



Appendix A

## Harmonia<sup>+PL</sup> – 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. Władysław Danielewicz
2. Dan Wołkowycki
3. Anna Gazda

acomment01.	Comments:	degree	affiliation	assessment date
		(1) dr hab.	Department of Forest Botany, Faculty of Forestry, Poznań University of Life Sciences	27-03-2018
		(2) dr	Faculty of Forestry, Białystok University of Technology	14-05-2018
		(3) dr hab. Inż.	Department of Forest Biodiversity, Institute of Forest Ecology and Silviculture, Faculty of Forestry, University of Agriculture in Krakow	06-02-2018

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

Polish name: Dereń rozłogowy  
Latin name: ***Cornus sericea* L.**  
English name: Redosier dogwood

acommm02.

Comments:

Apart from the accepted scientific name, the species has more than 50 different synonymous names. It has also been included in *Ossea*, *Swida*, *Thelycrania* genera (The Plant List 2013 – B). Most frequently mentioned synonyms are *Cornus stolonifera* Michx., *C. alba* L. subsp. *stolonifera* (Michx.) Wangenrin, *Swida sericea* (L.) Holub., *Swida stolonifera* Rydb. Some authors (Zieliński et al. 2014 – P) are in favour of broad classification of *C. alba* L. with two subspecies – *C. a.* subsp. *alba* and *C. a.* subsp. *stolonifera* (Michx.) Wangenrin, which in their opinion is justified by theoretical and practical reasons, related to the possibility of identifying individuals of this species during their flowering, fruiting and even in a vegetative state. Other English names of the species are red willow, redstem dogwood, redtwig dogwood, red-rood, American dogwood, creek dogwood, western dogwood (Gucker 2012 – P).

Polish name (synonym I)

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Polish name (synonym II)

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Latin name (synonym I)

*Cornus stolonifera*

Latin name (synonym II)

*Swida sericea*

English name (synonym I)

Redosier

English name (synonym II)

Red-osier

**a03. Area under assessment:**

**Poland**

acommm03.

Comments:

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

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

aconf01.

Answer provided with a

low

medium

high

**X**

level of confidence

acommm04.

Comments:

A species with a wide natural range in North America, extending from the Atlantic to the Pacific and from Alaska, Canada and the northern regions of the USA to California and North Mexico (Little 1977 – P, USDA, NRCS 2000 – B, Gucker 2012 – P, CABI 2017 – B). It is established in many European countries and is considered invasive in Denmark, Finland, Switzerland and Scotland (CABI 2017 – B). In Poland, the species is grown as an ornamental plant and occurs spontaneously in many regions in anthropogenic, semi-natural and natural habitats, including non-forest wetlands and riparian forests. It is considered to be established and classified as a regionally invasive plant, which occurs in few sites or is dispersed in many sites. Although small in number it poses a significant ecological, economic and social risk (Tokarska-Guzik et al. 2012 – P).

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

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

acom05.

Comments:

Species enters wet and marshy habitats, natural and semi-natural communities, forests and non-forests, scrublands, rushes and meadows, in which (thanks to the high rooting capacity of the shoots) it can expand widely and change the structure of phytocoenoses (Charles-Dominique et al. 2009, Danielewicz and Wiatrowska 2014, Biereżnoj-Bazille and Werpachowski 2015 – P). This applies in particular to rushes on floodplain terraces of river valleys and the understory of alder and riparian forests (Wołkowycki 2000–2018 – A, Brzosko et al. 2016 – P). It also easily spreads generatively to anthropogenically disturbed habitats, especially in areas where it is frequently cultivated (Danielewicz 1980–2017 – A). It can transform ecosystems by limiting access to light for other plants, and by changing the process of decomposition and nitrogen availability (Kelly 1990 – P). Birds and other animals enjoy eating the fruits, ungulates and beavers gnaw the sprouts of this species. In the area of natural occurrence, the species was among the edible plants (fruits) and was used in traditional medicine (USDA, NRCS 2000 – B). Redosier dogwood is an insect host (Burke and Anderson 1989, Ranger et al. 2010, Seljak 2012, Sjöman et al. 2014 – P) and possibly also hosts viruses attacking other organisms (EPPO 2008 – B). Therefore, the negative impact of the species on forest plantations and other cultivated plants cannot be excluded. Strong growth of the species may cause minor damage to such infrastructure as pavements of paths in parks, drainage ditches or small culverts (Danielewicz 1980–2017 – A).

