



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. Zbigniew Celka
2. Julian Chmiel
3. Alina Urbisz

acomment01.	Comments:	degree	affiliation	assessment date
	(1)	dr hab.	Depart. of Plant Taxonomy, Institute of Environmental Biology, Faculty of Biology, Adam Mickiewicz University in Poznań	11-04-2018
	(2)	dr hab.	Depart. of Plant Taxonomy, Institute of Environmental Biology, Faculty of Biology, Adam Mickiewicz University in Poznań	23-04-2018
	(3)	dr hab.	Faculty of Biology and Environmental Protection, University of Silesia in Katowice	10-04-2018

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

Polish name: Świdośliwa kłosa

Latin name: ***Amelanchier spicata*** (Lam.) K. Koch

English name: Dwarf serviceberry

acomm02.

Comments:

The Latin name has been provided according to The Plant List (2013 – B), and Polish name – according to Flowering plants and pteridophytes of Poland checklist (Mirek et al. 2002 – P). Besides those specified below, synonymic names are: *Amelanchier humilis* Wiegand, *A. mucronata* E.L. Nielsen, *A. ovalis* auct. non Medik. (low shadbush), *A. arborea* (F. Michaux) Fernald var. *austromontana* (Ashe) H.E. Ahles (downy shadbush), *A. austromontana* Ashe, *A. lucida* (Fernald) Fernald, *A. canadensis* auct. non (L.) Medik. (eastern shadbush), *A. stolonifera* Wiegand, *Amelancus spicata* (Decne.) Vollm., *Crataegus spicata* Lam., *Pyrus ovalis* Willd. (The International Plant Names Index 2005, Kabuce and Priede 2010, The Plant List 2013, ITIS 2017, e-Floras 2018 – B).

Obligatory Polish name of the species is ‘świdośliwka kłosowa’, and synonymic: ‘świdwośliwa kłosowa’ (Mirek et al. 2002 – P). In horticulture it is popularly called pigeon berry (Szkótki Konieczko 2016 – B). Other English names include: thicket shadbush, garden shadblow, low juneberry, dwarf serviceberry, low serviceberry, running serviceberry, sarvis, sugarplum, pigeon berry (Schorger 1955 – P, BSBI List 2007, Kabuce and Priede 2010, e-Floras 2018, U.S. National 2018 – B). The *Amelanchier* genus is very complex from taxonomic point of view, and it includes many hybrids. *Amelanchier spicata* is specified in different publications as a hybrid of *A. oblongifolia* and *A. stolonifera* (Chittenden 1956 – P). It was also considered a hybrid of *A. canadensis* and *A. ovalis* (see Underwood 2012, The Friends 2015 – B), however other experts found it to be wrong (Krüssmann 1984, Peniašteková 1992 – P). On the other hand, Tutin et al. (1968 – P) indicate close relationship of *A. spicata*, *A. humilis* and *A. canadensis*. A detailed study containing a discussion on the taxonomic status of the *Amelanchier* genus is provided in the work of Burgess (2010 – N).

Polish name (synonym I)

Świdośliwka kłosowa

Polish name (synonym II)

Gołębia jagoda

Latin name (synonym I)

Amelanchier humilis

Latin name (synonym II)

Amelanchier mucronata

English name (synonym I)

Low juneberry

English name (synonym II)

Thicket shadbush

a03. Area under assessment:

Poland

acomm03.

Comments:

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

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

aconf01.

Answer provided with a

low

medium

high

X

level of confidence

acomm04.

Comments:

Amelanchier spicata (thicket shadbush – see comment a02) originating from North America, in Poland is classified in the group of alien species, invasive kenophytes settled both in anthropogenic and natural ecosystems (Tokarska-Guzik 2005, Seneta and Dolatowski 2008, Tokarska-Guzik et al. 2012 – P). In Poland it occurs locally. It has been met for few dozen years in forest areas in various regions of Poland, in large cities and around them. Larger concentrations of its sites of occurrence are reported primarily in western and central parts of Poland, i.a. in Wielkopolska and Kujawy Regions, in Bolimowska and Kampinos Forests (Adamowski et al. 2002, Seneta and Dolatowski 2008, Purcel 2009,

Tokarska-Guzik et al. 2012, Bomanowska et al. 2014, Rutkowski 2014 – P). Within occupied area it occurs predominantly in large numbers of specimens covering vast fields (Tokarska-Guzik et al. 2012 – P). In Poland, it is the most often grown and running wild species of the *Amelanchier* genus. Actual propagation degree is not fully known as it is frequently mistaken for *A. canadensis* and *A. ovalis* (Mirek et al. 2002 – P). It is an ornamental fruit shrub with reduced habitat requirements. It was introduced into forest areas as a species of phytomeliorative and biocenotic significance (Danielewicz and Wiatrowska 2014, Tokarska-Guzik et al. 2012 – P).

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

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

acom05.

