EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Ailanthus altissima*
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Risk Assessment Area: Europe

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EU CHAPPEAU	
QUESTION	**RESPONSE**
1. In how many EU member states has this species been recorded? List them.	30 DAISIE EU regions and 24 EU Member States: Austria, Azores, Baleares, Belgium, Bulgaria, Canary Islands, Corse, Croatia, Cyprus, Czech. Rep., Denmark, France, Germany, Great Britain, Greece, Hungary, Italy, Liechtenstein, Luxembourg, Madeira, Malta, Moldova, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Slovenia, Spain, Sweden (DAISIE 2009, Ries & Pfeiffenschneider 2017, Boer 2012l).
2. In how many EU member states has this species currently established populations? List them.	At least in 24 DAISIE European regions and 19 EU Member States: Austria, Baleares, Belgium, Canary Islands, Corse, Croatia, Cyprus, Czech. Rep., Denmark, France, Germany, Great Britain, Greece, Hungary, Italy, Liechtenstein, Madeira, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Slovenia, Spain (DAISIE 2009, Boer 2012).
3. In how many EU member states has this species shown signs of invasiveness? List them.	In most of the countries where it is naturalized (established) (see Questions 2.16, 2.18, and 2.20 below). Especially in the Mediterranean, southern and central Europe (Kowarik & Säumel 2007).
4. In which EU Biogeographic areas could this species establish?	The species is already present in the majority of biogeographic regions (atlantic, black sea, continental, macaronesia, mediterranean, pannonian and stepic) with the exception of north part of Europe (majority of boreal biogeographic region). Similarly, the species is restricted in alpine regions. Climatic constraints are characterized by a long and warm growing season, with regular winter frost and annual precipitation of mostly >500 mm/year (Kowarik & Säumel 2007). In Spain, *Ailanthus altissima* showed considerable plasticity with regard to the Mediterranean climate which is characterized by persistent summer droughts and unpredictable soil water (Constán-Nava et al. 2010). Even though the species has been reported from colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005) it is not established in the north part of

	Europe (majority of boreal biogeographic region), but it is also planted in urban environments. In Denmark *A. altissima* is only found as isolated populations and only recorded from 0.3% of the Atlas Flora Danica registration quadrates (Hartvig 2015). The database Fugle og Natur have this species recorded at 26 localities, all but two observations are in Copenhagen and Aarhus, the two largest cities in Denmark. The match between the native range and temperate climate (studied for N. America but comparable for Europe) was proven by Albright et al. (2010).
5. In how many EU Member States could this species establish in the future [given current climate] (including those where it is already established)? List them.	As the species is already present in many countries and cities in Europe, the potential for establishment in climatically suitable regions is significant. Potential climate change in the future may enhance further range expansion (Miller 1990; Kowarik & Säumel 2007). *Ailanthus altissima* is already planted in colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005) so naturalization due to high propagule pressure and change of climate is highly probable. The species occurs in Austria, Azores, Baleares, Belgium, Bulgaria, Canary Islands, Corse, Croatia, Cyprus, Czech. Rep., Denmark, France, Germany, Great Britain, Greece, Hungary, Italy, Liechtenstein, Luxembourg, Madeira, Malta, Moldova, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Slovenia, Spain, Sweden (DAISIE 2009, Ries & Pfeiffenschneider 2017, Boer 2012) and in countries with suitable climate where it is not reported as naturalized can establish (e.g. Bulgaria, Malta, Slovenia, Luxembourg).
6. In how many EU member states could this species become invasive in the future [given current climate] (where it is not already established)?	The same as the section 5 as negative impact of the species is linked to man-made habitats and open habitats occurring in all regions (Sirbu & Oprea 2011). The species is reported from the following habitats (E5.1, E5.6, G1, G1.C, J6.1/E1, I1.5, J4, J6.1; data from Slovakia and Romania, Ferus et al. 2015). As the species is already present in many countries and cities in Europe, the potential for establishment in climatically suitable regions is significant. Potential climate change in the future may enhance further range expansion (Miller 1990; Kowarik & Säumel 2007). *Ailanthus altissima* is already planted in colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005) so naturalization and subsequent invasion due to change climate is highly probable.

	The species occurs in Austria, Azores, Baleares, Belgium, Bulgaria, Canary Islands, Corse, Croatia, Cyprus, Czech. Rep., Denmark, France, Germany, Great Britain, Greece, Hungary, Italy, Liechtenstein, Luxembourg, Madeira, Malta, Moldova, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Slovenia, Spain, Sweden (DAISIE 2009, Ries & Pfeiffenschneider 2017, BOER 2012) and in countries with suitable climate where it is not reported as naturalized can establish (e.g. Bulgaria, Malta, Slovenia, Luxembourg).

SECTION A – Organism Information and Screening

Stage 1. Organism Information	**RESPONSE** **[chose one entry, delete all others]**	**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?	*Ailanthus altissima* (Mill.) Swingle)	Several subspecies in the native range and several horticultural cultivars of *A. altissima* exist (Kowarik & Säumel 2007). Recently, a triploid individual has been found in the native range (Kurokochi et al. 2014). Similar to Kowarik & Säumel (2007) the risk assessment refers to *Ailanthus altissima,* its subspecies and to the variety altissima (*Ailanthus altissima* var. altissima). **Therefore, even though there is less information for individual varieties this RA includes all varieties or forms within the species *A. altissima*.** Synonymes: *Ailanthus glandulosa*, *Ailanthus peregrina*, *Toxicodendron altissimum* Family Simaroubaceae has a tropical/subtropical distribution with no genera native to Europe
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)	no need to redefine	
3. Does a relevant earlier risk assessment exist? (give details of any previous risk assessment)	Yes	RA are available in: Netherlands (Boer 2012; detailed RA; “From neighbouring countries, however, it is clear that by its invasive traits (high seed production and easy dispersal by wind, enormous capacity of resprouting from roots, stems and stumps) and its adaptability to different (and changing)