## 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
		<b>X</b>

level of confidence

acom06.

Comments:

The species is cultivated and occurs spontaneously in the neighbouring countries of Poland: Germany, the Czech Republic (EPPO 2008, CABI 2017 – B), Slovakia (i.a. Rendeková et al. 2015 – P), Lithuania (i.a. Gudžinskas et al. 2017 – P). In Belarus, it is maintained in cultivation in the parks and gardens (Parfenov 1999 – P). While the effectiveness of generative spread of this species in those countries is unknown, Kelly (1990 – P) pointed out that in Ireland mainly specimens that originated from vegetative growth were observed, and they were most often transported by flood waves. Redosier dogwood is spread by birds and mammals, although the distance of the spread remains unknown (Gucker 2012 – P). No research has been conducted on this subject in Central Europe, however, it cannot be excluded that by this means the species may appear in border regions of Poland, especially in river valleys of Bug, Odra, Świsłocz and other rivers. The likelihood of the population to appear in Poland through colonisation from abroad depends to a large extent on the size, density and location of Redosier dogwood sites in the neighbouring countries, but there is no data regarding this.

**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 <b>X</b>	level of confidence
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acomm07. Comments:  
*Cornus sericea* is already established in Poland. Introduction of the species as a result of unintentional actions may include the relocation of soil, compost or garden waste with whole plants or their fragments to the natural environment. This group of actions also includes mistakes in the identification of dogwoods and their introduction into forests with the belief that introduced plants were native common dogwoods. Redosier dogwood is also introduced by humans into green areas in urban and rural areas, including roadside green belts, parks and green areas in towns adjacent to natural areas of high natural value, such as the Biebrza and Narew river valleys and the Białowieża Forest (Adamowski et al. 2002, Biereźnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). The species can easily spread in the natural environment from sites in green areas thanks to spreading by birds.

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 <b>X</b>	level of confidence
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acomm08. Comments:  
*Cornus sericea* is a valued element of ornamental greenery – its wide clusters look attractive. In winter it is bright red in colour. In dendrological literature, it is recommended for low, wet peat and marshy areas, for parks and trees in river valleys, by lakes and other water reservoirs (Seneta 1994, Bugała 2000 – P). The species is maintained in collections of 15 botanical gardens and arboreta in Poland on an estimated total area of approx. 90 m<sup>2</sup>. In six botanical gardens and arboreta, spontaneous spread of the species has been confirmed, and in five of them, control measures have been undertaken (Employees of botanical garden ... 2018 – N). It is introduced by humans into green areas in urban and rural settings, including towns adjacent to natural areas of high natural value (Adamowski et al. 2002, Biereźnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). From sites in green areas, the species can be easily spread by birds across the natural environment. Recently, it has been cultivated near highways quite frequently. Redosier dogwood was sometimes planted in forests as a so-called biocenotic intermixture and can be introduced there unintentionally, as it is often confused with common dogwood of the *Cornus sanguinea* which is recommended for such purposes (PGL LP 2011 – I). It is also used in the rehabilitation of degraded areas, such as waste dumps and heaps (Danielewicz and Wiatrowska 2012, 2014 – P).

