely’ if any of the current GB records were known to be established (naturalised) plants, with a higher confidence rating.

PROBABILITY OF SPREAD

Important notes:

- Spread is defined as the expansion of the geographical distribution of a pest within an area.

QUESTION	RESPONSE	CONFIDENCE	COMMENT
2.1. How important is the expected spread of this organism in the risk assessment area by natural means? (Please list and comment on the mechanisms for natural spread.)	minimal	medium	*Phyllostachys* spp. are rhizomatous bamboos (Department of Primary Industries, 2020) and mainly spreads vegetatively (BioNET-EAFRINET, 2011). However, there is conflicting evidence on the growth form of *P. nigra* as a ‘clump forming’ or ‘running’ bamboo in GB. This is an important distinction because ‘running’ bamboos spread rapidly (Canavon et al., 2020; Taylor et al., 2021). In Brickell (2008) *P. nigra* is described as ‘clump forming’ and that it usually grows in compact clumps in cool-temperate climates. The RHS (2021a) also mentioned that it will remain clump-forming in poor or dry soils but in warm, moist or favourable conditions it can become ‘invasive’ (in gardens). Taylor et al. (2021) also suggest that the distinction depends on soil type because *Phyllostachys* spp. are known to be ‘clump forming’ in poor soils but become ‘running bamboos’ in fertile soil. Taylor et al. (2021) classify *P. nigra* as a ‘running bamboo’ in GB, but Bamboo Identification (2021) say that the lack of hot summers in GB means *Phyllostachys* spp. remain in clumps and do not spread. *Phyllostachys* spp. are rhizomatous bamboos (Department of Primary Industries, 2020) and therefore have the potential to grow as ‘running bamboos’ in GB as they do in other parts of the world (Pagad, 2016) such as South Africa (Canavan et al., 2020). See section 3.1. for further information.

			Bamboos flower irregularly (although show synchronisation) (Stace & Crawley, 2015). *P. nigra* f. *henonis* has a flowering cycle of around 60 years (Veller et al., 2016 (see citation therein); Zimmer, 2015)). The last documented evidence of *P. nigra* flowering in GB might be 1931 - 1935 (Bean, 1976). Walters et al. (1984) commented on it flowering between 1932 and 1935 although does not specify where in Europe. Seed dispersal is therefore not considered as important for its spread. Not expected to increase its spread in habitable resources more than 0-10% in the next 5 years.
2.2. How important is the expected spread of this organism in the risk assessment area by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	minimal	high	Human activity would be the primary method of spread (Taylor et al., 2021). This includes soil contamination, the possibility of 'dumping' plant waste material in the wild (e.g. Department of Primary Industries, 2020) or deliberate planting in the wild. However, it is not expected to increase its spread in habitable resources more than 0-10% in the next 5 years.
2.3. Within the risk assessment area, how difficult would it be to contain the organism?	difficult	medium	This partly depends on whether it grows as a clump, or as a 'running bamboo' (see 2.1.). 'Running bamboos can be very difficult to contain even in gardens (RHS, 2021b; Taylor et al., 2021). In Tanzania, it spreads from gardens by rhizomes into nearby areas. The rhizomes can also be dispersed in soil (BioNET-EAFRINET, 2011).
2.4. Based on the answers to questions on the potential for establishment and spread in the risk assessment area, define the area endangered by the organism.	See comment	high	The climate in most of GB is not currently likely to be optimal (see 1.12.). However, the current distribution of *P. nigra* in GB (see section A.7.) suggests that London and the Thames Valley basin are most suitable. Stace & Crawley (2015) mention bamboos (although not *P. nigra*) as being problems in woodlands and scrub in GB, especially near human settlements due to habitat disturbance, high 'propagule pressure' (including dumping of plant waste) which is particularly problematic along woodland edges. Based on its potential for establishment and spread, habitats in (or near) urban areas are most endangered.

			In its native range, it is found in open forests on slopes and in valleys (Flora of China, 2006).
2.5. What proportion (%) of the area/habitat suitable for establishment (i.e. those parts of the risk assessment area were the species could establish), if any, has already been colonised by the organism?	0-10	high	See comments on records in GB in section A.7.
2.6. What proportion (%) of the area/habitat suitable for establishment, if any, do you expect to have been invaded by the organism five years from now (including any current presence)?	0-10	high	A plant would take 5-10 years to spread 2.5 - 4m (RHS, 2021a).
2.7. What other timeframe (in years) would be appropriate to estimate any significant further spread of the organism in the risk assessment area? (Please comment on why this timeframe is chosen.)	80	medium	See section on climate change, specifically projections from Beck et al. (2018) for the end of the century.
2.8. In this timeframe what proportion (%) of the endangered area/habitat (including any currently occupied areas/habitats) is likely to have been invaded by this organism?	0-10	medium	Only London is projected to have a climate classification (Cfa) which matches that currently in part of its native range (Beck et al., 2018), which might increase its potential to spread by rhizomes. This might also be true in other urban habitats in GB (beyond London) at a local level due to the urban 'heat island' effect. Its current distribution (see section A.7) suggests that London and the Thames Valley basin are already preferable.
2.9. Estimate the overall potential for future spread for this organism in the risk assessment area (using the comment box to indicate any key issues).	very slowly	medium	On balance, the potential for future spread is considered to be 'very slowly', defined as a 0-10% relative increase in the occupancy of potentially habitable areas.

