EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Heracleum mantegazzianum*
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Risk Assessment Area: Europe

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EU CHAPEAU	
QUESTION	**RESPONSE**
1. In how many EU member states has this species been recorded? List them.	20 countries: Austria, Belgium, Croatia, Czech. Rep., Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, Poland, Netherlands, Slovakia, Slovenia, Sweden and United Kingdom, some of those member states with very dense populations (DAISIE 2009, NOBANIS, EPPO 2009). Additionally it is present in non-member EU countries like Ukraine or Switzerland.
2. In how many EU member states has this species currently established populations? List them.	It is established in the 20 countries wherein it has been recorded (see above).
3. In how many EU member states has this species shown signs of invasiveness? List them.	Sign of invasiveness were recorded in all European countries where the plant is established (Pyšek et al. 2008). However, population density strongly varies between countries and regions with highest densities and largest populations observed in countries/regions where the plant is established for a very long time like west of the Czech Republic, some parts of Germany and Baltic countries (Thiele & Otte 2008; Fried 2009; Branquart et al. 2011; Pyšek et al. 2008; Pyšek et al. 2012).
4. In which EU Biogeographic areas could this species establish?	The following regions are considered as optimal for species establishment: Alpine, Atlantic, Boreal, Continental and Pannonian regions (Pyšek et al. 1998; EPPO 2009). Establishment is unlikely in Black see, Mediterranean and Steppic regions because the species is unlikely to tolerate warm winters and severe dryness during the summer time (Tiley et al. 1996; Pyšek et al. 1998; EPPO 2009)
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.	Giant hogweed is likely to establish also in Bulgaria, Lithuania, Romania and Northern Spain.
6. In how many EU member states could this species become invasive	Same as above. Invasiveness in Southern Europe may be reduced due to increased

in the future [given current climate] (where it is not already established)?	dryness and temperature conditions.

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?	*Heracleum mantegazzianum*	A close genetic relationship between the three invasive *Heracleum* species in Europe was found (Jahodová et al. 2007a, b). There are two other close related species *H. sosnowskyi* and *H. persicum* and some confusion between *Heracleum mantegazzianum,* and them may occur. In recent gene studies was found that there are three distinct tall *Heracleum* species invading Europe. Nevertheless identification problems may occur, to elimite the identification problems, use of guide books is adviced (e.g. Nielsen et al. 2005). Please note as all the species have high invasion potential (Jahodová et al. 2007a, Pyšek et al. 2007a), the management should be targeting all of them. The taxonomy of giant hogweed complex in native area is still disputed and e.g. *H. grossheimii* and *H. circassicum* are regarded as synonyms of *H. mantegazzianum* (Jahodová et al. 2007a).
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)	not relevant	
3. Does a relevant earlier risk assessment exist? (give details of any previous risk assessment)	no	Risk assessments was performed by EPPO for two other giant hogweeds species, i.e. *H. persicum* and *H. sosnowskyi* (EPPO 2009).
4. If there is an earlier risk assessment is it still	partly	There exist EPPO risk assesment (RA) for *H.*

