



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

1. Dan Wołkowycki
2. Damian Chmura
3. Bogdan Jackowiak

acomment01.	Comments:	degree	affiliation	assessment date
		(1) dr	Faculty of Forestry, Białystok University of Technology	01-02-2018
		(2) dr hab.	Institute of Environmental Protection and Engineering, University of Bielsko-Biala	21-01-2018
		(3) prof. dr hab.	Department of Plant Taxonomy, Institute of Environmental Biology, Faculty of Biology, Adam Mickiewicz University in Poznań	03-02-2018

a02. Name(s) of *the species* under assessment:

Polish name: –

Latin name: ***Microstegium vimineum*** (Trin.) A. Camus

English name: Japanese stiltgrass

acommm02.

Comments:

The full name of the species is *Microstegium vimineum* (Trin.) A. Camus. There are 31 synonyms in the literature, e.g. *Andropogon vimineus* Trin. 1832, *Arthraxon lanceolatus* Miq. 1866, *Arthraxon nodosus* Kom. 1901, *Eulalia cantonensis* (Rendle) Hitchcock 1929 [1931]. *Pollinia cantonensis* Rendle 1904. The remaining ones are other names from the genera mentioned above. There is no Polish name for the plant due to the fact that the species is not noted in Poland. The English name is Nepalese browntop or Japanese stiltgrass. The most common scientific name is *Microstegium vimineum* (CABI 2017 – B).

Polish name (synonym I)

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Polish name (synonym II)

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Latin name (synonym I)

Andropogon vimineus

Latin name (synonym II)

Arthraxon lanceolatus

English name (synonym I)

Nepalese browntop

English name (synonym II)

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a03. Area under assessment:

Poland

acommm03.

Comments:

–

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:

The species does not occur in Poland in the wild nor in cultivation. Information about stands in Poland is missing in published sources, as well as databases and websites. It does not appear in any of the EU countries.

The original range of *Microstegium vimineum* includes China, Korea, Japan, far eastern regions of Russia, north-east India, Nepal, Vietnam, Philippines, Malaysia, Myanmar (Burma), Thailand and Iran (CABI 2017 – B). The species was dragged to Turkey, Georgia, Armenia, Azerbaijan and the regions of Russia around the globe (EPPO 2014, 2015 – B). It occupied the most of the eastern US regions. First localities in North America were reported in 1919 in Tennessee (where parts of the plant with seeds arrived as a packaging material for ceramics), from where it quickly spread to the northeast, reaching New England in the 1980s, Connecticut in 1984, Massachusetts in 1998, and Rhode Island in 2005. Currently, the species is found in 26 US states, including commonly in the States of Tennessee, Kentucky, Virginia, North and South Carolina, Mississippi, Alabama, Georgia, Indiana, Pennsylvania, New York, less often in other regions of the eastern part of the country. The expansion of the species in the USA continues. It is one of the most dangerous invasive plants (CABI 2017 – B, EDDMapS 2018, Invasive.org 2018 – I).

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

the environmental domain

the cultivated plants domain

- the domesticated animals domain
- the human domain
- the other domains

acom05.

Comments:

Within the primary range, the species occurs in forest edges and in grasslands in moist habitats (Chen and Phillips 2018 – P). In areas of secondary occurrence, the species spreads to natural, semi-natural and anthropogenic habitats, such as forests, wetlands in river valleys, meadows, roadside areas and others. The species competes with many plants and affects various types of habitats, including forests and wetlands. It also appears as a weed on plantations, in gardens and on lawns (EPPO 2014, 2015, CABI 2017 – B).

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:

- low
- medium
- high

aconf02.

Answer provided with a

low	medium	high
	X	

level of confidence

acom06.

Comments:

The species does not exist in countries bordering Poland. It is closest to Poland in Turkey and the Caucasus. It has a status of an alien, established species in those regions (EPPO 2014 – B). The probability of originating from there spontaneously is minimal. It is an annual plant with seeds lacking special adaptations to long-distance dispersion. It spreads baro-, hydro-, zoo- and anthropochorically, meaning by seeds falling under gravity, transferred by water, animals, directly by humans (e.g. on clothing and footwear), as well as through transport of various materials and products (Anderson et al. 2013 – P, CABI 2017 – B).

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

- low
- medium
- high

aconf03.

Answer provided with a

low	medium	high
	X	

level of confidence

acom07.

