



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. Alina Urbisz
2. Marcin Nobis – external expert
3. Adam Zając

acomment01.	Comments:	degree	affiliation	assessment date
		(1) dr hab.	Faculty of Biology and Environmental Protection, University of Silesia in Katowice	21-01-2018
		(2) dr hab.	Institute of Botany, Jagiellonian University, Kraków	19-01-2018
		(3) prof. dr hab.	Institute of Botany, Jagiellonian University, Kraków	21-01-2018

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

Polish name: Rozplenica szczecinkowata
Latin name: ***Pennisetum setaceum*** (Forssk.) Chiov.
English name: Fountain grass

acommm02.

Comments:

The Latin name *Pennisetum setaceum* has been taken according to Index Seminum (IPNI 2005 – B). Besides more often used and listed below, there are many synonyms of Latin names: *Pennisetum erythraeum* Chiovenda, *Pennisetum macrostachyum* Fresenius, *Pennisetum orientale* var. *altissimum*, *Pennisetum parisii* Trab, *Pennisetum phalaroides* Schultes, *Pennisetum ruppelii* Steud, *Pennisetum scoparium* Chiovenda, *Pennisetum spectabile* Figari & De Notaris, *Pennisetum spectabile* Figari & De Notaris, *Pennisetum tiberiadis* Boiss *Phalaris setacea* Forssk. (CABI 2018 –B). According to the Plant List (The Plant List 2013 – B), the following shall be deemed synonymous or conspecific with *Pennisetum setaceum*: *Pennisetum cupreum* Hitchc., *Pennisetum erythraeum* Chiov., *Pennisetum macrostachyon* Fresen., *Pennisetum macrostachyum* Fresen., *Pennisetum numidicum* Paris, *Pennisetum orientale* var. *altissimum* Chiov., *Pennisetum orientale* subsp. *parisii* Trab., *Pennisetum orientale* var. *parisii* (Trab.) Leeke, *Pennisetum parisii* (Trab.) Trab., *Pennisetum phalaroides* Schult., *Pennisetum ruppelii* Steud., *Pennisetum ruppelii* var. *depauperatum* Schweinf., *Pennisetum scoparium* Chiov., *Pennisetum setaceum* var. *parisii* (Trab.) Maire, *Pennisetum spectabile* Fig. & De Not., *Pennisetum tiberiadis* Boiss., *Phalaris setacea* Forssk. According to the most recent phylogenetic studies, *Pennisetum setaceum* shall be considered a synonym of *Cenchrus setaceus* (Forssk.) Morrone (Chemisquy et al. 2010 – P).

Polish name (synonym I)

–

Polish name (synonym II)

–

Latin name (synonym I)

Cenchrus setaceus (Forssk.) Marrone

Latin name (synonym II)

Pennisetum ruppelii Hitchc

English name (synonym I)

African fountain grass

English name (synonym II)

Crimson fountaingrass

a03. Area under assessment:

Poland

acommm03.

Comments:

–

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

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> | native to Poland |
| <input type="checkbox"/> | alien, absent from Poland |
| <input checked="" type="checkbox"/> | alien, present in Poland only in cultivation or captivity |
| <input type="checkbox"/> | alien, present in Poland in the environment, not established |
| <input type="checkbox"/> | alien, present in Poland in the environment, established |

aconf01.

Answer provided with a

low

medium

high

X

level of confidence

acommm04.

Comments:

Until now, *Pennisetum setaceum* is known in Poland only from plant culture. On the basis of information obtained from botanical gardens and arboreta in Poland, its presence (cultivation) has been confirmed in two sites only (Botanical Garden employees...2018 – N). Varieties of this grass are grown in Botanical Garden in Bolestraszyce (the Arboretum and Institute of Physiography in Bolestraszyce). The plant does not spread within the garden Czerniecki 2018 – A)). The species is also present in the collection of the Botanical Garden at A. Mickiewicz University in Poznan. Cultivation of the plant began before 1989. Currently, it occupies the area of ca. 2m2. It seeds strongly and it is highly competitive, thus there are actions undertaken within the garden in order to reduce its spreading ((Grabowska 2018 – A). Sometimes, the species is also grown in private gardens. However, until now there is no information confirming sites occupied by this species in natural environment. Garden shops offer first of all its variety – *Pennisetum setaceum* ‘rubrum’

(currently regarded as a separate species - *Pennisetum advena*). *Pennisetum setaceum* is often cultivated because of its attractive appearance. This tuft grass forms picturesque cascade of long, narrow, green leaves, and overhanging ears look like bottle-brushes – this is why the species is also called fountain grass. The plant is not frost-resistant and temperatures above freezing point must be ensured to allow its successful wintering (Albamar 2018, Ornamental grasses 2018a and b – I).