entirely valid, or only partly valid?		*sosnowskyi* and *H. persicum* (http://www.eppo.int/INVASIVE_PLANTS/ias_lists.htm; accessed November 2015) which are based mainly on information valid for *Heracleum mantegazzianum* as this species is mostly studied globally (Morton 1978; Tiley et al. 1996; Pyšek et al. 2007). Preparation of RA for *Heracleum mantegazzianum* was created for purpose of EPPO workshop "Organisation and running of a scientific workshop to complete selected invasive alien species (IAS) risk assessments" held in 2007.
5. Where is the organism native?	Caucasus (Russia, Georgia)	Native range of *Heracleum mantegazzianum* is in Western Greater Caucasus (Satsyperova 1984; Ochsmann 1996; Tiley et al. 1996; Jahodová et al. 2007a; Otte et al. 2007).
6. What is the global distribution of the organism (excluding Europe)?	N. America, Asia, European part of Russia,, Australia and New Zealand (EPPO 2009); native in Russia and Georgia (Caucasus).	The species is considered invasive in northern states of USA and in Canada (Page et al. 2006). It is also common in Russia outside areas of high mountains where it is considered native (Pergl et al. 2006)
7. What is the distribution of the organism in Europe?	as above, widespread	It is established in Alpine, Atlantic, Boreal, Continental and Pannonian regions of Europe (Pyšek et al. 1998, EPPO 2009). Unlikely to establish in Southern regions and Mediterranean islands characterized by warm and dry conditions (Nielsen et al. 2005; Jahodová et al. 2007a; DAISIE 2009, EPPO 2009).
8. Is the organism known to be invasive (i.e. to threaten organisms, habitats or ecosystems) anywhere in the world?	Yes, one of the top 10 invasive plant species in Europe. Is also invasive in USA and Canada. There are many reports on its negative effects on biodiversity and human health	Yes, outside Europe also in North America (Tiley et al. 1996; Nielsen et al. 2005; Page et al. 2006; DAISIE 2009; Hejda et al. 2009)
9. Describe any known socio-economic benefits of the organism in the risk assessment area.	*Heracleum mantegazzianum* can be used for fodder, ornamental purposes, and honey	Satsyperova 1984; Ochsmann 1996; Nielsen et al. 2005; Buttenschon & Nielsen 2007; Pyšek et al.

	production.	2007b

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 (Jahodová et al. 2007a; DAISIE 2009). Not existing (very low probability) of intentional and unintentional introduction from Caucasus. There is a higher probability of secondary introductions from alien range in Europe (Pyšek et al. 2007c, 2008). High confidence is caused by the species widespread distribution in Europe and the low probability of the opportunities to be unintentionaly transported from native range.
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).			Soil as a commodity or a contaminant have been identified as relevant introduction pathways for other *Heracleum* species (EPPO PRAs), nevertheless there are no active vectors in present. In the case of *H. mantegazzianum*, secondary spread within the European Union is likely to be much more important than importation from outside regions.

Pathway name:			
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.			
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?			
1.10. Estimate the overall likelihood of entry into Europe based on this pathway?			
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).			

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	In its native range the species grows in open meadows under the treeline. However, it is able to grow there in similar habitats as in the alien range (Pergl et al. 2006; Otte et al. 2007). The species grows from (semi-)natural grassland

			habitats, road verges, river banks and riparian habitats, open forests and ruderal stands; habitats with a regular and intensive management as arable lands and improved pastures with high livestock density are unlikely to be invaded (Tiley et al. 1996; Otte et al. 2007; Thiele et al. 2007; Fried 2009; Branquart et al. 2011). The optimal habitats are found on well-lit, nutrient rich and moist soils; it avoids dense forest cover (Pyšek & Pyšek 1995; Thiele & Otte 2006; Thiele et al. 2007; Pergl et al. 2012). 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	moderately likely	high	Species is reproducing only by seeds, so management of reproduction stage and

