Revision of the Risk assessment of the Staff-vine (*Celastrus orbiculatus*), as based on Member State comments

Introduction

This document explains how the comments received through the Scientific Forum and the consultation of stakeholders on the **Risk assessment of the Staff-vine (*Celastrus orbiculatus*)** by Beringen et al. (2017)[1] have been considered.

Disclaimer: The authors of the present document have prepared this note with the only purpose to process the Member States comments to the original Risk Assessment by Beringen et al. 2017, on behalf of the European Commission. For the same reason, the present document does not represent an endorsement of the statements and scores given within the original document. Since the focus of this document was limited to the Member States comments, it cannot be considered as a revision of the original document, whose contents and bibliography have not been through a comprehensive check, and remain the sole responsibility of the original authors.

Name of species assessed: ***Celastrus orbiculatus* Thunb.**
Date of completion of this document: **01/03/2021**
Member States that provided comments: • **Austria** (AT) • **Belgium** (BE) • **Denmark** (DK) • **Estonia** (EE) • **Germany** (DE) • **Poland** (PL) • **Romania** (RO) Stakeholder organizations that provided comments: none.

Outline

The first part of this document highlights how the comments from Member States have been dealt with. The second part of this document deals with the specific comments from Member States. The text should be read as an addendum and corrigendum to the original risk assessment (Beringen et al. 2017). The headings from the original assessment are repeated to facilitate direct comparison.

[1] Beringen R., van Duinen G.A., de Hoop L., de Hullu P.C., Matthews J., Odé B., van Valkenburg J.L.C.H., van der Velde G., Leuven R.S.E.W. (2017) Risk assessment of the alien Staff-vine (*Celastrus orbiculatus*). © Department of Environmental Science, Radboud University, 6525 AJ Nijmegen, The Netherlands

References that were included in the original risk assessment are not repeated. New references are provided at the end of this document.

Part 1: Comments per Member State

Austria (AT)

AT suggested a *minor revision*. Specific comments are dealt with in the second part of this document.

Belgium (BE)

BE considered the risk assessment was *fit-for-purpose* and had no additional comments.

Denmark (DK)

DK suggested a *major revision*. Specific comments are dealt with in the second part of this document.

Estonia (EE)

EE considered the risk assessment was *fit-for-purpose* and had no additional comments.

Germany (DE)

DE provided additional informations, which are dealt with in the second part of this document.

Poland (PL)

PL suggested a *minor revision*. Specific comments, especially on the distribution of the species in Poland, are dealt with in the second part of this document.

Romania (RO)

RO considered the risk assessment was *fit-for-purpose* and had no additional comments.

Part 2: Specific comments

This part provides additions and corrections under the respective headings of the original assessment (Beringen et al. 2017). The Member State on whose comment it is based, is indicated between brackets.

The following table provides details of where the common elements of risk assessments defined by Article 5 of the Regulation 1143/2014 of 22 October 2014 can be found in the *Celastrus orbiculatus* risk assessment.

Table 1 -- The elements of risk assessments as defined by Regulation 1143/2014, and the headings under which they are treated by Beringen et al. (2017)

Element	Headings
Art 5(1)(a) — *a description of the species with its taxonomic identity, its history, and its natural and potential range*	2.2.1
Art 5(1)(b) — *a description of its reproduction and spread patterns and dynamics including an assessment of whether the environmental conditions necessary for its reproduction and spread exist*	2.1.2
Art 5(1)(c) — *a description of the potential pathways of introduction and spread of the species, both intentional and unintentional, including where relevant the commodities with which the species is generally associated*	2.4
Art 5(1)(d) — *a thorough assessment of the risk of introduction, establishment and spread in relevant biogeographical regions in current conditions and in foreseeable climate change conditions*	3.1, 3.2
Art 5(1)(e) — *a description of the current distribution of the species, including whether the species is already present in the Union or in neighbouring countries, and a projection of its likely future distribution*	2.3.1, 2.3.2, 3.1.2
Art 5(1)(f) — *a description of the adverse impact on biodiversity and related ecosystem services, including on native species, protected sites, endangered habitats, as well as on human health, safety, and the economy including an assessment of the potential future impact having regard to available scientific knowledge*	2.5
Art 5(1)(g) — *an assessment of the potential costs of damage*	2.5
Art 5(1)(h) — *a description of the known uses for the species and social and economic benefits deriving from those uses*	2.5

Overarching comments from Germany

DE provided additional information from recent studies that should be included in the risk assessment. The following text details the comments and includes suggestions of text and its position in the risk assessment.