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

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

acomm05.

Comments:

Until now, this species does not live wild in Poland. The species is grown in two botanical gardens in Poland. Moreover, it is planted in private gardens and as a decorative component of urban greenery. It is unlikely for this species to winter beyond cultures without human help, however considering its significant invasive potential and climate warming in progress, it is possible that in future it may "escape" from plant cultures to natural habitats, e.g. xerothermic and on-sand grasslands, and will limiting floristic diversity, as it happens in those countries, where it is an invasive taxon (e.g. North America, Australia; CABI 2018 – B). This species affects humans to a lesser extent. During direct contact with the grass, due to its sharp leaves and inflorescences with awns it may cause skin irritation and/or minor wounds (Queensland Government 2012 – I, CABI 2018 – B).

Currently, in Poland we do not observe any impact of the species on the above-mentioned areas.

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

aconf02.

Answer provided with a

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

level of confidence

acomm06.

Comments:

Today, the species is not observed living wild either in Poland or in the neighbouring countries. In Europe, it is settled in Spain (including the Balearic Islands and the Canary Islands), France, Italy (including Sardinia and Sicilia) and Malta (EPP0 2014 – B, Species Invasive 2018 – I), in Portugal (Valdes and Scholtz 2009 – B) and Cyprus (Species Invasive 2018 – I). The species, as settled-in, occurs in areas distant from Polish boundaries. In our country it is sporadically grown in gardens and it does not winter in soil. Fountain grass is very unlikely to expand into the territory of Poland from abroad spontaneously. Admittedly, its seeds are very resistant and capable of germination for 6 years, but only in regions characterised by mild winters without frost (Sanz Elorza et al. 2004 – P, Species Invasive 2018 – I). Seed production by the plant is characterised as very high, and as much as 80% of seeds are qualified as viable (Nonner 2005 – P, Species Invasive 2018 – I). The seeds may be

spread by vehicles, machines, equipment, farm animals and birds, which eat the seeds and use grass blades to build their nests (Joubert and Cunningham 2002 – P, Species Invasive 2018 – I).

However, on the basis of expert knowledge, the probability of spontaneous (unaided by man) and long-distance expansion of the species (from the areas of spontaneous occurrence of the species and/or its cultures) in the territory of Poland has been evaluated as “low”. Ornamental varieties: *P. setaceum* "rubrum" (regarded as a separate species - *Pennisetum advena*) and "Eaton Canyon" usually do not produce seeds, therefore there is no fear that they will “escape” from their cultures and will become a threat (Gardner Laidback 2018 –I)..

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

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

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

acomment07. Comments:
 Currently, in our climatic conditions, spontaneous occurrence of a species in natural environment resulting from unintended activities of man, as e.g. bringing its diaspores from the south of Europe is rather unlikely (there is no such information available in the literature so far). However, since *Pennisetum setaceum* is already grown in Poland, it seems probable that its diaspores have been unintentionally brought/introduced into natural environment, e.g. during compost removal, sowing grass for animals, or spreading seeds. However, in current climatic conditions in Poland this species is not capable of surviving wintertime.

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	

acomment08. Comments:
 The species has reached Poland as a subject of planned transport and trading (as an exotic and highly ornamental plant), only for cultivation in gardens (Albamar 2018, Ornamental grasses 2018a and b – I) and it is grown both in botanical gardens and home gardens. In many countries the plant is also used in land reclamation processes, e.g. to stabilise soil on slopes etc. (EPPO 2012 – B), however no actions of this type have been confirmed in Poland so far. At current stage, in Polish climatic conditions, the species occurrence in natural environment as a result of intended human activity (planned seeding or replanting) is rather improbable (until now there is no such information available in Polish literature). In case of "escape from cultures" successful wintering of the species is unlikely in current climatic conditions (Albamar 2018, Ornamental grasses 2018a – I).

