RISK ASSESSMENT SUMMARY SHEET

Dwarf Serviceberry (*Amelanchier spicata*)

- A small (up to 2m) deciduous shrub in the rose family that forms dense thickets and produces clusters of small white flowers.
- Not known to be established in the wild in GB, but present in the ornamental trade. Likely to be able to establish in GB.
- Can spread quickly by seed, as occurred in Latvia where it spread across much of the country within 50 years.
- Could alter habitats and supress vegetation, particularly in woodlands currently without shrub cover and potentially coastal systems.

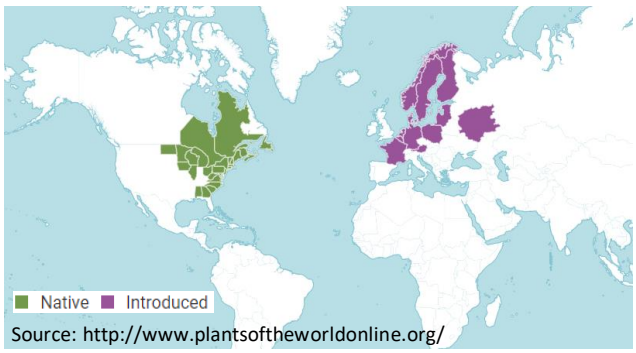

Photograph: Hardyplants, Wikimedia

History in GB

Sold as a horticultural plant in GB, but less widely sold than *A. lamarckii* (a similar species in the same genus). It is not known to be established in the wild, but records of *A. lamarckii* could be misidentified. Lack of establishment is likely to be due to low propagule pressure, which could change if popularity increases. Non-native range in Europe suggests it is likely to be able to establish in GB climate and habitats.

Global Distribution

Native to the eastern seaboard of US and Canada, and inland in northern US, to North Dakota, and to Ontario in Canada.



Source: http://www.plantsoftheworldonline.org/

GB Distribution

Present in trade, but not known to be established in GB. There are no records of occurrence in the National Biodiversity Network or the Atlas of British and Irish Flora

Impacts

Environmental: (major, medium confidence)

- Capable of establishing and invading habitats where similar woody shrub cover does not occur, changing from open forest to dense understory.
- Has the potential to suppress ground floras and reduce habitat available for both plant and non-plant species.

Economic: (minimal, medium confidence)

- No economic losses reported in invaded parts of Europe. However, management of both newly establishing and well-established populations would be very difficult: removal of a population will require repeat visits for several years due to suckering and persistent rhizomes in soil.

Societal: (minimal, very high confidence)

- None known.

Introduction pathway

Present in ornamental trade in GB, though less popular than *A. lamarkii*. There is potential for its popularity to increase.

Spread pathway

Natural: (moderate, high confidence) – spreads by seed and vegetatively, dispersed by birds and mammals. Self-fertile with rapid generation time means it could quickly form new populations. Spread across most of Latvia in 50 years.

Human: (moderate, medium confidence) – main human spread is by planting in gardens. There is little evidence to suggest dumping of garden waste has caused spread.

Summary

	Response	Confidence
Entry	LIKELY	HIGH
Establishment	LIKELY	HIGH
Spread	MODERATE	HIGH
Impact	MODERATE	HIGH
Overall risk	MEDIUM	MEDIUM

GB NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Amelanchier spicata*, Dwarf Serviceberry
Author: Wayne Dawson, Durham University
Risk Assessment Area: Great Britain
Version: Draft 1 (Jan 2021), NNRAP 1 (Mar 2021), Draft 2 (May 2021), NNRAP 2 (Jul 2021), Draft 3 (Mar 2022), NNRAF (Dec 2022)
Signed off by NNRAF: December 2022
Approved by GB Committee: January 2024
Placed on NNSS website: January 2024

What is the principal reason for performing the Risk Assessment?

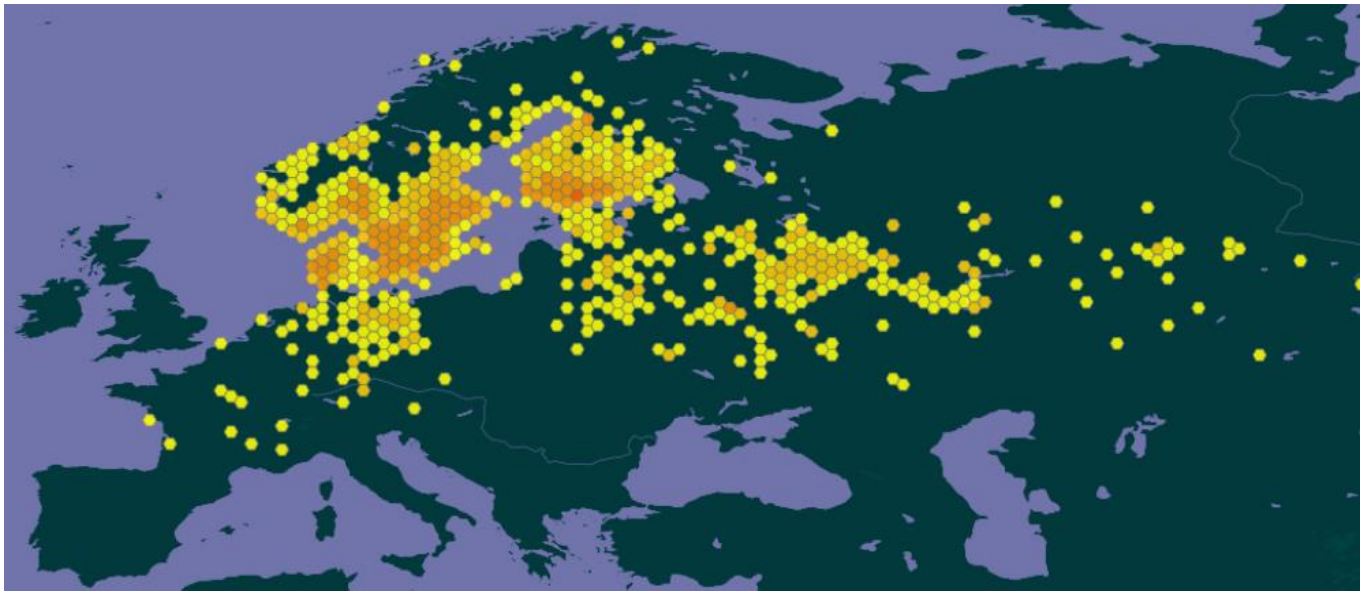
The GB Committee for non-native species is considering whether to add this species to the list of species of special concern. This assessment will form part of the evidence used to inform the Committee's decision. This species was selected for consideration following horizon scanning[1], in which *Amelanchier spicata* was ranked in the top 30 threats to biodiversity because of its potential to arrive, establish and cause negative biodiversity impact.

