

Information about GB Non-native Species Risk Assessments

The Convention on Biological Diversity (CBD) emphasises the need for a precautionary approach towards non-native species where there is often a lack of firm scientific evidence. It also strongly promotes the use of good quality risk assessment to help underpin this approach. The GB risk analysis mechanism has been developed to help facilitate such an approach in Great Britain. It complies with the CBD and reflects standards used by other schemes such as the Intergovernmental Panel on Climate Change, European Plant Protection Organisation and European Food Safety Authority to ensure good practice.

Risk assessments, along with other information, are used to help support decision making in Great Britain. They do not in themselves determine government policy.

The Non-native Species Secretariat (NNSS) manages the risk analysis process on behalf of the GB Programme Board for Non-native Species. Risk assessments are carried out by independent experts from a range of organisations. As part of the risk analysis process risk assessments are:

- Completed using a consistent risk assessment template to ensure that the full range of issues recognised in international standards are addressed.
- Drafted by an independent expert on the species and peer reviewed by a different expert.
- Approved by an independent risk analysis panel (known as the Non-native Species Risk Analysis Panel or NNRAP) only when they are satisfied the assessment is fit-for-purpose.
- Approved for publication by the GB Programme Board for Non-native Species.
- Placed on the GB Non-native Species Secretariat (NNSS) website for a three month period of public comment.
- Finalised by the risk assessor to the satisfaction of the NNRAP.

To find out more about the risk analysis mechanism go to: www.nonnativespecies.org

Common misconceptions about risk assessments

To address a number of common misconceptions about non-native species risk assessments, the following points should be noted:

- Risk assessments consider only the risks posed by a species. They do not consider the practicalities, impacts or other issues relating to the management of the species. They therefore cannot on their own be used to determine what, if any, management response should be undertaken.
- Risk assessments are about negative impacts and are not meant to consider positive impacts that may also occur. The positive impacts would be considered as part of an overall policy decision.
- Risk assessments are advisory and therefore part of the suite of information on which policy decisions are based.
- Completed risk assessments are not final and absolute. Substantive new scientific evidence may prompt a re-evaluation of the risks and/or a change of policy.

Period for comment

Draft risk assessments are available for a period of three months from the date of posting on the NNSS website*. During this time stakeholders are invited to comment on the scientific evidence which underpins the assessments or provide information on other relevant evidence or research that may be available. Relevant comments are collated by the NNSS and sent to the risk assessor. The assessor reviews the comments and, if necessary, amends the risk assessment. The final risk assessment is then checked and approved by the NNRAP.

*risk assessments are posted online at: <https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=51>

comments should be emailed to nnss@fera.gsi.gov.uk

GB NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

For more information visit: www.nonnativespecies.org

Name of Organism:	<i>Ambrosia artemisiifolia</i>, Common Ragweed
Objectives:	Assess the risks associated with this species in GB.
Version:	First published on the NNSS website: 03/09/13
Author:	Katharina Dehnen-Schmutz
Suggested citation:	Dehnen-Schmutz, K. (2013). GB Non-native Organism Risk Assessment for <i>Ambrosia artemisiifolia</i> . www.nonnativespecies.org

Stage 1: Initiation

1 - What is the principal reason for performing the Risk Assessment? (Include any other reasons as comments)

Request by GB Programme Board

Comments:

Ambrosia artemisiifolia is already known to be invasive in part of continental Europe (Hungary, France, Italy, Switzerland, Germany, Austria) and has increased its range and abundance in continental Europe over the last decade. The species is also listed in the EPPO list of invasive plants posing an important threat to plant health, the environment and biodiversity in the EPPO region.

2 - What is the Risk Assessment Area?

Great Britain

3 - What is the name of the organism? **This will appear as a heading** (Other names used for the organism can be entered in the comments box)

Ambrosia artemisiifolia L.

Comments:

Common ragweed, Ambrosia (Synonyms: *Ambrosia elatior* L., *Ambrosia elata* Salisbury, *Ambrosia paniculata* Michaux). Asteraceae, Order Asterales, Kingdom Plantae.