in Europe?			minimizing the seed production and transport is crucial (Pyšek et al. 2007d). It is known, that the species has short term persistent seed-bank with majority of seeds germinating in the first and second year (Moravcová et al. 2006, 2007). Nevertheless, a small proportion of seeds is able to survive up to 7 years (Moravcová et al. 2007). If any management action against *Heracleum mantegazzianum* is planned, following monitoring is needed. Mowing and grazing are not effective as an eradication techniques, but root cutting and application of herbicides are recommended (Caffrey 2001, Nielsen et al. 2005; Pyšek et al. 2007b). Due to good detectability of the plant prior to reproduction (large size), absence of spread by vegetative fragments and high effectiveness of control techniques, its eradication may be easily achieved when management is repeated during several years. Eradications of small and isolated populations is relatively easy (Wadsworth et al. 2000; Panetta & Timmins 2004; Branquart et al. 2011; Pergl et al. 2012). 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	This species is reproducing by winged fruit (mericarps), that are mainly dispersed in the immediate vicinity of mother plants (Ochsmann 1996; Tiley et al. 1996; Moravcová et al. 2006; Pergl et al. 2011). Linear expansion coefficient is between 4 and 30 m/year (Müllerová et al. 2005). However, seeds may be dispersed over large distances by water (> 10 km) (Wadsworth et al. 2000; Moravcová et al. 2010). Spread by natural means by wind and water from populations occurring along water courses and transport corridors is highly frequent (Pyšek & Pyšek 1995; Thiele et al. 2007; Pergl et al. 2012). High confidence was chosen as there is a relatively good information on its dynamics at landscape scale from Europe.
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	Human activities like transport of biomass or soil, traffic and planting for honey production and ornamental purposes are significant component for the landscape dynamics (Pergl et al. 2012). Although public awareness has been increased (Nielsen et al. 2005), ornamental spread is still important (Pergl et al., in press). High confidence was chosen as there is a relatively 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	very high	Small populations are relatively easily manageable by root cutting, in large infestations eradications can be problematic (Pluess et al. 2012). Eradications are possible also in large scale where herbicides may be used (Wadsworth et al. 2000, Pergl et al., in press). Grazing or mowing are usually not effective and can only reduce the number of produced seeds (Nielsen et al. 2005; Pyšek et al. 2007d). There are several methods how to eradicate the species (Nielsen et al. 2005). Based on recording of the species in the Czech Republic (revisiting ca 600 sites, the species persist only at 25 % sites), the ability to eradicate is high. Similarly, three years project on heavily infested area of Western Czech Republic revealed, that it is possible to lower its distribution to ca 20%. The costs of such campaign (including also supression of Fallopias and Impatiens glandulifera) were 2.7 mio. Euro (L. Pocová, pers. comm.). In Sweden, the costs were calculated to ca. 1-4 SEK/m2,. but much higher along roads (100 SEK) (Gren et al. 2007).
2.4. Based on the answers to questions on the potential for establishment and spread in Europe, define the area endangered by the organism.	Species may colonise the Alpine, Atlantic, Boreal, Continental and Pannonian biogeographic regions of Europe (Pyšek et al. 1998; EPPO 2009).	very high	It is able to colonise easily new sites in vicinity of already existing stands (Thiele et al. 2007; Pergl et al. 2012). Giant hogweed presence is still limited in areas where the plant is recently established (e.g. Belgium, France or Slovenia) compared to areas where it has established since a very long time (e.g. Czech Republic, Baltic countries and Germany) (Muller 2004; Thiele & Otte 2006; Fried 2009; Branquart et al. 2011; Pyšek et al. 2008; Pyšek et al. 2012). High confidence was chosen as there is a relatively good information on ecology, biology and distribution in Europe.
2.5. What proportion (%) of the area/habitat suitable for	10-40%	medium	This area is difficult to assess because of lack of

establishment (i.e. those parts of Europe were the species could establish), if any, has already been colonised by the organism?			detailed distribution data all over Europe. In Germany, the saturation (% area covered) of the preferred habitats was 8.7% and the invasion percentage (% area invaded) was 18.5% in 2001 (Thiele & Otte 2008). When upscaling to occupied grid cells the available information range around 30%; in the Czech Republic is occupied 690 cells (3'×6') out of 2600 (27%, www.florabase.cz) and in UK: England 1079 squares of 10 km2 out of 2810 (38%; www.brc.ac.uk), Ireland 163 occupied squares out of 985 (17%, www.brc.ac.uk). Scoring is provided with medium certainty because of lack of accurate distribution data all over Europe especially for different scales. E.g. there were in 2008 over 200 independent populations in the Czech Republic excluding the highly infested area in W Bohemia (Pergl et al. 2012).
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)?	33-67%	medium	As the species is short lived perennial with age of fruiting in average between 3 to 5 years (Pergl et al. 2006) and the species can spread and reproduce easily (Pergl et al. 2007; Pyšek et al. 2007b), the timeframe of change is relatively short. Time of 50% invasion is about 20 years at local and regional scale and 60 years at continental scale (Wadsworth et al., 200; Pyšek et al. 2008). Scoring is provided with medium 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	See comments and references for question 2.5 and 2.6. The species is short lived perennial with age of fruiting in average between 3 to 5 years (Pergl et al. 2006) and the species can spread and reproduce easily (Pergl et al. 2007; Pyšek et al. 2007b), the