[1] Roy et al 2019. Horizon-scanning for invasive alien species with the potential to threaten biodiversity and ecosystems, human health and economies in Britain. https://www.nonnativespecies.org/assets/Document-repository/Horizon_scanning_short_report_2019-2.pdf

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. Accepted name is *Amelanchier spicata* (Lam.) K. Koch (Plants of the World Online 2019) While it is a single taxonomic identity, the species can be confused with other species both in the native and introduced range. Schroeder (1970) provides a key to *Amelanchier* species in Europe. There is a key to North American taxa in the Flora of North America (2020). The species' origin and relation to congeners has also been a topic of debate: see excerpt from CABI Invasive Species Compendium (2020)- "The genus *Amelanchier* is taxonomically complex and contains many hybrids. Various botanical works cite different origins for *A. spicata*. Chittenden (1956) lists *A.* x *spicata* as a hybrid probably between *Amelanchier oblongifolia* and *Amelanchier stolonifera*, and Krüssmann (1984) states that until recently, *A. spicata* was erroneously considered to be a hybrid between *Amelanchier canadensis* and *Amelanchier ovalis*. Tutin et al. (1968) suggest *A. spicata* is conspecific with *Amelanchier humilis* from northeastern North America. However, Schroeder (1970) does not agree that *A. spicata* is conspecific with either *A. humilis* or *A. stolonifera*. In the past. *A. spicata* had been considered a microspecies in North America (Schroeder et al. 1970), however it is listed as a true species in the Flora of North America (2020). The correct name for *A. spicata* is much debated; see the University of Maine's website on Amelanchier Systematics and Evolution for further discussion. (http://biology.umaine.edu/Amelanchier/spi.html)." Missouri Botanic Garden (2020) lists *Amelanchier stolonifera*, but Plants of the World Online (2019) does not recognise this name; *A. spicata var. stolonifera* is a synonym of *A. spicata*.

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)	NA
3. Does a relevant earlier risk assessment exist? (give details of any previous risk assessment)	No Full risk assessments are not available; however, this species does occur on various lists for which some screening assessment has been undertaken: EPPO (2020) has the species on its invasive alien plant list, but it has been categorized as lower priority for a pest risk analysis. Estonia does not have an official risk assessment protocol, but included this species on a list of invasive alien plants "compiled by experts considering the invasive behaviour of the species in Estonia and in neighboring countries, as well as their use as ornamental plants." (EPPO 2011, and references therein; https://gd.eppo.int/reporting/article-1716). For Sweden, 721 identified invasive plant species were assigned a 'concern value', calculated from 6 components: "(A) competitive ability in natural vegetation, (B) current population density of the species, (C) dispersal capacity, (D) potential hybridization, (E) time since introduction and (F) distance to native range. Following the scoring of these 6 components the invasion concern value was calculated by: Invasion concern value (I) = (A + B + C + D) x (E + F) – 4." *A. spicata* was ranked #18 according to this concern value (EPPO 2015; Tyler et al. 2015; https://gd.eppo.int/reporting/article-4956). The species is included in a list of potentially invasive alien plants for Spain, but is not yet present: "The Catalogue of invasive alien plants of the Spanish legislation on invasive alien plants was launched in December 2011 (see EPPO RS 2012/043) and revised in August 2013 (see EPPO RS 2013/227). The Annex 2 of this Spanish legislation consists of a list of alien species determined to have an invasive

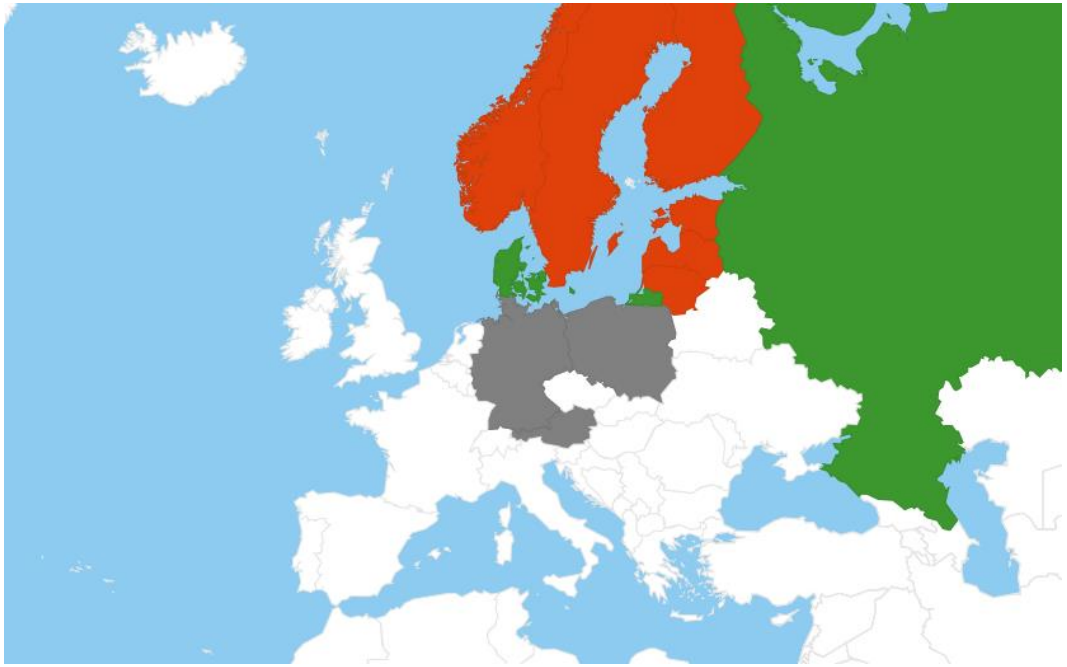
	potential and to present a potential threat for Spain. It is prohibited to introduce these listed species in the natural environment." (EPPO 2014a; https://gd.eppo.int/reporting/article-3294). Furthermore, the species received a score of 22 in a Europe-adapted weed risk assessment (Weber & Gut 2004), targeted at species not yet present in Spain (Andreu & Vila 2009). The score for this species represented intermediate-risk (EPPO 2010; https://gd.eppo.int/reporting/article-478). For Norway, 2320 species (multiple taxa) have been assessed for invasion status/impact. *A. spicata* has been placed in the severe impact category (Gederaas et al. 2012; EPPO 2014b; https://gd.eppo.int/reporting/article-2780).
4. If there is an earlier risk assessment is it still entirely valid, or only partly valid?	RAs in other European countries may be partially relevant, but difficult to gauge without access to full details of process.
5. Where is the organism native?	In summary – the eastern seaboard of USA and Canada, and inland in northern US, to North Dakota, and to Ontario in Canada. Plants of the World Online (2019): North America (USA, Canada)- Alabama, Connecticut, Georgia, Illinois, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Brunswick, New Hampshire, New Jersey, New York, Newfoundland, North Carolina, North Dakota, Nova Scotia, Ohio, Ontario, Pennsylvania, Prince Edward I., Québec, Rhode I., South Carolina, Vermont, Virginia, West Virginia, Wisconsin USDA Agricultural Research Service (2015): Native Northern America • EASTERN CANADA: **Canada** [Québec, Nova Scotia, Ontario, Prince Edward Island, New

	Brunswick, Newfoundland and Labrador] • NORTHEASTERN U.S.A.: **United States** [Connecticut, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia] • NORTH-CENTRAL U.S.A.: **United States** [Illinois, Iowa, Minnesota, North Dakota, Wisconsin] • SOUTHEASTERN U.S.A.: **United States** [Alabama, Delaware, Georgia, Maryland, North Carolina, South Carolina, Virginia]
6. What is the global distribution of the organism (excluding the risk assessment area)?	Plants of the World Online (2019) introduced range: Austria, Baltic States, Belgium, Central European Rus, Denmark, Finland, France, Germany, Netherlands, Norway, Poland, Sweden. Global Biodiversity Information Facility (2020a) records in Europe are shown in map in comments: 
7. What is the distribution of the organism in the risk assessment	Introduced, distribution unknown.