Comments:

Thicket shadbush (*Amelanchier spicata*) is in the EPPO List (2018) of invasive alien species, which have considerable dissemination potential, pose serious threat to natural environment and biodiversity, and thus have detrimental social effects. In Poland, it colonises first of all natural and semi-natural habitats, thus generating significant ecological threats (Danielewicz and Maliński 2003, Tokarska-Guzik et al. 2012 – P). It grows in pinewoods, oak-pine forests and on their edges. It is also met in substitute communities with pines on former farmlands, in forest stands of dry-ground habitats, overgrowing turfs, on littoral and inland dunes, in anthropogenic habitats, along roads and road shoulders. The plant prefers sunny to half-shady sites (i.a. Adamowski et al. 2002, Purcel 2009, Danielewicz and Wiatrowska 2012, 2014, Rutkowski 2014 – P). According to the studies completed by Rurane (2004 – P), location of *A. spicata* is mostly correlated with soil eutrophication. Sparse forest stands foster formation of dense undergrowth including *A. spicata* (Kabuce and Priede 2010 – B). According to the information from Laivinš (1998 – P) and Rurane (2004 – P), in Latvia during the last 10-20 years large areas of clear pine forests have changed into forests with dense shrub coverage. In the conditions of its intensified invasion, *A. spicata* contributes to soil eutrophication and reduces availability of light in the undergrowth. By spontaneous spread the plant subdues and hinders (in some cases even prevents) restoration of forest stands (natural sowing and growth of trees). In favourable conditions it may dominate the undergrowth layer. As a result of deteriorated light conditions, the green layer gets reduced to several species or it does not evolve at all (Tokarska-Guzik et al. 2012, Danielewicz and Wiatrowska 2014 – P). In woodland crops it is regarded as a harmful plant, which disturbs forestry operations and requires control. This causes measurable economic losses in production forests, forcing expensive removal operations (Tokarska-Guzik et al. 2012, Danielewicz and Wiatrowska 2014 – P). It poses a threat in protected areas, e.g. in Wielkopolska National Park, in Bolimowska and Kampinos Forests (Adamowski et al. 2002, Purcel 2009, Bomanowska et al. 2014 – P), as well as in protected natural habitats 'Natura 2000' – Central European and subcontinental dry-ground forests – code 9170 (Tokarska-Guzik et al. 2012 – P). Thicket shadbush has no negative impact on animal breeding, human health, and other objects.

A1 | Introduction

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

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

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

aconf02.	Answer provided with a	low	medium	high X	level of confidence
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acomment06. Comments:

In Poland, thicket shadbush *Amelanchier spicata* is classified in the group of settled alien species, invasive kenophytes (Tokarska-Guzik 2005, Seneta and Dolatowski 2008, Tokarska-Guzik et al. 2012 – P). In Europe it was introduced first time in 1783 in France (Hereźniak 1992 – P). At the turn of the 19th and 20th century *A. spicata* was already present in many countries of Northern Europe – from England to Russia – appearing both in cultivation and spontaneously in anthropogenic and natural ecosystems. First reports of its introduction in Poland, in a garden located in Niedźwiedź near Krakow reach back to 1820 (Hereźniak 1992 – P). The species is grown as an ornamental (e.g. for hedges), food (fruit abundant with vitamin C) and melliferous plant, i.a. in home gardens and along motorways in many regions of Poland, also as a shrub that improves aesthetics of urban environment (Seneta and Dolatowski 2008, Purcel 2009, Renda and Trzaskowska 2015 – P). Thicket shadbush cuttings are in business offer of many European countries. In former Soviet Union the species was recommended as helping to improve forest habitats and increase their productivity (Levinš 1959 – P). In the mid 50s of the 20th century it was introduced in production forests in Poland and other European countries for the purposes of biocenotic and phytomeliorative enrichment of forests, primarily pine (Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P). In majority of cases that experiment did not succeed (Kabuce and Priede 2010 – B). From its cultivation areas, *Amelanchier spicata* spreads easily through seeds carried by birds and small mammals, and grows from offshoots and suckers (Birkmane et al. 1957, Bugała 2000, Rurane 2004, Danielewicz and Wiatrowska 2014 – P). Considering the lack of terrain barriers between Poland and neighbouring regions of Europe, the reproductive potential and the way of self-seeding, it can be assumed that, with high probability, thicket shadbush may spontaneously penetrate into natural environment of Poland from croplands located in immediate vicinity of Poland – especially from Germany – owing to birds.

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

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

aconf03.	Answer provided with a	low	medium	high X	level of confidence
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acomment07. Comments:

In the literature there is no information on an unintentional (that is resulting from unplanned human activity) bringing of thicket shadbush *Amelanchier spicata* to the natural environment in Poland. Expert knowledge provides no such information, as well. However, the following answer has been chosen according to the procedure *Harmonia*^{+PL} for species already settled in Poland: high probability, at significant degree of certainty.

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

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

aconf04.	Answer provided with a	low	medium	high X	level of confidence
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acommm08. Comments:

Currently, the species thicket shadbush *Amelanchier spicata* is classified in Poland as settled alien species, invasive kenophytes (Tokarska-Guzik 2005, Seneta and Dolatowski 2008, Tokarska-Guzik et al. 2012 – P). For many years it has been planted in forests as an undergrowth species for phytomeliorative and biocenotic purposes (Danielewicz and Wiatrowska 2014, 2015 – P) and in the so-called hunting plots established in order to reduce losses caused by game in arable crops and forests (Danielewicz and Wiatrowska 2012 – P). Today, in woodland crops it is regarded as a harmful plant which requires control (Danielewicz and Wiatrowska 2014 – P). This species is offered for sale by numerous horticultural companies (i.a. Marosz 2013, Szkółki Konieczko 2016 – B). It is grown for ornamental, honey and fruit production purposes (Kabuce and Priede 2010, Marosz 2013, Nasze krzewy 2016, CABI 2017 – B). Its fruit, although small (ca. 8 mm in diameter), is rich in iron and copper, and is edible either raw or after processing (Nasze krzewy 2016 – B). *Amelanchier spicata* is recommended (together with other species of the *Amelanchier* genus) for plantings along motorways as land reclamation plants (Seneta and Dolatowski 2008 – P, Marosz 2013 – B). It is recommended for home gardens, as park shrubs, for urban green areas, as a solitary shrub (single shrub, exposed in an open area, distinguished by attractive features). Moreover, it is suitable for cut and formed hedges (Bugala 2000 – P, Marosz 2013, Szkółki Konieczko 2016, TreeEbb 2018 – B). From its cultivation areas the plant often grows wild and penetrates into semi-natural and natural habitats, e.g. in the Białowieża Forest, Wielkopolski National Park or Kampinos Forest (Adamowski et al. 2002, Purcel 2009, Bomanowska et al. 2014 – P). Considering the reproductive potential and the way of self-seeding, it can be assumed that thicket shadbush still penetrates into natural environment from existing croplands.