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

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

acomm09.	<p>Comments:</p> <p>Native land of the species is the Near East and North Africa (Henderson 1995, Gibbs Russell et al. 1990 – P), all the way to Tanzania, Sudan, Ethiopia, Kenya and Somalia (Clayton and Renvoize 1982 – P). <i>Pennisetum setaceum</i> is a species adapted to warm and dry climate. In regions of warm moderate climate and dry summer the species prefers average temp. in summer >10°C and in winter >0°C; in continental climate with dry summer – temp. in summer >10°C and in winter slightly below 0°C, however it is worth emphasising that the species does not tolerate frosts, which make it perish (CABI 2018 – B). <i>Pennisetum setaceum</i> is widespread on Hawaiian Islands (Kauai, Lanai, Oahu, Kahoolawe, East Maui). In United States it grows in Oregon, California, Arizona, New Mexico and Colorado, as well as in Louisiana, Florida and Tennessee (Wunderlin and Hansen 2008 – P, Jepson Flora Project 2012, GBIF 2012 – B). It is reported in Australia, where it is most widespread in Queensland, New South Wales and Western Australia (GBIF 2012 – B).</p> <p><i>Pennisetum setaceum</i> has been brought to Southern Africa from Northern Africa, and it is considered to be an invasive grass in Namibia and the Republic of South Africa (Joubert and Cunningham 2002 – P).</p> <p>The resemblance between Polish climate and the climate of <i>Pennisetum setaceum</i> natural range of extent remains within 0-45%, which means that the species climatic requirements are not satisfied in Poland. The plant is not frost-resistant and temperatures above freezing point must be ensured to allow its successful wintering (Albamar 2018, Ornamental grasses 2018a and b – I). Within the plant secondary coverage in Europe, the levels of climatic conformity in majority of European countries, where the species occurrence has been confirmed (see a06), remain within 45-94% on average.</p>
----------	---

a10. Poland provides **habitat** that is

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

aconf06.	Answer provided with a	low	medium	high X	level of confidence
----------	------------------------	-----	--------	------------------	---------------------

acomm10.	<p>Comments:</p> <p>Within its natural range of extent <i>Pennisetum setaceum</i> occurs in various habitat types, including rocky and stony areas, sandy and dry grasslands, and non-salinized coastal areas (Sanz Elorza et al. 2004 – P). Frequently, it grows in disrupted areas, as road shoulders, cracks in concrete and rocks along roads, open urban areas (FloraBase 2013 – B, Species Invasive 2018 – I). When we compare the types of habitats, in which this species occurs in those countries, where it is considered to be an invasive plant (e.g. the USA, the Canary Islands, Spain, France, Italy and Australia), it rather prefers thermophilic and xerothermic habitats, and there are quite many of those in Poland (xerothermic grasslands, thermophilic meadows, on-sand grasslands). Thus, habitat conditions occurring in Poland can be deemed optimal for its settlement. However, in spite of as it seems optimal habitat conditions in Poland, the species has not been observed beyond its cultivation sites yet.</p>
----------	--

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	high X	level of confidence
----------	------------------------	-----	--------	------------------	---------------------

acomm11.	Comments:
	<p><i>Pennisetum setaceum</i> is a grass with relatively light seeds, which easily move with wind blows. Thus, its potential for spreading without help of man may be evaluated as high (Nobis 2016-2017 – A,, GISD 2018 – B). The species produces seeds every year. Each plant may produce 100 seeds on the average, and they may stay live in soil for 6 years or more (Rahlao et al. 2010 – P). Seeds of this species may be also carried by: water, animals, and people – motorised transport along roads (air blows generated by moving vehicles), agricultural machines and equipment (Joubert and Cunningham 2002, Halvorson and Guertin 2003 – P, GISD 2018 – B, Species Invasive 2018 – I). In the areas, where this species is already settled-in, it has been observed that new specimens may appear in a distance exceeding 1 km from parent plants (EPPO 2012 – B). Moreover, the plant shows high potential for vegetative propagation and formation of descendant plants straight on parent organism in form of the so-called propagules.</p> <p>Assuming that the species occurs in Poland, probability of its spreading (without help of man) has been evaluated as high. Data concerning dispersion from a single source (Type A – from ca. 5 km up to ca. 50 km per year).</p>