<table>
<tr><td>area?</td><td>There are no records of occurrence in the National Biodiversity Network (2020), The Atlas of British and Irish Flora (UK Biological Records Centre 2020a), or the Global Biodiversity Information Facility (2020a). This corroborates earlier work on the distribution of Amelanchier species in Western Europe (Schroeder 1970). Binggeli (1998) suggests the species is in W Europe from England to Sweden but presents no evidence of this. However, the species has been introduced to the RA area: it is sold by at least two nurseries in England (Royal Horticultural Society 2020a). However, misidentification of Amelanchier plants in the wild (particularly misidentification as A. lamarckii) cannot be ruled out. Known introduction dates in northern and central Europe range from 1875 to 1934 (NOBANIS 2021). Date of introduction in GB unknown.</td></tr>
<tr><td>8. Is the organism known to be invasive (i.e. to threaten organisms, habitats or ecosystems) anywhere in the world?</td><td>Yes.

EPPO (2020) cites this species as being an invasive alien plant in Norway, Sweden, Russia, and potentially invasive in Spain:

<table>
<tr><th>Num.</th><th>Title</th><th>year-month</th></tr>
<tr><td>2018/063</td><td>Invasive alien plants in Russia</td><td>2018-03</td></tr>
<tr><td>2015/158</td><td>Invasive plant species in Sweden</td><td>2015-08</td></tr>
<tr><td>2014/201</td><td>List of alien species determined to be potentially invasive in the Spanish regulation</td><td>2014-10</td></tr>
<tr><td>2014/079</td><td>Q-bank database on invasive alien plants</td><td>2014-04</td></tr>
<tr><td>2014/060</td><td>Invasive alien species in Norway</td><td>2014-03</td></tr>
<tr><td>2013/089</td><td>Invasive alien plants in Finland</td><td>2013-04</td></tr>
<tr><td>2012/136</td><td>New EPPO lists of invasive alien plants</td><td>2012-06</td></tr>
<tr><td>2011/147</td><td>Estonia: national initiatives on Code of conduct</td><td>2011-06</td></tr>
<tr><td>2011/045</td><td>The Black book of invasive alien plants in Central Russia</td><td>2011-02</td></tr>
<tr><td>2010/092</td><td>Risk analysis of potential invasive plants in Spain</td><td>2010-04</td></tr>
<tr><td>2009/149</td><td>Lists of invasive alien plants in Russia</td><td>2009-07</td></tr>
<tr><td>2006/217</td><td>Invasive species in the flora of the Upper Volga Basin</td><td>2006-10</td></tr>
</table>
</td></tr>
</table>

	The species has also been described as invasive in Lithuania and Latvia, naturalised in Estonia and Denmark (and on Denmark's black list of species), and rare but escaping cultivation in Germany, Poland and Czech Republic (Kabuce and Priede 2020). It is also invasive in Finland (https://gd.eppo.int/reporting/article-2551). The following map shows invasion status for central and Northern Europe (NOBANIS 2021):  Red= Invasive; Green= Not invasive (but established); Grey= Present and unknown.
9. Describe any known socio-economic benefits of the organism in the risk assessment area.	Ornamental Plant; Landscaping Plant. Planted as an ornamental throughout introduced range in Europe; used as a field boundary and windbreak in Denmark (Kabuce & Priede 2020).

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 species is only likely to be introduced intentionally as an ornamental or landscaping plants in the RA area. The seeds of the species are borne in fleshy fruits, which are bird or mammal dispersed; no evidence that they could be introduced unintentionally by means of attachment/contamination.
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).	i. Ornamental Plant ii. Landscape Improvement		The CABI Invasive Species Compendium (2020) lists the following pathways: • Horticulture • Ornamental Plant • Landscape Improvement Horticulture and ornament plant are combined below under ornamental plant, as there is no clear reason why the pathways of introduction into the RA area would be different for this species.
Pathway name:	i. Ornamental Plant		

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)? (If intentional, only answer questions 1.4, 1.9, 1.10, 1.11)	intentional	very high	
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.	moderately likely	high	The species is sold by continental plant nurseries that export to GB, and thus may be introduced as live plants in high numbers (Ebben Nurseries 2020; van den Berk Nurseries 2020): However, it is likely sold in fewer numbers/is less popular with RA area gardeners as *A. lamarckii*, which is already widely naturalised. *A. lamarckii* is sold by 66 nurseries in RA area, compared to only 2 for *A. spicata* according to the RHS (Royal Horticultural Society 2020a, b), so propagule pressure may be lower currently for *A. spicata*. The species is listed and described by gardening websites (e.g. Shoot Gardening 2020). The species can also be purchased online as seeds (etsy 2020; Sheffield Seeds 2020; Trade Winds Fruit 2020), though unclear if shipping to GB from these sources is possible.
1.9. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very likely	high	Through direct planting, and then seed escape through (bird) dispersal. The species is described as being planted widely as an ornamental in gardens, parks and urban forests in Latvia, Estonia, Lithuania & Russia, and is considered common and established in all these countries; it is still a popular plant available for sale in nurseries (Kabuce & Priede 2010).
1.10. Estimate the overall likelihood of entry into the risk assessment area based on this pathway?	very likely	high	Even without domestic sales of live plants, it is very likely live plants for ornamental plant sales would still be imported.
Pathway name:	ii. Landscape Improvement		
1.3. Is entry along this pathway	intentional	very high	Species is used as a windbreak and for hedging of field boundaries in

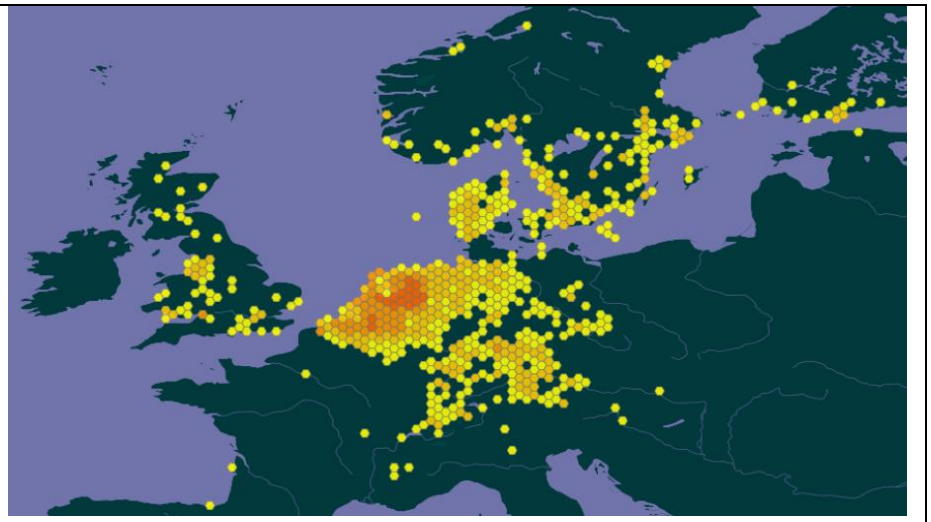
intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)? (If intentional, only answer questions 1.4, 1.9, 1.10, 1.11)			Denmark (Kabuce & Priede 2010).
1.4. How likely is it that large numbers of the organism will travel along this pathway 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.	unlikely	high	While there is no evidence of a market for the plant being used in landscaping in the RA area, it is used in Denmark for hedging and as a windbreak (Kabuce & Priede 2010). Thus, unlikely that large numbers will be introduced via this pathway, but confidence is low.
1.9. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very likely	high	Planting in landscapes as windbreaks or field boundaries will increase the likelihood that the species escapes cultivation/control, and that seeds are dispersed into semi-natural/unmanaged habitats.
1.10. Estimate the overall likelihood of entry into the risk assessment area based on this pathway?	unlikely	high	If the species was already favoured for landscape improvement planting, one would expect it to be recorded in the risk assessment area, and potentially already establishing. The absence of such records suggests that currently the species is not planted widely as a field boundary or windbreak in the RA area. Thus it seems unlikely to enter through this pathway in future: more information on pathway would help to confirm.
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	The species is already present in the RA area and is sold as an ornamental plant, both by GB-based and continental plant nurseries. Thus, continued entry through the ornamental plant trade is very likely.