A2 | Establishment

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

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

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

aconf05.	Answer provided with a	low	medium	high X	level of confidence
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acommm09. Comments:

Thicket shadbush *Amelanchier spicata* originates from the northeastern part of North America, mainly the USA, where the climate is much like that in Europe (Hereźniak 1992, Adamowski et al. 2002, Seneta and Dolatowski 2008 – P, USDA-NRCS 2014, e-Floras 2018, U.S. National 2018 – B). Within North America, *Amelanchier spicata* settles in significantly different freezing resistance zones: 1-7, areas characterised by average minimum temperatures ranging from -50°C to -15°C (Pirs 2000a – P). The entire area of Poland stays within 5-7 freezing resistance zones, which means that thermal conditions prevailing in the whole country are very suitable for this species. Low temperatures observed in wintertime are needed to interrupt seed dormancy (Underwood 2012 – B). In its native part of range seeds germinate faster after passing through digestive tract of cedar waxwing (*Bombycilla cedrorum*) (Dwarf Serviceberry 2012 – B). *Amelanchier spicata* is highly resistant to water scarcity, therefore humidity conditions prevailing in Poland are not among factors that hinder the species spread within Poland. Similarity between the climate in Poland and in parts of both

natural range of extent and secondary coverage of the species is within 94-100%, which means that climatic conditions in Poland are optimal for the analysed species.

a10. Poland provides **habitat** that is

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

aconf06.	Answer provided with a	low	medium	high X	level of confidence
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acomm10. Comments:
 In North America within its primary range of extent, thicket shadbush *Amelanchier spicata* grows in forests and scrubs, on dunes, rocky and sandy river banks and slopes, and also in modified habitats, on edges of fields and road shoulders, in peat, sandy and gravel soils. The plant prefers sour soils (Lange et al. 1978, Krüssmann 1984, Danielewicz and Maliński 1996 – P, Kabuce and Priede 2010, e-Floras 2018 – B), although it is able to grow in various soil types and tolerates wide range of soil pH (Pirs 2000b – P). In mountain areas it reaches elevations up to 1200 m above sea level. (e-Floras 2018 – B). Within its secondary coverage the plant colonises much the same habitat types – first of all it is met in fresh pine forests, mixed oak-pine forests, in substitute communities with pines (e.g. on former farmlands), in forest stands of dry-ground habitats, overgrowing turfs, forest edges, on littoral and inland dunes. The plant also appears in anthropogenic habitats, along roads and road shoulders, it prefers sunny to half-shady sites (i.a. Tabaka et al. 1988, Schroeder 1995, Tzvelev 2000, Adamowski et al. 2002, Purcel 2009, Pyšek et al. 2012, Danielewicz and Wiatrowska 2012, 2014, Rutkowski 2014 – P, Kabuce and Priede 2010, CABI 2017 – B). Currently, the greatest stocks of *A. spicata* are concentrated in western part of Poland (Tokarska-Guzik et al. 2012 – P), however favourable habitat conditions exist in many places all over the country – primarily in forests and ruderal areas.

A3 | Spread

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

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

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

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

aconf07.	Answer provided with a	low	medium	high X	level of confidence
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acomm11. Comments:
 The first information about thicket shadbush *Amelanchier spicata* in Poland comes from a garden in Niedźwiedź near Krakow from the year 1820 (Hereźniak 1992 – P), whereas its first spontaneous sites of occurrence out of croplands are known from the early 20th century from Silesia (Schube 1903, Tokarska-Guzik 2005 – P). According to Sukoppa and Wurzel (2003 – P), the time between introduction and invasion into natural environment for non-native shrubs and trees may reach even 100-180 years. The expansion of *Amelanchier spicata* is faster owing to proper ecological conditions and little competition of other species (Laime