4 - What is the status of any earlier Risk Assessment?

none exists

Comments:

There is no earlier PRA covering the area of this PRA. However, the species has been assessed in other countries and PRAs are available for the following countries: Poland (Karnkowski 2001), Germany (Starfinger & Schrader 2009), Lithuania (2003 - not published?). The Polish and Lithuanian PRAs have been reviewed by the European Food Safety Authority (EFSA) with the result that they do not provide sufficient evidence to assess on a scientifically sound basis whether Ambrosia spp. qualify as quarantine pests (EFSA 2007a, 2007b).

Stage 2a: Organism Risk Assessment

6 - If you are sure that the organism clearly presents a risk, or that in any case a full Risk Assessment is required, you can omit this section and proceed directly to Section B.

Go to the main Risk Assessment, SECTION 2B

Stage 2b: Pathways

20 - How many pathways are relevant to the potential entry of this organism?

For organisms which are already present in Great Britain, only complete the entry section for current active pathways of new entry.

few

Comments:

The main pathways mentioned for the British Isles are through contamination of bird seed, oil-seed, grain and other agricultural seed, and with animal feed (Clement & Foster 1994, Preston et al. 2002). Other pathways mentioned from other European countries are the translocation of seeds with machinery/equipment used for ragweed clearance or harvest of ragweed infested crops, and transport of soil or compost containing seeds (Buttenschøn *et al.* 2009).

The EFSA also concluded in a recent assessment that bird feed seems to play an important role in introducing *Ambrosia* to new, previously not infested areas, whereas contamination in other animal feeds were not considered to contribute to the spread of the species due to the extensive processing (EFSA 2010).

21 - Please list relevant pathways through which the organism could enter (one per line).

Give details about specific origins and end points of the pathways (where possible) in the comment box.

bird seed

Comments:

Bird seed seems to be the main currently active pathway for the introduction of the species into the Risk Assessment Area whereas the other pathways seem to be more of historical importance. The BSBI together with Fera are currently looking for reports of other pathways that may have to be considered (Lockton & Crocker, 2010. www.bsbi.org.uk). The transport of seeds attached to machinery is not seen as a major pathway for the introduction into the country and this form of transport is therefore considered in the spread module.

22 - Please select the pathway:

bird seed

PATHWAY – BIRDSEED

23 - How likely is it that the organism is strongly associated with the pathway at the point(s) of origin?

likely

Level of confidence: high

Comments:

A. artemisiifolia seeds enter the pathway at the point of origin as seed contaminants in crops sold as bird seed. Countries of origin may vary depending on crops used, but some of the main ingredients like sunflower seeds and millet are grown in countries in which *A. artemisiifolia* is either a native or introduced weed (North America, Hungary, China) in these crops. Hanson & Mason (1985) report *A. artemisiifolia* as regularly imported with millet seeds from the USA to Britain.

24 - How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin?

very likely

Level of confidence: high

Comments:

The annual amount of bird seed presented to birds in the UK has been estimated at 60,000 tonnes in 2003 (Glue, 2006) and even though detailed statistics are not available most of it is assumed to

be produced outside the UK, probably mostly in North America (EPPO reporting service 2007/122). Using the average number of about 3 viable seeds per kg bird seed found by Alberternst et al. (2006) this results in about 180 million viable seeds arriving annually in the UK.

25 - How likely is the organism to survive during passage along the pathway?

moderately likely

Level of confidence: high

Comments:

The germination rate of about 15% found by Alberternst et al. (2006) and Bohren et al. (2005) suggests that at least a certain proportion of the seeds are surviving transport or possible storage within the pathway. However, seeds not derived from birdseed showed up to 95% germination rates (Baskin & Baskin, 1980).