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?	likely	high	The species has become invasive in southern Norway, Sweden, and Finland, and throughout Denmark. Northern Britain (Northern England and Scotland) are probably closest in climate within the RA area to these countries, making establishment based on climate suitability likely. Climate requirements (Van den Berk Nurseries 2020): • Winter Hardiness Zone 5a (-28.8 to -26.1 °C) • Resistant to frost (WH 1 - 6), can withstand wind. USDA Hardiness Zones: 4-9 (-34.4 °C to -1.1 °C) (Native Plant Trust Plantfinder 2020). RBG Kew reports 100% germination of seeds over 189 days at 0°C on agar, 12h/12h light-dark (RBG Kew Seed Information Database 2020), but uncertain if cold stratification is essential for germination. However, this is unlikely to be a limitation in the RA area. The congener *A. lamarckii* is similarly recorded in southern Fennoscandia and also in N Germany, Poland, and Benelux countries, but is also widely recorded in GB. Below is a map of records of *A. lamarckii* in Europe (GBIF 2020b):

			 However, *A. spicata* is described as being a very rare escape in Belgium (Alien Plants Belgium 2020), and rare in Germany and Austria (Kabuce & Priede 2010). It is not clear if these differences between Fennoscandia and countries further south are the result of differences in climate or propagule pressure; If climate, then species may be less likely to establish in southern Britain.
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?	Very likely	high	In the native range, the species is described as occurring in: - "Anthropogenic (man-made or disturbed habitats), cliffs, balds, or ledges, forest edges, grassland, meadows and fields, woodlands" (Go Botany Native Plant Trust, New England 2020) - "*A. spicata* is found in forests, dunes, rocky areas and riverbanks of northeastern North America (Krüssmann, 1984)" (CABI Invasive Species Compendium 2020). "Summits and cliffs of low mountains, open woods, woodland clearings, rocky soil, crevices, shores, fields, roadsides, peaty, sandy,

			or gravelly and, typically, acidic soil; 0–1200 m" (Flora of North America 2020). In the introduced range: "In Europe *A. spicata* can be found in dry pine forests, pine-oak forests, scrubby grasslands, forest edges, coastal and inland dunes, as well along railways and roadsides". The species is also described as tolerating wide range of soil types (Kabuce & Priede 2010), but is more light demanding, and may perform better on nutrient-rich soils in Latvia (Rurane et al. 2004).
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	very high	Species would most likely become established after propagule escape from gardens, or (less likely) landscape plantings.
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	Species in Europe appears to be successful in sandy, acid soils, and rocky habitats which are found throughout the RA area, but especially so in north and west. Native and introduced range habitats suggest a wide habitat breadth (see 1.13), including disturbed anthropogenic habitats and forests/forest edges. The species is described as being attractive to bees and other pollinating insects in the native range (Native Plant Trust Plantfinder 2020); pollination is therefore likely in RA area, however may not be necessary for seed

			production as the species is described as self-fertile (Plants for a Future Database 2020; Useful Temperate Plants 2020), and may be apomictic (Burgess et al. 2014; Melchier 2016).
1.16. If the organism requires another species for critical stages in its life cycle then how likely is the organism to become associated with such species in the risk assessment area?	NA	medium	The species is very unlikely to require a specialist pollinator, as it is known to be attractive to bees and other pollinators (1.15), is already established outside of its native range, and is described as self-fertile. There is no evidence of other mutualists required for establishment.
1.17. How likely is it that establishment will occur despite competition from existing species in the risk assessment area?	very likely	high	The species is unlikely to encounter high levels of competition from native species of a similar growth form in the habitats where it typically establishes in continental Europe; it can establish in disturbed areas and urban forests (Gudzinskas 2005; Chindyaeva et al. 2018), as well as open rocky habitats, pine woods and sand dunes, where there is little competition from understorey shrubs (Kabuce & Priede 2010).
1.18. How likely is it that establishment will occur despite predators, parasites or pathogens already present in the risk assessment area?	very likely	high	The species may suffer from insect herbivores in the native range (Native Plant Trust Plantfinder 2020) but given the success of the species in continental northern Europe and of *A. lamarckii* in the RA area, it seems unlikely the species will be impeded by heavy insect herbivory in GB. Similarly, the species can suffer from fireblight and powdery mildew (Missouri Botanic Garden 2020), but this has not prevented invasion in Fennoscandia.
1.19. How likely is the organism to establish despite existing management practices in the risk assessment area?	very likely	high	Dispersal of seeds by frugivorous birds will make escape from cultivation and establishment despite management practices very likely. There is no reason to assume the species is more likely to be contained by management practices in the RA area than in Fennoscandia and Baltic States. Moreover, *A. lamarckii* has established in the RA area: "A shrub or small tree mostly growing on acidic, usually sandy soils and naturalised in open woodland (often *Quercus* or *Betula*), wood borders and scrub, and on dry heaths and roadsides. Lowland. [map shows most common in NW England,

			Shropshire. Hampshire, Home Counties, but in all GB Nations.]" (UK Biological Records Centre 2020b).
1.20. How likely are management practices in the risk assessment area to facilitate establishment?	very unlikely	low	No evidence that management practices would inadvertently facilitate establishment, but low confidence. Main means of establishment would be through natural dispersal of seeds and seedling recruitment, or abandonment of management of plantings (allowing formation of thickets from suckering individuals).
1.21. How likely is it that biological properties of the organism would allow it to survive eradication campaigns in the risk assessment area?	likely	high	The species is described as being vigorously rhizomatous and suckering, able to form dense thickets (Flora of North America 2020; Go Botany Native Plant Trust (New England) (2020)). Vegetative spread and resprouting will make eradication more difficult, as repeat visits for manual cutting would be needed. Kabuce & Pieder (2010) and references therein describe fast rates of shoot regrowth from stems cut the previous year (52% of shoots regenerate); stems can produce fruits in their 3rd to 4th year. Information on seed bank formation is lacking, but seeds are known to be orthodox with 100% viability after drying and cold storage for >300 days, and germination % is 100% after storage (RBG Kew Seed Information Database 2020). This suggests seeds could remain dormant and viable for up to a year, potentially longer.
1.22. How likely are the biological characteristics of the organism to facilitate its establishment?	very likely	very high	The species is described as self-fertile (Plants For a Future Database 2020; Useful Temperate Plants 2020), and may be apomictic (Burgess et al. 2014), meaning that pollination is not required for seed set, and successful establishment requires relatively small founder populations. The species produces fruit after 3-4 years, which means new individuals can be recruited into a self-sustaining population relatively quickly. Suckering and thicket formation will increase the number of stems producing seeds, increasing the likelihood of subsequent dispersal and recruitment, and likelihood of population persistence.