2002 – P). Flowers are pollinated by wide range of insects, mainly bees (Pirs 2000b – P). Today, *Amelanchier spicata* appears in various regions of our country, especially in its western and central parts (Tokarska-Guzik et al. 2012, Danielewicz and Wiatrowska 2014 – P). Total number of sites is estimated to exceed 200 (Danielewicz and Wiatrowska 2014 – P). In its sites of occurrence it appears in large numbers, sometimes covering whole fields (Tokarska-Guzik et al. 2012 – P). It reproduces easily from seeds (Bugala 2000 – P); birds and small mammals consuming fruit help the plant to spread (Kabuce and Priede 2010 – B). Thicket shadbush begins fruiting at the age of 3-4 years and lives even 50-70 years. The plant is distinguished by very high vitality of seeds – even 100%. The best germination effects were observed in recently picked seeds (Vinogradova et al. 2010 – P). *Amelanchier spicata* is also able to grow from offshoots and suckers (Bugala 2000, Danielewicz and Wiatrowska 2014 – P). The information from Wielkopolski National Park indicates that *Amelanchier spicata* appeared in this area before 1963 (Szulczewski 1963, Danielewicz and Maliński 1996 – P). Since then it has colonised mostly anthropogenic habitats in eastern part of the Park, where it grows wild from home crops, forming communities of even more than 100 specimens (Purcel 2009 – P). In northern and south-eastern part of the Park the plant also enters forests, and strict protection areas, where it covers fields in groups of few dozen specimens (Żukowski et al. 1995, Danielewicz and Maliński 1996, Purcel 2009 – P). The species range of extent in many regions of northern and central Europe has increased considerably and in quite short time; for example in Poland in the last century the number of sites has grown from several at the beginning of the 20th century to more than 200 at the beginning of the 21st century (Schube 1903, Tokarska-Guzik 2005, Danielewicz and Wiatrowska 2014 – P). It should be emphasised that thicket shadbush spread rate is intensified by both planned and unintentional activities of man.

The data on the expansion from a single source (Type A data): although propagation through offshoots and suckers occurs only few meters around the parent plant, zoochory has considerable share in the species proliferation (seed spreading by animals, participation of animals in propagation of diaspores – primarily seeds and fruit). Most often these are birds and small mammals. It can be assumed that possible distance that the species will cover in one year, will be from 500 m to ca. 5 km; the dispersion is average.

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

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

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

acom12. Comments:

Thicket shadbush *Amelanchier spicata* was introduced in Polish production forests in a planned way to improve biocenotic diversity in pine monocultures, and for phytomeliorative purposes (Danielewicz and Wiatrowska 2014, 2015 – P). Today, it is not planted in forests any more, since in forestry it is regarded as a harmful plant for crops (Danielewicz and Wiatrowska 2014 – P). It is recommended for cultivation as an ornamental, melliferous and nutritive plant. It is continuously on sale in numerous horticultural nurseries (i.a. Marosz 2013, Nasze krzewy 2016, Szkółki Konieczko 2016, TreeEbb 2018 – B). In Poland the species began to spread after introducing for cultivation in production forests and home gardens. *Amelanchier spicata* may enter environment by spontaneous sowing – its seeds are carried by birds and small animals. Moreover, the plant propagates vegetatively through offshoots and suckers (Birkmane et al. 1957 – P, Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P). Significant role in the species long distance propagation is played by the internet sale, which has increased globally (e.g. Nasze krzewy 2016, Szkółki Konieczko 2016 – B). With high probability it can be assumed that locally *A. spicata* spreads with soil (with pieces of runners), which is transported during forestry or road works. *Amelanchier spicata* is cultivated in 11 collections in Poland (Botanical Garden at the University of Wrocław, Botanical Garden at the University of Wrocław in Wojsławice, Forest Arboretum of Professor

Stefan Białobok, Botanical Garden at Maria Curie-Skłodowska University in Lublin, Botanical Garden at the University of Zielona Góra, Botanical Garden in Łódź, Botanical Garden at Rogów Forestry Experimental Station, Botanical Garden in Bolestraszyce: Arboretum and Institute of Physiography in Bolestraszyce, Forest Botanical Garden in Marszewo, Botanical Garden at AMU in Poznań). In total, crop registers contain 40 specimens, additionally in one garden the plant covers the area of 3 m². The oldest specimen was planted in 1940 (Botanical Garden at AMU in Poznań). In one case (Botanical Garden at Rogów Forestry Experimental Station) the species proliferates spontaneously, and thus preventive operations have been undertaken there in order to control its spread (Employees of botanical garden ... 2018 – N). Considering various options of the species dissemination – mainly due to planned activities of man, the frequency of diaspore relocation to distances exceeding 50 km as a result of human activity should be evaluated as high (more than 10 cases per a decade are expected).

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
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 level of confidence

acomm13. Comments:
The species is a non-parasite 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 checked="" type="checkbox"/> | medium |
| <input type="checkbox"/> | high |

aconf10. Answer provided with a

low	medium	high
		X

 level of confidence

acomm14. Comments:
Penetrating into fresh and mixed pine forests, substitute communities with pines in forest stands of dry-ground habitats and in forests planted on former farmlands, thicket shadbush *Amelanchier spicata* strongly competes with native species of shrub and undergrowth layer. Thus, it contributes to species impoverishment and modification of forest layer structure (Kabuce and Priede 2010 – B, Tokarska-Guzik et al. 2012, Danielewicz and Wiatrowska 2014 – P). The plant has considerable potential for adaptation to diverse climatic and habitat