Comments:

There are many vectors thanks to which the species can arrive in the territory of Poland. The seeds of the plant are brought accidentally, mainly with different types of organic materials: along with gardening soil, materials used in gardening, with feed for birds, materials used for packaging (including agricultural produce and ceramics), along with railway and vehicle traffic, transport of machines, on footwear and clothing (EPPO 2014, 2015 – B). The likelihood of introducing a species will increase with the intensification of goods exchange with China, especially through railway transport, the development of which along with the construction of a logistics node providing services the Far East is planned in Poland. The accidental insertion of seeds by vehicle traffic seems, however,

unlikely at such a large distance. Seeds of the species end up in the UK with bird feed, yet so far it has not been found in the wild. The dynamic expansion of the genre in the USA, lasting until the present times in climatic zones analogous to the conditions prevailing in Poland began with the introduction of plant seeds in ceramic packaging materials in 1919 (EPPO 2014, 2015 – B).

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

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

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

acomm08. Comments:
 The species is not deliberately planted as an ornamental plant, pasture plant, etc., including within the natural range. It is also absent in botanical gardens. It is not used to counteract erosion (EPPO 2014 – B). It is not an energy plant nor is it used in phytoremediation. Overcoming geographical barriers and the expansion of the species outside the original range starts only as a result of unintentional human activities, bringing the seeds accidentally.

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

aconf05.	Answer provided with a	low	medium	high	level of confidence
			X		

acomm09. Comments:
 The species is found in temperate areas, including e.g. in temperate transitional and warm climate zones, in terms of the continental variety. The lowest recorded Winter temperatures for the *M. vimineum* seed bank are approx. -21°C to -23°C, and therefore correspond to the 6b frost resistance zone (according to USDA), covering a significant part of northern, central and western Poland; some data indicate its presence in conditions corresponding to zone 5. The species prefers sunny, moist places. It demonstrates worse performance in shade. In areas of secondary occurrence in the east part of the USA, *M. vimineum* spreads in eco climatic conditions similar to those prevailing in Poland (EPPO 2014, 2015, CABI 2017 – B). Individual sites within the primary range (China) and many stands within the secondary range (USA) are characterized by high, and therefore optimal values of climatic similarity to Poland (within 94-100%). There are also beneficial places – similarity range of 45-94%, e.g. secondary localities found in Turkey which are the nearest to Poland. A large part of the species' stands within the native range falls within the range of 0-45% of the climatic similarity. These are the regions of south-east Asia (southern China, Indochina Peninsula, India, Indonesia).

a10. Poland provides **habitat** that is

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

aconf06.	Answer provided with a	low	medium X	high	level of confidence
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acomm10.	Comments: <i>Microstegium vimineum</i> is characterized by a wide ecological-habitat amplitude. It prefers well-moistened soils and sites from well-sunlit to semi-shady stands. The species colonizes the riverside habitats, riparian forests, thickets, forest edges, damp fields, economic forests, forest plantations, roadside ditches, and other types of habitats. Similar habitats occur in Poland. Such a variety of habitats, including semi-natural, slightly changed by humans, this species effectively controls spreading in the eastern part of the USA, in ecoclimatic conditions similar to those occurring in Poland (EPPO 2014, CABI 2017 – B). Despite the fact that in Poland the conditions for species establishment are theoretically met, having considered the absence of the species in Europe, lack of knowledge on all conditions, e.g. mycorrhizal relationships, potential species interactions with European plants, the habitat conditions cannot be considered as optimal.
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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:

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

aconf07.	Answer provided with a	low	medium X	high	level of confidence
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acomm11.	Comments: Estimation (data type C) – in areas inhabited by the species, it spreads spontaneously at a rapid pace, without human participation, creating extensive, compact clusters over short time. An effective generative reproduction contributes to this. One shoot produces 100-1000 seeds/year, and plant clusters of 0.1-4 million seeds/m ² . The fruits and seeds of the plant can be transmitted by water currents, floods, water flooding. Transmission by animals was found in secondary range, e.g. by deer (Anderson et al. 2013 – P, EPPO 2014, 2015 – B). Currently, the species does not occur in Poland. Assuming, however, that it will appear in this country, rapid spontaneous spread is highly probable, as demonstrated by the history of explosive expansion in the USA, in habitat and climate conditions similar to those prevailing in Poland.
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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 X	high
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 level of confidence

acomment12. Comments:
Microstegium vimineum effectively spreads with human participation in the areas to which it has been brought. At the moment, the species does not occur in Poland. Assuming that there will be initial outbreaks of expansion in the territory of Poland, further species spread with human involvement is highly likely due to the seed movement. They can stick to clothes, shoes, car tires, agricultural and forestry machinery and other equipment. In addition, by acting through disturbances, man creates habitats and conditions favoring the spread and the establishment of the species. Disturbances such as mowing, fertilization, irrigation, fires, and logging favor the expansion of *M. vimineum* (EPPO 2014, CABI 2017 – B). Recent reports point to road transport as the main factor favoring its spread (Rauschert et al. 2017 – P).