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

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

aconf08.	Answer provided with a	low	medium	high X	level of confidence
----------	------------------------	-----	--------	------------------	---------------------

acomm12.	Comments:
	<p>Until now, there are no fountain grass populations known in Poland, which would occur beyond its cultures. There is also no sufficient data on the frequency of the species expansion into new areas with the help of man. Therefore, the assessment of the current potential of spreading of this species in Poland with human participation is low. This plant is offered for sale by garden shops, however does not produce seeds and is not frost-resistant (Albamar 2018, Ornamental grasses 2018a and b – I).</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:

<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
----------	------------------------	-----	--------	------	---------------------

acomm13.	Comments:	The species is a plant; it does not affect native species as a predator, parasite or herbivore.			
----------	-----------	---	--	--	--

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
----------	------------------------	-----	--------	------	---------------------

acomm14.	Comments:	<p>Dense populations of <i>Pennisetum setaceum</i> reduce diversity of native species. The plant significantly restricts access of moisture to surrounding plants, and it may change the circulation of nutrients in soil (FloraBase, 2012 – B). For example, the species intensely competes with rare native plants in Hawaii, e.g. with endemic <i>Haplostachys haplostachya</i> (Cordell and Sandquist 2008, Litton et al. 2008 – P). It causes perishing of <i>Argyranthemum lidii</i> in the Gran Canaria Island, the Canary Islands (IUCN 2012 – B). In southern part of the USA <i>Pennisetum setaceum</i> is concurrent with <i>Stipa</i> genus species (Species invasive 2018 – I). If the species settles in Poland, it could potentially penetrate into the habitats of xerothermic grasslands and dunes and displace native species.</p> <p>Until now, no fountain grass impact on native species in Poland exerted through competition has been observed. Since this species forms large tufts and produces many seeds during vegetation season, its competitive potential with the native xerothermophilous species would be considerable in case of settlement in Poland.</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 X
-----	--------	------------------

 level of confidence

acomment15. Comments:
In Poland there are no native species of the *Pennisetum* genus (Mirek et al. 2002), therefore there is no chance for the species to cross in natural conditions.

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

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

aconf12. Answer provided with a

low	medium X	high
-----	--------------------	------

 level of confidence

acomment16. Comments:
In Poland there were no pathogens or parasites detected and carried by *Penissetum setaceum* that could be harmful to native species.

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

- low
- medium
- high

aconf13. Answer provided with a

low	medium	high X
-----	--------	------------------

 level of confidence

acomment17. Comments:
No species impact on abiotic factors has been observed; moreover, there is no information concerning such an impact from the regions, where this species is settled-in. Assuming that the species would be spreading throughout Poland – in our climatic conditions its impact would be probably restricted to synanthropic habitats (roadsides, walkway cracks), and perhaps semi-natural ones (dry grasslands). However, it does not seem possible that it would significantly modify abiotic factors.

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

- low
- medium
- high

aconf14. Answer provided with a

low	medium	high X
-----	--------	------------------

 level of confidence

acomment18. Comments:
The species impact on biotic factors has not been confirmed in Poland yet. Assuming that the species would be spreading throughout Poland – in our climatic conditions its impact would be probably visible in dry habitats along roads, where this impressive plant would displace native species. In southern part of the USA *Pennisetum setaceum* is concurrent with *Stipa* genus species (Species Invasive 2018 – I). If the species settles in Poland, it could potentially penetrate into the habitats of xerothermic and on-sand grasslands, further reducing floristic diversity. Biomass produced by the plant restricts access of moisture to surrounding plants, and it may change the circulation of nutrients in soil; moreover, it induces intensified habitat nitrification (Species Invasive 2018 – I). It has been observed that the occurrence of the species in habitats far from roadsides, in which it occurs most

frequently, considerably reduces diversity of species in these areas (Rahlao et al. 2010a; Questad et al. 2012 – P).

In Polish climatic conditions the impact of fountain grass on ecosystems integrity through disturbances of their biotic factors would be limited to thermophilic habitats (if the species settling-in and proliferation takes place), and the plant would displace native species here, thus reducing floristic diversity (CABI 2018 – B).

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:

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

aconf15.

Answer provided with a

low	medium	high
		X

level of confidence

acomm19.