conditions, intensive generative reproduction, and ability to propagate vegetatively. In the conditions of its intensified invasion, the species contributes to soil eutrophication and reduces availability of light in the undergrowth (Laivinš 1998, Rurane 2004 – P). Undergrowth consisting of native species gets completely dominated by thicket shadbush. Deteriorated light conditions resulting from thicket shadbush growth strongly affect species in the green layer and thus their number drops down to several species, or the layer does not evolve at all. The potential for tree species restoration and growth is reduced as well (Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P). There is no documented data concerning the impact of *A. spicata* on native species due to competition, however it can be assumed that it competes both with native undergrowth species (e.g. sheep fescue *Festuca ovina*, common bilberry *Vaccinium myrtillus*, common cow-wheat *Melampyrum pratense*) typical for old acidophilous oak wood habitat (habitat 9190 – Old acidophilous oak woods) (Chmiel 2007 – A) and woody plants (Scots pine *Pinus sylvestris*, common oak *Quercus robur*, sessile oak *Q. petraea*). None of mentioned species has the status of special care species. *Amelanchier spicata* poses threat to native species in protected areas, e.g. in Wielkopolski National Park, where it occurs in 59 forest sections, in some of them on a mass scale (Purcel 2009 – 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
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acommm15. Comments:
 In Poland there are no native species of the *Amelanchier* genus (Mirek et al. 2002 – P). According to different sources, in Poland there are from 4 to 17 species of the *Amelanchier* genus either grown or running wild from croplands (Seneta 1991, Hereźniak 1992, Bugała 2000, Mirek et al. 2002, Seneta and Dolatowski 2008 – P). The taxonomic status of *A. spicata* is not definitely explained, yet. Various sources state that it can be a hybrid (i.a. Chittenden 1956, Krüssmann 1984 – P, por. a02). Moreover, in the literature there are descriptions of hybrids between *Amelanchier spicata* and *A. arborea*, *A. bartramiana*, *A. canadensis*, *A. intermedia*, *A. laevis* and *A. sanguinea* (Fernald 1950, Cinq-Mars 1971, Angelo and Boufford 2012 – P). From Poland, the only ones are *A. arborea* and *A. laevis* (Hereźniak 1992, Bugała 2000, Mirek et al. 2002 – P), however there is no information regarding crossing of these species in our country. Also, in the literature there is an information regarding the intergenus hybrid \times *Amelasorbus* (*Amelasorbus raciborskiana*) grown in Kórnik Arboretum in 1934 after crossing *Amelanchier asiatica* and *Sorbus* sp. from the *Sorbus aucuparia* group (Bugała 2000 – P).

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

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

aconf12.	Answer provided with a	low X	medium	high	level of confidence
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acommm16. Comments:
 The literature contains little information on pathogens transmitted by thicket shadbush *Amelanchier spicata*. The species of the *Amelanchier* genus are hosts for *Erwinia amylovora*

bacteria, which induce fire blight, a bacterial disease of many plants, mainly from the rose family (Rosaceae), e.g. apple tree (*Malus*) and pear tree (*Pyrus*) genus (CABI 2017 – B). *Erwinia amylovora* is in the EPPO A2 list. Natural range of extent of this bacterium and disease symptoms covers North America and most of Eurasia. Considering the lack of information whether *A. spicata* is actually the vector of this pathogen, and that its natural range of extent is Eurasia as well, it has been indicated that the taxon has very little impact on the transmission of pathogens harmful for native species at small degree of certainty. In the literature on the subject there is quite a lot of information on pathogens and pests posing a threat to commodity crops of alder-leaved shadbush *Amelanchier alnifolia*, both in North America (Pluta 2018 – B) and in Poland (Piątek 2016 – B).

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

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

aconf13.	Answer provided with a	low	medium	high	level of confidence
				<input checked="" type="checkbox"/>	

acomm17.	Comments:
	By its spread and vegetative expansion, thicket shadbush <i>Amelanchier spicata</i> contributes to increase in substratum trophic. Higher content of biogenes in soil (soil eutrophication) and reduced availability of light in the undergrowth induces change in species composition of this layer (Rurane 2004 – P). The presence of thicket shadbush and its proliferation triggers changes in the physiognomy of natural and semi-natural habitats (Kabuce and Priede 2010, CABI 2017 – B). In natural systems, which are not special care habitats (forests planted on former farmlands), the plant hinders regeneration processes. In special care habitats (especially in habitat 9190 – Old acidophilous oak woods), in case of considerable coverage and subduing large areas, <i>Amelanchier spicata</i> may induce hardly reversible changes (due to rare coincidence of these situations, the impact has been assessed as average, Chmiel 2007 – A).

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

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

aconf14.	Answer provided with a	low	medium	high	level of confidence
				<input checked="" type="checkbox"/>	

acomm18.	Comments:
	Penetrating into pine and mixed forests, substitute communities with pines on former farmlands, old acidophilous oak woods and leaner dry-ground forests, thicket shadbush has strong negative impact on the undergrowth and the green layer. Biodiversity is reduced, the undergrowth becomes dominated by thicket shadbush, characteristic composition of undergrowth containing meso- and oligotrophic species gets impoverished. Rump undergrowth is formed in this way, which includes even nitrophilous (nitrophilic) species. In the extreme cases all plants belonging to the undergrowth are eliminated, and the process involving restoration of tree species forming the top layer in forest, the so-called layer A, gets deteriorated (Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P, Chmiel 2017 – A). In the worst case <i>Amelanchier spicata</i> induces hardly reversible changes regarding processes occurring in special care habitats (habitat 9190 – Old acidophilous oak woods) (Chmiel 2007 – A). Reduced biodiversity was observed in various, valuable from environmental point of view, regions of Poland, e.g. in the Białowieża Forest (Adamowski et al. 2002 – P), Kampinos National Park (Bomanowska et al. 2014 – P), or Wielkopolski National Park (Purcel 2009 – P). Moreover, <i>Amelanchier spicata</i> has negative impact on the Natura 2000 habitats: Central European and subcontinental dry-ground

forests – code 9170 (Tokarska-Guzik et al. 2012 – P). In Poland, same as in Latvia (Laivinš 1998, Rurane 2004 – P), large areas of clear forests may change into forests with dense shrub coverage. The layer structure of forests changes.