- In Germany, male and female plants occur together in the field. Seed formation and first spread were observed.

Page 10 (reproduction)

Flowers of *Celastrus* species frequently become unisexual through the abortion of male or female organs. Plants are often functionally dioecious (Brizicky 1964, Burnham & Santanna 2015). Occasionally monoecious plants, with both male and female flowers, are reported (Hou, 1955), and occasionally plants develop both unisexual and perfect flowers on the same plant (polygamo-dioecious) (Dreyer et al. 1987). In Germany, male and female plants occur together in the natural environment which enables reproduction and seed production (Alberternst & Nawrath 2018). The cultivar *C. orbiculatus* ‘Hermaphroditus' is self-pollinating. The cultivar *C. orbiculatus* 'Diana' is a female clone and only sets fruit if a male clone is present locally. *C. orbiculatus* 'Hercules' is a male clone and is used as a pollinator for female plants (e.g., Marczyński 2016).

Page 21 (2.4.1. Dispersal potential by natural means)

- A zoochore spread by birds is to be assumed on the basis of the distribution pattern and the growth place.

Page 43 (probability of spread)

The unintentional distribution of plants from gardens into the wild, caused by berry eating birds can contribute to the spread of *C. orbiculatus*. In Germany, bird dispersal has been recorded at 400 m from the parent plants (Alberternst & Nawrath, 2018). Addtionally, the improper disposal of (bonsai) trees or decorations outdoors or in compost can contribute to spread.

- In Hesse similar habitats are already populated as in the USA, where the species is classified as invasive.

Page 16

In Europe, most sites are situated in or near urban areas. Therefore, it is not clear in which EU habitats C. orbiculatus will establish. The most likely areas for establishment are forest habitats on moist, fertile, neutral soils like 91E0: "Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)" or 91F0 "Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along major rivers (Ulmenion minoris)".

A detailed survey in Hessen, Germany (Alberternst & Nawrath, 2018) recorded dominant stands with vegetative and generative regeneration. One stand originated from a nursery and has spread into an area protected under the EU Habitats Directive and classified as Annex I habitat type code 91E0. Another stand occurs in a nature protection area of light pine forest on sandy soils resembling 91T0. Regeneration and spread of the species was observed in three of the four stands. Another stand was found on railway land, where the plant covers unused tracks. Such mentioned habitats are similar to those where the species occurs in the USA.

Summary (p. 3/4)

Comment (AT): The authors assume that the applied risk assessment method (internet version of Harmonia+) is compliant with the criteria for RA derived from Reg 1143/2014. This review confirms this assumption in large parts; however, it also identified some gaps that need revision. While the risk assessment is very clear and well written in general, it is sometimes difficult to find the necessary information related to the specific criteria of the Regulation. It would be helpful to modify (or add) the Summary accordingly. The summary lacks explicitly clear information related to current and possible future occurrences with regard to Member States and biogeographical regions.

Answer: The following text should be included in the summary:

Celastrus orbiculatus currently occurs in ten EU countries (Austria, Belgium, the Czech Republic, Denmark, Germany, Latvia, Lithuania, the Netherlands, Poland, Sweden), and the United Kingdom. Under climate change, in the future, the entire Atlantic, Continental and southern Boreal biogeographical regions of Europe are likely to be suitable for the establishment of the species. Therefore, this has the potential to increase the future occurrence of *C. orbiculatus* to the following countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden, Spain, and the United Kingdom.

Comment (AT): The summary lacks indications for the associated levels of uncertainty of the scorings.

Answer: The only score that is detailed in the summary section is the overall score, which is medium. This score was produced with the Harmonia system which does not provide an uncertainty score associated with the overall score.

Comment (DK): On p. 3, it is stated that the report also includes a risk assessment of *C. orbiculatus* focussed on the Netherlands, we question whether it is the right place to publish a national risk assessment.

Answer: The inclusion of the statement is a decision of the authors and does not impact the results of the risk assessment and therefore there is no change suggested.

