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. Justyna Wylazłowska
2. Dorota Michalska-Hejduk
3. Alina Urbisz

acomm01. Comments:

	degree	affiliation	assessment date
(1)	dr	Department of Geobotany and Plant Ecology, Faculty of Biology and Environmental Protection, University of Lodz	09-04-2018
(2)	dr	Department of Geobotany and Plant Ecology, Faculty of Biology and Environmental Protection, University of Lodz	06-04-2018
(3)	dr hab.	Faculty of Biology and Environmental Protection, University of Silesia in Katowice	17-04-2018

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

Polish name: Uczep amerykański

Latin name: ***Bidens frondosa*** L.

English name: Common beggar-ticks

Współfinansowano w ramach projektu nr POIS.02.04.00-00-0100/16 pn. *Opracowanie zasad kontroli i zwalczania inwazyjnych gatunków obcych wraz z przeprowadzeniem pilotażowych działań i edukacją społeczną* ze środków Unii Europejskiej w ramach Programu Infrastruktura i Środowisko 2014-2020

acomm02. Comments:

Listed Latin and Polish names are in accordance with Flowering plants and pteridophytes of Poland – a checklist (Mirek et al. 2002 – P). The most frequently used synonym for the Latin name is *Bidens melanocarpus* Wiegand. The species is also referred to as *Bidens frondosus* L. f. *anomalus* (Porter ex Fernald) Fernald; *Bidens frondosus* L. var. *anomalus* Porter ex Fernald; *Bidens frondosus* L. var. *caudatus* Sherff; *Bidens frondosus* L. var. *pallidus* Wiegand; *Bidens frondosus* L. var. *puberulus* Wiegand; *Bidens frondosus* L. var. *stenodontus* Fernald H. St. John (The Plant List 2013 – B). The following are used as synonyms of English names: beggarticks, bur marigold, devil's bootjack, devil's-pitchfork, leafy beggarticks, pitchfork weed, sticktights, tickseed sunflower (EPPO 2004 – B).

Polish name (synonym I)	Polish name (synonym II)
–	–
Latin name (synonym I)	Latin name (synonym II)
Bidens melanocarpus	*Bidens comosus*
English name (synonym I)	English name (synonym II)
devil's beggarticks	bur marigold

a03. **Area** under assessment:

Poland

acomm03. 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
X	alien, present in Poland in the environment, established

aconf01. Answer provided with a

low	medium	high	level of confidence
		X	

acomm04. Comments:

Bidens frondosa is a neophyte, established and invasive on a national scale (Tokarska-Guzik 2005 – P). In the great majority of areas, there are many dispersed sites with a moderate number of individuals or a large number of sites with larger clusters. It remains in its current sites (Tokarska-Guzik et al. 2012 – P). It is widespread in Poland in the valleys of Vistula and Odra rivers and their tributaries (Zając A, Zając M. 2001, Urbisz et al. 2009 – P, Atlas roślin Polski 2015 – B). Over the last decade, sites of Common beggar-ticks have been described in numerous cross-sectional studies on invasive species as well as in floristic and inventory studies concerning such regions as Greater Poland (Dyderski and Jagodziński 2016a, b, Nowińska et al. 2016 – P), Silesian Foothills and Silesian Beskids (Wilczek et al. 2015 – P), Silesian Upland (Tokarka-Guzik et al. 2010, Urbisz and Urbisz 2014 – P), Lubuskie Lake District (Jasińska et al. 2015 – P), West Pomerania (Popiela et al. 2015 – P), Carpathian Mountains (Zając M. and Zając A. 2015 – P), Lesser Poland (Wagner and Hruševar 2015 – P), Rzeszów Foothill (Jaźwa and Stadnicka-Futoma 2015 – P), Central Poland (Kirpluk and Bomanowska 2015, Kopeć et al. 2014, Kucharski and Kopeć 2014, Michalska-Hejduk et al. 2014 – P), Podlachia (Fyałkowska et al. 2015 – P), Suwałki Lake District (Pliszko 2015 – P). The invasive nature of the species is enhanced by its manner of spreading through zoochoria (with the participation of animals), antropochoria (with the participation of man) and hydrochoria (with water flow) (Urbisz et al. 2009 – P).