		environments, dispersal to natural and agricultural areas is a high risk. It is recommended to **stop planting** *Ailanthus altissima* in all type of plantations to **reduce risks of infestations and seed dispersal and to stop trade of this species as well**.”): https://www.nvwa.nl/binaries/nvwa/documenten/risicobeoordeling/plantenziekten/archief/2016m/hemelboom/20130510_Risk_assessment_A+_altissima.pdf. Germany (relatively brief RA, conclusions: **high reproduction and spreading potential, negative impact on biodiversity**) http://www.bfn.de/fileadmin/MDB/documents/service/skript352.pdf Belgium: **A2 species (restricted range with high environmental hazard) with ISEIA score 12 (high impact); black listed** http://ias.biodiversity.be/species/show/32 Spain: Gassó et al. (2010) - identified *Ailanthus* as a species likely to be of high invasive risk (**WRA score=12**) Denmark: In Denmark is given a total score of 13 out of 18 possible (in a modified version of the Harmonia scoring system). Today it is only found as isolated populations mainly in urban areas in Denmark.

		Luxembourg: Iseia index C1 (Ries et al. 2013)
4. If there is an earlier risk assessment is it still entirely valid, or only partly valid?	Valid	All listed RA are valid.
5. Where is the organism native?	Asia (eastern, China)	The native range of *A. altissima* is in eastern China and North Vietnam, where the species grows as a natural component of broadleaf forests (Kowarik & Säumel 2007).
6. What is the global distribution of the organism (excluding Europe)?	Macaronesia Islands, Africa, United States, Canada, South America, Asia, Australia, Japan, New Zealand	*Ailanthus altissima* occurs in all permanently populated continents (DAISIE 2009, CABI ISC). The distribution is restricted to a broad latitudinal range from the temperate to meridional zones (Kowarik & Säumel 2007, Singh et al. 1992, Weber 2003, Meloche & Murphy 2006). E.g. in South Africa it invades forest margins, roadsides and riverbanks in relatively cool and moist regions (Henderson, 2001). Outside Europe the species is documented to invade areas of high conservation value in Georgia (Thalmann et al. 2015).
7. What is the distribution of the organism in Europe?	as above, widespread	In Europe, *Ailanthus* is distributed mainly in southern and central Europe. It has a wide distribution in the Mediterranean. *Ailanthus* occurs along a gradient from the meridional to the temperate zone, and it grows in a wide range of habitats. Its distribution in cities at northern outposts of its range is a result of the effects of urban climate (Kowarik & Säumel 2007). 30 DAISIE EU regions and 24 EU Member States: Austria, Azores, Baleares, Belgium, Bulgaria, Canary Islands, Corse, Croatia, Cyprus, Czech. Rep.,

		Denmark, France, Germany, Great Britain, Greece, Hungary, Italy, Liechtenstein, Luxembourg, Madeira, Malta, Moldova, Netherlands, Poland, Portugal, Romania, Sicily, Slovakia, Slovenia, Spain, Sweden, Switzerland, (DAISIE 2009, Ries & Pfeiffenschneider 2017, Boer 2012). According to Thalmann et al. (2015) who did a climatic modelling, *A. altissima* also has a potential to naturalize in large areas in Georgia (Europe/Asia). The match between the native range and temperate climate (studied for N. America but comparable for Europe) was proven also by Albright et al. (2010).
8. Is the organism known to be invasive (i.e. to threaten organisms, habitats or ecosystems) anywhere in the world?	yes	*Ailanthus altissima,* Mill.) Swingle, is considered as one of the worst invasive plant species in e.g. Europe (DAISIE 2009, Vila et al. 2006, Rodrigues et al 2015, Thalmann et al. 2015, Medina-Villar et al. 2016), in North America (NISIC, USDA 2014, DAISIE 2009, species fact sheet). Outside Europe the species is documented to invade areas of high conservation value in Georgia (Thalmann et al. 2015). See Probability of Impact below.
9. Describe any known socio-economic benefits of the organism in the risk assessment area.	E.g. ornamental purposes, fuelwood, chemical industry (herbicides), pharmaceutical industry, bee keepers and revegetation/ restoration of disturbed sites.	See detailed description of benefits in appendix below the tables.

SECTION B – Detailed assessment

PROBABILITY OF ENTRY

Important instructions:

- Entry is the introduction of an organism into Europe. Not to be confused with spread, the movement of an organism within Europe.
- For organisms which are already present in Europe, 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 [chose one entry, delete all others]	CONFIDENCE [chose one entry, delete all others]	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	high	Species is already present in Europe with wide distribution (DAISIE 2009, Boer 2012, Kleinbauer et al. 2010). The species is not extensively used in forestry as a primary species. More frequently it is used as an ornamental species in parks. There is a higher probability of secondary introductions from alien range in Europe than from its native range. Nevertheless, the species is still available in trade as an ornamental plant or for horticulture, which is an active pathway (Vanderhoeven et al. 2011). So questions related to intentional entry are also answered (Q1.4, 1.9, 1.10 and 1.11). Species can exceptionally occur as a contaminant in wood chips (Ferus et al. 2015). Horticulture, forestry, seed contaminant of trade; Introduction in the past (introduced intentionally by Chinese immigrants: Feret 1985; Hoshovsky 1988; planted in European and North American cities because

			of its resistance to herbivory and its tolerance to urban conditions). Another explanation comes from Hu (1979) who said "*Ailanthus* seed was first carried from Peking to Paris in a transcontinental trip via Siberia in the 1740's. The seed was collected and shipped from Peking by Pierre d'Incarville, a Jesuit priest who joined the China Mission in 1740 at the age of thirty-four" [...] "On account of the rapid growth and the beautiful foliage of ailanthus, its popularity soared in Europe, and it soon became one of the most commonly planted and highly esteemed trees in European cities.". High confidence is selected as the species is widespread in Europe and the transport pathways and modes of entry are clearly known.
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).			
Pathway name:	Ornamental trade		
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)			