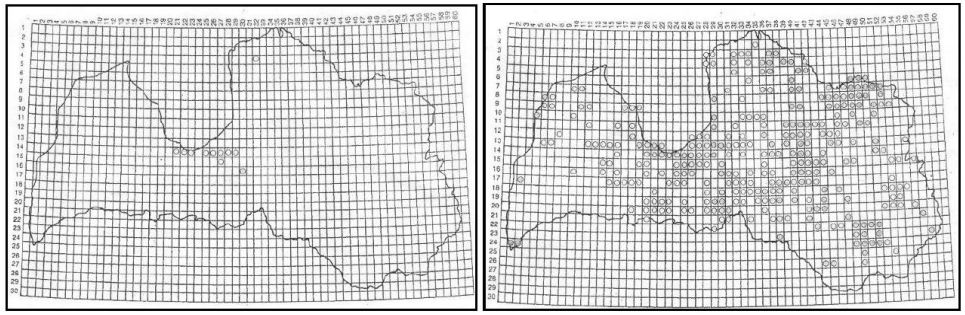
			Dispersal by birds and mammals (Kabuce & Priede 2010) will increase the chances that offspring are deposited to new sites away from intraspecific competition, therefore increasing chances of recruiting new adults into the population.
1.23. How likely is the capacity to spread of the organism to facilitate its establishment?	very likely	very high	Fleshy fruits are described by a number of sources as being very attractive to birds (Kabuce & Priede 2010; Go Botany Native Plant Trust (New England) (2020); North Carolina Extension Gardener Plant Tool Box 2020; CABI Invasive Species Compendium 2020). Dispersal of seeds and recruitment in new areas will make eradication difficult at landscape to regional scales.
1.24. How likely is the adaptability of the organism to facilitate its establishment?	very likely	high	The species has a broad environmental tolerance, and while showing a preference for acidic soils, it can occur on neutral to alkaline soils. It appears to be somewhat tolerant of drought (North Carolina Extension Gardener Plant Toolbox 2020) and can occur in anthropogenic to semi-natural and natural habitats (Kabuce & Priede 2010).
1.25. How likely is it that the organism could establish despite low genetic diversity in the founder population?	likely	medium	Previous work concluded the species to be apomictic in the native range (Burgess et al. 2014). Recent work suggests apomixis likely occurs in the introduced range (Kuklina et al. 2018), so the species is likely to do well despite low genetic diversity.
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.)	very likely	high	The species has become widely established/invasive in southern Fennoscandia, and is escaping cultivation/becoming established further south in Germany, and Poland. The species is a rare escape in Belgium, but the species may be under-recorded there (Alien Plants Belgium 2020). This, plus the successful establishment of *A. lamarckii* in the RA are, gives high confidence that the species is very likely to establish in the RA area given sufficient propagule pressure. However, the propagule pressure required to establish may be relatively low if apomixis is confirmed, and given short generation time, with habitat breadth and bird dispersal.
1.27. If the organism does not establish, then how likely is it that	very likely	medium	Transient populations would likely occur if there was sufficient propagule pressure from any increased planting effort. This would increase the

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.			frequency of dispersal events and casual occurrences outside of cultivation. However, such an increase in escape from cultivation will naturally increase probability of establishment: there are no known restrictions on reproduction for this species in other parts of Europe where the species occurs.
1.28. Estimate the overall likelihood of establishment (mention any key issues in the comment box).	very likely	high	The success of the species in Fennoscandia suggests the species is very likely to establish in the RA area, particularly in the north. It can establish in a wide range of habitats, from anthropogenic to natural, and has a short time to reproduction. Establishment will be facilitated by suckering, increasing population expansion and seed output quickly. Birds are likely to aid recruitment of new individuals and establishment of new populations. More information is needed on potential for apomixis in this species, but if it is apomictic in RA area, then only relatively small increases in propagule pressure and small founder populations are likely to result in establishment.

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.)	moderate	high	Multiple sources describe the fruit of the species as being very attractive to birds (Kabuce & Priede 2010; Go Botany Native Plant Trust (New England) (2020); North Carolina Extension Gardener Plant Tool Box 2020; CABI Invasive Species Compendium 2020), including corvids in the introduced range, identified very early in the 1900s in Sweden as a disperser (Green et al. 2019). Spread in Latvia has been particularly rapid (circles represent occurrences in 1950, left, and 2000, right) (from Vibans 2001, in Kabuce & Priede 2010):  It is unclear how much of this spread over this time period is from natural bird dispersal versus from planting effort, but the habitats often invaded indicate a strong role of bird dispersers in allowing the species to infiltrate habitats far from planting sites. It is also possible that overwintering frugivorous birds that migrate to GB from Fennoscandia (Redwing, Fieldfare, Waxwing) could disperse seeds to RA area, but information needed on likelihood of fruit consumption before migration and gut passage time of seeds. Spread by hydrochory through river systems is not recorded, but may be possible

			where species occurs in riparian habitats (Krüssman 1984).
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.)	moderate	medium	Literature emphasises the role of animal dispersal but has less to say about the role of human-assisted dispersal, beyond planting. While the species can spread vegetatively/sucker, there is no evidence from sources that spread occurs through dumping of garden waste. Discarded cut branches are not likely to root unless embedded and kept moist in substrate; fruits on discarded branches however may result in further spread. As the species has rhizomes, spread through digging up of rhizomes (Kabuce & Priede 2010) and translocation of substrate is a possibility, particularly in more urban areas/anthropogenic habitats where construction, landscaping and thus substrate movement is more likely.
2.3. Within the risk assessment area, how difficult would it be to contain the organism?	very difficult	high	The potential for bird dispersal described in multiple sources suggests that large numbers of seeds will be dispersed away from cultivated plants and founder populations. The potential for vegetative spread through rhizomes will also make removal of populations difficult if they remain undetected for longer than a few years and become large in extent and well-established.
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.	Sand dune systems and other open coastal habitats, open pine woods, heaths and rocky habitats, riverbanks and urban forests, roadsides and railway sidings, particularly in northern	medium	Confidence is medium, because the success of the species in Fennoscandia (and thus potentially in the north of RA area) may depend on propagule pressure being higher there than elsewhere further south in continental Europe. It remains a possibility that greater propagule pressure further south could result in wider establishment and spread, thus extending the area endangered.

	England and Scotland.		
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	Given how well *A. lamarckii* has been recorded in the RA area (GBIF 2020b), on the one hand it would seem unlikely that widespread establishment of *A. spicata* would be missed (and propagule pressure is likely to be less for *A. spicata*- Royal Horticultural Society 2020a, b). There are currently 0 records of the species in the NBN Gateway (2020) and The Atlas of British and Irish Flora (UK Biological Records Centre 2020a). However, because *A. lamarckii* is well established, it is likely the default identification given to wild *Amelanchier* plants by recorders. Thus, misidentifications of *A. spicata* and resultant under-recording are certainly possible.
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	medium	Given that the species sexually (or by apomixis) reproduces after 3-4 years, and that current propagule pressure appears to be low in terms of planting, the species is not likely to spread beyond 10% of the suitable habitat/area. But this depends strongly on planting effort in the RA area, and potentially on natural bird dispersal.
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.)	50	high	Spread in Latvia between 1950 and 2000 was shown to be considerable (Kabuce & Priede 2010). Given this, along with the low apparent propagule pressure, lack of occurrence records, but also short generation time of the species, its current distribution and signs of spread would need to be captured within a short time-frame to aid decision-making. The species was first recorded in 1896 in Latvia (Kabuce & Priede 2010), so significant spread may only be detected after ~50 years.
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	Given the rate of spread seen elsewhere (Latvia) and strong potential for dispersal by birds, the species could reach 10% of suitable habitat in 50 years. Spread to 10% or more in this timeframe is of course more likely if propagule pressure increases. It is unclear how long lag phases are for this species, or how long it has been introduced to the RA area for.
2.9. Estimate the overall potential	moderately	high	The species is highly likely to find suitable habitat in the RA area, and recruit

for future spread for this organism in the risk assessment area (using the comment box to indicate any key issues).			multiple species of bird dispersers, but also potentially mammals. Populations are likely to establish in new areas due to short generation time and dispersal, and because of self-fertility, viable seed production is highly likely. Established populations will likely expand both vegetatively and via seed, increasing distribution and abundance at a local scale. The species spread from a small area of grid cells in Latvia in 1950, to most of the country 50 years later. However, the first record year from Latvia is 1896, implying that spread rates may have been much slower initially (Kabuce & Priede 2010).