26 - How likely is the organism to enter Great Britain undetected?

likely

Level of confidence: high

Comments:

Imports of bird seeds into the UK are subject to standards for the import of feed and food products but no evidence has been found that inspections would cover *A. artemisiifolia* contamination in particular. Also, the standards of the Birdcare Standards Association (BSA) do not include any requirements regarding *A. artemisiifolia* contamination (www.birdcare.co.uk). It seems therefore likely that under current procedures contamination of bird seed with *A. artemisiifolia* seeds will not be detected when entering the Risk Assessment Area.

27 - How likely is the organism to multiply/increase in prevalence during transport /storage?

very unlikely

Level of confidence: very high

Comments:

As only seeds are transported in conditions not favouring germination no increase is expected.

28 - How likely is the organism to survive existing management practices within the pathway (answer N/A for intentional introductions)?

likely

Level of confidence: high

Comments:

There are no current practises specifically directed against *A. artemisiifolia* seed contamination in bird seed although certain minimum standards regarding the tolerance of bird seed contamination with other seeds exist.

According to an EPPO report (EPPO 2007) seeds are cleaned in the importing country resulting in a standard of 98-99% purity of the bird seed. This process seems not to remove *A. artemisiifolia* seeds entirely as seen in the contaminations found. It is unclear what happens to the removed unwanted material after the cleansing process and if it may be another opportunity for *A. artemisiifolia* seeds to enter suitable habitats in the Risk Assessment Area.

29 - How likely is the organism to arrive during the months of the year most appropriate for establishment (if intentional introduction answer N/A)?

moderately likely

Level of confidence: medium

Comments:

A. artemisiifolia germinates in late spring but has also been found to germinate in summer and still producing seeds later in the year. This is usually a time of the year when less bird feed is used. However, seeds arriving in the bird feeding winter season are still able to germinate later in the year. It seems that time of the year is not important for the chance of the species to start growing in the Risk Assessment Area. (For the process to establishment the arrival time seems not to be important as it is a process over several years anyway).

30 - How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?

likely

Level of confidence: high

Comments:

Most bird feed is used around houses in rural and urban areas from where the species could transfer to suitable habitats in and around gardens. According to Preston et al. (2002) the species is found 'in places where bird seed is scattered' and this may explain the vague association with urban areas Lockton & Crocker (2010) found from analysing distribution records.

31 - Do other pathways need to be considered?

no

END

32 - Please estimate the overall likelihood of entry into the Risk Assessment Area for this organism (please comment on the key issues that lead to this conclusion).

very likely

Level of confidence: high

Comments:

Existing occurrences and new recordings in recent years (BSBI Map Scheme 2010) of *A. artemisiifolia* in the Risk Assessment Area, attributed to the introduction of the species through the pathways described here, which are still active, confirm the likelihood of further entry.

Establishment

33 - How likely is it that the organism will be able to establish in Great Britain based on the similarity between climatic conditions in Great Britain and the area of the organism's current distribution?

likely

Level of confidence: medium

Comments:

Currently *A. artemisiifolia* is not widespread in the risk assessment area and its status in most locations is rated as 'casual (rarely persisting)' (Preston *et al.* 2002). An analysis of the British 10 km square distribution data in the EFSA report (2010) concludes that only 25 % of the squares recorded in 1987-1999 were still found positive for ragweed in 2000-2009 indicating that ragweed failed to persist in at least 75 % of its recorded sites. Rich (1994) assumes that climatic conditions, especially cooler and damp autumn conditions are the reason why *A. artemisiifolia* is not established in Britain but points out that in the predicted warmer future climate establishment seems likely. It has also been suggested that spring temperatures in Britain may result in low germination success of the seeds (Rich 1994). In continental Europe a similar pattern has been observed where the species had been found as a casual for decades in many areas before starting to establish and spread linked to an increase in summer temperatures (Essl *et al.* 2009). In Germany the potential to establish has been found to shift northwards recently (Starfinger and Schrader 2009).