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	low	The volumes of imported seeds/plants are not available. Therefore low confidence was selected. Volumes are not expected to be considerably high as using *A. altissima* for the ornamental purposes is not so popular.
1.5. How likely is the organism to survive during passage along the pathway (excluding management practices that would kill the organism)? Subnote: In your comment consider whether the organism could multiply along the pathway.			
1.6. How likely is the organism to survive existing management practices during passage along the pathway?			
1.7. How likely is the organism to enter Europe undetected?			
1.8. How likely is the organism to arrive during the months of the year most appropriate for establishment?			
1.9. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very likely	very high	Being the species that is intentionally introduced by horticulture/forestry/landscaping industry, there is high probability of reaching suitable environment in invaded range. High confidence was selected as the general requirements of intentional introductions need suitable climatic and environmental conditions in native and alien ranges.
1.10. Estimate the overall likelihood of entry into Europe based on this pathway?	likely	low	*Ailanthus* is introduced and planted for many purposes (see detailed description in appendix to the RA):

			fuelwood, in charcoal and timber production as quality material and for paper production (Gill 2004; VDOF 2009; Barclay 2013; Baptista et al. 2014). Fast growth and low environmental requirements are ideal factors for planting in polluted and degraded environments with the aim of forest restoration, land reclamation, and shelterbelts planting worldwide (Jovković 1950; Chokkalingam et al. 2006; Kowarik & Säumel 2007). Ailanthus was used also for landscaping to eliminate the soil erosion on slopes or stabilize dunes (Kowarik & Säumel 2007). Therefore the volumes of newly imported individuals will depend on the trade requirements. The proportion between import from European countries and other regions is unclear and depends on the trade options. Generally, the import depends mainly on the trade requirements of ornamental plantings. The low confidence was selected due to lack of knowledge and documented trade between the plant sellers.
End of pathway assessment, repeat as necessary.			
1.11. Estimate the overall likelihood of entry into Europe based on all pathways (comment on the key issues that lead to this conclusion).	likely	high	As there is a little economic importance of this species as primary tree in timber of fuel production and there are no intentional pathways for this purpose, the only significant pathway is ornamental plantings. However, the overall importance of this import is not significant compared to the secondary spread and dispersal within Europe. High confidence was selected as there is enough information about the dynamics of the species in Europe and that the intentional spread is not so much important for current distribution.

PROBABILITY OF ESTABLISHMENT

Important instructions:

- For organisms which are already well established in Europe, only complete questions 1.15 and 1.21 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 Europe based on the similarity between climatic conditions in Europe and the organism's current distribution?			
1.13. How likely is it that the organism will be able to establish in Europe based on the similarity between other abiotic conditions in Europe and the organism's current distribution?			
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 Europe? Subnote: gardens are not considered protected conditions			
1.15. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Europe?	widespread	very high	Habitats suitable for *Ailanthus* are widely distributed as *Ailanthus* grows on a broad range of anthropogenic to natural sites which are subject to a higher level of natural or human disturbance such as urban habitats and transportation corridors. In

			urban environment Ailanthus behaves as a colonizer of open gaps (Udvardy 2008). *Ailanthus altissima* is known to invade open and disturbed sites. As a shade-intolerant species, it is not generally identified as a potential invader of closed forests. Nevertheless, there are records of dominance of *Ailanthus* in old-growth hemlock-hardwoods forest in the North America (Knapp & Canham 2000). In suburban areas and outside of cities suitable habitats for *A. altissima* are transportation corridors (road and railroad verges, Adolphi 1995), borders of agricultural fields, meadows, vineyards and old fields (Kowarik 1983; Facelli & Pickett 1991; Huebner 2003). *Ailanthus* can be found also in floodplain forests, riparian forests, and mesic and xeric woodlands. As the species prefers open and disturbed habitats, it grows in pioneer forests on urban sites, urban areas, grasslands, regularly or recently cultivated agricultural land, horticultural and domestic habitats, forest edges and along roads. (Kowarik & Säumel 2007). Very high confidence was chosen as there is a wide range of information based on many detailed studies from its native and alien range.
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 Europe?			
1.17. How likely is it that establishment will occur despite competition from existing species in Europe?			

1.18. How likely is it that establishment will occur despite predators, parasites or pathogens already present in Europe?			
1.19. How likely is the organism to establish despite existing management practices in Europe?			
1.20. How likely are management practices in Europe to facilitate establishment?			
1.21. How likely is it that biological properties of the organism would allow it to survive eradication campaigns in Europe?	likely	high	Methods used for management of *Ailanthus* include mechanical and chemical approaches, burning, grazing, and biocontrol (Hoshovsky 1988; Hunter 2000; Harris et al. 2013). *Ailanthus* is very difficult to remove once it has established a taproot, therefore all treatments require subsequent monitoring and control of shoots emerging from remaining seeds, roots or stumps. The only treatment that effectively reduced/eradicated *A. altissima* was the combination of cutting and glyphosate application Constán-Nava et al. 2010). *Ailanthus altissima* is species reproducing mainly by seeds. Beside the high reproduction capacity (quick growth, large seedling growth) it has high vegetative resprout potential which affects the management. *Ailanthus* does not form a long-term seed bank, and establishes temporary soil seed bank, but produces large amount of easily dispersed seeds. Natural (e.g. frost, fire), and human (e.g. cutting, chopping, girdling of stems) disturbances induce rapid vegetative regeneration by sprouts that may emerge from the root, the root

			crown or the stem (von Bartossagh 1841; Hoshovsky 1988; Bory et al. 1991; Hunter 2000; Udvardy 2008; Badalmenti & La Mantia 2013). Nevertheless, undisturbed individuals have also been reported to produce root sprouts (Kowarik 1995). Additionally, shoot fragments can set adventitious shoots and roots (Kowarik & Säumel 2006). Viability of seeds after one year from full maturation, remains still quite high (Cabra-Rivas & Castro-Díez 2016a). Even effectiveness of the spraying on the *Ailanthus* after nine months is over 99%, in the long term the effectiveness decreases (Erdos et al. 2005). The comprehensive and up to date overview of the available management methods without using herbicides was published in Germany (Schmiedel et al. 2015). For biocontrol see the reviews in Brundu (2017) and Ding et al. (2006). There is a variety of insects and diseases affect tree-of-heaven with varying success; however, there are no biological control agents currently approved for use in the United States (USDA, 2014). In addition, it should be borne in mind that the release of macro-organisms as biological control agents is currently not regulated at EU level. Nevertheless national/regional laws are to be respected. Before any release of an alien species as a biological control agent an appropriate risk assessment should be made. Review of biological agents currently being researched in the USA, proposes three fungal pathogens, two weevils, and a moth. Approval for one of the weevil species, *Eucryptorrhynchus brandti* (Coleoptera: Curculionidae), is anticipated in the near future (Ding et al. 2006; USDA 2014).