Comments:

The species is a plant, and it also has no parasitic properties.

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	high
	X	

level of confidence

acomm20.

Comments:

There is no sufficient data concerning the impact of the species on crops of species, which are important from economic point of view.

Since this species forms large tufts and produces many seeds during vegetation season, its competitive potential in corn, sunflower, soy and cereal crops is rather high, however in our current climatic conditions it poses no hazard at all, or possible risk is insignificant.

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
-----	--------	------------------

 level of confidence

acommm21. Comments:
In Poland there are no crops of plants relative to *Pennisetum* genus, therefore the species has no impact on crops of plants, which are important from economic point of view, through crossing with related species.

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
-----	--------------------	------

 level of confidence

acommm22. Comments:
There is no information regarding *Pennisetum setaceum* impact on plant crops through disturbance of their integrity. In Poland, the plant exerts no influence on crop integrity. The species forms large tufts and produces many seeds during vegetation season, its competitive potential is rather high; however, in our current climatic conditions it poses no hazard.

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

acommm23. Comments:
Available data from the literature contains no information regarding the species' impact on crops in connection with transmitting pathogens and parasites harmful for crop plants. In Hawaii, carried out studies covered only the impact of insects and fungal pathogens on the invasive species and on native species – *Heteropogon contortus*. In case of *Pennisetum setaceum*, no fungal pathogens were found on it, while presence of insects would have never caused defects of the plant exceeding 5% (Goergen and Daehler 2001). However, insect eggs left on the grass could be potentially taken/carried with the plant fragments or seeds beyond the area of its occurrence.

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
-----	--------	------

 level of confidence

acomm24. Comments:
The species is a 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 X	high
-----	--------------------	------

 level of confidence

acomm25. Comments:
Until now, in Poland *Pennisetum setaceum* is not found out of gardens, therefore in practice there is zero probability of its contact with breeding animals. However, similarly as in other regions of the species occurrence, its young shoots could be eaten by cattle, goats and sheep (Motooka et al. 2003 – P, CABI 2018 – B). However, there is no sufficient information in the literature as regards the species' impact on animal health and/or animal production (EPPO 2012 – B). Dry grass biomass is flammable, and fires may appear more often in the areas occupied by the plant. These fires may be harmful both for birds nesting on ground, and for other animals linked with these habitats (EPPO 2014 – B).

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
-----	--------	------

 level of confidence

acomm26. Comments:
The species is a plant. The plants are neither hosts nor vectors of animal parasites/pathogens.

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
-----	--------	------

 level of confidence

acommm27. Comments:
The species is not a parasitic organism.

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	high
-----	--------	------

 level of confidence

acommm28. Comments:
During direct contact with the grass, due to its sharp leaves and inflorescences with awns it may cause skin irritation. It is recommended to wear protective gloves, especially when removing the plant (Queensland Government 2012 – P). While in bloom, pollen of the grass may constitute potential hazard, however so far there is no information regarding allergy to pollen of this plant.

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
-----	--------	------

 level of confidence

acommm29. Comments:
The species is a plant, which is not a vector of human parasites or pathogens.

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:

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

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

acommm30. Comments:
Large amounts of dry biomass generated by the species increases frequency of fires in the areas, where the plant occurs in large numbers (FloraBase 2013 – B), which may have potential effect on the infrastructure, e.g. in case of grass burning off.

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	high X	level of confidence
----------	------------------------	-----	--------	------------------	---------------------

acommm31. Comments:
There is no data concerning harmful effect of the species on supply services. However, taking into account the morphology and biology of this species, its impact on the assessed parameter is neutral.

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	high X	level of confidence
----------	------------------------	-----	--------	------------------	---------------------

acommm32. Comments:
Due to its biology and ecology, the species has no serious effect on control services. Dry biomass generated by the species increases frequency of fires and intensifies their spreading (FloraBase 2012), which may cause local air pollution.

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
----------	------------------------	-----	--------	------------------	---------------------

acommm33.

Comments:

Pennisetum setaceum is used as an ornamental plant (EPPO 2014, CABI 2018 – B). Its cultivation on a wider scale would affect the area aesthetics (aesthetic and decorative functions). Crimson fountain grass is seen by part of the community as an attractive and desired decorative component of natural environment. However, due to the species intolerance to temperatures below freezing point in Poland, the plant will appear as a one-year grass wherever man plants it intentionally.