## 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 <b>X</b>	level of confidence
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acommm09. Comments:  
 Redosier dogwood is a foreign species already established in Poland (Tokarska-Guzik et al. 2012 – P). The species is native to a very large area of North America, from Alaska to North Mexico and from the Atlantic to the Pacific, in regions with very different climatic conditions. It grows in both harsh and temperate climates, but is more often found in areas with rainfall above 500 mm per year (Gucker 2012 – B), in mountains up to 2500 m above sea level (USDA, NRCS 2000, CABI 2017 – B). It is one of the plants which are characterized by high resistance to low temperatures (Krüssmann 1984 – P). In Poland, it is cultivated in cities and rural areas throughout the country (Bojarczuk et al. 1980 – P). It grows spontaneously in regions with harsh, subboreal and sub-continental climates, i.e. Biebrza Valley, Narew Valley, Białowieża Forest and Masurian Lake District (Wołkowycki 2000–2018 – A, Adamowski et al. 2002, Biereżnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). Certain differences in the species' preferences in relation to the climate may result from its variability and separateness of the climates, the origins of which cannot be determined in Poland.

**a10.** Poland provides **habitat** that is

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

aconf06.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acommm10. Comments:  
 Within the natural area, redosier dogwood occurs in particular on fairly fertile and wet soils, on the banks of lakes and ponds, in periodically flooded river valleys, including fen mires. It tolerates strong fluctuations of surface water levels, their high levels in spring and the dryness of habitats in summer. It also occurs on sandy dry soils (USDA, NRCS 2000 – B, Gucker 2012 – P). In Poland, under similar habitat conditions, the species most frequently spreads spontaneously, and colonises river valleys and non-forest wetlands, where it occurs on peat and marshy soils, among reed and sedge reeds and the understory of alder and riparian forests (Wołkowycki 2000–2018 – A, Danielewicz and Wiatrowska 2012, Biereżnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). However, it is also artificially introduced into fresh and drying habitats in parks, gardens, roadside green belts, as well as into degraded areas undergoing rehabilitation (Danielewicz and Wiatrowska 2012, 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
- very high

aconf07. Answer provided with a 

low	medium <b>X</b>	high
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 level of confidence

acomment11. Comments:  
 Approximation (type C data).  
 Redosier dogwood is mainly spread by birds (endoornitochoria), who like to eat its fruits, but also by other animals, such as trout and mice, or other rodents, often as a result of secondary dispersion (Vander Wall et al. 2005 – P). The shrubs start to produce fruit at the age of 3–4 years. The seeds have a resting and stratification period of 1–3 months and remain viable for 4–8 years (EPPO 2008 – B). Given the relatively short time between ingestion and excretion of the seeds (Podbielkowski 1995 – P), the distances of effective propagation of the seeds by the birds are relatively small. This is confirmed by the results of cursory observations (Danielewicz 1980–2017 – A), as most of the secondary spontaneous bush sites are located within a few hundred metres from the point of origin, which is usually the place of its cultivation. Nevertheless, like other arborescent plants using this dispersion vector (Wołkowycki and Próchnicki 2015 – P), redosier dogwood is able to occupy relatively large areas in river valleys and forests within a short time, forming compact clusters. The plant does not grow stolons. Effective expansion of the population under optimum conditions can be achieved by vegetative growth thanks to lower shoots which lay on and take root (Danielewicz 1980–2017 – A, EPPO 2008 – B, Charles-Dominique et al. 2009, Zieliński et al. 2015 – P). The vegetative shoots are carried by the rivers, especially by the flood water (Kelly 1990 – P). It is likely that seeds can also be spread in this way, although there is no evidence to support this. It is possible that rooted sprouts may be spread by beavers feeding on this species in river valleys (USDA, NRCS 2000 – B).

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

	low
	medium
<b>X</b>	high

aconf08. Answer provided with a 

low	medium <b>X</b>	high
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 level of confidence

acomment12. Comments:  
 The human contribution to the spread of the species involves introducing it into cultivation and most often accidental movement of whole plants or their fragments in the form of plant waste, including compost, soil material, etc. The species was introduced into forests as a so-called biocenotic intermixture. It is used for the rehabilitation of heaps, excavations and garbage dumps (Danielewicz and Wiatrowska 2012, 2014 – P). However, human activities are only of initiating and indirect importance for the spread of the species in the environment, as spontaneous populations often develop from seeds carried by birds from bushes cultivated in green areas (Wołkowycki 2000–2018 – A, Biereżnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P).