			Importantly, the biological control of *Ailanthus* using the wilt-inducing fungi in the genus *Verticillium* spp. as "mycoherbicides" could be a promising alternative in Europe (Maschek & Halmschlager 2017). High confidence was chosen as there is a wide range of information based on many detailed studies from its native and alien range. However, information on interaction between traits and management methods are limited.
1.22. How likely are the biological characteristics of the organism to facilitate its establishment?			
1.23. How likely is the capacity to spread of the organism to facilitate its establishment?			
1.24. How likely is the adaptability of the organism to facilitate its establishment?			
1.25. How likely is it that the organism could establish despite low genetic diversity in the founder population?			
1.26. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)			
1.27. If the organism does not establish, then how likely is it that transient populations will continue to occur? Subnote: Red-eared Terrapin, a species which cannot re-produce in GB but is established because of continual release, is an example of a transient species.			

1.28. Estimate the overall likelihood of establishment (mention any key issues in the comment box).			

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 Europe by natural means? (Please list and comment on the mechanisms for natural spread.)	major	high	*Ailanthus* is a fast growing tree that typically reaches flowering maturity after 3–5 years (Kowarik & Säumel 2007). Natural spread of *Ailanthus* is based on spread of seeds. Seeds are winged to be easily transported by wind and water. Therefore the species spreads for long distances along water courses, and transport corridors (roads, railways) from the urban sites where they are originally planted (Kowarik & Säumel 2006; Kowarik & von der Lippe 2006; von der Lippe et al. 2013). Spread by water does not affect the germinability of the seeds (Kowarik & Säumel 2006, 2008). The species has high germination potential which usually reaches over 70% (Kowarick & Säumel 2007, Cabra-Rivas & Castro-Díez 2016b). Ailanthus altissima is a long-lived species, reaching ages of > 100 years at which age female trees are still being able to produce seeds (Kasson et al. 2013). Clonal spread is possible, but only playing a role at a limited scale, however, capability to form dense stands is important for its negative impact. Medium confidence was chosen even though there is a good knowledge on its biology leading to establishment, however, there is a lack of

			information on volume of traded and planted individuals.
2.2. How important is the expected spread of this organism in Europe by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	major	high	Ornamental plantings, landscaping and tolerance of its presence leading to massive seed production is a major cause for the species being spread both between and within MS. There are no hard data on trading volumes and number of planted individuals. Unintentional spread to long distances can be realized by exceptional contamination in wood chips (Ferus et al. 2015). At short distance by contamination of machines and transported soil. The core distribution of the species is in urban areas where it is planted for several reasons: resistance to herbivory, tolerance of urban conditions, and ornamental purposes (Hegi 1906; Moussalli 1939; Adamik 1955; Buchholz & von Maydell 1965; Singh et al. 1992). In many natural or suburban areas *Ailanthus* was planted in plantations for shelterbelts, energy plantations or for erosion control on slopes, verges of traffic lanes and dunes, for afforestation or reforestation and for restoration management of landfill sites and mine spoils (Witte 1952; Cozzo 1972; Hu 1979; Gutte et al. 1987; Udvardy 1998; Howard 2004; Křivánek et al. 2006). Therefore, such intentional planting can create new foci for further invasion. Seedlings are still available in stock gardening (also in the Internet sale e.g. http://www.jarajardineria.com/AILANTUS_ALTISSIMA.html). In Belgium, the 23% horticulture professionals (based on questionnaires) sell *Ailanthus* (Vanderhoeven et al. 2011).

			Establishment of the *Ailanthus* outside the areas of original planting is well documented (e.g. Sirbu & Oprea 2011 and reference therein). Some countries (e.g. Spain) already banned its trading and use (Spanish Royal Decree 630/2013), which may reduce its direct spread by humans in the future. High confidence was chosen as there is a good information on its dynamics at landscape scale from Europe.
2.3. Within Europe, how difficult would it be to contain the organism?	with some difficulty	medium	*Ailanthus* is difficult to remove once it has established a taproot. Recent review of available approaches and context of their planning is given by Brundu (2017). If possible, use of herbicides during treatments increases the probability of successful eradication. If only mechanical methods are available then the cutting of tree leads to resprouting and eradication is problematic. Even though effectiveness of the spraying on the *Ailanthus* after nine months is over 99%, in the long term the effectiveness decreases (Erdos et al. 2005). Viability of seeds after one year since full maturation, remains still quite high (Cabra-Rivas & Castro-Díez 2016a) The methods used to control *Ailanthus* include manual, mechanical and chemical means, burning, grazing, and biocontrol (Hoshovsky 1988; Hunter 2000; Harris et al. 2013; Burch & Zedaker 2003; DiTomaso & Kyser 2007; Badalamenti & La Mantia, 2013). Root and stump sprouting requires extensive follow-up treatment. Girdling the cambial tissue on the stem induces root sprouting as does burning (Hoshovsky 1988; Hunter 2000; Drescher & Ließ