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

X	the environmental domain
X	the cultivated plants domain
	the domesticated animals domain
	the human domain
	the other domains

acomm05. Comments:

Common beggar-ticks enters natural, semi-natural and plant communities developing in anthropogenic habitats (Tokarska-Guzik et al. 2012 – P). It prefers humid places. The species can be found in river meadows and alluviations, drying lakes and ponds, roadside ditches, railway tracks, waste disposal sites (Urbisz et al. 2009 – P). It is considered to be a species characteristic for *Chenopodion fluviatile* (Matuszkiewicz 2001 – P). In 1984, common beggar-ticks group was described in Poland (Dąbska 1984 – P). The species is also observed in the immediate surroundings of cultivated fields, in so-called marginal habitats in agricultural areas, mainly on the edges of ponds and watercourses, and in buffer strips within fields (Dajdok and Wuczyński 2008 – P). In southern Europe, it grows as weed in cultivated areas (Danuso et al. 2012 – P), however, in Poland significant introduction of common beggar-ticks into cultivation is not observed (Wylazłowska 2018 – A). To a large extent, it threatens the native plant species of waterside habitats. Often found in mixed populations with other *Bidens* species such as *B. tripartita* and *B. cernua*. The high level of invasiveness of *B. frondosa* and its strong competitiveness in relation to *B. tripartita* are attributed to a broader ecological amplitude, high reproductivity and a more dynamic development of *B. frondosa*, which favours the ousting of native species (Gladunova et al. 2016, Gruberová et al. 2001 – P). The species competes with some native aquatic *Bidens* species (such as *B. tripartita*, *B. cernua*), *Alopecurus aequalis*, *Atriplex prostrata* (Urbisz et al. 2009 – P).

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
X	high

aconf02. Answer provided with a

low	medium	high	level of confidence
		X	

acomm06. Comments:

Common beggar-ticks has been reported in Europe since 1736. (Lohmeyer and Sukopp 1992, Tokarska-Guzik 2005 – P). It was probably brought to Poland from Germany. It was first observed in 1777 on the Oder River in Szczytniki near Wrocław (Tokarska-Guzik 2005 – P), and then it was reported in 1896 in Słubice (Schumacher 1942, Trzcińska 1961), Tokarska-Guzik 2005 – P), in 1897 on the banks of the Vistula near Elbląg (Graebner 1897 – P) and Ciechocinek (Ascherschon 1898 – P), and then in 1898 in the area of Głogów (Fiek and Schube 1898 – P). It spread east and south, mainly along the main rivers and their tributaries (Tokarska-Guzik 2005, Urbisz et al. 2009 – P), as well as along railway tracks (Kornaś et al. 1959, Kornaś 1960 – P). Currently, it is present throughout Poland (Zając and Zając 2001 – P). Although the species is already widespread in Poland, it can still migrate to Poland from the border areas with Czech Republic, Slovakia and Germany, with the

participation of animals, people and – above all – water. The spread of *Bidens frondosa* along river valleys by the seeds carried with the water (especially during freshets) is facilitated by the adaptation of the seeds to a prolonged stay in the aquatic environment. It was observed that seeds which stayed in water sprouted more often than those which were stored in dry conditions. Between 40% and 65% of *B. frondosa* seeds remain germinable even after 60 months of storing in water (Comes et al. 1978 – P).

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

	low
	medium
X	high

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

acomm07. Comments:

In Europe, the common beggar-ticks appeared in 1736 and was probably introduced to botanical gardens. Due to the way its dissemination (zoochoria, hydrochoria as well as anthropochoria), it can be spread as a result of unintentional human actions (one of the frequent dispersion routes is traffic along railway lines (Kornaś 1960 – P). Its achenes with a pair of awns with barbs pointing downward can easily stick to not only animal hair but also to clothing and so it can travel long distances with humans (Michalska-Hejduk 2018 – A). Another documented manner of spreading of the species as a result of unintentional human actions is the transfer of seeds with hay (CABI 2018 – B) and the transport of seeds with soil used during works related to strengthening the banks of water courses and reservoirs (Michalska-Hejduk 2018 – A).

