



Appendix A

Harmonia^{+PL} – procedure for negative impact risk assessment for invasive alien species and potentially invasive alien species in Poland

QUESTIONNAIRE

A0 | Context

Questions from this module identify the assessor and the biological, geographical & social context of the assessment.

a01. Name(s) of the assessor(s):

first name and family name

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acomment01.	Comments:	degree	affiliation	assessment date
	(1)	dr	Department of Botany, Institute of Environmental Biology, University of Wrocław	15-06-2018
	(2)	dr	Department of Botany, Institute of Environmental Biology, University of Wrocław	27-06-2018
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a02. Name(s) of *the species* under assessment:

Polish name: Stokłosa spłaszczona
Latin name: ***Bromus carinatus*** Hook. & Arn.
English name: California brome



acommm02.

Comments:

Bromus carinatus is a member of the section *Ceratochloa* within the genus *Bromus*, sometimes separated as a distinct genus *Ceratochloa*, see Stace 2010). This section includes two groups of similar taxa (Verlove 2012 – P): 1) the *Bromus catharticus* group, with two taxa – *B. catharticus* var. *rupestris* (synonym *B. brevis*) and *B. catharticus* var. *catharticus*; 2) the *Bromus carinatus* group, including: *B. carinatus* var. *marginatus* (synonym *B. marginatus*), *B. carinatus* var. *carinatus*, *B. polyanthus* and *B. sitchensis*. It is a group of species indigenous to North America. In Poland *B. carinatus* is an established species, and *B. catharticus* is locally established. The whole group needs to be investigated in detail, because larger numbers of species may occur and the current classifications may have to be revised. Studies carried out in Lower Silesia suggest that the vast majority of populations are formed of *B. carinatus* (Szczęśniak 2000-2018 – N).

Polish name (synonym I)

Stokłosa tódkowata*

Polish name (synonym II)

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Latin name (synonym I)

Ceratochloa carinata

Latin name (synonym II)

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English name (synonym I)

Mountain brome

English name (synonym II)

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* only in relation to data from before the 1990s. – the effect of incorrect validation; currently this name is not a synonym for *B. carinatus*, but for *B. catharticus*.

a03. Area under assessment:

Poland

acommm03.

Comments:

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a04. Status of the species in Poland. The species is:

- native to Poland
 alien, absent from Poland
 alien, present in Poland only in cultivation or captivity
 alien, present in Poland in the environment, not established
 alien, present in Poland in the environment, established

aconf01.

Answer provided with a

low

medium

high

X

level of confidence

acommm04.

Comments:

Bromus carinatus (actually the *B. carinatus* group) is distributed throughout Poland except in the high mountains (sites have not been reported above the lower mountain forest zone). This species was introduced to cultivation as a meadow grass under the name *Bromus unioloides* in the 1960s (Zajac and Zajac 2015 – P), and for the first time in Poland described as *Bromus carinatus* by Z. Mirek (1982 – P). Today it is found throughout most of Poland (Sowa and Warcholińska 1992 – P). In some areas it is the subject of detailed floristic research and is considered a common species with very numerous sites, which can be seen, for example, in a report on vascular plants of the Gniezno Lake District (Chmiel 1993 – P), Łódź (Witosławski 2006 – P), or in 'Kenofity Karpat i ich przedpola'/Kenophytes of the Carpathians and their foothills, where the highest site of *B. carinatus* was recorded at an altitude of 680 m a.s.l. (Zajac and Zajac 2015 – P).

California brome is usually found in habitats where plant cover is from time to time, but not frequently, disturbed or destroyed: sunny or partially shaded roadsides, home gardens, field margins, unmown lawns, and all kinds of wasteland (Pasierbiński et al. 2005 – P, Szczęśniak 2000-2018 – N). This grass has been also found in meadows, where it is usually quickly eliminated by native species. *B. carinatus* is a light-demanding species and does not invade

forest communities where is limited to the roadsides. Tokarska et al. (2012 – P) classified *B. carinatus* as an established and invasive kenophyte.

a05. The impact of *the species* on major domains. *The species* may have an impact on:

<input checked="" type="checkbox"/>	the environmental domain
<input checked="" type="checkbox"/>	the cultivated plants domain
<input type="checkbox"/>	the domesticated animals domain
<input checked="" type="checkbox"/>	the human domain
<input checked="" type="checkbox"/>	the other domains

acomm05.