34 - How likely is it that the organism will be able to establish in Great Britain based on the similarity between other abiotic conditions in Great Britain and the area of current distribution to be similar?

likely

Level of confidence: high

Comments:

A. artemisiifolia grows best in open sunny and warm habitats, preferring nutrient rich, moist and slightly acidic soils (Brandes and Nitzsche 2006, Buttenschøn *et al.* 2009). Under current conditions temperature may be the only limiting factor preventing its establishment (see question 33).

35 - How many species or suitable habitats vital for the survival, development and multiplication of the organism species are present in Great Britain? Please specify in the comment box the species or habitats.

moderate number

Level of confidence: high

Comments:

The main habitats where *A. artemisiifolia* is found in Britain are human disturbed habitats. Preston *et al.* (2002) list as the main habitats rubbish tips, dockyards, arable fields, waste ground and places where bird-seed is scattered. It has also been found in sand dunes (Rich 1994). In other European countries roadsides are one of the most important habitats and are likely future habitats for *A. artemisiifolia* in the Risk Assessment Area.

36 - How widespread are the species or suitable habitats necessary for the survival, development and multiplication of the organism in Great Britain?

ubiquitous

Level of confidence: very high

Comments:

Human disturbed habitats are widely available in the risk assessment area, in particular arable fields, roadsides and urban habitats.

37 - 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 Great Britain?

N/A

Level of confidence: very high

38 - How likely is it that establishment will occur despite competition from existing species in Great Britain?

likely

Level of confidence: high

Comments:

A. artemisiifolia requires open habitats for germination but once it is established it is a fast growing pioneer plant giving it competitive advantages (Brandes and Nitzsche 2006). In its introduced range *A. artemisiifolia* has readily established in habitats that are available with similar species composition in the Risk Assessment Area. It seems therefore unlikely that competition from existing species would prevent establishment.

39 - How likely is it that establishment will occur despite predators, parasites or pathogens already present in Great Britain?

likely

Level of confidence: high

Comments:

There is no evidence that existing natural enemies have been effective in preventing the establishment of *A. artemisiifolia* in its introduced range in Europe or of any impact of predators, parasites or pathogens on the occurrences of *A. artemisiifolia* already present in the Risk Assessment Area.

40 - How likely are management practices in Great Britain to favour establishment?

moderately likely

Level of confidence: medium

Comments:

In arable fields *A. artemisiifolia* is favoured by the cultivation of summer grown crops and if producing seeds could establish a seed bank with seeds remaining viable for 20 years or more (Buttenschøn *et al.* 2009). Similarly, the species is favoured by disturbance in urban and ruderal habitats.

41 - How likely is the organism to establish despite existing management practices in Great Britain?

very likely

Level of confidence: high

Comments:

Currently there are no control or management measures against *A. artemisiifolia*.

42 - How likely is it that biological properties of the organism would allow it to survive eradication campaigns in Great Britain?

unlikely

Level of confidence: medium

Comments:

Currently *A. artemisiifolia* is still considered a casual in the Risk Assessment Area recorded in less than one hundred hectads (Lockton & Crocker, 2010). Therefore, a well designed eradication campaign including the control of the main pathway from bird seed could be successful.

43 - Is establishment likely to be aided by the biological characteristics of the organism?

very likely

Level of confidence: high

Comments:

Biological characteristics of the species that may contribute to its potential establishment success are in particular the production of large amounts of seeds (between 340 and 6100 per plant) (Fumanal *et al.* 2007a) and the ability to build up a seedbank with seeds remaining viable for more than 20 years (Buttenschøn *et al.* 2009).

44 - Is the organism's capacity to spread likely to aid establishment?

moderately likely

Level of confidence: high

Comments:

Naturally *A. artemisiifolia* is not able to spread very far, although there is evidence that hydrochory could play a role in longdistance dispersal of *A. artemisiifolia* (Fumanal *et al.* 2007b) thereby increasing chances of the seeds to be introduced in habitats suitable for establishment.