PROBABILITY OF IMPACT

Important instructions:

- When assessing potential future impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment.
- Where one type of impact may affect another (e.g. disease may also cause economic impact) the assessor should try to separate the effects (e.g. in this case note the economic impact of disease in the response and comments of the disease question, but do not include them in the economic section).
- Note questions 2.10-2.14 relate to economic impact and 2.15-2.21 to environmental impact. Each set of questions starts with the impact elsewhere in the world, then considers impacts in the risk assessment area separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis.

QUESTION	RESPONSE	CONFIDENCE	COMMENTS
2.10. How great is the economic loss caused by the organism within its existing geographic range **excluding the risk assessment area**, including the cost of any current management?	minor	low	There is no economic cost readily available for *P. nigra* in Tanzania or Australia (where it is invasive). *P. aureosulcata* can cause economic damage to buildings (CABI, 2019b).
2.11. How great is the economic cost of the organism **currently** in the risk assessment area **excluding management** costs (include any past costs in your response)?	minimal	high	There is no evidence of economic impact in GB.
2.12. How great is the economic cost of the organism likely to be **in the future** in the risk assessment area **excluding management** costs?	minimal	medium	There is no evidence of economic impact in GB and any impact globally seems to be environmental (e.g. Tanzania).
2.13. How great are the economic costs **associated with managing** this organism **currently** in the risk assessment area (include any past costs in your response)?	minor	high	There are no known instances of this plant causing economic cost in GB associated with its management in the wild. There is a cost to gardeners who want to remove or control it within gardens. Chemical and/or mechanical methods of control and removal require several years to be successful (Taylor et al., 2021). Bamboos can cause considerable

			economic costs due to structural damage they can cause as well as neighbour disputes. There is an example for *P. nigra* in Taylor et al. (2021). It is difficult to quantify the monetary impact, but it is ranked 'minor' because costs are likely to be localised.
2.14. How great are the economic costs **associated with managing** this organism likely to be **in the future** in the risk assessment area?	moderate	medium	There is limited evidence on managing this species in the wild, but mechanical methods are effective, and/or chemical control (Department of Primary Industries, 2010). Fire could also be a management option (BioNET-EAFRINET, 2011) but see section 2.23 on possible human health concerns. If it starts to grow as a 'running bamboo' (i.e. spreading by rhizomes) it could be very difficult to contain even in gardens (RHS, 2021b). Any economic cost is likely to be associated with structural damage and/or neighbour disputes but still localised.
2.15. How important is environmental harm caused by the organism within its existing geographic range **excluding the risk assessment area**?	moderate	medium	In Tanzania, it forms dense clumps thus excluding other plants (BioNET-EAFRINET, 2011) and drops heavy leaf litter (Department of Primary Industries, 2020). In Hawaii there is a record of it dominating early successional habitats following fire (Tunison et al., 2002; Space & Imada, 2004). This suggests that it has invasive potential as a 'pioneer' in disturbed habitats.
2.16. How important is the impact of the organism on biodiversity (e.g. decline in native species, changes in native species communities, hybridisation) **currently** in the risk assessment area (include any past impact in your response)?	minimal	high	There are no known instances of this plant having an impact on biodiversity in GB.
2.17. How important is the impact of the organism on biodiversity likely to be in the **future** in the risk assessment area?	minimal	medium	Any impact on biodiversity is likely to be localised and in - or near - urban habitats.

2.18. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the organism **currently** in the risk assessment area (include any past impact in your response)?	minimal	high	There are no known instances of this plant altering ecosystem function in GB.
2.19. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the organism likely to be in the risk assessment area in the **future**?	minor	medium	Any alterations likely to be localised and reversable (with effective management) but the dense clumps and heavy leaf litter would impact trophic interactions.
2.20. How important is decline in conservation status (e.g. sites of nature conservation value, WFD classification) caused by the organism **currently** in the risk assessment area?	minimal	high	There are no known instances of this plant having an impact on areas of conservation value in GB.
2.21. How important is decline in conservation status (e.g. sites of nature conservation value, WFD classification) caused by the organism likely to be in the **future** in the risk assessment area?	minimal	medium	Very dependent on whether it will spread by natural means beyond the immediate vicinity of gardens and urban habitats.
2.22. How important is it that genetic traits of the organism could be carried to other species, modifying their genetic nature and making their economic, environmental or social effects more serious?	minimal	high	Mainly spreads vegetatively, and rarely flowers (see section 1.12) which reduces the risk of any hybridisation. There are no native bamboos for it to hybridise with but many ornamental *Phyllostachys* spp. including *P. aurea* and *P. aureosulcata* which are considered highly invasive (CABI, 2019b; CABI, 2020) although no hybrids are known.