			2006). Thus the combination of mechanical and chemical treatment will provide the best results. Testing the biocontrol by *Verticillium* showed promising results (Harris et al. 2013). Containment of *Ailanthus* depends mainly on management (suppression) of seed rain from urban populations. Special attention must be paid to reinvasion of already cleared sites (Lookingbill et al. 2014). If chemical treatment is not allowed, then the most suitable methods are manual mechanical removal of smaller individuals and incomplete girdling; in less sensitive sites cutting of trees in combination with grazing and mowing (Schmiedel et al. 2015. Burning of the invaded areas is not recommended method due to high facilitation of seedling recruitment (Gurthrie et al. 2016). For biocontrol of *Ailanthus* (Brundu 2017; Ding et al. 2006), there are several agents currently being researched in the USA, there are three fungal pathogens, two weevils, and a moth. Approval for one of the weevil species, *Eucryptorrhynchus brandti* (Coleoptera: Curculionidae), is anticipated in the near future (Ding et al. 2006; USDA 2014). The biological control of *Ailanthus* using the wilt-inducing fungi in the genus *Verticillium* spp. as “mycoherbicides” could be a promising alternative in Europe (Maschek & Halmschlager 2017). Medium confidence was chosen as there is not much detailed information focused only on this species and the information on the management is not generally available.

2.4. Based on the answers to questions on the potential for establishment and spread in Europe, define the area endangered by the organism.	all Europe except the northern part	very high	see 7 and 1.15. Very high confidence was chosen as there is relatively good information on ecology, biology and distribution in Europe. The species is already present and established in the majority of biogeographic regions of Europe (atlantic, black sea, continental, macaronesia, mediterranean, pannonian and stepic) with the exception of north part of Europe (majority of boreal biogeographic region). Similarly, the species is restricted in alpine regions, but it is also planted in urban environments. Climatic constraints are characterized by a long and warm growing season, with regular winter frost and annual precipitation of mostly >500 mm/year (Kowarik & Säumel 2007). *Ailanthus altissima* occurs in Mediterranean coastal sites (cities) but is also known from colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005). In Spain, *Ailanthus altissima* showed considerable plasticity with regard to the Mediterranean climate which is characterized by persistent summer droughts and unpredictable soil water (Constán-Nava et al. 2010).
2.5. What proportion (%) of the area/habitat suitable for establishment (i.e. those parts of Europe were the species could establish), if any, has already been colonised by the organism?	10% (0-10%)	low	Impossible to quantify properly. This area is difficult to assess because of lack of detailed distribution data at various scales all over Europe. When using occupied grid cells, the available information ranges between 3 and 7%; in the Czech Republic 173 cells (3’×6’) out of 2600 (7%, www.florabase.cz) are occupied and in the UK 73 grid cells (10 km^2) out of 2823 (3%, Preston et al. 2002). In Spain, there is a conservative estimate of ca 30% of potential range filling (Cabra-Rivas et al. 2016). Data from Germany show that the species is now occupying 4.6% of

			quadrats and based on modelling, the number of suitable quadrants reaches 18% (Kleinbauer et al. 2010). Scoring is provided with low certainty because of lack of accurate distribution and coverage data across Europe especially for different scales.
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)?	20% (10-33%)	low	As the species has a fast turnover and is able to produce easily dispersed seeds in a relatively short period, the timeframe of change is relatively short. Kleinbauer et al. (2010) showed by modelling for Germany, that under climate change scenario A1/A2/B1/B2, the number of suitable quadrants will rise to 51.1-66.2%. In USA it was shown, that the rate of spread was slower than expected, however such data can't be used for precise prediction (Kasson et al. 2013). Scoring is provided with low certainty because of lack of accurate data all over Europe to be used to define baseline distribution (see question 2.5).
2.7. What other timeframe (in years) would be appropriate to estimate any significant further spread of the organism in Europe? (Please comment on why this timeframe is chosen.)	20 (years)	high	*Ailanthus* is a fast growing tree normally reaching flowering maturity after 3–5 years (Kowarik & Säumel 2007) and it can also spread by vegetative means. It also occurs in urban habitats with rapid change of land-use. Therefore short timeframe with high confidence level was selected.
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?	40-50% (33-67%)	low	*A. altissima* reaches flowering maturity early. The species is fast growing, therefore a short timeframe can be suitable to assess any significant further spread in Europe. The species has short generation time and can disperse easily but exact properly quantification of the change is difficult as it depends on land use change and management.

2.9. Estimate the overall potential for future spread for this organism in Europe (using the comment box to indicate any key issues).	rapidly	high	The spread of the species depends on several issues: i) land use; the level of urbanization, proportion of abandoned areas, ii) propagule pressure; planting frequency mainly in urban and (semi-)natural areas (plantations), and (iii) possible climate change that will enable this species invade northern parts of Europe. The species can tolerate wide range of environmental conditions that enables it to establish on many habitat types, from stony and sterile soils to rich alluvial bottoms (e.g. Kowarik & Säumel 2007). *Ailanthus altissima* occurs in Mediterranean coastal sites (cities) but is known from colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005). In Spain, *Ailanthus altissima* showed considerable plasticity with regard to the Mediterranean climate which is characterized by persistent summer droughts and unpredictable soil water (Constán-Nava et al. 2010). The match between the native range and temperate climate (studied for N. America but comparable for Europe) was proven by Albright et al. (2010). In Denmark *A. altissima* is only found as isolated populations and only recorded from 0.3% of the Atlas Flora Danica registration quadrates (Hartvig 2015). The database Fugle og Natur have this species recorded at 26 localities, all but two observations are in Copenhagen and Aarhus, the two largest cities in Denmark. High confidence was chosen because there is good information on its ecology, biology and current distribution in Europe, and the effects of future climate change are positive for this species.