Comments:

In disturbed habitats, *Bromus carinatus* is a strongly competitive species. Previous observations have demonstrated that it can form dense patches in which it is an absolute dominant. This indicates that California brome can reduce species diversity in colonized phytocenoses. Importantly, it often affects marginal habitats (field margins, roadsides) in agricultural areas, where such ecosystems are vital sources of food and habitats for invertebrates, birds or small mammals. Less often *B. carinatus* invades arable fields – it has been reported from rape, rye and wheat fields, usually growing in a narrow belt (approx. 1 m, sometimes wider) along field margins or roadsides, occupied by plants derived from a maternal population (Szczęśniak 2000-2018 – N). Changes towards a simplified species composition of plant communities in these habitats, and above all the replacement of species pollinated by insects by anemophilous plants, leads to the depletion of the associated assemblages of insects, and this in turn contributes to the reduction of the food base for vertebrates. Therefore, *B. carinatus* is a species that has a negative impact on ecosystem services provided by marginal habitats in agricultural areas (Rosin et al. 2011 – P). California brome can also affect human health by the production of pollen, which may, like the pollen of other grass species, cause allergies. As a result of competition with plantings, it can have a negative impact on urban greenery.

A1 | Introduction

Questions from this module assess the risk for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation. This leads to *introduction*, defined as the entry of *the organism* to within the limits of *the area* and subsequently into the wild.

a06. The probability for *the species* to expand into Poland’s natural environments, as a result of self-propelled expansion after its earlier introduction outside of the Polish territory is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf02.

Answer provided with a

low	medium	high
		<input checked="" type="checkbox"/>

level of confidence

acomm06.

Comments:

California brome is an already widely distributed plant in Poland and reproduces sexually and asexually. It is an anemophilic plant, but self-pollination by using non-opening flowers (cleistogamy) is also possible (Zajac and Zajac 2015 – P). California brome flowers between the end of May and the beginning of July, but after mowing and the regrowth of the flowering shoots it may repeat flowering until the end of the growing season. Therefore, in Poland the seeds of this species are produced in large quantities – with occasional mowing and at favourable temperatures, up to 4 times per growing season (Szczęśniak 2000-2018 – N). *Bromus carinatus* reproduces asexually via stolons. Lemma awns enable the epizoochoric dispersal of *B. carinatus* seeds (Sutkowska 2013 – P), which means the seeds can attach to animal hair and be transported. Lemma awns also additionally facilitate dispersal by the

wind by increasing the surface area associated with the seeds. California brome grows along roads, and this can also promote the expansion of the species when diaspores are transported by motor vehicles and with rush of air generated by traffic. The species is also established in countries neighbouring Poland (the Czech Republic, Pysek et al. 2002 – P, Germany, e.g. Saxony Hardtke, Ihl 2000 – P), and from there propagules can continuously migrate into Poland.

a07. The probability for *the species* to be introduced into Poland’s natural environments by **unintentional human actions** is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf03.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm07. Comments:
 Considering the type of habitats occupied and the predominant share taken by roadsides and other ruderal habitats, it should be assumed that California brome spreads in anthropochoric way. The seeds are carried by people on clothing, motor vehicles and with removed biomass, and perhaps also on equipment used for mowing. Road transport also contributes to seed dispersal over long distances, e.g. between European countries, and in this way the species can be repeatedly introduced to Poland.

a08. The probability for *the species* to be introduced into Poland’s natural environments by **intentional human actions** is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf04.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm08. Comments:
 California brome has been imported from North America with the seeds of other sown species (Tokarska-Guzik 2003 – P). In some regions this species was sown for fodder (wrongfully named *Bromus unioloides*), but in the long term it was eliminated by native species from meadows. Observations show that it is grazed by goats, though not completely (Szczęśniak 2000-2018 – N). Currently, it is not a popular fodder grass used for establishing or regenerating grasslands, but *B. catharticus*, a species from the large *B. carinatus* group, is advertised for creating environmentally-friendly marginal grassy habitats (Żurek et al. 2013 – P, IOR PIB 2015).