Currently, there are no observations of the species' harmful effect on cultural services.

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	level of confidence
-----	--------------------	------	---------------------

acommm34.

Comments:

Assuming that the temperature will rise in the future, it should be anticipated that the species will overcome climatic barriers and will start to escape from its cultures more and more often, or will be brought to anthropogenic and/or semi-natural and natural habitats. Thus, it will be much easier for the plant to penetrate into areas not occupied by it yet.

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	level of confidence
-----	--------------------	------	---------------------

acommm35.

Comments:

Assuming that the temperature will rise in the future, it should be anticipated that the species will overcome climatic barriers and will start to escape from its cultures more and more often (Albamar 2018, Ornamental grasses 2018 a and b – I). Moreover, the grass will start settling in natural and semi-natural habitats, as grasslands on sands, dry and xerothermic grasslands – much like those it occupies by its nature.

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
-----	--------------------	------

 level of confidence

acomm36. Comments:
 Assuming that in the future the temperature will rise by 1-2 °C, the probability that the species will break other barriers, preventing its proliferation in Poland until now – will increase moderately. The plant is not frost-resistant and temperatures above freezing point must be ensured to allow its successful wintering (Albamar 2018, Ornamental grasses 2018 a and b – I).
 If the main barrier – too harsh climate – is eliminated, this perennial species may quickly spread locally and settle in semi-natural habitats displacing native species, often rare and endangered.

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
-----	--------------------	------

 level of confidence

acomm37. Comments:
 As a result of climate changes, the impact of the discussed species on wild plants, animals, habitats and ecosystems in Poland may increase moderately. If the main barrier – too harsh climate – is eliminated, this perennial species may spread and settle in natural habitats, displacing native species.

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
-----	--------------------	------

 level of confidence

acomm38. Comments:
 Hypothetically, as a result of climate changes, the impact of the discussed species on crop plants or plant production in Poland may increase moderately. If the main barrier – too harsh climate – is eliminated, this perennial species may spread and settle locally in various habitats, it may also become a weed in crops (e.g. maize).

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
-----	--------	------------------

 level of confidence

acomm39. Comments:
If the main barrier – too harsh climate – is eliminated, this perennial species may spread and settle in semi-natural habitats, however it should not affect animal breeding. So far, there is also no information available in the literature regarding negative impact of this species on 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 X	high
-----	--------------------	------

 level of confidence

acomm40. Comments:
Due to climate changes, the impact of the discussed species on people in Poland may increase moderately.
If the main barrier – too harsh climate – is eliminated, this perennial species may spread and settle in semi-natural habitats, and through higher pollen production while in bloom, it may constitute a source of allergic diseases (undoubtedly, grass pollens are among such allergens).

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
-----	--------	------------------

 level of confidence

acomm41. Comments:
Since *Pennisetum setaceum* does not show any morphological or ecological properties, which would argue for deeming it hazardous and threatening various types of objects, we assume that as a result of climate changes the impact of the discussed species on other objects in Poland will not alter.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.17	0.67
Establishment (questions: a09-a10)	0.50	1.00
Spread (questions: a11-a12)	0.38	1.00
Environmental impact (questions: a13-a18)	0.35	0.90
Cultivated plants impact (questions: a19-a23)	0.10	0.70
Domesticated animals impact (questions: a24-a26)	0.25	0,5
Human impact (questions: a27-a29)	0.25	0.50
Other impact (questions: a30)	0.25	0.50
Invasion (questions: a06-a12)	0.35	0.89
Impact (questions: a13-a30)	0.35	0.62
Overall risk score	0.12	
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.

acommm42.