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?	minimal	high	There are no reported economic losses in invaded parts of Europe (Kabuce & Priede 2010) or from the native range.
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	very high	The species is not yet known to be established in the RA area
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	Behaviour of the species is unlikely to differ markedly in RA area compared to invaded areas of Europe, if it establishes and invades. Thus, economic losses are unlikely in future.
2.13. How great are the economic costs **associated with managing** this organism **currently** in the risk	minimal	very high	The species is not yet known to be established in the RA area

assessment area (include any past costs in your response)?			
2.14. How great are the economic costs **associated with managing** this organism likely to be **in the future** in the risk assessment area?	minor	medium	The risk of the species establishing and spreading in general is high in future, especially if propagule pressure increases. Management of both newly establishing and well-established populations would be very difficult: removal of a population will require repeat visits for several years due to suckering and persistent rhizomes in soil (Kabuce & Priede 2010). However, there is little evidence that the species would invade and impact on areas where management is unavoidable (e.g. infrastructure). But, in Germany, the species is known to grow along railways and roadsides, though no negative effects were reported up to 2010 (Kabuce & Priede 2010). Overall, therefore, score is minor.
2.15. How important is environmental harm caused by the organism within its existing geographic range **excluding the risk assessment area**?	major	medium	The species is capable of establishing and invading habitats where similar woody shrub cover does not occur, changing the structure of forest communities in particular, from open forest to dense understory. This may result in suppression of ground flora and recruitment of tree seedings (Rurane et al. 2004). Invasion of heathlands in Denmark will probably alter vegetation structure markedly, and establishment on dunes may affect dune dynamics. However, impacts do not occur uniformly in all parts of the introduced range in Europe; the species is widely distributed in Russia, very common in Fennoscandia,, but is rarer in Germany, Czech Republic and Poland (Kabuce & Priede 2010). In Germany, the species tends to occur more in anthropogenic habitats. The species may be more likely to invade and have impacts in areas of high nutrient availability (Kabuce & Priede 2010, and references therein; CABI Invasive Species Compendium 2020). However, precise impacts probably require further study to capture the full range of habitats invaded. In the native range the species occurs on rocky and gravelly river-banks and slopes, rocky habitats (Kabuce & Priede 2010; Krussmann 1984). Thus, the species is likely to alter these habitats markedly when it colonises.

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	very high	The species is not yet known to be established in the RA area
2.17. How important is the impact of the organism on biodiversity likely to be in the **future** in the risk assessment area?	major	medium	Many of the habitats invaded in continental Europe are present in the RA area and are likely to be colonised here with sufficient propagule pressure (increase in propagule pressure is moderately likely, given current rarity of species in RA area, and potential as an alternative for *A. lamarckii*). Thus, the impacts on biodiversity are likely to be similar (suppression of ground floras in invaded vegetation, loss of habitat for both plant and non-plant species). However more work is needed to understand biodiversity impacts fully in the invaded range. Species distribution is more northerly than *A. lamarckii* in Europe; there is therefore the possibility that it would represent an additional biodiversity/ecosystem impact to *A. lamarckii*, if it established and spread in northern Britain.
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	very high	The species is not yet known to be established in the RA area
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	major	medium	The evidence for changes in habitat structure and function from the invaded range is greater than evidence for biodiversity impacts: in particular, increases in understorey shrub density/changes in forest community structure, and invasion of treeless vegetation (dunes, heaths) are described (Kabuce & Priede 2010). Moreover, *A. lamarckii* is already established in similar habitat in southern England especially but also

assessment area in the **future**?			elsewhere and is spreading by bird-sown fruit (UK Biological Records Centre 2020b). It is plausible that *A. spicata* will behave in a similar way in the RA area, particularly in the north.
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	very high	The species is not yet known to be established in the RA area
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?	major	medium	While evidence of invasion in protected areas of continental Europe is not described in sources used, dunes, open pine forest and heathlands are all vulnerable to invasion and are all habitats of high conservation value in the RA area. More evidence is needed on the exact habitat types that *A. spicata* invades in continental Europe, and how similar they are to habitats occurring in the RA area, but four RA area dune habitats are Annex 1 priority habitats under the Habitats Directive (McCleod et al. 2009): fixed dunes with herbaceous vegetation, decalcified fixed dunes with *Empetrum nigrum*, Atlantic decalcified fixed dunes, Coastal dune with *Juniperus* species. The following are also Annex 1 priority habitats: temperate Atlantic wet heaths, dry Atlantic heaths, Caledonian forest. Based on descriptions of habitats invaded elsewhere, invasion of at least some of these priority habitats is plausible, and there are likely to be other annex 1 habitat types of high conservation value at the UK level that are vulnerable to invasion.
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?	moderate	low	Hybridisation is common in the *Amelanchier* complex (Flora of North America 2020), and there is even debate as to whether *A. spicata* is of hybrid origin or not (Kuklina et al. 2018). While no evidence has been found demonstrating hybridisation between *A. lamarckii* and *A. spicata* in continental Europe where they co-occur, hybridisation and increased hybrid vigour cannot be ruled out in the RA area.
2.23. How important is social,	minimal	very high	There are no negative human health/societal impacts reported from the

human health or other harm (not directly included in economic and environmental categories) caused by the organism within its existing geographic range?			invaded range of continental Europe (Kabuce & Priede 2010).
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)?	minor	high	This species is a known host of the following pest and disease species that pose a UK biosecurity risk, but which are known to be polyphagous (Shoot Gardening 2020)- Insect: grape ground pearl (*Margarodes vitis*), currently absent in RA area, DEFRA Risk Register #1- on a scale of 1-5, with 1 being lowest and 5 being highest; Likelihood of spread =2, impact = 5 Insect: Round headed apple tree borer (*Saperda candida*), currently absent in RA area, DEFRA Risk Register #2- likelihood of spread= 3, impact = 4 Pathogen: Quince rust (*Gymnosporangium clavipes*), currently absent in RA area, DEFRA Risk Register #3- likelihood of spread= 2, impact =4 The species is also a host of fireblight (*Erwinia amylovora*). As these are generalist species, additional impact from introduction of this plant would be minor.
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	Reasonably confident that other impacts different from those on continent are unlikely, though more information needed on habitats and species that would be most likely vulnerable to invasion in the RA area.
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	major	medium	While insect herbivory is reported to be intense in the native range (Native Plant Trust Plantfinder 2020), any herbivory in countries hosting invasions is evidently not enough to regulate the species' abundance and spread.

already be present in the risk assessment area?			
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).	Northern England and Scotland (including Hebrides, Orkney and Shetland), especially coastal open habitats, heaths, dunes, pine forest, open rocky/gravelly habitats including along rivers; anthropogenic habitats including urban forests, roadsides, railway sidings.	medium	Habitats and parts of RA area most likely to be impacted by invasion are based on knowledge of species' impacts in continental Europe, especially Fennoscandia. However, it is plausible that invasion pattern on the continent is a function of greater propagule pressure in northern countries, meaning that higher propagule pressure in the south could also increase likelihood of invasion and impact.
2.28. Estimate the overall impact of this organism in the risk assessment area (using the comment box to indicate any key issues).	moderate	high	There is no reason to assume that the broad range of habitats colonised and invaded elsewhere in Europe will be resistant to invasion in the RA area. Coastal habitats lacking taller woody vegetation, open forests, and low-lying vegetation especially on acid soils seem especially at risk of change in structure and function, and invasion may be facilitated by human disturbance or nutrient addition. On balance moderate, given limited evidence of economic or human/social impacts; impacts are likely to be predominantly on biodiversity and ecosystems.