Comment (DK): On p. 3 it is stated that "Suitable habitats in the EU are most likely forests on moist, fertile, and neutral soils…", from the sections 2.3.3 and 2.3.4 it is not clear why e.g. urban sites, former agricultural fields, reforested agricultural fields and sand dunes are not suitable habitats in the EU as they are in other parts of the its introduced range. Furthermore, the RA (p. 29) states that "the species thrives best in recently disturbed habitats" and forests may not be regarded as recently disturbed.

Answer: The sentence should be amended to read:

"The most suitable habitats in the EU are most likely forests on moist, fertile, and neutral soils…"

Species description (p. 7)

Comment (DK): There are difficulties in distinguish *C. orbicultatus* from *C. scandens*, except when the species are fertile. The species, however, forms a "seedling bank" (mentioned on p. 12) that may last for many years especially in forest ecosystems (shaded habitats). This problem should be mentioned because it also have implications for early identification and eradication. Furthermore, *C. orbicultatus* from *C. scandens* hybridize (Pooler et al. 2002). The Ra needs to mention problems separating hybrids from parental species.

Answer: On page 9 of the RA, it is clearly stated that folding of the leaves is a useful identifying characteristic and therefore it is not correct to say the species can only be told apart when they are fertile. Additionally, there is no evidence that hybrids occur in the risk assessment area, and therefore identifying characteristics of hybrids and parent species is not required.

2.1.2 Species characteristics (p. 10)

Reproduction:

Comment (DK): It should be mentioned in the section on reproduction that *C. orbiculatus* requires gaps in the canopy for sexual reproduction (flowering and fruiting) as mentioned on p. 21 (reference to study by Silveri et al. (2001).

Answer: The paragraph should be amended to read:

Gaps in the canopy are required for sexual reproduction, flowering and fruiting (Silveri et al. 2001).

2.2 Probability of introduction (p. 13)

Comment (DK): It is stated that *C. orbiculatus* has been cultivated for many years in several member states". How many? And which?

Answer: This is a general statement which is then further elaborated in the remaining text of section 2.2 giving the information Denmark requests.

2.3 Probability of establishment (p. 13)

Comment (AT): An explicit answer to which Member States and biogeographical regions are suitable under current and foreseeable future conditions is missing. This information should also be provided in the Summary.

Answer: The following text should be included:

Celastrus orbiculatus currently occurs in ten EU countries (Austria, Belgium, the Czech Republic, Denmark, Germany, Latvia, Lithuania, the Netherlands, Poland, Sweden), and the United Kingdom. Under climate change, in the future, the entire Atlantic, Continental and southern Boreal biogeographical regions of Europe are likely to be suitable for the establishment of the species. Therefore, this has the potential to increase the future occurrence of *C. orbiculatus* to the following countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden, Spain, and the United Kingdom.

Table 2 – Summary of the status of *C. orbiculatus* in Member States of the European Union, and the United Kingdom

Member State	Recorded	Currently established	Potential establishment	Currently invasive
Austria	Yes	Yes (locally)	Yes	No
Belgium	Yes	Yes (locally)	Yes	No
Bulgaria	No	No	Yes	No
Croatia	No	No	No	No
Cyprus	No	No	No	No
Czech Republic	Yes	No	Yes	No
Denmark	Yes	Yes (locally)	Yes	No
Estonia	No	No	Yes	No
Finland	No	No	Yes	No
France	No	No	Yes	No
Germany	Yes	Yes	Yes	No
Greece	No	No	No	No
Hungary	No	No	Yes	No
Ireland	No	No	Yes	No
Italy	No	No	Yes	No
Latvia	Yes	Yes (locally)	Yes	No
Lithuania	Yes	Yes	Yes	Yes
Luxembourg	No	No	Yes	No
Malta	No	No	No	No
Netherlands	Yes	Yes (locally)	Yes	No
Poland	Yes	Yes	Yes	Yes
Portugal	No	No	No	No
Romania	No	No	Yes	No
Slovakia	No	No	Yes	No

Slovenia	No	No	Yes	No
Spain	No	No	Yes	No
Sweden	Yes	Yes (locally)	Yes	No
United Kingdom	Yes	Yes (locally)	Yes	No

Table 3 -- Summary of the status of *C. orbiculatus* in biogeographical regions of the European Union

Biogeographical region	Recorded	Currently established	Potential establishment	Currently invasive
Alpine	Yes	Yes	Yes	No
Atlantic	Yes	Yes	Yes	No
Black Sea	No	No	No	No
Boreal	Yes	Yes	Yes	Yes
Continental	Yes	Yes	Yes	Yes
Mediterranean	No	No	No	No
Pannonian	No	No	No	No
Steppic	No	No	No	No

2.3.2 Current distribution in the European Union (p. 14/15)

Addition (PL): *Celastrus orbiculatus* is currently recorded in the central segment of the Międzyrzecz Reinforced Region and its expansion has been observed near Panzerwerkes (Purcel, 2010, 2011).