A2 | Establishment

Questions from this module assess the likelihood for *the species* to overcome survival and reproduction barriers. This leads to *establishment*, defined as the growth of a population to sufficient levels such that natural extinction within *the area* becomes highly unlikely.

a09. Poland provides **climate** that is:

<input type="checkbox"/>	non-optimal
<input type="checkbox"/>	sub-optimal
<input checked="" type="checkbox"/>	optimal for establishment of <i>the species</i>

aconf05.	Answer provided with a	low	medium	high X	level of confidence
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acommm09. Comments:
 Considering the distribution of identified sites of *B. carinatus*, it can be assumed that climatic conditions in Poland are favourable for the development of populations of this species. In terms of climate, the area of its occurrence in Poland is similar to the part of its natural distribution area in North America, which also indicates the existence of optimal climatic conditions for this species in Poland – plants are viable, they develop high-quality seeds several times during the growing season and overwinter without damage (Szczęśniak 2000-2018 – N). In the mountains the highest sites of this species have been reported from the lower forest zone (Mirek and Piękoś-Mirkowa 2002, Zajac and Zajac 2015 – P, Szczęśniak 2000-2018 – N), but considering the conditions at which it occurs in its native range, it should be taken into account that the species may eventually colonize areas at higher altitudes (Sutkowska 2013 – P).

a10. Poland provides **habitat** that is

- non-optimal
- sub-optimal
- optimal for establishment of *the species*

aconf06.	Answer provided with a	low	medium	high X	level of confidence
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acommm10. Comments:
 In Poland, *Bromus carinatus* occupies a wide range of habitats, including highly transformed, semi-natural, and natural ones. It is most often reported as an element of synanthropic plant communities in anthropogenic habitats, such as roadsides, trampled areas near human dwellings, and near fences (Kompała and Woźniak 2001, Wołkowycki 2001, Sutkowska and Pasierbiński 2009 – P), field margins (Dajdok and Wuczyński 2008 – P), railway areas (Wrzesień 2005), and ports (Misiewicz 2001), from semi-natural grasslands developed in disturbed habitats (Kompała and Woźniak 2001, Budyś and Dobrzyńska 2004 – P), and river valleys (Wróbel 2015 – P). The diversity of habitats occupied by California brome indicates that there are optimal conditions for its growth in Poland. In addition, a large number of disturbed and eutrophic habitats, including those located at small distances from roads which are currently the main migration routes for *B. carinatus*, promotes the rapid spread of this species after accidental introduction (Szczęśniak 2000-2018 – N).

A3 | Spread

Questions from this module assess the risk of *the species* to overcoming dispersal barriers and (new) environmental barriers within Poland. This would lead to spread, in which vacant patches of suitable habitat become increasingly occupied from (an) already-established population(s) within Poland.

Note that spread is considered to be different from range expansions that stem from new introductions (covered by the Introduction module).

a11. The capacity of *the species* to disperse within Poland by natural means, **with no human assistance**, is:

- very low
- low
- medium
- high
- very high

aconf07.	Answer provided with a	low	medium X	high	level of confidence
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acomm11.

Comments:

Approximation (data type C)

Bromus carinatus is currently at the stage of expansion; it regenerates well after mowing and is resistant to low temperature (Tokarska-Guzik 2003 – P). It produces a large amount of viable seeds that can be dispersed by animals and wind. However, the literature does not provide specific data on the annual distances of dispersal for this species. Therefore, assuming the biology of *B. carinatus* and the rate at which new patches of vegetation with this grass are formed, the capacity of this species to spread without human assistance has been estimated as medium.

a12. The frequency of the dispersal of *the species* within Poland by **human actions** is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf08.

Answer provided with a

low	medium	high	level of confidence
	X		

acomm12.

Comments:

California brome has been imported from North America with seeds of other cultivated species (Tokarska-Guzik 2003 – P). In some regions it was sown for fodder, mistaken for *Bromus unioloides*. In the 1970s growers created and registered the variety 'Una', and in 1988 further efforts of growers led to the creation and registration of the variety 'Broma'. Both varieties are listed by the Polish Research Centre for Cultivar Testing (COBORU). Research carried out by Sutkowska and Pasierbiński (2009 – P) on material gathered from over 50 sites located across Poland showed that most specimens collected represented the 'Broma' variety, especially in samples from field margins and roadsides by fields. The study also revealed that the material collected contained genotypically different specimens of *Bromus carinatus*, which suggests that wild populations of this species in Poland have more than one source of origin (Sutkowska and Pasierbiński 2009 – P). California brome occupies linear and disturbed anthropogenic habitats; moreover today human activity is one of the most important factors facilitating the expansion of this species (Szczęśniak 2000-2018 – N). *Bromus carinatus* is probably still sown as a component of lawn grass mixtures (Tokarska-Guzik 2003 – P), and therefore if we assume that diaspores can be dispersed with human assistance to a distance not shorter than 50 km, there may be more than 10 such cases of dispersal per decade (a high frequency).