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 Europe 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, including the cost of any current management?	moderate	medium	The real costs are almost impossible to calculate accurately. The species is not being managed properly due to absence of efficient methods and to the costs. Just the management cost of one area invaded in the North Mountains of Seville would rise up to several million euros (Elias David Dana Sanchez, pers. comm.). *Ailanthus* is reported to cause damages on infrastructure (damaging pavements, archaeological mains, walls, etc. by root system) and cause allergic reactions, respiratory problems, and skin rashes in the local population (Derrick & Darley 1994; Ballero et al. 2003; Celesti-Grapow & Blasi 2004; Udvardy 2008; Luz-Lezcano Caceres & Gerold 2009; Burrows & Tyrl 2013). Direct reports from other parts of the World are scarce, therefore we list references mainly from Europe as it can be expected that the impact will be similar. Overall negative economic impact of *Ailanthus* is relatively low

			(Reinhardt 2003). For Europe, an estimate of costs due to *Ailanthus* does not exist, but local studies e.g. for state of Hesse (Germany) estimated damages to 5 million €/year (Luz-Leczano Caceres & Gerold 2009). Medium confidence was chosen as the estimates of eradication costs can largely differ between regions and by used methods. The management cost of just one area invaded in the North Mountains of Seville would rise up to several million euros (Elias David Dana Sanchez, pers. comm.). Furthermore, the species is often overlooked by management actions and separate data do not exist. Economic benefits of *A. altissima* are described separately below the RA.
2.11. How great is the economic cost of the organism currently in Europe excluding management costs (include any past costs in your response)?	minor	medium	*Ailanthus* is reported to cause damages on infrastructure (damaging pavements, archaeological remains, walls, etc. by root system) and cause allergic reactions, respiratory problems, and skin rashes in the local population (Derrick & Darley 1994; Ballero et al. 2003; Celesti-Grapow & Blasi 2004; Luz-Lezcano Caceres & Gerold 2009; Bennett et al. 2013; Burrows & Tyrl 2013; Majd et al. 2013). For Europe, an estimate of costs due to *Ailanthus* does not exist, but local studies e.g. for state of Hesse (Germany) estimated damages to 5 million€/year (Luz-Leczano Caceres & Gerold 2009). Study of health in Sardinia, revealed that out of 54 patients with allergy symptoms, 10 were found to have been caused by *A. altissima* pollen. There are also rare reports of myocarditis in cases of sap entering the body through cuts or abrasions (Bisognano et al. 2005). Real costs are almost impossible to calculate properly.

			Overall negative economic impact of *Ailanthus* is relatively low (Reinhardt 2003). Medium confidence was chosen as the estimates of eradication costs can largely differ between regions and by used methods. Furthermore the species is often overlooked by management actions and separate data do not exist
2.12. How great is the economic cost of the organism likely to be in the future in Europe excluding management costs?	moderate	low	Depends on the change of its distribution. This question cannot be answered properly without an economic 'valuation' of invaded forests by *Ailanthus* (e.g. loss of riparian forests with *Alnus glutinosa*). The level of response is expected to be higher due to larger area occupied by the species in the future. Low confidence was chosen as the estimates of costs are not yet quantified.
2.13. How great are the economic costs associated with managing this organism currently in Europe (include any past costs in your response)?	moderate	low	The species is in the top one hundred of IAS species in Europe and it is also considered as one of the top invasive species by managers of protected areas (Pyšek et al. 2013). The costs of its eradication/management are not fully estimated. E.g. estimated cost of management is for an area in S Spain: ca. 160.000 € to control its presence in 106.555 m2 in several mountain areas (with a variable % of coverage) (Elias David Dana Sanchez, pers. comm.). Low confidence was chosen as the estimates of eradication costs can largely differ between regions and by used methods.
2.14. How great are the economic costs associated with managing this organism likely to be in the future in Europe?	moderate	low	Depends on the change of its distribution and the level of control. This question cannot be answered properly. The species is in the top one hundred of IAS species in Europe and it is also considered as one of the top invasive species by managers of protected areas (Pyšek et al. 2013). The current costs as a basis for future

			plans of its eradication/management are not fully estimated. If efficient biocontrol will be applied, than the management costs will be minimal (Brundu 2017). Low confidence was chosen as the estimates of costs are not yet quantified.
2.15. How important is environmental harm caused by the organism within its existing geographic range excluding Europe?	major	medium	Most information on impacts of *Ailanthus* on biodiversity comes from Europe. Impacts on native biodiversity in the alien ranges are similar in Europe and North America (NISIC, USDA 2014, Meloche & Murphy 2006). *Ailanthus* occurs in many regions of the USA (e.g. Appalachians and Northeast, California, Tenenessee) and in all regions it is associated with disturbed areas, sites along roadsides, urban abandoned lands, limestone clifftops, and successional mixed shrublands (NatureServe 2004, Patterson 2008). *Ailanthus altissima* has been rated a threat or potential threat in many areas of the United States. It is rated a potential invader in low-montane areas of the Cascade Range, the Sierra Nevada, and the Middle Rocky Mountains (Parks et al. 2005). More details about impact in N. America is reviewed in https://www.fs.fed.us/database/feis/plants/tree/ailalt/all.html. For detailed information on impacts see 2.16. The major impacts on biodiversity are visible in grasslands and open areas in protected areas, although there are also serious impacts on riparian forests with e.g. *Alnus glutinosa*). *Ailanthus* forms dense thickets that displace native vegetation, and is especially invasive along stream banks. Young trees grow rapidly and out-compete other plant species. *Ailanthus* is an

			allelopathic species which toxins in the bark and leaves accumulate in the soil and inhibit the growth of other plants. It was confirmed, that in riparian communities there was a lower plant species richness and phytodiversity within stands of *Ailanthus* (Constán-Nava et al. 2015). Medium confidence was chosen even though there is good information on its ecology and biology in Europe, but there are few studies focused only on effects of this species.
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 Europe (include any past impact in your response)?	major	high	*Ailanthus altissima* as a highly invasive species that affects biodiversity especially of plants and invertebrates particularly in natural habitats and protected areas with rich biodiversity (competition, allelopathy) (Italy: Casella 2011; Casella & Vurro 2013; Greece: Fotiadis et al. 2011). Distribution of *Ailanthus* in urban areas is often neglected, and its negative impact there is less expressed. *Ailanthus* invades a wide range of habitats with dominance of grasslands and open areas. It also invades forest gaps (Knapp & Canham 2000), maquis schrubland, open forests as in forest steppe, other deciduous woodlands, early-stage natural and semi-natural woodlands and regrowth, communities of cliffs (DAISIE 2009 species account). The major impacts on biodiversity are visible in grasslands and open areas in protected areas, although there are also serious impacts on riparian forests. *Ailanthus* is known to affect: (i) diversity of communities (replacement of taxa) in different habitats (replacement of natural pastures and grassland by bushes and dense low forests of *A. altissima*, France: Motard et al. 2011; Bulgaria: Kožuharova et al. 2014),