2.23. How important is social, human health or other harm (not directly included in economic and environmental categories) caused by the organism within its existing geographic range?	minimal	high	Although no evidence was found for *P. nigra*, *P. aurea* and *P. aureosulcata* are known to be associated with a fungus responsible for the disease Histoplasmosis (CABI, 2019b; 2020).
2.24. How important is the impact of the organism as food, a host, a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	medium	*P. nigra* has been awarded an RHS AGM which is awarded if, among other attributes, a plant is "reasonably resistant to pests and diseases" (Cubey, 2018: 37).
2.25. How important might other impacts not already covered by previous questions be resulting from introduction of the organism? (specify in the comment box)	NA	medium	
2.26. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in the risk assessment area?	minimal	medium	It is not known whether this species has natural enemies, and whether these are present in GB. As an ornamental, it is considered generally disease free (Cubey, 2018; RHS, 2021a).
2.27. Indicate any parts of the risk assessment area where economic, environmental and social impacts are particularly likely to occur (provide as much detail as possible).	See 2.4. under probability of spread	high	
2.28. Estimate the overall impact of this organism in the risk assessment area (using the comment box to indicate any key issues).	minor	medium	Very dependent on its spreading ability (growth form), whether it will be able to spread beyond gardens and urban habitats into habitats of conservation concern. If it is - or becomes in future - a 'running' bamboo this is an important indicator of potential impact (Lieurance et al., 2018; Canavon et al., 2020). Economic and social impacts likely to be localised.

RISK SUMMARIES			
	RESPONSE	**CONFIDENCE**	**COMMENT**
Summarise Entry	very likely	high	Despite uncertainty on the status of current records in GB (see section A.7.), it has entered the wild in Europe, being considered a casual in France and Austria (van Valkenburg et al., 2014). There is also considerable propagule pressure because of its popularity as an ornamental.
Summarise Establishment	moderately likely	medium	It has been introduced into cultivation in GB since around 1825 (Bean, 1976). It is widely available (Cubey, 2018) and possibly increased in popularity in recent years. This suggests considerable number of plants in gardens within GB as a source of potential establishment. It would be considered 'likely' or 'very likely' if any of the current GB records were known to be established (naturalised) plants, with a higher confidence rating.
Summarise Spread	very slowly	medium	On balance, the potential for future spread is considered to be 'very slowly', defined as a 0-10% relative increase in the occupancy of potentially habitable areas.
Summarise Impact	minor	medium	Very dependent on its spreading ability (growth form), whether it will be able to spread beyond gardens and urban habitats into habitats of conservation concern. If it is - or becomes in future - a 'running' bamboo this is an important indicator of potential impact (Pagad, 2016; Lieurance et al., 2018; Canavon et al., 2020). Economic and social impacts likely to be localised.
Conclusion of the risk assessment	low	medium	This is based on the current status of *P. nigra*. If its spreading habits change (i.e. it begins to grow as a 'running bamboo' in GB) then its potential for spread and impact are increased and might become similar to *P. aurea* and *P. aureosulcata* which are considered highly invasive globally (CABI, 2019b; CABI, 2020) but not currently in GB.

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change, if any, are most likely to affect the risk assessment for this organism?	Temperature and precipitation	medium	It is likely to spread as a 'running bamboo' in warm, moist or favourable conditions (RHS, 2021a). London is projected to have a Cfa climate classification by the end of the century (Beck et al., 2018) which matches with part of the native range (Plants of the World Online, 2021). However, any potential effect on establishment and spread from increasing temperatures in GB might be limited by the drier summer conditions projected in south-east England.
3.2. What is the likely timeframe for such changes?	See comment	medium	Based on climate classification projections for 2071-2100 in Beck et al. (2020) who used an ensemble of 32 climate model projections under Representative Concentration Pathway (RCP) 8.5 for the future Köppen-Geiger maps. This RCP is the worst-case scenario but the only one considered in this study.
3.3. What aspects of the risk assessment are most likely to change as a result of climate change?	See comment	medium	If it succeeds in establishing and has an increased spreading ability (by natural means) due to a more favourable then it could invade urban - or near urban - habitats. Urban habitats beyond London might also become suitable because of the 'heat island' effect.
ADDITIONAL QUESTIONS - RESEARCH			
4.1. If there is any research that would significantly strengthen confidence in the risk assessment please summarise this here.	See comment	high	Research into whether it currently spreads by rhizomes in gardens in GB, and if this has been during recent years.

Please provide a reference list on the following page ...

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