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/EEG 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/EEG 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:

inapplicable
 low
 medium
 high

aconf09. Answer provided with a

low	medium	high
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 level of confidence

acomment13. Comments:
 It is not a parasitic plant.

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

low
 medium
 high

aconf10. Answer provided with a

low	medium X	high
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 level of confidence

acomment14. Comments:
 In areas of secondary occurrence, *Microstegium vimineum* forms surface-extensive clusters over short time, effectively eliminating the majority of native species. In the patches of communities dominated by this species, there is a decline in diversity and biomass of native flora representatives. The mass occurrence of *M. vimineum* in the forest groundcover limits the recruitment and survival of tree seedlings (EPPO 2014, 2015, CABI

2018 – B). The leaves of the species present allelopathic properties, as demonstrated by experiments, and they may cause dying of tree seedlings. In addition, there was an observed decrease in the number of arthropod species as well as the number of their populations (EPPO 2014, CABI 2017 – B). The species also causes unfavorable changes in the soil microbial flora (Craig et al. 2017, Cunard et al. 2017 – P).

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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acomm15. Comments:
In the native flora, there are no species of this genus or other closely related species with which hybridization could occur. In addition, *M. vimineum* hybridizing with other plants in the secondary range was not observed.

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 checked="" type="checkbox"/>	low
<input 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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acomm16. Comments:
Available data indicate the presence of about 15 pathogens on *Microstegium vimineum*, including fungal pathogens of the *Bipolaris*, *Cochliobolus*, *Curvularia*, and *Phyllachora* genera which, however, are often common, and in many cases demonstrate narrow specialization, therefore it is unlikely that the expansion of the species will increase risk of native plant infestation (Flory et al. 2011, Kleczewski et al. 2012, Bruckart et al. 2014 – P, EPPO 2014, 2015 – B, Huang et al. 2017 – P). None of the pathogens has been classified as the most dangerous pests by the European and Mediterranean Plant Protection Organization (EPPO 2014, 2015 – B) and the most dangerous diseases by the World Organization for Animal Health (Najberek, in preparation – N).

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

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

aconf13.	Answer provided with a	low	medium	high	level of confidence
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acomm17. Comments:
The mass occurrence of the species may adversely affect ecosystem processes, such as the nitrogen and carbon cycle, and the decomposition of organic matter (EPPO 2014, 2015, CABI 2017 – B and literature cited therein). However, there is no data to assess the extent and intensity of this type of disturbance, which could possibly cause the species in ecosystems occurring in Poland.

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 X	high	level of confidence
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acomm18. Comments:
In the patches of communities dominated by this species, there is a decline in diversity and biomass of native flora representatives. The massive occurrence of *M. vimineum* in the forest groundcover limits the recruitment of tree seedlings, as well as the growth of older trees. It also reduces diversity and density in arthropod species, and this reduces the number of predators (birds) feeding on arthropods (EPPO 2014, 2015, CABI 2017 – B and literature cited therein).

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

aconf15.	Answer provided with a	low	medium	high X	level of confidence
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acomm19. Comments:
This is not a species of a parasitic plant.

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

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

aconf16.	Answer provided with a	low	medium X	high	level of confidence
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acomm20. Comments:
The species occurs in gardens and plantations. However, there is no known information about its massive development in this type of habitats, and its nuisance as a weed and the costs of its eradication are assessed as low (EPPO 2014, 2015, CABI 2017 – B).

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	high X
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 level of confidence

acomm21. Comments:
Among the plants cultivated in Poland and in other European countries, there are no species which would phylogenetically close to the *M. vimineum*, with possibility of hybridization.

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 X	high
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 level of confidence

acomm22. Comments:
Within the areas of secondary occurrence, the species does not grow massively on arable lands. Changes on a larger scale are not observed. There is no information confirming the disruption of crop integrity caused by it.

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
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 level of confidence

acomm23. Comments:
The available data indicate the presence on *Microstegium vimineum* fungal pathogens of the *Bipolaris*, *Cochliobolus*, *Curvularia*, *Phyllachora* genera, which are often common and in many cases are narrowly specialized, therefore the expansion of the species is unlikely to increase the risk of crop infestation. The observed pathogens are mostly not the most dangerous. Only *Cochliobolus heterostrophus* (= *Bipolaris maydis*) found on *M. vimineum* is one of the dangerous maize pathogens (Flory et al. 2011, Kleczewski et al. 2012, Bruckart et al. 2014 – P, EPPO 2014, 2015 – B, Huang et al. 2017 – P).