			(ii) threat to rare and endemic species (Bulgaria: Grozeva 2005; Uzunov et al. 2012; Vladimirov 2013), and (iii) soil community of microorganisms, mycorrhizal fungi, and invertebrates, such as nematodes, arthropods, earthworms, and some groups of springtails, mites, spiders, pseudoscorpionidas, isopods, and insects (Spain: Arbea & Jordana 1988; Vila et al. 2006; Gutiérrez-López et al. 2014; Medina-Villar et al. 2016; France: Motard et al. 2015; Hungary: Udvardy 2008;). Due to number of studies, the confidence can be set high.
2.17. How important is the impact of the organism on biodiversity likely to be in the future in Europe?	major	medium	As above. The sum of impact is dependent on the invaded area which can increase due to climate and land –use change. Certainty is lower than e.g. in 2.16 because the future climate change can be only predicted.
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 Europe (include any past impact in your response)?	moderate	high	Changes of ecosystem functions induced by the spread of *A. altissima* are also documented. *Ailanthus* affects the environment by acting as allelopathic species changing soil conditions and also changing the trophic cascade (Constán-Nava et al. 2015). The toxicity of *Ailanthus* has been proven to affect many other plants, including weed, crops, and trees, through preemergence and postemergence treatments (Mergen 1959; Heisey 1990, 1996; Lin et al. 1995; Pedersini et al. 2011). Changes of soil properties are mainly due to increasing nutrient availability and cycling rates (Gómez-Aparicio & Canham 2008; study not from Europe) and altered physicochemical properties of litter (Pinto et al. 1997; Motard et al. 2015). There is a limited effect of *Ailanthu*s on N-cycle

			(González-Muñoz et al. (2013), Castro-Díez et al. (2009) and Castro-Diez et al. (2012). Effect of *Ailanthus* on trophic chain can be assumed from large number of chemical compounds (Kožuharova et al. 2014). Additionally, moderate or minimal impacts of *Ailanthus* on other plants or invertebrates were documented (Alonso et al. 2010, Medina-Villar et al. 2015, 2017). Consumption of *Ailanthus* seeds by birds and terrestrial fauna is similar to that of the native seeds (Cabra-Rivas & Castro-Diez 2016). There is also moderate-low phytotoxic effects of *Ailanthus* on other plants when soils from Ailanthus stands are used as substratum (Medina-Villar et al. 2017). Coverage of impacts on ecosystem services for *Ailanthus* includes all types of categories defined by Mill. Ecosyst. Assessesment (cultural, provisioning, regulating and supporting) (Potgieter et al. 2017). The number of reports is highest for provisioning followed by supporting categories. In total there are 32 records relevant for urban ecosystem services. *Ailanthus* is also reported to provide “ecosystem disservices” (cultural and aesthetic, environmental problems, health, material and security and safety) (Potgieter et al. 2017). In China the species was also evaluated for improving irrigation, soil stabilization, wind protection and filtering the dust (Döll 2018). From the studies it is clear, that the impacts on ecosystem properties are highly context-dependent, so that they cannot be extrapolated easily.
2.19. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic	moderate	medium	As above

interactions), including losses to ecosystem services, caused by the organism likely to be in Europe in the future?			Certainty is lower than e.g. in 2.18 because the future climate change can be only predicted.
2.20. How important is decline in conservation status (e.g. sites of nature conservation value, WFD classification) caused by the organism currently in Europe?	moderate	medium	Invades many nature protected areas. Considered as one of the top invasive species marked by managers of protected areas (Constán-Nava et al. 2010; Pyšek et al. 2013). Affects biodiversity and ecosystem functions as described in 2.16 and 2.18 and also affects habitats listed in Habitat directive (Erdos et al. 2005). Medium confidence was chosen as there is relatively good information on the effects.
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 Europe?	major	medium	as above. The sum of impact is dependent on the invaded area which can increase due to climate and land –use change. Certainty is lower than e.g. in 2.18 because the future climate change can be only predicted.
2.22. How important is it that genetic traits of the organism could be carried to other species, modifying their genetic nature and making their economic, environmental or social effects more serious?	minimal	high	According to the current knowledge, there is minimal/low risk of impact on genetic makeup of native species. High certainty was chosen as the species is thoroughly studied, there is no co-familial species in Europe susceptible to become genetically affected and no indication of such impacts is reported.
2.23. How important is social, human health or other harm (not directly included in economic and environmental categories) caused by the organism within its existing geographic range?	minimal	high	See above (question 2.10). Leaves and flowers of Ailanthus are known to cause dermatitis and its pollen is allergenic (Boer 2012). Declined landscape value is also caused by *Ailanthus* invasion. In total there are 32 records relevant for evaluation urban ecosystem services. *Ailanthus* is also reported to provide “ecosystem disservices” (cultural and aesthetic, environmental problems, health, material and security and safety) (Potgieter et al. 2017).

			In China the species was also evaluated for improving irrigation, soil stabilization, wind protection and filtering the dust (Döll 2018). Economic benefits of *A. altissima* are described separately below the RA.
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)?	moderate	medium	Effect of *Ailanthus* on trophic chain can be assumed from large number of chemical compounds (Kožuharova et al. 2014).
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)	minimal	medium	No other impacts known.
2.26. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Europe?	major	medium	There is no efficient biocontrol of *A. altissima* in Europe, although experiments with a Verticillium fungus seem promising (Harris et al. 2013). Therefore the impacts refer mainly to 2.11, 2.15, 2.16 and 2.18.
2.27. Indicate any parts of Europe where economic, environmental and social impacts are particularly likely to occur (provide as much detail as possible).	in all occupied area	high	Economic benefits of *A. altissima* are described separately below the RA. Negative impact occur in all countries where the species is naturalized.