RISK SUMMARIES

	RESPONSE	CONFIDENCE	COMMENT
Summarise Entry	likely	high	The species is already present in the RA area and is sold as an ornamental plant, both by GB-based and continental plant nurseries. Thus, continued entry through the ornamental plant trade is likely. The species seems less popular/less widely sold than *A. lamarckii* in the UK. There is potential for it to increase in popularity as an alternative ornamental to *A. lamarckii* under certain growing conditions*;* it has a much lower stature than *A. lamarckii*, is described as low-maintenance, and as a potential hedge plant (Shoot Gardening 2020).
Summarise Establishment	likely	high	The success of the species in Fennoscandia suggests the species is very likely to establish in the RA area, particularly in the north. It can establish in a wide range of habitats, from anthropogenic to natural, and has a short time to reproduction. Establishment will be facilitated by suckering, increasing population expansion and seed output quickly. Birds are likely to aid recruitment of new individuals and establishment of new populations. More info needed on potential for apomixis in this species, but if it is apomictic (able to produce seed without fertilisation), then only relatively small increases in propagule pressure and small founder populations are likely to result in establishment. The species may not have established in the RA area yet, because propagule pressure is currently low. The potential for misidentifying plants in the wild as *A. lamarckii* also needs to be considered.
Summarise Spread	moderately	high	The species is highly likely to find suitable habitat in the RA area, and recruit multiple species of bird dispersers, but also potentially mammals. Populations are likely to establish in new areas quickly due to short generation time and dispersal, and because of self-fertility, viable seed production is highly likely. Established populations will likely expand both vegetatively and via seed, increasing distribution and abundance at a local scale. The species spread from a small area of grid cells in Latvia in 1950, to most of the country 50 years later.

Summarise Impact	moderate	high	There is no reason to assume that the broad range of habitats colonised and invaded elsewhere in Europe will be resistant to invasion in the RA area. Coastal habitats lacking taller woody vegetation, open forests, and low-lying vegetation especially on acid soils seem especially at risk of change in structure and function, and invasion may be facilitated by human disturbance or nutrient addition. Species could act as a host of DEFRA-recognised pests and pathogens, but as these are polyphagous, it is unlikely to add a new economic cost through crop damage.
Conclusion of the risk assessment	medium	medium	The species has many biological attributes typical of successful invasive plants including vegetative spread, bird dispersal, early age to maturity and self-fertility. It has already demonstrated a high capacity for spread and wide environmental tolerance/niche breadth in the invaded range of Europe. Impacts of vegetation structure and species composition are likely in multiple habitats that could be invaded, including sand dunes, heaths, open pine forests, forest edges and open rocky/gravelly habitats. More information is needed on the level of niche overlap with *A. lamarckii*, but given the distribution of *A. lamarckii* in GB and continental Europe, and of *A. spicata* in northern Europe, it is plausible that *A. spicata* could establish in cooler, more northerly parts of the RA area compared to *A. lamarckii*. The wide habitat breadth of *A. spicata* would also mean there is potential for the species to invade habitats additional to those invaded by *A. lamarckii*.

Additional questions are on the following page ...

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change, if any, are most likely to affect the risk assessment for this organism?	[changes in temperature and precipitation]	medium	Not clear if species will do less well in south with warmer drier climate, or better relative to natives due to tolerance of drier soils, given the habitats it occurs in in the native and invaded ranges. The genus *Amelanchier* is largely found in cool/mesic environments. If the climate of southern England continues to warm and rainfall become more episodic it is probable that this species will have limited tolerance of the conditions. In the warmer/southern parts of USA Amelanchier are largely restricted as post-glacial relict populations in uplands (Flora North America 2020)
3.2. What is the likely timeframe for such changes?	50	medium	By 2070, GB average temperatures will have increased by show increases of 3.7 °C to 6.8 °C, under a high emissions scenario, and an increase in hot spells (2 or more consecutive days >30°C) largely in SE England (UK Met Office 2019). This combined with projected decreases in soil moisture resulting from lower precipitation (UK Met Office 2019) may decrease invasion success of this species, or increase its performance compared to natives under drought conditions.
3.3. What aspects of the risk assessment are most likely to change as a result of climate change?	[establishment spread impact]	high	Relatively better performance under warmer drier conditions than natives would likely give the species a competitive advantage, promoting establishment, spread an impact.

ADDITIONAL QUESTIONS - RESEARCH			
4.1. If there is any research that would significantly strengthen confidence in the risk assessment please summarise this here.	a) Importance of apomixis b) Increase efforts to detect any existing escapes/established populations, and monitor species in plantings for indications of escape and recruitment of new individuals c) Obtain more information on habitats invaded and species affected in continental Europe. d) Seed bank information needed	high	a) More evidence for apomixis needed; confirmation could mean risk of population establishment and spread from a small founder population is increased. b) Should already check now for escape from cultivation, locate nascent populations outside cultivation, identifying habitats colonised and map distribution. c) Need more solid and precise evidence/information on most vulnerable habitats invaded and species threated in the invaded range in Europe, to better identify which habitats of high conservation value will be most vulnerable to invasion in the RA area context. d) While seeds are orthodox and have high germination success/viability after storage, evidence on seed bank formation would inform on difficulty of eradication and management if established.

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

REFERENCES:

Andreu J, Vilà M (2009) Risk analysis of potential plants in Spain. Journal for Nature Conservation. doi: 10.1016/j.jnc.2009.02.002.

Alien Plants Belgium (2020) *Amelanchier spicata*. http://alienplantsbelgium.be/content/amelanchier-spicata Accessed 02.01.2021

Binggeli P (1998) Plants of the Pacific Northwest in Western Europe. https://www.ou.edu/cas/botany-micro/ben/ben195.html Accessed 02.01.2021

Burgess MB, Cushman KR, Doucette ET, Talent N, Frye CT & Campbell CS (2014). Effects of apomixis and polyploidy on diversification and geographic distribution in Amelanchier (Rosaceae). *American Journal of Botany* 101: 1375-1387.

CABI Invasive Species Compendium (2020) Amelanchier spicata. https://www.cabi.org/isc/datasheet/4836 Accessed 02.01.2021; 28.05.2021

Chindyaeva LN, Belanova AP & Kiseleva TI (2018) Patterns of natural regeneration of alien species of woody plants in Novsibirsk. Russian Journal of Biological Invasions 9: 273-285.