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:
The species is not a parasitic plant.

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:
The species has no toxic properties. There are no published studies showing the possible effect on breeding animals.

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
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 level of confidence

acomm26. Comments:
The species does not participate, as an indirect host, in the life cycles of pathogens and animal parasites in any way.

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:

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

aconf23.	Answer provided with a	low	medium	high	level of confidence
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acomm27.	Comments: The species is a plant and it is not a parasite.
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a28. The effect of *the species* on human health, by having properties that are hazardous upon **contact**, is:

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

aconf24.	Answer provided with a	low	medium	high	level of confidence
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acomm28.	Comments: The allergenic or toxic properties of this plant are unknown. No data on the negative effect on human health.
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a29. The effect of *the species* on human health, by hosting **pathogens or parasites** that are harmful to humans, is:

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

aconf25.	Answer provided with a	low	medium	high	level of confidence
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acomm29.	Comments: This species does not carry parasites and pathogens that harm humans.
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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 checked="" type="checkbox"/>	very low
<input type="checkbox"/>	low

- medium
- high
- very high

aconf26. Answer provided with a

low	medium	high X
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 level of confidence

acomm30. Comments:
There are no known negative effects of the species on infrastructure objects.

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:

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

aconf27. Answer provided with a

low	medium X	high
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 level of confidence

acomm31. Comments:
Micostegium vimineum does not interbreed with native or cultivated plant species present in Poland.
The species occurs in gardens and plantations. It is also believed that it can limit the growth of mushrooms in places where they are grown. However, there is no known information about its massive development in field and garden habitats or indications that it disturbs the integrity of crops. Its nuisance as a weed and the costs of combating it are assessed as low (EPPO 2014, 2015, CABI 2017 – B). The presence of *Cochliobolus heterostrophus* (= *Bipolaris maydis*) parasitic fungus, one of dangerous maize pathogens, was found on the plants (EPPO 2014, 2015 – B).
The species is not a parasitic plant. It does not participate, as an indirect host, in the life cycles of pathogens and animal parasites in any way. It also has no toxic properties. There are no published studies showing its possible effect on breeding animals. The species causes losses in forestry, making it difficult to regenerate the forest, e.g. by resulting in higher mortality of tree seedlings and undergrowths; it may contribute to the decline in timber production (EPPO 2014 – B).

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

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

aconf28. Answer provided with a

low	medium X	high
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 level of confidence

acomm32.

Comments:

In the patches of plant communities dominated by this species, there is a decline in species diversity and biomass of native flora representatives, forming a herbal layer in forests and in non-forest phytocoenoses. The species has negative effect on soil processes, causing disturbances in the carbon and nitrogen cycle and processes of organic matter decomposition. These effects are related to e.g. decrease in the density and diversification of arthropod fauna living in the bedding and the soil, and demonstrate trophic cascade nature. It competes with species having larger roots, capable of stabilizing the soil, and thus can accelerate soil erosion processes (EPPO 2014, 2015, CABI 2017 – B). However, there is no data to assess the extent and intensity of this type of disturbance, which could possibly cause the species in ecosystems occurring in Poland.

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 X	high
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level of confidence

acomm33.

Comments:

Extensive aggregations of the species, especially in the forest floor, may cause changes in the aesthetic values of the landscape and affect its perception by human. However, it is difficult to assess the nature and scope of such effects as clearly negative. Uniform patches of forest vines controlled by *M. vimineum* can be received neutrally or even positively, due to the more "park" nature.

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 X	high
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level of confidence

acomm34.

Comments:

Climate change should rather not affect the chances of species introduction. The species is found in temperate to warm continental areas. In the areas of secondary occurrence, it

spreads under climatic conditions similar to those currently present in Poland and is characterized by relatively high frost resistance (EPPO 2014, 2015 – B). The species is introduced to new areas only as a result of long-distance transport and by accidentally bringing the seeds. Climate change will not affect the chances of introducing the species, but it will facilitate its establishment (see question a35).

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 study results indicate that it is a plant that is in the best condition in sunny and well-moistened sites. The warming up and increase in climate humidity may lead to an increase in the chances of an effective establishment of the species. However, the species is adapted to the climatic conditions corresponding to the 6b frost resistance zone (according to USDA), covering a significant part of the northern, central and western Poland, it is also present in areas with milder climate. Because of that, even now there are favorable conditions for its establishment in a large part of the country.