## A4a | Impact on the environmental domain

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

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

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

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

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

aconf09.	Answer provided with a	low	medium	high	level of confidence
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acom13. Comments:  
Redosier dogwood is a nonparasitic plant.

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

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

aconf10.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acom14. Comments:  
Redosier dogwood is highly competitive. It is able to form compact and extensive groups among rushes in river valleys, understory of alder, willow and ash-alder forests, as well as oak-elm-ash forests, which are natural habitats of types 91E0 and 91F0 (Danielewicz 1980–2017 – A, Kelly 1990 – P, Wołkowycki 2000–2018 – A, Danielewicz 2008, Purcel 2011, Danielewicz and Wiatrowska 2014, Biereźnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). At an advanced stage of secondary population development, a species may create its own phytocoenosis and influence the stadium structure of native species, contribute to the reduction of the number of native plant specimens, reduce the flora composition and transform the structure of natural and semi-natural plant communities. Compact groups of individuals are able to effectively eliminate other plants by restricting their access to light and soil resources (Kelly 1990 – P). It seems that the competition from redosier dogwood plays a much greater role in the riparian and other forests than in the river valleys inhabited by large rushes which are not rich in species. The species that grows massively in the understory of the riparian forests may effectively limit the recruitment of seedlings and the survival of young native plants (both arborescent and herbaceous), which in turn may lead to fundamental changes in the species composition and structure of the communities (Wołkowycki 2000–2018 – A).

**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 <b>X</b>	high	level of confidence
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acom15. Comments:  
There are no known crossbreeds of redosier and common dogwood that are a native species in Poland.

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

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

aconf12.	Answer provided with a	low	medium <b>X</b>	high	level of confidence
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a16.16. Comments:  
Redosier dogwood can be a host for pathogens and parasites that also affect other species of this genus and other plants. These include *Anoplophora chinensis* (Sjöman et al. 2014 – P), *Anthonomus quadrigibbus* (Burke and Anderson 1989 – P), *Xylosandrus crassiusculus*, *X. germanus* (Ranger et al. 2010 – P), *Ceroplastes ceriferus* (Seljak 2012 – P), and butterfly *Malacosoma disstria* (EPPO 2008 – B). These insects also feed on birches, beeches, oaks, ashes, hazelnut trees, alders, poplars and willows, but have not been observed in Poland so far (EPPO 2008 – B). Perhaps the Tobacco ringspot virus (TRSV), which affects not only different plant species but also bees (Li et al. 2014 – P), may also be transmitted by the redosier dogwood, but there is no confirmed data on this matter (EPPO 2008 – B).

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

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

aconf13.	Answer provided with a	low	medium <b>X</b>	high	level of confidence
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a17.17. Comments:  
The species may significantly impair light conditions in the lower layers of forest communities and in non-forest phytocenoses. No data are available regarding other types of disturbances of abiotic components caused by it.

**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 <b>X</b>	level of confidence
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a18.18. Comments:  
Redosier dogwood is able to form compact and extensive groups among rushes in river valleys, understory of alders and ash-alder forests, as well as in oak-elm-ash forests (Wołkowycki 2000–2018 – A, Danielewicz and Wiatrowska 2014, Biereżnoj-Bazille and Werpachowski 2015, Banaszuk and Wołkowycki 2016, Brzosko et al. 2016 – P). When a species dominates the layer of the understory and undergrowth in forests and aggregates in places of previous occurrence of non-forest communities (reeds and meadows), disturbances caused by it result primarily in a change in the role of species determining the structure and functioning of phytocenoses, by replacing native species. This entails further changes in the flora composition, mainly due to a decline in the species richness and in the quantitative share of the undergrowth components (Kelly 1990 – 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:

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

aconf15.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acomm19. Comments:  
Redosier dogwood is a nonparasitic plant.