Comment (DK): Six records in Denmark (Hartvig, P. 2015 Atlas Flora Danica, Gyldendal, København. See also GBIF[2]. First record 1981. Map p. 14 need correction.

Answer: The maps cannot be updated within this document due to copyright issues.

Comment (DK): In Denmark, *C. orbiculatus* is also found in woodland (Hartvig, 2015).

Answer: The first paragraph on page 15 should be amended to include the following sentence at the end of the paragraph: In Denmark, the species is also found in woodland (Hartvig 2015).

2.3.3 Habitat description and physiological tolerance (p. 15/16)

Comment (DK): In Denmark, the species is found in forest habitats (coniferous forest, thicket, park), along railways and in urban areas (Hartvig 2015).

Answer: The second paragraph on page 16 should be amended to include the text below at the end of the paragraph: In Denmark, the species is found in forest habitats (coniferous forest, thicket, park), along railways and in urban areas (Hartvig 2015).

2.3.4. Climate match and bio-geographical comparison (p. 17)

Endangered areas:

[2] https://www.gbif.org/occurrence/search?country=DK&taxon_key=8104460)

Comment (AT): The statement that the area with suitable climate will expand northward (in 2.3.4) needs be expanded with information on possible changes in the biogeographic regions.

Answer: The paragraph should be amended to read:

Based on expert opnion (authors of the current risk assessment), under climate change, in the future, the entire Atlantic, Continental and southern Boreal biogeographical regions of Europe are likely to be suitable for the establishment of the species.

2.4.1 Dispersal potential by natural means (p. 21/22)

Comment (DK): We wonder why starlings are the only seed eating birds mentioned as potentially contributing significantly to spread of the species? Other berry-eating birds may serve as vector as well?

Answer: Starlings are the only specific bird species mentioned in the risk assessment as this is where there is evidence. Throughout the RA, berry eating birds are mentioned often with the example of Starlings, therefore confirming that other bird species may spread seed.

Comment (DK): Although the scoring might be right, the fact that "to date the species has not shown considerable spread at the current recorded locations in Europe" should be discussed and reflected in the section on spread.

Answer: The first paragraph in the spread section (p. 31) can be amended as follows:

It should be noted, that to date the species has not shown considerable spread at the current recorded locations in Europe. Reasons for this could include that the propagule pressure is not currently that high, or the species is in its lag phase.

2.5. Impacts (p. 22)

Comment (DK): Referring to Gederaas et al. (2012) (the Norwegian species database) is not a valid reference for the mentioned biodiversity effects. Furthermore, the reference indicate that *C. orbiculatus* is a low risk species, i.e. the reference is not correctly cited.

Answer: The reference to Gederaas et al. (2012) can be deleted from the reference list as it is only cited in the above case. The paragraph can be amended to read:

Fryer (2011) regard *C. orbiculatus* as a severe invasive species, mainly because of detrimental interactions with indigenous endangered or rare species and endangered or rare habitats.

Comment (DK): Referring to Glastonbury Partners in Planting (GPIP 2013) is not a valid reference for effects of the species.

Answer: The reference to GPIP (2013) can be deleted from the reference list as it is only cited in the above case and can be replaced by Fryer (2011).