Comments:

Until now, Crimson fountaingrass has not been observed living wild in Poland. Whereas, it is grown in two botanical gardens: Botanical Garden in Bolestraszyce and Botanical Garden at A. Mickiewicz University in Poznan (Botanical Garden employees...2018 – N). Moreover, it is grown in home gardens, however, the species cannot winter in soil here. It is very important, because in some countries of Southern and Western Europe *Pennisetum setaceum* has the status of an invasive species (EPPO 2014 – B, Species Invasive 2018 – I). After completed risk assessment for Poland (total rating 0.12), *Pennisetum setaceum* has been classified in the category – "non-invasive alien species". Its highest rating (0.50) has been reached in the module 'Settlement' (questions: a09-a10). Within its natural range of extent *Pennisetum setaceum* occurs in various habitat types, including rocky and stony areas, sandy and dry grasslands, and non-salinized coastal areas (Sanz Elorza et al. 2004 – P). It often grows in disturbed areas, including roadsides, cracks in concrete and rocks along roads, open urban areas (FloraBase 2013 – B, Species Invasive 2018 – I). Average result (0.38) has been reached for the module 'Proliferation' (questions: a11-a12), much the same as current impact of this species on environment (0.35). With high probability these results may be due to its considerable competitiveness in relation to other concurrent species and lack of natural enemies within its secondary coverage. The species proliferation may be fostered by climatic changes in progress. Therefore, assuming that the temperature will rise in the future, we should expect that the species will overcome the climatic barriers and will start to escape from its cultures more and more often, and to settle in natural and semi-natural habitats, as e.g. grasslands on sand, dry and xerothermic grasslands – much like those occupied by the plant within its natural range of extent.

Data sources

1. Published results of scientific research (P)

Chemisquy MA, Giussani LM, Scataglini MA, Kellogg EA, Morrone O. 2010. Phylogenetic studies favour the unification of *Pennisetum*, *Cenchrus* and *Odontelytrum* (Poaceae): a combined nuclear, plastid and morphological analysis, and nomenclatural combinations in *Cenchrus*. *Annals of Botany* 106(1): 107-130 (<http://aob.oxfordjournals.org/cgi/content/full/106/1/107>)

Clayton WD, Renvoize SA. 1982. Graminae (Part III). In: R.M. Pohill (ed.). *Flora of Tropical East Africa*. Crown Agents, London.

Cordell S, Sandquist DR. 2008. The impact of an invasive African bunchgrass (*Pennisetum setaceum*) on water availability and productivity of canopy trees within a tropical dry forest in Hawaii. *Functional Ecology* 22(6): 1008-1017 (<http://www3.interscience.wiley.com/cgi-bin/fulltext/121391033/HTMLSTART>)

Gibbs Russel GE, Watson L, Koekemoer M, Smook L, Barker NP, Anderson HM, Dallwitz MJ. 1990. *Grasses of Southern Africa*. Mem. Bot. Surv. S. Afr. 58: 250

Halvorson WL, Guertin P. 2003. Fact sheet for: *Pennisetum setaceum* (Forssk.) Chiov. USGS Weeds in the West: Status of Introduced Plants in Southern Arizona Parks. Tucson, Arizona, USA: USGS Southwest Biological Science Center. (<http://sdrsnet.snr.arizona.edu/data/sdrs/ww/docs/pennseta.pdf>)

Henderson L. 1995. *Plant invaders of southern Africa*. Plant Protection Research. Institute Handbook 5. Agricultural Research Council.

Joubert DF, Cunningham PL. 2002. The distribution and invasive potential of Fountain Grass. *Dinteria* 27: 37-47

Litton CM, Sandquist DR, Cordell S. 2008 A non-native invasive grass increases soil carbon flux in a Hawaiian tropical dry forest. *Global Change Biology*. 14(4): 726-739 (<http://www.blackwell-synergy.com/loi/gcb>)

Mirek Z, Piękoś-Mirkowa H, Zając A, Zając M. 2002. Flowering Plants and Pteridiophytes of Poland. A checklist. *Krytyczna lista roślin naczyniowych Polski*. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków

Nonner ED. 2005. *Seed bank dynamics and germination ecology of fountain grass (Pennisetum setaceum)*. Hawaii, USA: University of Hawaii.

Questad EJ, Thaxton JM, Cordell S. 2012. Patterns and consequences of re-invasion into a Hawaiian dry forest restoration. *Biological Invasions*.

Rahlao SJ, Milton SJ, Esler KJ, Barnard P. 2010. The distribution of invasive *Pennisetum setaceum* along roadsides in western South Africa: the role of corridor interchanges. *Weed Research* 50(6): 537-543 (<http://www.blackwell-synergy.com/loi/wre>)

Sanz Elorza M, Dana Sánchez ED, Sobrino Vesperinas E (eds.). 2004. *Atlas de las plantas alóctonas invasoras en España*. 384 Dirección General para la Biodiversidad, Madrid.