RISK SUMMARIES			
	RESPONSE	**CONFIDENCE**	**COMMENT**
Summarise Entry	very likely	very high	already widely present in Europe; there is a higher probability of secondary introductions from alien range in Europe than from its native range.
Summarise Establishment	very likely	very high	already present in Europe
Summarise Spread	rapidly	high	depends on the management and awareness, but its potential is to spread rapidly; We therefore conclude that more information is necessary to understand whether active pathways are relevant for the actual and future spreading compared to natural spread and whether management of active pathways would thus efficiently reduce the impacts or not.
Summarise Impact	major	high	*Ailanthus altissima* is a highly invasive species that affects biodiversity especially of plants and invertebrates particularly in natural habitats and protected areas. Its socio-economic impact is lower (exact data are not available), but it is recognized as important pollen allergen or tree spontaneously growing in open sites (damages on infrastructure - damaging pavements, archaeological remains, walls, etc. by root system).
Conclusion of the risk assessment	high	very high	

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change, if any, are most likely to affect the risk assessment for this organism?	species is now limited by cold climate, climate change will enable its spread to other regions	high	The species is already present in many countries and cities in Europe, the potential for establishment in climatically suitable regions is significant. *Ailanthus altissima* occurs in Mediterranean coastal sites (cities) but is also known from colder areas (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005). In Spain, *Ailanthus altissima* showed considerable plasticity with regard to the Mediterranean climate which is characterized by persistent summer droughts and unpredictable soil water (Constán-Nava et al. 2010). The match between the native range and current temperate climate (studied for N. America but comparable for Europe) was proven by Albright et al. (2010). In Denmark *A. altissima* is only found as isolated populations and only recorded from 0.3% of the Atlas Flora Danica registration quadrates (Hartvig 2015). The database Fugle og Natur have this species recorded at 26 localities, all but two observations are in Copenhagen and Aarhus, the two largest cities in Denmark. The species is already present in majority of available regions with the exception of Finland, Estonia, Latvia and Lithuania (EASIN, accessed Jan 2018). Climatic constraints are characterized by a long and warm growing season, with regular winter frost and annual precipitation of mostly >500 mm (Kowarik & Säumel 2007). Therefore, potential climate change may enhance further range expansion (Miller 1990; Kowarik & Säumel 2007).

			The question is speculative and the distribution depends largely on degree of climate change and on the human induced spread. If the temperature will increase the area where the species will be able to naturalize and spread will increase.
3.2. What is the likely timeframe for such changes?	20	medium	Depends on the rate of climate change. *Ailanthus* is a species with fast reproduction. As *Ailanthus altissima* is already known to survive in colder areas as planted (e.g. Zurich, Landolt 2001; Poland, Sudnik-Wojcikowska 1998; Tokarska-Guzik 2005), future climate change may enhance its further spread into (semi-) natural areas (Henderson 2001; Thalmann et al. 2015).
3.3. What aspects of the risk assessment are most likely to change as a result of climate change?	distribution	high	Depends on the rate of climate change. The most affected aspects will be the distribution area and the resulting level of impact within communities invaded: the greater climate impact, the greater stress for native communities and the larger magnitude of change (floristic composition, relative abundance, etc.).
ADDITIONAL QUESTIONS – RESEARCH			
4.1. If there is any research that would significantly strengthen confidence in the risk assessment please summarise this here.	control, pathways, management, economics	high	For many species and *Ailanthus* as well we need more robust information on: - Feasibility and efficiency of cost-efficient management methods - Economic costs including and excluding management - Status (volumes, associated pathways, regional patterns) of current pathways of introduction

Use of *Ailanthus altissima* (beneficiary socioeconomic impact)

Ailanthus was intentionally introduced from its native range for aesthetic and cultural reasons (Jovković 1950; Feret 1985; Hoshovsky 1988; Kowarik & Säumel 2007). Nowadays it is used for ornamental horticulture, bee keeping, forestry, landscaping, revegetation/ restoration and in medicine and chemical industry (Kundu & Laskar 2010; Sladonja et al. 2015). It is popular especially in urban areas due to its fast growth, tolerance of poor soil, drought, pollution, and to low soil pH values, and resistance to herbivory (Witte 1952; Plass 1975; Gutte et al. 1987; Sladonja et al. 2015). According to van der Valk et al. (2018), the total trade value in the Netherlands of *Ailanthus altissima* as an ornamental tree was estimated to be approximately 0.5 million euro/year. *Ailanthus altissima* wood has been used as a fuelwood, in charcoal and timber production as quality material and for paper production (Gill 2004; VDOF 2009; Barclay 2013; Baptista et al. 2014). Fast growth and low environmental requirements are ideal factors for planting in polluted and degraded environments with the aim of forest restoration, land reclamation, and shelterbelts planting worldwide (Jovković 1950; Chokkalingam et al. 2006; Kowarik & Säumel 2007). *Ailanthus* was used also for landscaping to eliminate the soil erosion on slopes or stabilize dunes (Kowarik & Säumel 2007).

In chemical industry *Ailanthus* is valued for its sap, which contains a large range of chemical substances used in medicine and e.g. for developing herbicides or insecticides (Heisey 1996, 1997; Tsao et al. 2002; De Feo et al. 2009). *A. altissima* leaves are also considered as a consolidated source of bioactive components; being useful in the formulation of supplementary food and pharmaceutical industry. The development of a new natural herbicide would be another commercial use of this underutilized species (Albouchi et al. 2013). Additionally, *Ailanthus altissima* is valuable as food for silk producing caterpillars and for honey bees (Hu 1979; Dalby 2000; Kowarik & Säumel 2007, Udvardy 2008). A full review of socio-economic benefits is provided by Sladonja et al. (2015).

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