Comment (DK): It should be noted that the observations by Lutz (1943) are made on the related species *C. scandens*. Just above the photo (Fig. 2.10) it is stated that: "Hardwoods are more commonly damaged than conifers because the relatively dense canopy of conifers offers unfavourable light conditions for *C. orbiculatus* (Lutz 1934)". Looking into another study cited in the RA (Ellsworth et al. 2004b) it is, however, found that survival and growth the first year did not differ between 2%, 28% and 100% sun, at the second season growth and biomass were greater in the 100% and 28% sun treatments than 2% sun…" and furthermore "The ability of *C. orbiculatus* to survive under deep shade despite its slow

growth implies that intact forest are vulnerable to invasion and that established understory populations should be controlled before harvesting or thinning the forest"

Answer: The paragraph should be amended as follows:

For *C. scandens*, hardwoods are more commonly damaged than conifers because the relatively dense canopy of conifers offers unfavourable light conditions [for the species to establish] (Lutz 1943). This is also likely to be the case for *C. orbiculatus* due to similarities in form, function and requirements. *Celastrus orbiculatus* can persist in forest understories in the USA for a number of years and following a disturbance in the canopy (i.e. tree or limb falls causing canopy gaps), rapid growth can occur (Patterson, 1973). *Celastrus orbiculatus* "uses a 'sit and wait' invasion strategy" (Greenberg *et al*., 2004).

Comment (DK): The study by Dreyer et al. (1987) should not be used as reference for "the competition and hybridization effects of introduced C. orbiculatus". This study does not include hybridization but tells that "this is being investigated". The study by Pooler et al. (2002) found in the reference list, however, deals with hybridization and vigour of the interspecific seedlings. This study should be mentioned here.

Answer: In the paragraph on page 23, Dryer et al. (1987) is not referring to hybridization but in fact the latter sentence. Pooler et al. (2002) can however be added to the paragraph.

Comment (DK): Zaya et al. (2015) is cited for the conclusion that interspecific hybrids between *C. orbiculatus* and *C. scandens* do not have increased invasiveness and vigour. The study by Pooler et al. (2002), however, found that seedlings from interspecific crosses had less dormancy and were more vigorous than the intraspecific seedlings. This should be discussed.

Answer: In the paragraph on page 35 the following text should be amended to read:

It should be noted that Pooler et al. (2002) found that seedlings from interspecific crosses had less dormancy and were more vigorous than the intraspecific seedlings.

Comment (DK): The study by Leicht-Young and Pavlovis (2012) is not correctly cited. It does not support that "C. orbiculatus has the ability to move out from the forest into the open dune habitats". Actually, it states (p. 172) "In full sun, we have often observed C. orbiculatus growing under the shade of shrubs, tree saplings, or grapes with ramets extending out into open habitats. These ecotonal habitats are where the threat to C. pitcheri is likely greatest from C. orbiculatus, because without some type of cover for C. orbiculatus to establish under, this species does not grow as well in wide open dunes where C. pitcheri is also present".

Answer: In the paragraph on page 35 the following text should be amended to read:

Along Lake Michigan. *C. orbiculatus* has the ability to encroach into the dune habitat which may be a threat to the endangered *Cirsium pitcheri* (Leicht-Young & Pavlovic 2012).

Comment (DK): Looking at effects on cultivated plants (chap. 2.5.2), effects on socio-economy (chap. 2.5.5) and effects on provisioning services (chap. 2.5.6) seem to be an overrepresentation of the same impact.

Comment (DK): As commented for section on impacts, there seem to be an over-assessment of effects on plant crops/provisioning services.

Answer: This is a common problem with evaluating ecosystem services. We don't have information on how the authors of the risk assessment weighted these scores and therefore cannot suggest a revision. The overall conclusion of the RA are nevertheless not affected.

Comment (DK): Section 2.5.4 Effects on public health states that no information regarding the effects of C. orbiculatus was found, however WOS have numerous citations of studies of the efficacy of extracts from the species against gastric cancer. The section on Provisioning services (P. 26) also document use in the treatment of poisoning, infectious disease and as an antidote for snakebites. This should also be mentioned here.

Answer: A risk assessment details negative effects. Although benefits are detailed as a requirement of the Regulation, they are not included in the scoring of this section.

Comment (DK): The study by Pavlovic et al. 2016. Oriental bittersweet (Celastrus orbiculatus): Spreading by fire. Forest Ecology and Management 364, 183-194) clearly documents that fire is not a good measure for control of C. orbiculatus. This needs to be reflected in the section on Physical measures. Pavlovic et al. (2016) also tested other methods such as cutting and herbicide application and the study should be mentioned in these paragraphs as well.