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, also it has no parasitic nature.

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:

In the past, thicket shadbush *Amelanchier spicata* was planted in forests for different purposes (Danielewicz and Wiatrowska 2014 – P). Today, it is regarded as harmful plant in forestry (Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P). In woodland crops, in the first years it may effectively compete with planted trees. It may also prevent natural restoration of trees – germination and growth of seedlings and young trees. It is not competitive in any way with arable crops. Probability of competition with woodland crops is expected to be average (it may affect from 1/3 to 2/3 of crops of invaded plants). Also, competition results are expected to be average (in the worst case the condition of plants or yield from a single crop is reduced by ca. 5% to ca. 20%).

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

- inapplicable
- no / very low
- low
- medium

high
 very high

aconf17. Answer provided with a

low	medium	high X
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 level of confidence

acommm21. Comments:
 The *Amelanchier* genus is regarded very complex from taxonomic point of view, and including many hybrids. Some scientists consider *Amelanchier spicata* the hybrid of *A. oblongifolia* and *A. stolonifera* (Chittenden 1956 – P). Certain publications inform that it is the hybrid of *A. canadensis* and *A. ovalis* (see Underwood 2012, The Friends 2015 – B), which is found incorrect by other researchers (Krüssmann 1984, Peniašteková 1992. – P). Whereas, Tutin et al. (1968 – P) indicate close relationship of *A. spicata*, *A. humilis* and *A. canadensis*. Considering the above circumstances, one should take into account the possibility of growing hybrids of *A. alnifolia* – the species so far very rarely cultivated for food purposes in Poland. There are from 4 to 17 species of the *Amelanchier* genus grown in Poland: *A. arborea*, *A. alnifolia*, *A. canadensis*, *A. cusickii*, *A. laevis*, *A. lamarckii*, *A. obovalis*, *A. ovalis*, *A. sanguinea*, *A. spicata* (Seneta 1991, Hereźniak 1992, Bugała 2000, Mirek et al. 2002, Seneta and Dolatowski 2008 – P). In the literature there are descriptions of hybrids between *Amelanchier spicata* and *A. arborea*, *A. bartramiana*, *A. intermedia*, *A. laevis* and *A. sanguinea* (Fernald 1950, Cinq-Mars 1971 – P). From Poland, the only ones are *A. arborea* and *A. laevis* (Hereźniak 1992, Bugała 2000, Mirek et al. 2002 – P), however there is no information regarding crossing of these species in our country. Also, in the literature there is an information regarding the intergenus hybrid: ×*Amelasorbus raciborskyana* (*Amelasorbus raciborskiana*) grown in Kórnik Arboretum in 1934 after crossing *Amelanchier asiatica* and *Sorbus* sp. from the *Sorbus aucuparia* group (Seneta 1991, Bugała 2000 – P).

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

very low
 low
 medium
 high
 very high

aconf18. Answer provided with a

low	medium	high X
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 level of confidence

acommm22. Comments:
 Thicket shadbush *Amelanchier spicata* is unable to cross with those tree species, which are important for forest economy. On the other hand, it is possible to grow hybrids of *A. alnifolia* (alder-leaved shadbush) – the species, which is very rarely grown in Poland for food purposes. In the literature there is no information regarding diseases and pests affecting *A. spicata*, which does not mean at all that it cannot be the vector of pests and pathogens. Here, we can use as an example fire blight induced by *Erwinia amylovora* bacterium, which affects the related species of *A. alnifolia*. It may also attack the *Malus* and *Pyrus* genera. Competing especially in the first years with planted trees and preventing natural restoration – germination and growth of young tree seedlings, are the essential aspects of disturbances in integrity of crops. Probability of disturbing the integrity of woodland crops is expected to be average (it may affect from 1/3 to 2/3 of crops of invaded plants). Also, its results are expected to be average (in the worst case the condition of plants or yield from a single crop is reduced by ca. 5% to ca. 20%).

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	high
X		

 level of confidence

acommm23. Comments:
 There is little information about pathogens transmitted by thicket shadbush *Amelanchier spicata*. It is known that *Amelanchier* spp. is a host for *Erwinia amylovora* bacterium, which induces fire blight, a bacterial disease of many plants, mainly from the rose family (Rosaceae) (CABI 2017 – B). The pathogen attacks i.a. cultivated species of the following genera: Japanese quince (*Chaenomeles*), cotoneaster species (*Cotoneaster*), apple tree (*Malus*), pear tree (*Pyrus*) and whitebeam (*Sorbus*). It generates greatest economic losses in pear and apple tree crops. *Erwinia amylovora* is in the EPPO A2 list. The literature on the subject provides information on pests and pathogens posing a threat to commodity crops of alder-leaved shadbush *Amelanchier alnifolia*, both in North America (Pluta 2018 – B) and in Poland (Piątek 2016 – B). These are bacterial diseases – fire blight (*Erwinia amylovora*) and fungal diseases – pear rust (*Gymnosporangium* sp.), leaf spot (*Entomosporium* sp.), brown rot (*Monilinia amelanchieris*), Nectria canker (*Nectria* sp.), Cytospora cancer (*Cytospora* sp.). Losses in crops of *A. alnifolia* are also generated by insect pests, e.g. tortrix moth, tarnished plant bugs, shadbush sawfly, apple blossom weevil, two-spotted spider mites and aphids (Pluta 2005, Jagodnik 2015 – B).