45 - How likely is the adaptability of the organism to aid its establishment?

likely

Level of confidence: high

Comments:

A study of *A. artemisiifolia* in France showed no loss of genetic diversity compared to its native North American range and found within-population diversity even higher in introduced populations than in source populations (Genton *et al.* 2005) indicating an increased potential to adapt to a changing environment. *A. artemisiifolia* has also developed several resistances to a range of herbicides in its native area as well as in its introduced range. In Hungary the first atrazine-resistant *A. artemisiifolia* plant was found in 1992, and after a decade this genotype could be found almost everywhere in the country (Hartmann *et al.* 2003 cited in Cseh *et al.* 2009).

46 - How likely is it that the organism could establish despite low genetic diversity in the founder population?

moderately likely

Level of confidence: medium

Comments:

A recent study in Canada found that *A. artemisiifolia* is a self-incompatible species and as such may suffer reduced reproductive success when population density or size is low (Friedman and Barrett 2008). There is however evidence that *A. artemisiifolia* has managed to establish from bird seed several times although it has not been analysed how genetically homogenous these populations are.

47 - How likely is the organism to be established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Great Britain?

(Note that home gardens are not considered protected conditions in this sense.)

very unlikely

Level of confidence: high

Comments:

No evidence was found that *A. artemisiifolia* had been recorded in protected conditions.

48 - Based on the history of invasion by this organism elsewhere, how likely is it to establish in Great Britain? (If possible, specify the instances of invasion in the comments box.)

very likely

Level of confidence: very high

Comments:

There is evidence of new establishment of *A. artemisiifolia* in continental Europe. For example in Germany, the range of established occurrences is currently moving northwards (Starfinger and

Schrader 2009). Published data covering the years from 2005 onwards are difficult to find, however, it seems unlikely that the previous trend should have stopped. A detailed study of the species in Austria found that from 1980 to 2005 the number of grid cells (30 square km) with established records increased from 25 to 97 and that the number of established populations has recently been increasing considerably faster than that of casual populations (Essl *et al.* 2009).

49 - If the organism does not establish, then how likely is it that transient populations will continue to occur?

very likely

Level of confidence: very high

Comments:

A. artemisiifolia is present in Britain as a casual since 1836 (Preston *et al.* 2002) and if it does not establish and introductory pathways are not controlled it seems likely that it will continue to be found as a casual.

50 - Please estimate the overall likelihood of establishment (mention any key issues in the comment box)

likely

Level of confidence: high

Comments:

It seems likely that at least in some of the warmest regions of the risk assessment area the species will become established. To what extent that will be the case depends on the effect of climate change and how active current pathways of introduction and distribution remain. Current predictions of warmer summers for Britain (<http://www.ukcip.org.uk/>) are very likely to favour the establishment success. A detailed analysis of the effects of climate change on *A. artemisiifolia* in Britain may be useful to get more detailed spatial and temporal information.

Spread

51 - How rapidly is the organism liable to spread in Great Britain by natural means?

very slowly

Level of confidence: high

Comments:

Seeds of *A. artemisiifolia* just fall to the ground and are not airborne. Experimental evidence shows that seeds can be transported in water where they remain viable which could result in longer distance dispersal along water courses or roadsides through water runoff (Fumanal *et al.* 2007). It has also been suggested that seeds could travel intact through the guts of birds and thus spread further (EFSA 2010) but no experimental evidence supporting this seem to exist. The high number of seeds produced could contribute to the successful spread of the species.

52 - How rapidly is the organism liable to spread in Great Britain by human assistance?

slowly

Level of confidence: high

Comments:

Spread is most likely to happen through human assistance in particular through the movement of soil containing seeds for building and road works as well as through the movement of machinery used in areas where *A. artemisiifolia* occurs. Given the long viability of the seeds in soil spread could happen even from locations where *A. artemisiifolia* may not actually been found growing when building/road works are carried out. Transport of seeds attached to car tyres seems also to contribute to the spread of the species and may explain the often linear occurrences along roads (Alberternst *et al.* 2006, Vitalos &Karrer, 2009).