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

	low
	medium
X	high

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

acomm08. Comments:

In Europe, the common beggar-ticks was first reported in 1736 (Tokarska-Guzik 2005 – P). It was probably brought to botanical gardens as an ornamental plant. *Bidens frondosa* is a potential source of essential oils with antibacterial and antioxidant properties (Rahman et al. 2011 – P). In North American countries, infusions and extracts made from *Bidens frondosa* are widely used in pharmaceutical applications and can be used to treat irritation, inflammation, pain and bleeding of mucosa of the urinary tract and to alleviate benign prostate hyperplasia symptoms, increase uric acid excretion and reduce the risk of gout attacks (Flora of North America 2014 – P). In Poland, the species is cultivated in several botanical gardens, from where it can potentially migrate to the surrounding areas (Employees of botanical garden ... 2018 – N). The species is not cultivated in Polish horticultural nurseries nor in private gardens as an ornamental plant (Wylazłowska 2018 – A).

Although currently the likelihood of introducing the species into the natural environment of Poland as a result of intended human activities is lowered by the lack of interest in this species, in accordance with the procedure of assessing the risk of negative impact of invasive and potentially invasive foreign species in Poland (*Harmonia*$^{+PL}$ instruction), for species already established in Poland the probability should be assessed as high, with a high degree of certainty.

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:

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

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

acomm09. Comments:

The natural range of common beggar-ticks extends from south-eastern Alaska, through southern Canada, to the northern and central states of the USA, from 55° to 30° N (Scoggan 1979 – P). According to the map of climatic similarity of the area of Poland to the rest of the world, included in the 'Risk assessment procedure...', the climatic conditions of Poland and the areas of natural occurrence of *Bidens frondosa* are in the range between 94–100% (temperate climate). Therefore, Common beggar-ticks does not encounter a climate barrier in Poland and can spread throughout the country, completing a full development cycle.

a10. Poland provides **habitat** that is

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

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

acomm10. Comments:

Poland has optimal habitat conditions for *Bidens frondosa*. Until recently, common beggar-ticks settled in humid ruderal places (roadside ditches, railway tracks, banks of watercourses and water reservoirs). Currently, it can be found in natural and semi-natural plant communities, as well as in plant communities developing in anthropogenic habitats (Tokarska-Guzik et al. 2012 – P). More frequently, it enters natural habitats within which it contributes to the formation of *Bidentetea* class communities, where it is a characteristic species of *Chenopodion fluviatile* group (Matuszkiewicz 2001 – P). Dąbska (1984 – P) even described the *Bidentetum melanocarpae* association. The species is also found in rush communities of the *Phragmitetea* class (e.g. reed, common club-rush, yellow iris and canary grass rushes), in tall-herb communities (e.g. *Filipendulo-Geranietum*) and in willow habitats – i.a. *Salicetum triandro-viminalis* (Kucharski 1992, Urbisz et al. 2009, Sudnik-Wójcikowska 2011, Dyderski and Jagodziński 2014, Michalska-Hejduk et al. 2014 – 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:

	very low
	low
	medium
	high
X	very high

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

acomm11. Comments:

Dispersion from a single source (type A data) – one individual can produce up to 30,000 seeds (Abramowa 2012 – P). The effective spreading of the species is a result of the morphology of the fruits. Their surface is rough and covered with sticky hooks, which allows them to be carried over long distances by both animals (zoochoria) and humans (anthropochoria) (Brändel 2004 – P). The expansion of the species along the rivers is also possible thanks to hydrochoria and adaptation of the seeds to a long stay in the water. It was observed that seeds which stayed in water sprouted more often than those which were stored in dry conditions. Between 40% and 65% of *B. frondosa* seeds remain germinable even after 60 months of storing in water (Comes et al. 1978 – P).

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

	low
	medium
X	high

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

acomm12. Comments:

Common beggar-ticks prefers fertile, humid habitats, rarely visited by people – humid forests, rushes, banks of water reservoirs (Urbisz et al. 2009, Michalska-Hejduk et al. 2014 – P), therefore, accidental sticking of the seeds to clothes and such way of propagation is not common (Wylazłowska 2018 – A). However, the plant grows at sites across Poland (Zając and Zając 2001 – P), also in urbanised and agricultural areas (Dyderski and Jagodzinski 2014, Urbisz and Urbisz 2014, Kucharski and Kopeć 2014 – P). Its achenes with a pair of awns with barbs pointing downward can easily stick to not only animal hair but also to clothing and travel long distances with humans (Michalska-Hejduk 2018 – A). Due to the way it spreads (zoochoria, hydrochoria as well as anthropochoria), *Bidens frondosa* can be spread as a result of unintentional human actions (frequent dispersion routes is, for example, traffic along railway lines (Kornaś 1960 – P)). Common beggar-ticks is not cultivated in Polish horticultural nurseries nor in private gardens as an ornamental plant, therefore the spread due to intended human actions is not expected (Wylazłowska 2018 – A).