A4a | Impact on the environmental domain

Questions from this module qualify the consequences of *the species* on wild animals and plants, habitats and ecosystems.

Impacts are linked to the conservation concern of targets. Native species that are of conservation concern refer to keystone species, protected and/or threatened species. See, for example, Red Lists, protected species lists, or Annex II of the 92/43/EWG Directive. Ecosystems that are of conservation concern refer to natural systems that are the habitat of many threatened species. These include natural forests, dry grasslands, natural rock outcrops, sand dunes, heathlands, peat bogs, marshes, rivers & ponds that have natural banks, and estuaries (Annex I of the 92/43/EWG Directive).

Native species population declines are considered at a local scale: limited decline is considered as a (mere) drop in numbers; severe decline is considered as (near) extinction. Similarly, limited ecosystem change is considered as transient and easily reversible; severe change is considered as persistent and hardly reversible.

a13. The effect of *the species* on native species, through **predation, parasitism or herbivory** is:

<input checked="" type="checkbox"/>	inapplicable
<input type="checkbox"/>	low

<input type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf09.	Answer provided with a	low	medium	high	level of confidence
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acommm13. Comments:
Bromus carinatus is an autotrophic plant and has no effect through predation, parasitism or herbivory.

a14. The effect of *the species* on native species, through **competition** is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf10.	Answer provided with a	low	medium	high	level of confidence
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acommm14. Comments:
 In disturbed habitats, California brome very effectively competes with native taxa, even if the disturbance is slight. During a period of 3-5 years it may displace other species and simplify plant communities (Szczęśniak 2000-2018 – N). This rapid simplification of the colonized patches towards one-species stands suggests potential allelopathic properties of *B. carinatus*. Patches of vegetation with *Bromus carinatus* (classified as association *Convolvulo-Brometum carinati* Kintzel 1997) are among those plant communities inhibiting the succession of trees and shrubs (Ziarnek 2009 – P). *Bromus carinatus* may affect species of special concern such as rare and endangered segetal weeds (e.g. Anioł-Kwiatkowska and Szczęśniak 2011 – P). Some of them, e.g. the forking larkspur *Consolida regalis*, occupy roadsides, field margins or balks. In many areas, these potential habitats for rare weed species are colonized by *Bromus carinatus*. Therefore, the effect of *B. carinatus* on the populations of species of special concern through competition was scored high.

a15. The effect of *the species* on native species, through **interbreeding** is:

<input checked="" type="checkbox"/>	no / very low
<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf11.	Answer provided with a	low	medium	high	level of confidence
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acommm15. Comments:
 Currently available publications do not provide conclusive evidence on the interbreeding of *Bromus carinatus* with native species.

a16. The effect of *the species* on native species by **hosting pathogens or parasites** that are harmful to them is:

<input type="checkbox"/>	very low
<input type="checkbox"/>	low
<input checked="" type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf12.	Answer provided with a	low	medium	high	level of confidence
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acommm16.

Comments:

Bromus carinatus is attacked by typical pathogens infesting native grass species, e.g. rusts and viruses (including barley yellow dwarf virus, transmitted by aphids; Seabloom et al. 2013 – P). Large plots dominated by California brome could be places more optimal for pathogen multiplication than pre-existing communities with a significant contribution of dicotyledonous species. Due to a lack of research and published information we assumed that in the case of *B. carinatus*, at least the following criterion of the *Harmonia*^{PL} procedure is fulfilled: *The species is a host or vector of at least one pathogen/parasite that infects native species that do not belong to special care species and causes the smallest decreases in their population size.* Therefore, the influence of *B. carinatus* on native species by transferring pathogens or parasites has been assessed as medium.

a17. The effect of *the species* on ecosystem integrity, by **affecting its abiotic properties** is:

<input checked="" type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high

aconf13.

Answer provided with a

low	medium	high	level of confidence
	X		

acommm17.

Comments:

Considering the facts of the biology and ecology of *B. carinatus*, it is difficult to specify any significant impact of this species on abiotic properties.

a18. The effect of *the species* on ecosystem integrity, by **affecting its biotic properties** is:

<input type="checkbox"/>	low
<input type="checkbox"/>	medium
<input checked="" type="checkbox"/>	high

aconf14.

Answer provided with a

low	medium	high	level of confidence
	X		

acommm18.