			timeframe of change is relatively short. Time of 50% invasion is about 20 years at local and regional scale and 60 years at continental scale (Pyšek et al. 2008). The species is now present in most of the European countries and within them the presence covers up to 40% grid cells. Therefore the invasion foci ready for further invasion are widely distributed. A high confidence level is expected due to the availability of validated distribution models in different European countries (see e.g. (Wadsworth et al., 2000; Pyšek et al. 2008).
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?	67-90%	medium	See comments and references for question 2.6 and 2.7. Scoring is provided with medium certainty because of lack of accurate data all over Europe to be used to define baseline distribution (see comments to previos questions).
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	Without adequate management, giant hogweed has a high potential for further spread in Europe (questions 2.5 and 2.7). It can colonize the few actually uninvaded EU member states and strongly increase its population density in the already invaded countries as it has highly dynamic pattern of distribution (Pergl et al. 2012). The maximal density observed in Germany may exceed 40 different populations per square kilometre, which is far to be reached in most areas invaded by the plant (Thiele & Otte 2008; Fried 2009; Branquart et al. 2011). The future spread depends highly on current infestations which is in Baltic and in east Europe high (e.g. remaining stands of crop plantations, unmanaged stands in close vicinities of parks) (Pergl et al. 2012; Nehrbass et al. 2007; Pyšek et al. 2007b). High confidence was chosen as there is a relatively good

			information on its ecology, biology and current distribution in Europe.

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?	massive	medium	Outside Europe and N America the species is not well managed and therefore there are no information on its eradication costs. But based on the estimate done by Reinhardt et al. (2003) and Branquart et al. (2011), the costs due to presence of *Heracleum mantegazzianum* are mostly due to eradication costs (ca 10 mil. Euro per year in Germany and about 0.5 mil. Euro per year in Southern Belgium). Giant hogweed may also limit tourism and leisure activities due to the areas made inaccessible; in United Kingdom, the cost incurred by tourism and recreational activities is estimated as 1 mil. £ per year (Williams et al. 2010). Direct health costs were calculated to reach ca. 1 mil. Euro per year (Reinhardt et al. 2003) but were more limited in United Kingdom due to a lower invasion intensity (Williams et al. 2010). In Sweden the costs are based on eradication costs that range from 1-4 SEK/m2 on municipal land to

			100 SEK/m2 along roads (Gren et al. 2007). More details are summarized in the report by Gren et al. 2007. The impact score is accompanied by a medium confidence level because estimates strongly diverge according to site conditions and control techniques.
2.11. How great is the economic cost of the organism currently in Europe excluding management costs (include any past costs in your response)?	moderate	medium	Based on the estimate done by Reinhardt et al. (2003) direct health costs were calculated to reach ca. 1 mil. Euro per year in Germany (Reinhardt et al. 2003). Other than health costs due to its toxicity are not known or are negligible (Linc 2012). Medium confidence was chosen as there are relatively fewer reports on its direct economic costs. However, there are some, so the confidence was set to be medium.
2.12. How great is the economic cost of the organism likely to be in the future in Europe excluding management costs?	major	low	Impacts on human health are likely to increase due to an increase in exposition rate linked with higher densities. However, improvement of plant knowledge and identification skills by citizen could more or less compensate for increase of giant hogweed density (Neuville et al. 2011). The confidence level is set to low because few studies investigate how escape behaviour by men linked to learning process evolves with plant density.
2.13. How great are the economic costs associated with managing this organism currently in Europe (include any past costs in your response)?	massive	medium	The species is in the top ten of IAS species in Europe (DAISIE; Pyšek et al. 2013) (because the risk of human injuries, high rate of spread and its impact on biodiversity) and therefore there are high costs invested to its eradication. But in many cases the eradication costs include also campaigns on other IAS. The management costs of dense populations of giant hogweed are between 1,000 and 50,000 EUR/ha/year depending on control technique and site conditions; much lower costs are however incurred to control low density populations (Nielsen et al. 2005, Gren et al.