Wunderlin RP, Hansen BF. 2008. *Atlas of Florida Vascular Plants*. Florida, USA: University of South Florida. (<http://www.plantatlas.usf.edu/>)

2. Databases (B)

CABI 2018. *Pennisetum setaceum* (<https://www.cabi.org/isc/datasheet/116202>) Date of access: 2018-01-20

EPPO 2012 EPPO – Mini data sheet on *Pennisetum setaceum*. (<https://gd.eppo.int/taxon/PESSA/documents>) Date of access: 2018-01-26

EPPO. 2014. PQR database. Paris, France: European and Mediterranean Plant Protection Organization. (<http://www.eppo.int/DATABASES/pqr/pqr.htm>) Date of access: 2018-01-20

Florabase. 2013. *Flora of Western Australia*. Perth, Western Australia: Department of Environment and Conservation. (<http://florabase.dec.wa.gov.au/>) Date of access: 2018-01-19

GBIF. 2012. Global Biodiversity Information Facility. Global Biodiversity Information Facility (GBIF). (<http://data.gbif.org>) Date of access: 2018-01-20

GISD. 2018. *Cenchrus setaceus*. (<http://www.iucngisd.org/gisd/species.php?sc=309#>) Date of access: 2018-01-28

IPNI 2005. International Plant Names Index (1. <http://www.ipni.org/ipni/idPlantNameSearch.do?id=79096-3>) Date of access: 2018-01-22

IUCN 2012 IUCN Red List of Threatened Species. Version 2012.2. (www.iucnredlist.org)

Jepson Flora Project. 2012. *Jepson eFlora*. Berkeley, California, USA: University of California. (<http://ucjeps.berkeley.edu/IJM.html>) Date of access: 2018-01-20

The Plant List. 2013. *Pennisetum setaceum*. (<http://www.theplantlist.org/tpl1.1/record/kew-432944>) Date of access: 2018-01-28

Valdes B, Scholz H. 2009. Euro and Med Plantbase. Berlin, Germany: Euro and Med Plantbase. (<http://ww2.bgbm.org/EuroPlusMed/query.asp>) Date of access: 2018-01-20

3. Unpublished data (N)

Botanical Gardens employees... 2018. Pracownicy ogrodów botanicznych i arboretów 2018 Ankieta dotycząca utrzymywania inwazyjnych gatunków roślin obcego pochodzenia w uprawie

4. Other (I)

Albamar 2018. Albamar (<https://albamar.pl/trawy-ozdobne/1679-rozplenica-szczecinkowata-rubrum-pennisetum-setaceum-000000001679.html>) Date of access: 2018-01-20

Laidback Gardner 2018 laidbackgardener.blog. (<https://laidbackgardener.blog/tag/pennisetum-setaceum-rubrum/>) Date of access: 2018-01-20

Queensland Government 2012 African Fountain Grass fact sheet. Queensland, Australia: Queensland Government. (http://www.daff.au/documents/Biosecurity_EnvironmentalPests/IPA-African-Fountain-Grass-PP146) Date of access: 2018-01-18

Species Invasive 2018. SpecieEsoticheInvasive. (<http://webcache.googleusercontent.com/search?q=cache:MExbAwVrcDwJ:ftp://ftp.minambiente.it/PNM/SpecieEsoticheInvasive/ValutazioneRischiolAS2016/Pennisetum%2520setaceum%2520RA%2520TC.docx+&cd=69&hl=pl&ct=clnk&gl=p>) Date of access: 2018-01-18

Trawy ozdobne 2018a. Trawy ozdobne (<http://trawyozdobne.com/2012-02-12-15-14-9/p/1624-phyllostachys-nigra-5.html>) Date of access: 2018-01-19

Trawy ozdobne 2018b. Trawy ozdobne (5. <http://trawyozdobne.com/2012-02-12-15-14-9/p/1983-pennisetum-setaceum-rubrum-dwarf.html>) Date of access: 2018-01-19

5. Author's own data (A)

Czerniecki M. 2018. Genus *Pennisetum* in Arboretum in Bolestraszyce.

Grabowska B. 2018. Collection of *Pennisetum* in Botanical Garden of A. Mickiewicz University.

Nobis M. 2016-2017. Genus *Pennisetum*.