A4a | Impact on the environmental domain

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

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

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

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

X	inapplicable
	low
	medium
	high

aconf09.	Answer provided with a	low	medium	high	level of confidence

acomm13. Comments:

Lack of such an impact, the species is a plant.

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

	low
	medium
X	high

aconf10.	Answer provided with a	low	medium	high **X**	level of confidence

acomm14. Comments:

Common beggar-ticks successfully competes with native plant species, often disturbing their growth and regeneration. To a large extent, it affects the native aquatic habitat species such as *Alopecurus aequalis*, *Atriplex prostrata* and *Catabrosa aquatica*. The species is often found in mixed populations with *Bidens tripartita* and *Bidens cernua* where it shows strong competitiveness (effective spreading and sprouting in lower temperatures) and even causes the decay of local populations of native species of bidens. *Bidens frondosa* is more ecologically plastic (it has a broader ecological amplitude) and reaches a larger size (Danuso et al. 2012 – P), thanks to which it colonizes new territories faster. High reproductive and dispersive capacity of the species may contribute to ousting of native species (Gruberowá et al. 2001 – P). It may endanger the following Natura 2000 habitats: 1310 – *Salicornia* and other annuals colonising mud and sand (*Salicornion ramosissimae*), 1340* – Inland salt meadows (*Glauco-Puccinietalia*), 3130 – Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoëto-Nanojuncetea*, 3150 – Natural eutrophic lakes with *Nympheion-* and *Potamion*-type vegetation, 3270 – Rivers with muddy banks, 6430 – Hydrophilous tall herb fringe communities of plains and of the montane levels (*Adenostylion alliariae*) and riverside tall-herb communities (*Convolvuletalia sepium*); 91E0 – Alluvial forests (*Salicetum albae*, *Populetum albae*, *Alnenion glutinoso-incanae*, alder forests).

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

	no / very low
	low
	medium
X	high
	very high

aconf11.	Answer provided with a	low	medium	high **X**	level of confidence

acomm15. Comments:

The phenomenon of cross-breeding of *Bidens frondosa* with European species of the *Bidens* genus was described by Ukrainian scholars. Formed hybrids, including *B.* ×*garumnae*, were characterized by a stronger growth than the parent species (Vasilyeva and Papchenkov 2011 – P). Due to the similar climatic, habitat and biocenosis conditions in which *B. frondosa* grows in Ukraine, it may be assumed that the hybridization process described above also occurs in populations located in Poland, hence the likelihood of cross-breeding

was assessed as high. The predicted effect is assessed as medium, as it leads to a loss of genetic integrity in native species that are not of particular concern.

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

	very low
	low
X	medium
	high
	very high

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

acomm16. Comments:

There are no examples of transmission of pathogens or parasites harmful to native plant species from Poland, although in Canada, *Bidens frondosa* is a host of parasitic nematode *Meloidogyne hapla* – a dangerous vegetable pest (Bélair and Benôit 1996 – P) which also occurs in Poland (Nowaczyk et al. 2008 – P). It spreads in the root system of native species which are common weeds in root crops (Samaliev and Kalinova 2013 – P). The species therefore hosts a parasite that infects native species that are not of particular concern.

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

	low
X	medium
	high

aconf13.	Answer provided with a	low	medium	high **X**	level of confidence

acomm17. Comments:

As a therophyte (an annual plant), common beggar-ticks easily dominates the water banks, river alluviates and ruderal habitats, however, there are no known changes in the abiotic conditions of habitats of particular concern in Poland that are difficult to reverse as a result of its presence. Mass occurrence in habitats of high natural value – e.g. banks or drained bottoms of water reservoirs with communities of *Littorelletea* and *Isöeto-Nanojuncetea* (Natura 2000 code: 3130), rivers with muddy banks (Natura 2000 code: 3270), montane and riverside tall-herb communities (Natura 2000 code: 3270) – should not cause changes that are difficult to reverse in the abiotic conditions of the habitat.