A4c | Impact on the domesticated animals domain

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

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

inapplicable
 very low
 low
 medium
 high
 very high

aconf20. Answer provided with a

low	medium	high
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 level of confidence

acommm24. Comments:
 The species is a plant, and it does not affect animals as a predator or parasite.

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

very low
 low
 medium
 high
 very high

aconf21. Answer provided with a

low	medium	high
		X

 level of confidence

acomm25.

Comments:

Thicket shadbush *Amelanchier spicata* has no negative impact on health of an individual animal and animal production. Its fruit abundant with vitamins is readily consumed by birds and smaller mammals.

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:

Thicket shadbush *Amelanchier spicata* is a plant and it is neither a host nor a vector of animal parasites and 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
- very high

aconf23.

Answer provided with a

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

level of confidence

acomm27.

Comments:

The species is a plant, and it does not affect human health as a parasite.

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 X
-----	--------	------------------

level of confidence

acomm28.

Comments:

Thicket shadbush *Amelanchier spicata* has no negative impact on human health. At the same time, it has fruit abundant with vitamins (Tutin et al. 1968, Kuusk et al. 1996 – P), which can be eaten by man.

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

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

aconf25.	Answer provided with a	low	medium	high	level of confidence
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acomm29. Comments:
The species is a plant, it 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:

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

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

acomm30. Comments:
In the literature there is no sufficient information on the impact of thicket shadbush *Amelanchier spicata* on the infrastructure. Nevertheless, in forests where the plant forms dense undergrowth, it may hinder keeping division lines clear (Chmiel 2007 – 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:

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

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

acomm31. Comments:
There is no direct research on the discussed issue, completed in Poland. *Amelanchier spicata* is used in horticulture as an ornamental plant (Kabuce and Priede 2010, Marosz

2013, Nasze krzewy 2016 – B). It is a melliferous plant, and its fruit abundant with vitamins may constitute valuable material in forest fruit-based food processing.

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

acomment32. Comments:
For years, thicket shadbush *Amelanchier spicata* was planted in forests for phytomeliorative and biocenotic purposes (Danielewicz and Wiatrowska 2014, 2015 – P). It turned out that the species did not meet expectations. *Amelanchier spicata* contributes to the change in abiotic (increase in trophy, changed light availability conditions) and biotic (displacing native species) factors, which results in modified nature of subdued plant communities (Rurane 2004 – P, Kabuce and Priede 2010 – B, Danielewicz and Wiatrowska 2014 – P). As a consequence of *A. spicata* invasion, large areas of pine forests change their physiognomy due to the occurrence of a dense layer of shrubs consisting of *Amelanchier spicata* (Laivinš 1998, Rurane 2004 – P, Kabuce and Priede 2010 – B).

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

acomment33. Comments:
The literature does not provide information on this subject. Thicket shadbush *Amelanchier spicata* is used in horticulture. The species is often planted on plots, in home gardens and urban green areas (Bugala 2000 – P, Marosz 2013, Szkółki Konieczko 2016, TreeEbb 2018 – B) becoming a popular plant (e.g. as a solitary shrub, that is forming isolated designs of cultivated green area architecture). Therefore, it contributes to a change in culture-related habits of Polish residents, which should be deemed as a negative effect (Celka 2017 – A). *Amelanchier spicata* growth in forests may restrict access and hinder recreational and touristic activities.

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

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

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

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

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

aconf30. Answer provided with a

low	medium X	high
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 level of confidence

acommm34. Comments:
 In Poland, cultivation of thicket shadbush *Amelanchier spicata* started in the year 1820 (Niedźwiedź near Kraków; Hereźniak 1992 – P). In Poland, the species is regarded as an invasive kenophyte, which has already overcome geographical barriers and now spreads spontaneously (Tokarska-Guzik 2005, Seneta and Dolatowski 2008, Tokarska-Guzik et al. 2012 – P). Natural range of extent of *A. spicata* covers cold regions in northeastern part of North America, while main species stocks within its secondary coverage concentrate in northern part of Europe. The species is resistant to very low temperatures. It withstands frosts reaching even ca. -50°C (Pirs 2000a – P). In North America, *Amelanchier spicata* settles in significantly different freezing resistance zones: 1-7, areas characterised by average minimum temperatures ranging from -50°C to -15°C. The entire area of Poland stays within 5-7 freezing resistance zones, which means that thermal conditions prevailing here cover upper range of thermal scale. This allows concluding that the assumed rise of average annual temperature by 1-2°C in the years 2046-2065 may result in moderate reduction of the species acclimation potential in the warmest regions of Poland.

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

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

aconf31. Answer provided with a

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

 level of confidence

acommm35. Comments:
 At the turn of the 19th and 20th century thicket shadbush *Amelanchier spicata* was already present in many countries of Northern Europe – from England to Russia – appearing both in cultivation and spontaneously in anthropogenic and natural ecosystems. In the literature there is no information regarding the time of *A. spicata* occurrence in natural environment of Poland. At least 50 years ago thicket shadbush was already appearing spontaneously in immediate vicinity of western and eastern borders of Poland. Therefore, it should be assumed that *A. spicata* appeared spontaneously minimum 50 years ago in natural environment of Poland as well. In Poland, the species invasiveness proceeded within 5-7 freezing resistance zones, that's in the upper range of the species thermal scale. It means that the assumed rise of average annual temperature by 1-2°C in the years 2046-2065 may result in moderate reduction of the species reproductive potential in natural environment conditions. This is so because there is information available that low temperatures prevailing in wintertime are required to interrupt seed dormancy (Underwood 2012 – B).