Ebben Nurseries (2020) *Amelanchier spicata*. https://www.ebben.nl/en/treeebb/amspicat-amelanchier-spicata/ Accessed 02.01.2021

EPPO (2010) Risk analysis of potential invasive plants in Spain. https://gd.eppo.int/reporting/article-478 Accessed 28.05.2021

EPPO (2011) Estonia: national initiatives on Code of conduct. https://gd.eppo.int/reporting/article-1716 Accessed 28.05.2021

EPPO (2014a) List of alien species determined to be potentially invasive in the Spanish regulation. https://gd.eppo.int/reporting/article-3294 Accessed 28.05.2021

EPPO (2014b) Invasive alien species in Norway. https://gd.eppo.int/reporting/article-2780 Accessed 28.05.2021

EPPO (2015) Invasive plant species in Sweden. https://gd.eppo.int/reporting/article-4956 Accessed 28.05.2021

EPPO (2020) *Amelanchier spicata*. https://gd.eppo.int/taxon/AMESP/reporting Accessed 02.01.2021

Etsy (2020) *Amelanchier spicata*. https://www.etsy.com/listing/902205656/amelanchier-spicata-bulk-wholesale-seeds Accessed 02.01.2021

Flora of North America (2020). *Amelanchier spicata*. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250100032 Accessed 02.01.2021

Gederaas L, Moen TL, Skjelseth S, Larsen LK (eds.) (2012) Alien species in Norway – with the Norwegian Black List 2012. The Norwegian Biodiversity Information Centre, Norway. 212 pp.

Global Biodiversity Information Facility (2020a) *Amelanchier spicata*. https://www.gbif.org/species/3023852 Accessed 02.01.2021

Global Biodiversity Information Facility (2020b) *Amelanchier lamarckii*. https://www.gbif.org/species/3024109 Accessed 02.01.2021

Go Botany Native Plant Trust (New England) (2020) *Amelanchier spicata*. https://gobotany.nativeplanttrust.org/species/amelanchier/spicata/

Green AJ, Elmberg J & Lovas-Kiss (2019) Beyond scatter-hoarding and frugivory: European Corvids as overlooked vectors for a broad range of plants. Frontiers in Ecology and Evolution. 7: 133.

Gudzinskas Z, 2005. Case studies on the alien flora of the vicinity of cemeteries in Lithuania. Latvijas Universitates Raksti, 685:21-37.

Kabuce, N. and Priede, N. (2010): NOBANIS – Invasive Alien Species Fact Sheet –Amelanchier spicata. – From: Online Database of the European Network on Invasive Alien Species – NOBANIS www.nobanis.org, Accessed 02.01.2021

Krüssmann G, 1984. Amelanchier Medic. - Rosaceae. Manual of cultivated broad-leaved trees and shrubs. Vol. 1. Amelanchier Medic. - Rosaceae. Manual of cultivated broad-leaved trees and shrubs. Vol. 1. London, UK: A-D. BT Batsford Ltd., 141-149.

Kuklina AG, Kuznetsova OI & Schanzer IA (2018) Molecular genetic study of invasive Shadberry species (*Amelanchier* Medik.). *Russian Journal of Biological Invasions* 9: 134-142.

McLeod, CR, Yeo, M, Brown, AE, Burn, AJ, Hopkins, JJ, & Way, SF (eds.) (2005, updated 2009) The Habitats Directive: selection of Special Areas of Conservation in the UK, 2nd edition (Version 4). Joint Nature Conservation Committee, Peterborough.

Melcher GJR (2016). Propagation and container production of the Amelanchier spicata complex. Electronic Theses and Dissertations, University of Maine USA, 2490. http://digitalcommons.library.umaine.edu/etd/2490 Accessed 02.01.2021

Missouri Botanic Garden (2020) *Amelanchier stolonifera* (A. spicata var stolonifera is a synonym of A. Spicata according to Plants of the World Online). http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=286378 Accessed 02.01.2021

National Biodiviersity Network (2020) *Amelanchier spicata* (no records). Accessed 02.01.2021

Native Plant Trust Plantfinder (2020) *Amelanchier spicata*. https://plantfinder.nativeplanttrust.org/plant/Amelanchier-spicata

NOBANIS (2021) *Amelanchier spicata*. https://www.nobanis.org/species-info/?taxaId=1475 Accessed 28.05.2021

North Carolina Extension Gardener Plant Toolbox (2020) *Amelanchier spicata*. https://plants.ces.ncsu.edu/plants/amelanchier-spicata/ Accessed 02.01.2021

Plants For a Future Database (2020) *Amelanchier spicata*. https://pfaf.org/user/Plant.aspx?LatinName=Amelanchier+spicata Accessed 02.01.2021

Plants of the World Online (2019) *Amelanchier spicata*. http://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:1184240-2 Accessed 02.01.2021

Royal Horticultural Society (2020a) *Amelanchier spicata*. https://www.rhs.org.uk/Plants/Nurseries-Search-Result?query=1070 Accessed 02.01.2021

Royal Horticultural Society (2020b) *Amelanchier lamarckii*. https://www.rhs.org.uk/plants/26602/Amelanchier-lamarckii/Details Accessed 02.01.2021

Rurane Rurane I, ZnotiHa V, Brumelis G, Tabors G, Balodis VA (2004) Distribution of *Amelanchier* spicata in Jurmala in relation to environmental factors. Latvijas Universitate, 39 pp. http://piekraste.daba.lv/LV/peetiijumi/Amelanchier_spicata_izplatiiba.pdf Accessed 02.01.2021

Schroeder FG, 1970. Exotic *Amelanchier* species naturalized in Europe and their occurrence in Great Britain. Watsonia, 8:155-162.

RBG Kew Seed Information Database (2020). *Amelanchier spicata*. https://data.kew.org/sid/SidServlet?ID=1598&Num=hav Accessed 02.01.2021

Sheffields Seeds (2020) *Amelanchier spicata*. https://sheffields.com/seeds/Amelanchier/spicata Accessed 02.01.2021

Shoot Gardening (2020) *Amelanchier spicata*. https://www.shootgardening.co.uk/plant/amelanchier-spicata Accessed 02.01.2021

Tyler T, Karlsson T, Sahlin U, Sundberg S (2015) Invasive plant species in the Swedish flora: developing criteria and definitions, and assessing the invasiveness of individual taxa. Nordic Journal of Botany. 33: 300-317.

UK Biological Records Centre (2020a.) Online Atlas of British and Irish Flora. *Amelanchier spicata* (no results to display). https://www.brc.ac.uk/plantatlas/finder/plant/amelanchier%20spicata Accessed 02.01.2021

UK Biological Records Centre (2020b) Online Atlas of British and Irish Flora. *Amelanchier lamarckii*. https://www.brc.ac.uk/plantatlas/plant/amelanchier-lamarckii Accessed 02.01.2021

UK Met Office (2019) UK Climate Projections: Headline Findings. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf Accessed 02.01.2021

USDA Agricultural Research Service (2015) *Amelanchier spicata*. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=2880 Accessed 02.01.2021

Useful Temperate Plants (2020) *Amelanchier spicata*. http://temperate.theferns.info/plant/Amelanchier+spicata Accessed 02.01.2021

Van den Berk Nurseries (2020) *Amelanchier spicata*. https://www.vdberk.co.uk/trees/amelanchier-spicata/ Accessed 02.01.2021

Vībāns K (2001) Svešzemju kokaugu sugu – dārzbēgļu izplatība Piejūras dabas parkā un Mežaparkā. Maģistra darbs. – Rīga, Latvijas Universitāte.Weber E, Gut D (2004) Assessing the risk of potentially invasive plant species in central Europe. Journal for Nature Conservation 12: 171–179.