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

	low
	medium
X	high

aconf14.	Answer provided with a	low	medium	high **X**	level of confidence

acomm18. Comments:

More frequently, *Bidens frondosa* enters natural habitats within which it contributes to the formation of *Bidentetea* class communities, where it is a characteristic species of *Chenopodion fluviatile* group (Matuszkiewicz 2001 – P). The species is also found in rush communities of the *Phragmitetea* class (e.g. reed, common club-rush, yellow iris and canary grass rushes), in tall-herb communities (e.g. *Filipendulo-Geranietum*) and in willow habitats – i.a. *Salicetum triandro-viminalis* (Kucharski 1992, Urbisz et al. 2009, Sudnik-Wójcikowska 2011 – P). *Bidens frondosa* was also observed in water communities of the *Lemnetea* class, e.g. in the pleuston community that included a rare and protected species of water fern – *Lemno minoris-Salvinietum natantis*, as well as in the communities of the *Potametea* class,

	including the colonies of *Hottonietum palustris* (Michalska-Hejduk et al. 2014 – P). In addition to the competition listed above, *Bidens frondosa* may indirectly (by altering the composition of native plant communities) affect their fauna. For example, in Europe the invasive muskrat *Ondatra zibethicus* eats the shoots of *Bidens frondosa* and many species of waterfowl feed on the seeds of the plant (Holter 1999 – P).

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:

X	inapplicable
	very low
	low
	medium
	high
	very high

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

acomm19.	Comments: Common beggar-ticks is a plant. Also, it is not parasitic.

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

	inapplicable
	very low
X	low
	medium
	high
	very high

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

acomm20.	Comments: In Poland, a widespread entry of *Bidens frondosa* into crops has not been observed (Wylazłowska 2018 – A). However, the species occurs in the immediate surroundings of cultivated fields, in so-called marginal habitats in agricultural areas, mainly on the outskirts of ponds and watercourses, and in buffer strips within fields (Dajdok and Wuczyński 2008 – P), and from there it spreads into some crops. Periodic abundant entry of the species into some root and vegetable crops was observed (Urbisz 2018 – A).

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

	inapplicable
X	no / very low
	low
	medium
	high
	very high

aconf17.	Answer provided with a	low	medium	high **X**	level of confidence

acomm21. Comments:

Bidens frondosa does not cross-breed with any cultivated species in Poland, but potentially it can indirectly, e.g. by cross-breeding with native species of the *Bidens* genus, enter into root crops and dominate in such an environment.

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

	very low
X	low
	medium
	high
	very high

aconf18.	Answer provided with a	low	medium **X**	high	level of confidence

acomm22. Comments:

In Italy, *Bidens frondosa* grows in maize, sugar beet and rice crops (Danuso et al. 2012 – P). So far, there are no documented/published data on entry into cultivation in Poland. However, the species occurs in the immediate surroundings of cultivated fields, in so-called marginal habitats in agricultural areas, mainly on the outskirts of ponds and watercourses, and in buffer strips within fields (Dajdok and Wuczyński 2008 – P), and from there it spreads into some crops, in particular root and vegetable crops in fields with humid and fertile soil, but there is no documented data on the effect of the species on disturbance of crop integrity by changing agrosystem properties (Urbisz 2018 – A). The probability of disturbing the integrity of the crops was therefore assessed as low and the effect as medium.

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

	very low
X	low
	medium
	high
	very high

aconf19.	Answer provided with a	low	medium **X**	high	level of confidence

acomm23. Comments:

In its natural range, *Bidens frondosa* is a host of the parasitic *Meloidogyne hapla* nematode, which is a dangerous vegetable pest (Bélair and Benoit 1996 – P) but is not included on EPPO lists A or B (EPPO 2004 – B). There are no examples of transmission of pathogens or parasites harmful to native plant species from Poland.

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:

X	inapplicable
	very low

	low
	medium
	high
	very high

aconf20.	Answer provided with a	low	medium	high	level of confidence

acomm24.	Comments: No of such interactions. 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:

X	very low
	low
	medium
	high
	very high

aconf21.	Answer provided with a	low	medium	high **X**	level of confidence

acomm25.	Comments: There are no documented interactions of this type.