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

acommm36. Comments:
 At the turn of the 19th and 20th century thicket shadbush *Amelanchier spicata* was already present in many countries of Northern Europe – from England to Russia – appearing both in cultivation and spontaneously in anthropogenic and natural ecosystems. In the literature there is no information regarding the time of *A. spicata* occurrence in natural environment of Poland. At least 50 years ago thicket shadbush was already appearing spontaneously in immediate vicinity of western and eastern borders of Poland. Therefore, it should be assumed that *A. spicata* appeared spontaneously minimum 50 years ago in natural environment of Poland as well. In Poland, the species invasiveness proceeded within 5-7 freezing resistance zones, that's in the upper range of the species thermal scale. It means that the assumed rise of average annual temperature by 1-2°C in the years 2046-2065 may result in moderate reduction of the species proliferation potential within Polish territory in natural environment conditions.

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

acommm37. Comments:
 The species is treated as invasive throughout Poland (Tokarska-Guzik 2005, Tokarska-Guzik et al. 2012 – P). However, the species invasiveness is distributed very unevenly throughout the country. Until now, it has proven to be relatively strong in Western Poland and proceeded within 5-7 freezing resistance zones, that's in the upper range of the species thermal scale. It means that the assumed rise of average annual temperature by 1-2°C in the years 2046-2065 may moderately reduce thicket shadbush impact on habitats and wild plant and animal species in Poland.

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

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

aconf34. Answer provided with a

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

 level of confidence

acommm38. Comments:
 Thicket shadbush *Amelanchier spicata* is not a segetal weed. Moreover, it does not appear spontaneously in agricultural landscape. The anticipated climatic changes will not contribute to turning the plant into a segetal weed any time in the future, or in any other way to

modifying it so that it affects agricultural plant production in Poland. The assumed rise of average annual temperature by 1-2 C in the years 2046-2065 may moderately reduce thicket shadbush impact on woodland crops.

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

acomment39. Comments:
In Poland, thicket shadbush *Amelanchier spicata* in any way affects farm animals and has no impact on animal production. The anticipated climatic changes will not contribute to modifying the species so that it affects animal production in Poland in the future.

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

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

aconf36. Answer provided with a

low	medium	high X
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 level of confidence

acomment40. Comments:
Utility potential of thicket shadbush *Amelanchier spicata* resulting from its edible values is not used in Poland – there is no custom of fruit picking and processing. The species has no allergenic properties. Therefore, the anticipated climatic changes will not contribute to changing the plant impact on people.

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

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

aconf37. Answer provided with a

low	medium	high X
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 level of confidence

acomment41. Comments:
The only aspect of current species impact on infrastructural elements is overgrowing of forest division lines (Chmiel 2007 – A). However, this phenomenon is not mass in scale and is limited to forest sections subdued by thicket shadbush to a largest extent. The assumed rise of average annual temperature by 1-2 °C will not change current species impact on other (infrastructural) objects.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.75	1.00
Environmental impact (questions: a13-a18)	0.40	0.70
Cultivated plants impact (questions: a19-a23)	0.35	0.80
Domesticated animals impact (questions: a24-a26)	0.00	1.00
Human impact (questions: a27-a29)	0.00	1.00
Other impact (questions: a30)	0.25	1.00
Invasion (questions: a06-a12)	0.92	1.00
Impact (questions: a13-a30)	0.40	0.90
Overall risk score	0.37	
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:

Thicket shadbush *Amelanchier spicata* belongs to alien species in Europe. In central and northern parts of the continent it is a settled and spreading species (Kabuce and Priede 2010 – B). In Poland, it is classified among invasive kenophytes (Tokarska-Guzik 2005, Seneta and Dolatowski 2008, Tokarska-Guzik et al. 2012 – P). *Amelanchier spicata* has been entered in the list of alien species, which may pose threat to the nature in Poland and the European Union (Tokarska-Guzik et al. 2015 – I) and in the list of plants used in horticulture that belong to invasive alien species, in case of which it has been agreed that it is needed not to put them up for sale and cultivation (“agreed species”) in the so-called “Code of Good Practices” (GDOŚ 2016 – P). In Europe it is listed among more threatening species having negative effect on biodiversity (EPPO 2018 – B). The distribution of thicket shadbush is the result of its dissemination from cultivation locations in forests, home gardens and urban green areas (Bugala 2000, Danielewicz and Wiatrowska 2014 – P). As a melliferous and fruit shrub, it is recommended for cultivation and it is continuously on sale in numerous horticultural farms and through the Internet (m.in. Marosz 2013, Nasze krzewy 2016, Szkółki Konieczko 2016, TreeEbb 2018 – B). After completed risk assessment for Poland, thicket shadbush has been classified in the category – “potentially invasive alien species”. Negative impact on natural environment remains in the category “low”, in spite of high rate of further expansion (maximum result in the module ‘Invasion process’). With high probability this result may be due to the species biological features (shrub) and dynamics of its population growth. The species enters many natural, semi-natural and ruderal habitats, establishing numerous populations. Thicket shadbush is entering areas protected in Poland; the species has been confirmed in 4 national parks (Bomanowska et al. 2014 – P).

Data sources

1. Published results of scientific research (P)

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