			2007, Delbart & Pieret 2009). Eradication costs can be very high in countries where large hogweed populations are already present: Reinhardt et al. (2003) estimated the costs to manage all populations of *Heracleum mantegazzianum* in Germany to ca 10 mil. Euro per year. It means that the economic cost to eradicate giant hogweed in Europe would be massive and could be considered as an unrealistic goal; containment associated with local eradication actions could however be considered as very cost-effective, especially in territories where large infestations are rarely found (Branquart *et al.* 2011). Three years project on heavily infested area of Western Czech Republic revealed, that it is possible to lower its presence to ca 20% (including pastures and areas where no herbicide application is allowed). The costs of such campaign (including also supression of *Fallopia* spp. and *Impatiens glandulifera*) were 2.7 mio. Euro (L. Pocová, pers. comm.). Medium confidence was chosen as there can be large amount of reports in grey inaccessible literature and that the estimates 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?	massive	medium	The economic cost associated with management may strongly increase in the future if coordinated actions are not undertaken rapidly within the European Union.
2.15. How important is environmental harm caused by the organism within its existing geographic range excluding Europe?	major	low	Giant hogweed occasionally forms dominant stands on abandoned crop fields and grasslands close to running waters in its native range (Otte et al. 2007). Reports of environmental impact in introduced range outside Europe are scarce and originate mainly from North America (Page et al. 2006). Due to data scarcity we set the confidence level to low.

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	medium	Because of its ability to create dense stands, its impact on native biodiversity can be significant. *Heracleum mantegazzianum* is one of the species that is able to change the floristic composition and it may strongly reduce the abundance of small pioneer plant species (Hejda et al. 2009; Thiele et al. 2010). Additionally it is documented how the species changes seedbank composition in invaded sites (Gioria & Osborne 2010). However, its impact at the landscape scale is usually limited because of a low saturation by the plant of the preferred habitats and regional species extinction has never been reported (see question 2.5). Species abundance is also usually observed to decrease on the long term in absence of management (Thiele et al. 2007 and 2010; Dostál et al. 2013). A major impact score for this question fits with species classification into national black lists (see e.g. Branquart et al. 2010 for Belgium, Nehring et al. 2013 for Germany, Ries et al. 2013 for Luxembourg and Pergl et al. 2016 for Czech Republic). Medium confidence was chosen as impact score is between medium (reversibility of impacts on the long term) and major (spreading beyond local area).
2.17. How important is the impact of the organism on biodiversity likely to be in the future in Europe?	major	medium	Biodiversity impact is likely to increase if saturation of habitats increases with time. A medium confidence score is chosen for the same reasons as in previous question.
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	medium	There is shown that the species is able to produce allelopathic compounds and change nutrient availability in the soil (Vanderhoeven et al. 2005; Koutika et al. 2007; Jandová et al. 2014). Although it was found, that the effect on soil can be time dependent and might be smaller after long period