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 X	medium	high
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 level of confidence

acomm36. Comments:
Climate warming may be favorable for the invasive properties of the species, already known from other areas in Poland. In such a situation, the chances of species success in the initial stage of invasion could be increased. It would be more effective to spread it all over the country, also in the eastern part, so far characterized by colder winters. After possible introduction, there is a probability (albeit small) that due to global warming the species will be able to spread more effectively in open areas, especially in anthropogenic habitats: in fringe communities, on abandoned lands, roadsides, etc. Climate warming can promote manifestation of invasive properties of the species in Poland – already known from other areas. However, there is no reliable data in this area.

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 X	medium	high
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 level of confidence

acommm37. Comments:
There is no data on this subject. The species does not exist in Europe, therefore it is difficult to predict potential changes in its impact on the natural environment at this stage. One can only assume that climate warming could increase the competitiveness of the species to a certain extent relative to native plants throughout the country, also in its eastern part, where suboptimal climatic conditions are currently present.

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	high X
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 level of confidence

acommm38. Comments:
The species is absent in Europe and it is difficult to predict at this stage the potential changes in its effect on plant cultivation along with global warming. However, within the areas of secondary range, the species does not grow massively on arable lands.

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

acommm39. Comments:
The species does not affect animal breeding.

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	high X
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 level of confidence

acommm40. Comments:
No effect of the species on people, especially on human health, is recorded.

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 X
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 level of confidence

acomm41. Comments:
The species does not exert effect on infrastructure objects. Lack of sufficient data to assess the effect of climate change on the negative effect of the species on other objects.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.17	0.67
Establishment (questions: a09-a10)	0.50	0.50
Spread (questions: a11-a12)	0.88	0.50
Environmental impact (questions: a13-a18)	0.55	0.50
Cultivated plants impact (questions: a19-a23)	0.10	0.70
Domesticated animals impact (questions: a24-a26)	0.00	1.00
Human impact (questions: a27-a29)	0.00	1.00
Other impact (questions: a30)	0.00	1.00
Invasion (questions: a06-a12)	0.51	0.56
Impact (questions: a13-a30)	0.55	0.84
Overall risk score	0.28	
Category of invasiveness	moderately 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:
This assessment is based on the state of knowledge existing at the time of its implementation, in particular data from North America, which only to a limited extent, through analogies, allow drawing conclusions for the conditions present in Poland. Keep in mind that over time the influence of the species may change. For this reason, it is justified to repeat the assessment procedure regularly.

The species is not present in Poland so far. It does not occur in any of the EU countries and is not introduced to cultivation here. Since 1999, it has been listed in Turkey, where it reproduces by itself, and at the same time it does not have invasive plant status. Therefore, the chances of the species appearing in Poland as a result of spontaneous spread were assessed as minimal. The primary outbreaks of expansion appear only as a result of unintentional human activities, e.g. bringing along with road or railway transport. The current risk of introducing the species into the territory of the country in this way was assessed as medium. However, it is expected that it will increase with the intensification of goods exchange with China (where the species occurs naturally), especially railway transport, the development of which, along with the construction of a logistics hub providing services for the Far East is planned in Poland.

Significant value of the assessment in terms of effect on the natural environment, as well as high values of indicators in the naturalization and spread modules were based on data on the species invasion in the USA, where it is considered to be one of the most dangerous invasive plant. It was accidentally brought there in 1919 and it occupied the greater part of the eastern regions of the country over short time. In North America, it spreads under climatic and habitat conditions similar to those occurring in Poland, developing massively, e.g. in natural and economic forests as well as in river valleys.

The course of the species' expansion, entailing deep, negative effects on the natural environment in North America, along with the premises resulting from the intensification of goods exchange with the Far East of Asia (the original area of occurrence of the species) give serious cause for fear of a negative scenario for Poland in the future.

Considering the nature of the impact on biodiversity observed in North America, one can expect a similar scenario in Poland after a possible introduction. This species may result in sodding of the riparian forests and other deciduous forests, and thus the elimination of many geophyte and hemicryptophyte species.

Despite the current assessment as a "low-invasive alien species", the above premises indicate that *Microstegium vimineum* should be treated in Poland as a species potentially threatening native species and natural habitats, and therefore should be covered by appropriate restrictions preventing introduction into the environment.

Data sources

1. Published results of scientific research (P)

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2. Databases (B)

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EPPO 2015. Report of a Pest Risk Analysis for *Microstegium vimineum*. European and Mediterranean Plant Protection Organization (http://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm)

3. Unpublished data (N)

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4. Other (I)

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5. Author's own data (A)

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