53 - Within Great Britain, how difficult would it be to contain the organism?

moderately difficult

Level of confidence: high

Comments:

As spread in the Risk Assessment Area is mainly through human assistance it could be contained by following some precautionary measures in particular with regard to the movement of soil and machinery from areas with occurrences of *A. artemisiifolia* in areas where it is not present.

54 - Based on the answers to questions on the potential for establishment and spread in Great Britain, define the area endangered by the organism.

Southern parts of Britain, Midlands, Southern coastel areas, urban areas.

Comments:

A. artemisiifolia is already present in the Risk Assessment Area and distribution maps are available in Preston *et al.* (2002) and more recent ones on the BSBI Map Scheme webpage (www.bsbimaps.org.uk). Spread and establishment is most likely to occur in the warmest areas of the Risk Assessment Area where *A. artemisiifolia* is already present as a casual.

55 - Please esitimate overall potential for spread (using the comment box to indicate any key issues).

slowly

Level of confidence: medium

Comments:

If the species establishes it is also very likely to spread from established seed producing populations.

Impacts

56 - How great is the economic loss caused by the organism within its existing geographic range, including the cost of any current management?

massive

Level of confidence: high

Comments:

Economic losses caused by *A. artemisiifolia* are reported for agriculture, human health and biodiversity but there are not many cost estimations available. Direct costs arise from its impact as an agricultural weed and the impacts on human health (see question 64). Indirect costs caused for example by impacts on biodiversity or other ecosystem services have not been analysed.

Agriculture: *A. artemisiifolia* is a problematic weed in its native area of origin in North America as well as in European countries where it is established. The main crops affected are summer grown crops like maize, sunflower, sugar beet, soy, beans and peas. Yield losses are depending on the first emergence of the weed and density of the occurrences. Yield losses of up to 70% are reported for sugar beet fields where the species had overgrown the crop (Buttenschøn *et al.* 2009). In Hungary, crop losses in agriculture attributed to *A. artemisiifolia* are estimated to be about 130 million Euros per year (Kömives *et al.* 2005, cited in Starfinger and Schrader 2009). The control of the weed is difficult and herbicide resistances have developed further contributing to its control costs.

57 - How great a loss of production is the organism likely to cause in Great Britain? For example, how serious is the direct negative economic effect of the organism likely to be on crop yield and/or quality, livestock or fish health and production? (Describe the nature and extent of expected losses in the comment box.)

major

Level of confidence: medium

Comments:

The main direct negative economic effects are expected for agriculture and human health (see question 64). The main crops affected are summer grown crops and therefore yield losses are to be expected in particular for maize, sugar beet, potatoes and peas, with the latter three all being high value arable crops. Due to the late emergence of seedlings routine herbicide applications in these crops seem not to be sufficient to control *A. artemisiifolia* causing additional management costs (Starfinger and Schrader 2009). To what extent *A. artemisiifolia* may be able to invade agricultural crops depends on effects of climate change and the success of prevention policies - this explains the medium level of confidence.

58 - How great are the additional economic costs associated with managing this organism likely to be?

major

Level of confidence: medium

Comments:

Experimental studies suggest that yields can be considerably reduced: a study in Germany found potato yields reduced by up to 30% and sugar beet by up to 70% depending on the density of *A. artemisiifolia* (Brandes and Nitzsche 2006). For maize, even low densities of *A. artemisiifolia* have been found to reduce yields (Varga *et al.* 2000 cited in Kovács *et al.* 2006). The current distribution of mainly casual occurrences of *A. artemisiifolia* in England includes the important potato and sugar beet production areas.

Production costs are likely to increase as due to the late emergence of seedlings of *A. artemisiifolia* routine herbicide applications in these crops seem not to be sufficient to control *A. artemisiifolia* causing additional management costs (Starfinger and Schrader 2009).

To what extent *A. artemisiifolia* may be able to invade agricultural crops depends on effects of climate change and the success of prevention policies - this explains the medium level of

confidence.