			(Dostál et al. 2013). Dense populations are also likely to affect accessibility to water courses (cultural services) (Williams et al. 2010). Confidence was chosen to be medium as the soil interaction is difficult to assess.
2.19. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the organism likely to be in Europe in the future?	moderate	medium	Alteration of ecosystem function is likely to increase if saturation of habitats increases with time. Confidence was chosen to be medium as the soil interaction is difficult to assess.
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	The giant hogweed is most often found in sites with disturbed and nutrient-rich soils. It may however also colonise sites of nature conservation value, especially riparian habitats, peaty meadows and humid grasslands (Thiele & Otte 2006; Thiele et al. 2007; Thiele & Otte 2008; Branquart et al. 2010; Pyšek et al. 2012). Considered as one of the top invasive species marked by managers of protected areas (Pyšek et al. 2013). Affects biodiversity and ecosystem functions as described in 2.16 and 2.18. Studies focusing on the alteration of site conservation status are limited, which justifies the adoption of a medium confidence score.
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	Decline in conservation status is likely to increase if saturation of habitats increases with time
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	Not known genetic risks (Tiley et al. 1996). There are known hybrids with native European hogweed (H. sphondylium) from several countries, but the presence of such hybrids is currently negligible. The impact score is accompanied by a high confidence level because scarcity of hybrids is well documented.
2.23. How important is social, human health or other harm (not directly included in economic and	major	high	See above (question 2.10). A survey of the health sector in Belgium conducted in 2011 showed that

environmental categories) caused by the organism within its existing geographic range?			several thousands of people were injured by photodermatitis in the country on an annual basis (Neuville 2011). Similar results exist for Poland (Rzymski et al. 2015). Studies on the effect of giant hogweed on human health are frequent and the photodermatitis is the major cause of its impact on human health, therefore the high confidence score is justified.
2.24. How important is the impact of the organism as food, a host, a symbiont or a vector for other damaging organisms (e.g. diseases)?	minimal	high	Not known or significant interaction with any pests (Seier & Evans 2007). There were detailed studies on its ecology including the effects of invertebrates and pathogens (Seier & Evans 2007; Tiley et al. 1996). Thus this justifies the adoption of a high confidence score.
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	not 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?	minimal	medium	There is no efficient biocontrol of *H. mantegazzianum* now in Europe (Pyšek et al. 2007b; Seier & Evans 2007). 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	Strong impacts are likely to occur where giant hogweeds meets its optimal ecological conditions (see question 2.4).

RISK SUMMARIES			
	RESPONSE	**CONFIDENCE**	**COMMENT**
Summarise Entry	very likely	very high	Has already entered in many member states.
Summarise Establishment	very likely	very high	May easily establish in a wide part of Europe due to wide ecological preferences but with different population densities depending on invasion histories.
Summarise Spread	rapidly	high	May spread easily by natural means when growing near river systems and by human assistance (plantations and movements of contaminated soils).
Summarise Impact	major	high	Causes strong economic loss due to impact on human health and areas made inaccessible. It is also responsible for a strong biodiversity decline in the invaded sites and may moderately affect ecosystem functions, processes and services.
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?	Increase of dryness and temperature conditions	medium	Native range of the species is in high mountain area, and it prefers colder areas (Pyšek et al. 1998; Pergl et al. 2006). The species is intolerant to dryness and high temperatures. Seeds need cold and wet conditions during the winter to break dormancy; dryness is also unfavourable to flowering (Moravcová et al., 2007, EPPO 2009). It is likely to lead to range contraction at the European scale as the Southern part of the continent will become unsuitable for species establishment. Niche models predict that *H. mantegazzianum* can loose between 5 and 36% of its habitat in some regions of Europe before 2050. The models also predict a shift in the distribution centroid of 55 km/decade towards the north on average (Gallardo et al. in prep.). The score is accompanied by a medium confidence level because consequence is based on prediction.
3.2. What is the likely timeframe for such changes?	20-50 years	medium	See results from Gallardo et al. (in prep.). The magnitude of change depends on the rate of climate change and the adopted scenario. The score is accompanied by a medium confidence level because consequence is based on prediction.
3.3. What aspects of the risk assessment are most likely to change as a result of climate change?	Establishment and impacts	medium	As described in question 3.1, climate change is likely to affect seed germination (establishment) and plant densities (impact). The score is accompanied by a medium confidence level because consequence is based on prediction.
ADDITIONAL QUESTIONS – RESEARCH			
4.1. If there is any research that would significantly	[insert text]	low	

strengthen confidence in the risk assessment please summarise this here.		medium high very high	

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