Answer: In the paragraph on page 26 the following text should be amended to read:

Physical measures
Prescribed burning is not considered a viable option for control. It is likely that *C. orbiculatus* is actually favored by fire due to rapid growth in response to opening the canopy and the large nutrient flushes that usually occur after fires (Pavlovic et al. 2016). However, if fire management is properly applied, the year's crop of seeds would be essentially eliminated (Leicht-Young et al. 2013). Cutting and herbicide application can be used to control the species (Pavlovic et al. 2016).

Comment (DK): Section 2.5.6 Effects on ecosystem services have very few references. The part on Provisioning services could be supplemented by numerous references on use extracts against gastric cancer.

Answer: The risk assessment scores negative impacts not positive impacts.

Comment (DK): The section on Supporting services should refer to the study by Leicht-Young et al. 2009 (found in the reference list) on effects of C. orbiculatus on soil composition and processes.

Answer: In the paragraph on page 28 the following text should be amended to read:

The species has a negative effect on ecosystem nutrient cycling due to the plant's ability to function like a nutrient pump (Leicht-Young et al. 2009). Minerals become available to other species as the *C. orbiculatus* litter layer degrades easily and enriches the soil (Leicht-Young et al. 2009).

3. Risk assessment (p. 29ff)

Comment (DK): There is little reasoning and justification of the statements and scoring of the species in the risk assessment section. One needs to seek around in the scientific section. That is not optimal.

Answer: The structure of the risk assessment cannot be addressed by this document.

3.1 Risk assessment and classification with Harmonia+ (p. 30)

Comment (AT): Table 3.1. does not correspond to the recommended pathway terminology (while Table 2.4 does).

Answer: In Table 3.1 the following text could be inserted between the line:

A06. Probability of introduction by natural means

Escape from confinement

A07. Probability of introduction by unintentional human actions

However, since Table 3.1. refers to the Harmonia+ protocol, no change to the wording of the categories should be made.

Comment (AT): Why the medium score for probability of intentional human actions (A08) was given a "high confidence"? According to the explanation in the text (3.1.1.), in comparison with A06 and A07, a "medium" confidence would fit better.

Answer: Under this pathway, the species is the commodity itself, and therefore any movement and planting of the species in the RA area can lead to the medium risk of entry. The confidence of high remains supported. It should be noted that no other reviewers highlighted this as an issue.

Comment (AT): Why is the confidence for establishment in habitats only "medium" and for climate "high"? There seems be no difference in the explanation in 3.1.1. I think both should be scored identical as "medium". Detailed information on probability of spread is equally uncertain, and was scored with "medium" confidence.

Answer: The paragraph on establishment (p. 29) should be amended to read:

The confidence differs though (habitats: medium and climate: high) which reflects the uncertainty of the species finding a suitable habitat and difference in habitats of the species in North America compared to the EU. For climate, the Köppen-Geiger system shows a strong suitability.

Environment: biodiversity and ecosystems (p. 31)

Comment (DK): The conclusion that C. orbiculatus cause medium effect on native species ("at worst, severe population declines in species that are not of conservation concern or limited population declines in species that are of conservation concern") might be right but it could not be drawn based on the information given in chapter 2.5.1. Chapter 2.5.1 needs to elaborated to support the conclusion.

Answer: The current score is considered appropriate and the point was not raised by other reviewers. Section 2.5.1 is detailed giving numerous examples to support a 'medium' impact.

Comment (DK): The risk of adverse effects on ecosystem integrity due to changes to biotic properties is estimated to medium. Again, that might be right but virtually no references are given on such effects. Even though, the risk estimates are based on professional knowledge the confidence should be "low" as effects on ecosystem biotic parameters might be highly variable.

Answer: Based on the fact that there are no supporting references, the suggestion to change the confidence score to low is reasonable.

Ecosystem services (p. 32)

Comment (DK): The scoring of effects on provisioning services as moderately negative should maybe be re-evaluated, as effects on timber might be severe. The outweighing of positive effect on pharmaceuticals, natural medicine and bio-chemicals against negative effects on timber production is not really a good idea.

Answer: Only negative effects are evaluated and thus, the sentence 'The positive effect of the species on bio-chemicals, natural medicines, and pharmaceuticals was outweighed by its negative effect on timber production' should be removed from the paragraph.