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

X	inapplicable
	very low
	low
	medium
	high
	very high

aconf22.	Answer provided with a	low	medium	high	level of confidence

acomm26.	Comments: No of such interactions. Plants are not hosts nor vectors of pathogens/parasites of animals.

A4d | Impact on the human domain

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

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

X	inapplicable
	very low
	low
	medium
	high
	vert high

aconf23.	Answer provided with a	low	medium	high	level of confidence

acomm27. Comments:

Lack of such interactions. The species is not a parasite of humans.

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

X	very low
	low
	medium
	high
	very high

aconf24.	Answer provided with a	low	medium **X**	high	level of confidence

acomm28. Comments:

Bidens frondosa has proven medicinal properties and information on this subject is publicly available. It can be used to treat cardiovascular, respiratory, reproductive and excretory diseases (HerbNet 2014 – B), hence the potential low risk of adverse effects on the human body, through inept attempts to use the plant for paramedical purposes, e.g. by eating sprouts or seeds (Wylazłowska 2018 – A).

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

X	inapplicable
	very low
	low
	medium
	high
	very high

aconf25.	Answer provided with a	low	medium	high	level of confidence

acomm29. Comments:

Lack of such interactions. Plants are not hosts nor vectors of pathogens/parasites of humans.

A4e | Impact on other domains

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

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

X	very low
	low
	medium
	high
	very high

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

acomm30. Comments:

There is no evidence of any significant damage to the infrastructure caused by common beggar-ticks in Poland (Wylazłowska 2018 – A).

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
X	moderately positive
	significantly positive

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

acomm31. Comments:

Bidens frondosa is a potential source of essential oils with antibacterial and antioxidant properties (Rahman et al. 2011 – P). In North American countries, infusions and extracts made from *Bidens frondosa* are widely used in pharmaceutical applications and can be used to treat irritation, inflammation, pain and bleeding of mucosa of the urinary tract and to alleviate benign prostate hyperplasia symptoms, increase uric acid excretion and reduce the risk of gout attacks (Flora of North America 2014 – P). Taking the above into account, it can be assumed that *Bidens frondosa* may affect medical and ornamental resources. Therefore, there is a likelihood of an increase in demand for sprouts and seeds and their economic value is unknown (CABI 2018 – B).

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

	significantly negative
X	moderately negative
	neutral
	moderately positive
	significantly positive

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

acomm32. Comments:

Common beggar-ticks ousts native *Bidens* species through competition for habitat resources and easily forms crossbred hybrids with them (Vasilyeva and Papchenkov 2011 – P). In addition, it ousts (also through competition) other native species naturally growing in the habitats occupied by this species (Urbisz et al. 2009 – P). This can potentially cause changes in seed pollination and seed propagation, which can result in changes in trophic networks and thus affect bioregulation.

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

	significantly negative
	moderately negative
X	neutral
	moderately positive
	significantly positive

aconf29.	Answer provided with a	low	medium	high **X**	level of confidence

acomm33.	Comments: Currently, this species is not grown as an ornamental plant in private gardens (Wylazłowska 2018 – A). Common beggar-ticks is not cultivated in Polish horticultural nurseries but, considering the growing interest in establishing naturalistic gardens and the ease of propagation of Common beggar-ticks and a very large similarity to the native *bidens* species, it can be expected that in the future it may be introduced to private gardens. Legislation in this area may restrict the species' availability on the market; for example, in Belgium, Common beggar-ticks is on the list of prohibited foreign invasive plant species (EPPO 2004 – B).

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
X	not change
	increase moderately
	increase significantly

aconf30.	Answer provided with a	low	medium	high **X**	level of confidence

acomm34.	Comments: The species is currently established in Poland where a climate barrier does not exist, so *Bidens frondosa* may continue to spread throughout the country and this will not be associated with global warming.

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
X	not change
	increase moderately
	increase significantly

aconf31.	Answer provided with a	low	medium	high **X**	level of confidence

acomm35.	Comments: Currently, common beggar-ticks is an established species in Poland 2012 – P). There is no climate barrier in Poland so it can spread throughout the country, completing a full development cycle. Also, in its natural range it occurs in a wider variety of climatic conditions (Scoggan 1979 – P, EPPO 2004 – B) than those present in Poland now. Further climate change will not affect its establishment.