59 - How great a reduction in consumer demand is the organism likely to cause in the Risk Assessment Area?

minor

Level of confidence: medium

Comments:

Prices for bird seed could increase due to consumer demand and/or prevention policies for bird seed products free from *A. artemisiifolia* seeds.

Increased production costs due to invasion of arable crop and vegetable fields could result in increased consumer prices.

60 - How significant might the losses in export markets be due to the presence of the organism in the Risk Assessment Area?

minimal

Level of confidence: high

Comments:

Legal requirements to control *A. artemisiifolia* in some countries (for example Hungary, Switzerland) could result in agricultural products contaminated with *A. artemisiifolia* seeds to be rejected.

61 - How important might other economic costs be resulting from introduction of the organism? (specify in the comment box)

NA

62 - How important is environmental harm caused by the organism within its existing geographic range under any current management regime?

moderate

Level of confidence: high

Comments:

A. artemisiifolia can grow in large dense populations out competing other species. However, as the species occurs mainly in frequently disturbed man made habitats it seems not to be regarded as a major problem for nature conservation. There are few reports about *A. artemisiifolia* in potentially valuable habitats: dry grasslands and sand dunes in Hungary (Mihály & Botta-Dukát 2004 cited in Essl 2009) and in a nature reserve in Germany where the species was threatening to overgrow a dry sand grassland (Alberternst et al. 2005). In arable fields the species changes plant weed communities and may also have a negative impact on endangered weeds as reported for Hungary where *A. artemisiifolia* was shown to be the most frequently found weed species in arable fields having seriously altered native arable field flora and vegetation including several red listed species (Pál 2003, Pinke et al. 2008). Indirect effects may be related to the control of the species with herbicides.

63 - How important is environmental harm likely to be in Great Britain taking into account any management interventions that might be implemented?

minor

Level of confidence: medium

Comments:

Currently there are no reports of environmental impacts caused by *A. artemisiifolia* in the Risk Assessment Area. However, should the species become established and start spreading environmental impacts similar to the ones described from its introduced range in Europe are likely to occur depending on effects of climate change on the species and management interventions.

64 - How important is social, health or other harm (not directly included in economic and environmental categories) caused by the organism within its existing geographic range under any current management regime?

massive

Level of confidence: very high

Comments:

A. artemisiifolia pollen are highly allergenic causing considerable impacts on human health in its native as well as alien range. In North America ragweed species are considered the predominant source of pollen and allergic rhinitis during the autumn. In European countries with large ragweed populations 10-20 % of patients with pollen allergy symptoms suffer from ragweed allergy (Buttenschøn et al. 2009), in the highly invaded country of Hungary about 25% of the population are affected with an estimated cost for the public health system of 110 Mill. Euros annually (Kazinski et al. 2008 cited in Starfinger & Schrader 2009). These figures clearly demonstrate the enormous impact of the species on human well being. Furthermore, *A. artemisiifolia* flowers very late in the season and therefore extends the 'pollen season' for hay fever sufferers. Few further estimates for the economic costs of these effects exist. For France and Italy health costs are estimated to be about 2 million Euros (Buttenschøn et al. 2009), a figure probably too low given reports about a single hospital in Milan spending 1.3 million Euros for the treatment of patients in 2002 alone (Taramarcacz 2005).

65 - How important is the social, health or other harm likely to be in Great Britain taking into account any management interventions that might be implemented?

moderate

Level of confidence: medium

Comments:

Currently there are no reports of health impacts caused by *A. artemisiifolia* in the Risk Assessment Area. However, should the species become established and start spreading health impacts similar to the ones described from its introduced range in Europe are likely to occur depending on effects of climate change on the species and management interventions. In a worst case scenario up to 20% of people suffering from pollen allergies could be affected causing high costs for the health system and social well being of individuals. Increasing CO₂-concentrations are also likely to potentially influence the negative health impacts. Ziska and Caulfield (2000) showed that pollen production of *A. artemisiifolia* in a projected 21st century concentration (600 µmol mol⁻¹) increased by 320% compared to pre-industrial levels (280 µmol mol⁻¹).