Comments:

California brome is a grass persisting on sites once they have been colonized for at least dozens of years (cases reported from Lower Silesia – Dajdok 2000-2018 – N). Due to its strong competitive potential and tendency to form one-species patches, the species eliminates native plant taxa and, indirectly, the animals associated with them. This includes insects (for example *B. carinatus* is an anemophilic plant and strongly limits the food base for pollinators) and vertebrates, causing a significant loss of biodiversity (Szczęśniak 2000-2018 – N). Therefore, assuming that *B. carinatus* reduces populations of species including some of special concern, the negative effect of the species on the biotic properties of the ecosystem has been scored high, however, the reversibility of these changes requires research.

A4b | Impact on the cultivated plants domain

Questions from this module qualify the consequences of *the species* for cultivated plants (e.g. crops, pastures, horticultural stock).

For the questions from this module, consequence is considered ‘low’ when presence of *the species* in (or on) a population of target plants is sporadic and/or causes little damage. Harm is considered ‘medium’ when *the organism’s* development causes local yield (or plant) losses below 20%, and ‘high’ when losses range >20%.

a19. The effect of *the species* on cultivated plant targets through **herbivory or parasitism** is:

<input type="checkbox"/>	inapplicable
<input checked="" type="checkbox"/>	very low

- low
- medium
- high
- very high

aconf15.	Answer provided with a	low	medium	high X	level of confidence
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acomm19.

Comments:
Bromus carinatus is an autotrophic photosynthesizing grass and does not show such effects.

a20. The effect of *the species* on cultivated plant targets through **competition** is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf16.	Answer provided with a	low	medium X	high	level of confidence
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acomm20.

Comments:
California brome is known from plant communities directly adjacent to arable fields (Dajdok and Wuczyński 2008 – P, Szczęśniak 2000-2018 – N), but also from marginal parts of fields, which it usually penetrates in a 1-5 m-wide belt near a field margin or roadside colonized by the maternal population. It competes with cereals and maize (as a grass it is not eliminated by the herbicides used for the protection of these crops). So far no crop field dominated by this species has been reported (Szczęśniak 2000-2018 – N), but because of its competitive properties *B. carinatus* can cause yield loss. The scale of yield loss still needs to be investigated. The impact of *B. carinatus* on meadow communities is similar, although they are less frequently colonized by this species, but this has been reported, e.g. from Upper Silesia (Kampała-Bąba and Woźniak 2001 – P) and the Kashubian Coast (Budyś and Dobrzyńska 2004 – P). However, the scale of the species' impact on the quantity and/or quality of the produced fodder is unknown; long-term observations have also demonstrated that *B. carinatus* is eliminated within a few years from the meadow sward by more competitive native species (Szczęśniak 2000-2018 – N). Undoubtedly, *B. carinatus* also has a negative effect on lawns established in places subject to rare disturbances and too rarely mowed – this species can gain completely control in such situations and eliminate the grass species deliberately introduced there. (Szczęśniak 2000-2018 – N). Due to the lack of detailed data on the species' impact itself, and the scope of the species impact concerns various types of crops, taking into account the evaluation criteria included in the *Harmonia*^{+PL} procedure, it has been presumed that this impact will apply from about 1/3 to 2/3 crops which are the object of invasion (medium probability), and that the condition of the stand of the cultivated plants can be reduced in the range of about 5% to 20% (medium effect), which results in assessing the impact of the species on crops through competition at the medium level.

a21. The effect of *the species* on cultivated plant targets through **interbreeding** with related species, including the plants themselves is:

- inapplicable
- no / very low
- low
- medium
- high
- very high

aconf17.	Answer provided with a	low	medium X	high	level of confidence
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acomm21. Comments:
In Poland, some species of the genus *Bromus* may have useful value (including *Bromus inermis*), however, despite the long-term presence of *B. carinatus* in Poland, no cross-fertilization has been observed and no hybrids have been described. Consequently, it is difficult to conclusively assess the effects of the direct and indirect interbreeding of the species with cultivated plant species. Therefore, at the present stage of evaluation, the degree of the effect of *B. carinatus* from its interbreeding with related species has been defined as irrelevant (none or very small), with an average degree of certainty.

a22. The effect of *the species* on cultivated plant targets by **affecting the cultivation system's integrity** is:

- very low
- low
- medium
- high
- very high

aconf18.	Answer provided with a	low	medium	high X	level of confidence
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acomm22. Comments:
Considering the current impact of *B. carinatus* on cultivated plant targets and meadow communities, it should be concluded that this impact is not significant enough to disturb the cultivation system's integrity – the species only occurs on field margins, and populations are not usually abundant (Szczęśniak 2000-2018 – N). Taking into account the species assessment criteria specified in the *Harmonia*^{+PL} procedure, the assumption has been made that this impact will concern from about 1/3 to 2/3 of crops of plants being invaded (medium probability), and the condition of cultivated plants or yield can be reduced by less than 5% (low effect), which results in the assessment of the species' impact on crops by disturbing their integrity to be at a low level.

a23. The effect of *the species* on cultivated plant targets by hosting **pathogens or parasites** that are harmful to them is:

- very low
- low
- medium
- high
- very high

aconf19.	Answer provided with a	low	medium X	high	level of confidence
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acomm23. Comments:
California brome is attacked by the typical pathogens infesting native grass species, e.g. rusts and viruses, including barley yellow dwarf virus (BYDV), transmitted by aphids (Seabloom et al. 2013 – P). Large and single-species stands of *B. carinatus* could be convenient places for pathogens to multiply. However, as the known pathogens of the species do not appear on the EPPO lists, according to the *Harmonia*^{+PL} assessment procedure, the influence of the species on crops due to the fact that it is a host or vector of pathogens and parasites harmful to these plants was considered to be small.

A4c | Impact on the domesticated animals domain

Questions from this module qualify the consequences of *the organism* on domesticated animals (e.g. production animals, companion animals). It deals with both the well-being of individual animals and the productivity of animal populations.

a24. The effect of *the species* on individual animal health or animal production, through **predation or parasitism** is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf20. Answer provided with a

low	medium	high
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 level of confidence

acomm24. Comments:
Bromus carinatus is an autotrophic photosynthesizing grass and does not show such effects.

a25. The effect of *the species* on individual animal health or animal production, by having properties that are hazardous upon **contact**, is:

- very low
- low
- medium
- high
- very high

aconf21. Answer provided with a

low	medium	high X
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 level of confidence

acomm25. Comments:
Bromus carinatus has no properties that could produce negative effects on individual animal health or animal production upon direct contact with the plant.

a26. The effect of *the species* on individual animal health or animal production, by hosting **pathogens or parasites** that are harmful to them, is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf22. Answer provided with a

low	medium	high X
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 level of confidence

acomm26. Comments:
Bromus carinatus does not transmit pathogens or parasites harmful to animals.

A4d | Impact on the human domain

Questions from this module qualify the consequences of *the organism* on humans. It deals with human health, being defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (definition adopted from the World Health Organization).

a27. The effect of *the species* on human health through **parasitism** is:

- inapplicable
- very low
- low
- medium
- high
- vert high

aconf23. Answer provided with a

low	medium	high
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 level of confidence

acomm27. Comments:
Bromus carinatus is an autotrophic plant and does not show such effects.

a28. The effect of *the species* on human health, by having properties that are hazardous upon **contact**, is:

- very low
- low
- medium
- high
- very high

aconf24. Answer provided with a

low	medium X	high
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 level of confidence

acomm28. Comments:
Bromus carinatus does not have chemical or physical properties that are harmful to humans upon contact, but like all grasses it produces large amounts of pollen, which can cause an allergic reaction in sensitive people. Among pollen that causes allergies it is difficult to identify the specific grass species that produce this allergenic pollen, therefore at the present stage of the assessment of the impact of *B. carinatus* it is not possible to determine its role in triggering allergies. Therefore, using the *Harmonia*^{+PL} assessment procedure, the impact of the species in this respect has been defined as medium, taking into account the average level of incidence (probability of this impact – i.e. 1-100 cases per 100,000 people per year), as well as its effects (i.e. medical examinations are frequent, the disease causes 1-5 days absence at work, permanent health losses are rare, average stress levels).

a29. The effect of *the species* on human health, by hosting **pathogens or parasites** that are harmful to humans, is:

- inapplicable
- very low
- low
- medium
- high
- very high

aconf25. Answer provided with a

low	medium	high
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 level of confidence

acomm29. Comments:
The species does not transmit any pathogens harmful to humans.