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
X	not change
	increase moderately
	increase significantly

aconf32.	Answer provided with a	low	medium	high **X**	level of confidence

acomm36. Comments:

The species is currently established in Poland where a climate barrier does not exist, so *Bidens frondosa* may continue to spread throughout the country. Further global warming will not affect the overcoming of the geographical barrier.

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
X	not change
	increase moderately
	increase significantly

aconf33.	Answer provided with a	low	medium	high **X**	level of confidence

acomm37. Comments:

The species is currently established in Poland where a climate barrier does not exist, so *Bidens frondosa* may continue to spread throughout the country and this will not be associated with global warming.

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
X	increase moderately
	increase significantly

aconf34.	Answer provided with a	low	medium **X**	high	level of confidence

acomm38. Comments:

Currently, common beggar-ticks is an established species in Poland (Tokarska-Guzik et al. 2012 – P). There is no climate barrier in Poland so it can spread throughout the country, completing a full development cycle. Also, in its natural range it occurs in a wider variety of climatic conditions (Scoggan 1979 – P, EPPO 2004 – B) than those present in Poland now. However, climate change may affect the choice of crop species and varieties, e.g. more akin to those grown in southern Europe, where examples of the strong entry of *Bidens frondosa* into maize, sugar beet and rice crops were reported (Danuso et al. 2012 – P).

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

X	not change
	increase moderately
	increase significantly

aconf35.	Answer provided with a	low	medium	high **X**	level of confidence

acomm39. Comments:

The species is currently established in Poland where a climate barrier does not exist, so *Bidens frondosa* may continue to spread throughout the country and its possible impact on animal husbandry will not be associated with global warming.

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

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

aconf36.	Answer provided with a	low	medium	high **X**	level of confidence

acomm40. Comments:

Currently, common beggar-ticks is an established species in Poland (Tokarska-Guzik et al. 2012 – P). There is no climate barrier in Poland so it can spread throughout the country, completing a full development cycle. Also, in its natural range it occurs in a wider variety of climatic conditions (Scoggan 1979 – P, EPPO 2004 – B) than those present in Poland now. No change in the impact of the plant on humans is expected due to climate change.

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

	decrease significantly
	decrease moderately
X	not change
	increase moderately
	increase significantly

aconf37.	Answer provided with a	low	medium	high **X**	level of confidence

acomm41. Comments:

The species is currently established in Poland where a climate barrier does not exist, so *Bidens frondosa* may continue to spread throughout the country and its possible impact on other sites will not be associated with global warming.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	1.00	1.00
Environmental impact (questions: a13-a18)	0.70	0.90

Cultivated plants impact (questions: a19-a23)	0.19	0.75
Domesticated animals impact (questions: a24-a26)	0.00	1.00
Human impact (questions: a27-a29)	0.00	0.50
Other impact (questions: a30)	0.00	1.00
Invasion (questions: a06-a12)	1.00	1.00
Impact (questions: a13-a30)	0.70	0.83
Overall risk score	0.70	
Category of invasiveness	moderately invasive alien speciesp	

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:

The risk assessment of *Bidens frondosa* has concluded that it is a medium-invasive foreign species with a total score of 0.70. The maximum score (1.00) was given to the species in the 'Introduction' (questions a06 – a08), 'Establishment' (a09 – a10) and 'Spreading' (a11 – a12) modules. It also received high scores in the 'Effect on the natural environmen' module (0.70; questions a13 – a18). At the same time, the species was given a low score in the 'Effects on plant cultivation' module. (0.19; questions a19 – a23). In the 'Effects on animal husbandry' (questions: a24 – a26), 'Effects on people' (questions a27 – a29), 'Effects on other sites' (question a30) modules the species scored 0,00.

Due to the fact that the species is established in Poland and has a high spreading capacity, actions limiting the negative impact of the species on areas of high natural value and research leading to the development of effective control methods should be encouraged. So far, mechanical elimination by regular mowing prior to flowering has been reported as the most effective method of reducing common beggar-ticks, especially in environmentally valuable areas (Urbisz et al. 2009 – P). For cultivated fields, methods for chemical elimination using glyphosate are also indicated (Sharma et al. 2000 – P).

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