66 - How important is it that genetic traits of the organism could be carried to native species, modifying their genetic nature and making their economic, environmental or social effects more serious?

very unlikely

Level of confidence: very high

Comments:

There is no *Ambrosia* species native to Britain, and there are furthermore no suggestions in the literature that genetic traits of the species have been carried to native species in its introduced range.

67 - 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 Great Britain?

very likely

Level of confidence: high

Comments:

There is little evidence that existing natural enemies have been effective in controlling *A. artemisiifolia* in its introduced range in Europe. A study in Hungary showed that three native aphid species significantly reduced *A. artemisiifolia* plant development and pollen production in a

greenhouse, however, under field conditions no deleterious effect occurred (Basky and Magyar 2009). Also in Hungary a fungal pathogen (*Phoma* sp. Isolate Ph-17) was recently found and is regarded as the first report of a *Phoma* sp. on *A. artemisiifolia* in Europe with its potential use as a biological control agent currently being investigated (Bohar 2009). Rich (1994) suggests that the fungal pathogen *Sclerotinia sclerotinorum* may affect *A. artemisiifolia* in Britain due to damp climate favouring the pathogen.

68 - How difficult is it likely to be to control the organism in Great Britain?

moderately difficult

Level of confidence: medium

Comments:

EPPO has produced a standard for the control of *A. artemisiifolia* (EPPO 2008) that recommends the implementation of the following measures at the national level: raising awareness, monitoring, regulating, management measures and further research. Given that the species is not currently widespread in the risk assessment area and its status in most locations is rated as 'casual (rarely persisting)' (Preston *et al.* 2002) it seems possible to prevent further spread or even eradication by the implementation of these measures. Raising awareness and regulating management in particular for the introduction pathway (bird seed) could result in cleaner standards of bird seed, early recognition and eradication of plants in gardens preventing further spread. An annual survey may be used to derive a control and eradication strategy. Reported herbicide resistances could make chemical control more difficult. However, the high uncertainty in this judgment comes from the potential facilitating impact climate change may have on the spread and establishment of the species which seems to have been a major reason for the spread of *A. artemisiifolia* in other European countries (Essl *et al.* 2009) and is one area where further research would be necessary

69 - How likely are control measures introduced for this new organism to disrupt existing biological or integrated systems used to control other organisms in Great Britain?

moderately likely

Level of confidence: low

Comments:

An increased usage of herbicides to control *A. artemisiifolia* could have negative effects on existing biological or integrated systems in particular if arable fields would be affected.

70 - How likely is the organism to act as food, a host, a symbiont or a vector for other damaging organisms?

moderately likely

Level of confidence: medium

Comments:

A. artemisiifolia is a host plant for Thrips species transmitting Tomato spotted wilt virus (TSWV), one of the most destructive plant viruses in particular affecting horticultural crops (Parrella *et al.* 2003). In Hungary, *Thrips tabaci* and *Frankliniella occidentalis* have been found in *A. artemisiifolia* populations and have been confirmed as TSWV transmitter under laboratory conditions (Jenser *et al.* 2008).

71 - Indicate any parts of Great Britain where economic, environmental and social impacts are particularly likely to occur (provide as much detail as possible).

The most likely areas to be affected are the southern parts of Britain.

Comments:

The current distribution of mainly casual occurrences may give an indication of where the species may become established and start causing problems. Occurrences in urban areas may be of particular concern because of the possible health effects.

72 - Overall impact rating (please comment on the main reasons for this rating).

major

Level of confidence: medium

Comments:

The main impacts are to be expected for human health and agriculture. To what extent they may occur depends very much on early intervention strategies as well as the impacts of climate change on the species potential to establish and spread.

Conclusion

73 – Conclusion of the risk assessment

high

Level of confidence: medium

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