A4e | Impact on other domains

Questions from this module qualify the consequences of *the species* on targets not considered in modules A4a-d.

a30. The effect of *the species* on causing damage to **infrastructure** is:

<input type="checkbox"/>	very low
<input checked="" type="checkbox"/>	low
<input type="checkbox"/>	medium
<input type="checkbox"/>	high
<input type="checkbox"/>	very high

aconf26.	Answer provided with a	low	medium	high	level of confidence
			X		

acommm30. Comments:
 So far, there are no estimates regarding measurable losses caused by *B. carinatus* on broadly connected infrastructure, however, it can be assumed that as a result of the effective spread of the species on rarely mowed lawns and (rarely) in plantings of ornamental perennials in public greenery, the species may generate additional expenses in keeping the relevant infrastructure in good condition. This situation can be exacerbated by the high fertility of the species and its ability to regenerate quickly after mowing. Taking into account the criteria of the *Harmonia*^{+PL} procedure, it has been assumed that the probability of this impact is medium and at the same time completely reversible. As a result, the overall impact of the species on infrastructure has been defined as low.

A5a | Impact on ecosystem services

Questions from this module qualify the consequences of *the organism* on ecosystem services. Ecosystem services are classified according to the Common International Classification of Ecosystem Services, which also includes many examples (CICES Version 4.3). Note that the answers to these questions are not used in the calculation of the overall risk score (which deals with ecosystems in a different way), but can be considered when decisions are made about management of *the species*.

a31. The effect of *the species* on **provisioning services** is:

<input type="checkbox"/>	significantly negative
<input checked="" type="checkbox"/>	moderately negative
<input type="checkbox"/>	neutral
<input type="checkbox"/>	moderately positive
<input type="checkbox"/>	significantly positive

aconf27.	Answer provided with a	low	medium	high	level of confidence
				X	

acommm31. Comments:
 On field margins and roadsides *Bromus carinatus* eliminates plant species that are useful to pollinating insects, dramatically reducing their food base, which reduces their population; this effect may also occur with respect to cultivated plants pollinated by insects, because pollination may be less effective and yield may be lower.

a32. The effect of *the species* on **regulation and maintenance services** is:

<input type="checkbox"/>	significantly negative
<input checked="" type="checkbox"/>	moderately negative
<input type="checkbox"/>	neutral
<input type="checkbox"/>	moderately positive
<input type="checkbox"/>	significantly positive

aconf28.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm32.

Comments:

The types of habitats usually occupied by *Bromus carinatus* suggest that the patches of vegetation formed by this species do not differ significantly in their impact on regulation services from the patches which they have replaced (and which were formed by the displaced species). However, taking into account the assessment relating to question a31, regarding the indirect impact of *Bromus carinatus* on the local richness of pollinators, in this respect the species' influence will be moderately negative. Depending on the area of the habitats under impact, the range of this effect may vary. However, it can be assumed that in most cases it will be at least moderately negative.

a33. The effect of *the species* on **cultural services** is:

- significantly negative
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf29.

Answer provided with a

low	medium	high
		X

level of confidence

acomm33.

Comments:

Bromus carinatus is one of the species whose communities inhibit further succession (Ziarnek 2009 – P), preventing the formation of the shrub and tree layer on long-term wasteland, thus creating an obstacle to the improvement of the microclimate, as well as to the aesthetic and recreational quality of urban open spaces. In addition, simplification of field margins and roadsides towards a monoculture causes a decline in the flowering plants and insects and birds associated with them, which significantly reduces the aesthetic value of the agricultural landscape.

A5b | Effect of climate change on the risk assessment of the negative impact of the species

Below, each of the Harmonia^{+PL} modules is revisited under the premise of the future climate. The proposed time horizon is the mid-21st century. We suggest taking into account the reports of the Intergovernmental Panel on Climate Change. Specifically, the expected changes in atmospheric variables listed in its 2013 report on the physical science basis may be used for this purpose. The global temperature is expected to rise by 1 to 2°C by 2046-2065.

Note that the answers to these questions are not used in the calculation of the overall risk score, but can be but can be considered when decisions are made about management of *the species*.

a34. INTRODUCTION – Due to climate change, the probability for *the species* to overcome geographical barriers and – if applicable – subsequent barriers of captivity or cultivation in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf30.

Answer provided with a

low	medium	high
	X	

level of confidence

acomm34.