Comment (DK): Effect on plant crops should be mentioned in a section on effects on socio-economy, which is missing? Why does the section on "Plant crops" not include effects on forest? Consequences for other crops are more speculative as it needs structures such as trees, shrubs, tree saplings, or grapes as support but may have ramets extending out into open habitats. Therefore, the score "medium impact" might be an overestimation if forest is not included.

Answer: An additional sentence should be added to the paragraph on plant crops on p. 32:

Additionally, *C. orbiculatus* can have negative impacts on tree species in forest systems, potentially killing trees by smothering them.

3.1.1 Classification for current situation (p. 29)

Species introduction

Comment (DK): The only pathway described is escape from cultivation/horticulture. On p. 29 the RA states that "Introductions via natural pathways are expected to occur less than once every 30 years, because it is highly unlikely that the species will enter the EU via earth-moving activities". Is this statement based on the knowledge that the species does not form a persistent seedbank (p. 12)? (This is an example that the reviewer need to seek around in the RA to find the relevant information, which is not optimal).

Answer: This statement is more related to the fact that soil as a pathway into the EU is mainly closed due to phytosanitary regulations. The paragraph should be amended to read:

Introductions via natural pathways are expected to occur less than once every 30 years, because it is highly unlikely that the species will enter the EU via earth-moving activities (due to the pathway of soil into the EU being mainly closed and regulated).

Comment (DK): *C. orbiculatus* is also recorded from Denmark (see below), therefore number of MS where the species has been recorded should be changed from "eight" to "nine".

Answer: Denmark should be added as a country where the species has been recorded, but it remains eight MS, excluding the United Kingdom.

Comment (DK): The finding that "to date the species has not shown considerable spread at the current recorded locations in Europe" (p. 29) is not an argument for establishment (where it is put now). Actually, it should be discussed in the section on spread that scores the capacity of *C. orbiculatus* to disperse within the EU by natural means as high.

Answer I: The paragraph on establishment (p. 29) should be amended to read:

This criterion is scored with medium confidence considering that there is no relevant information available within the EU and that the species thrives best in recently disturbed habitats.

Answer II: The paragraph on spread (p. 31) should be amended to read:

It should be noted, that to date the species has not shown considerable spread at the current recorded locations in Europe. Reasons for this could include that the propagule pressure is not currently that high, or the species is in its lag phase.

Comment (DK): What is the conclusion about probability of introduction to the EU's wild habitats being medium (between 1 and 9 events per decade) based on?

Answer: It appears to be expert opinion of the authors as documented information is not available.

3.1.2 Classification for future situation (p. 33)

Comment (AT): On the one hand the assessment (2.3.3, also 2.3.4 and 2.5.7) states that temperature/climate is relevant (… climate change may render high-elevation sites increasingly vulnerable …), but on the other hand (3.1.2) expects no effects on the risk scores (based on a conservative climate change scenario). This expectation should be backed up with some arguments. Is the argument still valid under more severe (>2°C) climate change scenarios?

Answer: It must be assumed that uncertainty increases, but the argument seems still valid under more severe scenarios.

3.2 Risk assessment and classification with ISEIA-protocol (p. 35)

Comment (DK): Only the study by Zaya et al. (2015) that found no evidence that invasiveness increases is cited in the section on adverse impacts on native species. The study by Pooler et al. (2002), however, showed increased vigour of hybrids.

Answer: Pooler et al. (2002) should be added in the paragraph on page 35 (see above).

5. Conclusions (p. 42)

Comment (AT): The RA is not organized in a question-answer-way, which makes it sometimes difficult to find the relevant information. An extended summary page with the relevant information (according to the requirements of the Regulation) would be helpful.

Answer: This is outside the scope of this document.

Comment (DK): As mentioned in the comments on the summary, the RA could be much improved if the structure was changed so sections on studies of relevant risks were put next to sections evaluating and scoring the respective risks. As it is now the reviewer/reader needs to do a lot of page turning in order to seek and eventually find the relevant information for the reasoning and the scoring.

Answer: This is outside the scope of this document.

Comment (DK): Including the Danish records, the species has been recorded in nine countries.

Answer: Following more recent information, it is recorded in ten EU Member States, and the United Kingdom.

Appendix 3 (p. 68)

Comment (DK): *C. orbiculatus* is present in Denmark

Answer: Appendix 3 should be amended to include Denmark

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