Comments:

The area occupied by *B. carinatus* in the current climate seems to indicate that climatic factors would not play a significant role in overcoming barriers related to the cultivation of this species in Poland.

a35. ESTABLISHMENT – Due to climate change, the probability for *the species* to overcome barriers that have prevented its survival and reproduction in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf31. Answer provided with a

low	medium X	high
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 level of confidence

acomm35. Comments:
The establishment status of *B. carinatus* in the current climate seems to indicate that climatic factors do not play a significant role in overcoming barriers that have prevented its survival and reproduction in Poland.

a36. SPREAD – Due to climate change, the probability for *the species* to overcome barriers that have prevented its spread in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf32. Answer provided with a

low	medium X	high
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 level of confidence

acomm36. Comments:
The current distribution of *B. carinatus* in Poland indicates that in most regions of the country there are no barriers preventing the spread of this species. The expected climate change is unlikely to change this situation in lowland areas, but the range of *B. carinatus* may increase in mountain areas, where it is likely that it will begin to colonize sites at higher elevations (Sutkowska 2013 – P).

a37. IMPACT ON THE ENVIRONMENTAL DOMAIN – Due to climate change, the consequences of *the species* on wild animals and plants, habitats and ecosystems in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf33. Answer provided with a

low	medium X	high
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 level of confidence

acomm37. Comments:
Assuming a future increase in the number of sites and acreage of *B. carinatus*, it should be concluded that the negative effect of this species on the environmental domain will also increase. In the lowlands, however, this will not be a direct result of climate change, because the current climate of this region perfectly meets the requirements of *B. carinatus*, but rather the effect of the growing spread of the species in the territory of Poland. On the other hand, assuming the possibility of extending the range of altitude by this species, it is possible to assume an increase in its impact on the natural environment of the mountain areas.

a38. IMPACT ON THE CULTIVATED PLANTS DOMAIN – Due to climate change, the consequences of *the species* on cultivated plants and plant domain in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf34. Answer provided with a

low	medium X	high
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 level of confidence

acomm38. Comments:
It is difficult to determine the current negative impact on cultivated plants – *B. carinatus* occupies field margins and it is occasionally found in meadow communities, where to some extent it can compete with cultivated species or those important from an economic point of view, but it is difficult to estimate the real economic loss associated with this. Forecasted climatic changes may weaken the species' competitive opportunities in areas with prolonged periods of higher than current temperatures that may cause a water deficit locally, but observations from dry years 2015 and 2018 (Szczęśniak 2000-2018 – N) indicate that the species is quite resistant under such conditions.

a39. IMPACT ON THE DOMESTICATED ANIMALS DOMAIN – Due to climate change, the consequences of *the species* on domesticated animals and animal production in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf35. Answer provided with a

low	medium	high X
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 level of confidence

acomm39. Comments:
No negative impact of *B. carinatus* on animal production has been reported – it is assumed that this will not change as a result of expected climate change.

a40. IMPACT ON THE HUMAN DOMAIN – Due to climate change, the consequences of *the species* on human in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf36. Answer provided with a

low	medium X	high
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 level of confidence

acomm40. Comments:
Currently, *Bromus carinatus* most likely affects humans because it produces pollen that may cause allergies in sensitive people. Predicted climatic changes are unlikely to be a major factor in the increase of the species population on the Polish lowlands. On the other hand, assuming that the range of the species can be widened in the mountain areas as a result of the climate change, it is also possible to assume an increase in its impact on people, not only in the mountains, but also beyond as a result of long-distance pollen transport.

a41. IMPACT ON OTHER DOMAINS – Due to climate change, the consequences of *the species* on other domains in Poland will:

- decrease significantly
- decrease moderately
- not change
- increase moderately
- increase significantly

aconf37. Answer provided with a

low	medium	high
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 level of confidence

acomm41. Comments:
 At present, there are very numerous sites of *B. carinatus* and large areas covered by its populations in some regions of Poland, but no significant impact of this grass on infrastructure has been reported. This impact may increase over time; however, most likely it will be the result of the species spreading from the locations already occupied, and not the result of climate change.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.75	0.50
Environmental impact (questions: a13-a18)	0.50	0.70
Cultivated plants impact (questions: a19-a23)	0.20	0.70
Domesticated animals impact (questions: a24-a26)	0.00	1.00
Human impact (questions: a27-a29)	0.50	0.50
Other impact (questions: a30)	0.25	0.50
Invasion (questions: a06-a12)	0.92	0.83
Impact (questions: a13-a30)	0.50	0.68
Overall risk score	0.46	
Category of invasiveness	potentially invasive alien species	

A6 | Comments

This assessment is based on information available at the time of its completion. It has to be taken into account. However, that biological invasions are, by definition, very dynamic and unpredictable. This unpredictability includes assessing the consequences of introductions of new alien species and detecting their negative impact. As a result, the assessment of the species may change in time. For this reason it is recommended that it regularly repeated.

acomm42. Comments:
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