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

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

aconf16.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acomm20. Comments:  
Redosier dogwood does not naturally occur in open fields, gardens, orchards or cultivated grasslands and does not compete with crops grown in such lands. This species, in places of mass occurrence in forests, may interrupt the development of the young generation of trees introduced to forest cultivation. Considering the data on the distribution of the species in Poland, this problem concerns only a few places. It is possible that the scale of this problem is not well recognized.

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

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

aconf17.	Answer provided with a	low	medium	high <b>X</b>	level of confidence
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acomm21. Comments:  
There is little information in the literature about hybrids of the species with roundleaf dogwood *Cornus rugosa* (Murell and Poindexter 2016 – P), flowering dogwood *C. florida*

and alternate-leaf dogwood *C. alternifolia* (Gucker 2012 – B). Mentioned dogwoods are rarely cultivated in Poland, so the chance of their crossbreeding within the species is very low. So far, there is no information in the literature on such hybridisation in Poland.

**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
		<b>X</b>

 level of confidence

acomm22. Comments:  
As a shrub, Redosier dogwood does not occur naturally in maintained fields, gardens, orchards or grasslands and so it does not disturb the integrity of this type of land.

**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
	<b>X</b>	

 level of confidence

acomm23. Comments:  
Redosier dogwood can be a host for pathogens and parasites that also affect other species of this genus and other plants. These include *Anoplophora chinensis* (Sjöman et al. 2014 – P), *Anthonomus quadrigibbus* (Burke and Anderson 1989 – P), *Xylosandrus crassiusculus*, *X. germanus* (Ranger et al. 2010 – P), *Ceroplastes ceriferus* (Seljak 2012 – P), and butterfly *Malacosoma disstria* (EPPO 2008 – B). These insects also feed on trees planted in Poland in forest cultivation, such as birches, beeches, oaks, ash, hazelnut tree, alders, poplars and willows, but they have not been observed in the country so far. It is possible that the redosier dogwood may also transmit Tobacco ringspot virus (TRSV), which attacks many plant species (e.g. cucumbers, pumpkins, apple trees, lupines, vines), but there is no confirmed evidence of this (EPPO 2008 – 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

acomm24. Comments:  
Redosier dogwood is a nonparasitic plant.

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

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

aconf21. Answer provided with a 

low	medium	high <b>X</b>
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 level of confidence

acomm25. Comments:  
The species in the homeland is not harmful to wild animals (Gucker 2012 – B), which allows to believe that in Poland its properties do not pose a threat to an individual animal or animal production during direct contact. Fruit, sprouts and leaves are frequently consumed by different species of animals.

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

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

aconf22. Answer provided with a 

low	medium <b>X</b>	high
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 level of confidence

acomm26. Comments:  
There are reports (EPPO 2008 – B) on Tobacco ringspot virus (TRSV) transmission by different species of dogwood, but no verified data are available. This virus affects not only different plant species, but also bees (Li et al. 2014 – P).

## A4d | Impact on the human domain

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

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

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

aconf23. Answer provided with a 

low	medium	high
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 level of confidence

acomm27. Comments:  
The species does not affect human health through parasitism.

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
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 level of confidence

acomm28. Comments:  
The species has no toxic or allergenic properties. Within the natural range, in North America it was eaten (fruit) and used in traditional medicine (USDA, NRCS 2000 – B).

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

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

aconf25. Answer provided with a 

low	medium	high
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 level of confidence

acomm29. Comments:  
The species does not participate in any way, as an intermediate host, in the development of human pathogens and parasites.

## A4e | Impact on other domains

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

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

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

aconf26. Answer provided with a 

low	medium	high
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 level of confidence

acomm30. Comments:  
Strong growth of the species may cause minor damage to such infrastructure as pavements of paths in parks, drainage ditches or small culverts (Danielewicz 1980–2017 – 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 checked="" type="checkbox"/>	neutral
<input type="checkbox"/>	moderately positive
<input type="checkbox"/>	significantly positive

aconf27.	Answer provided with a	low	medium	high	level of confidence
			<b>X</b>		

acommm31.	Comments:
	According to unconfirmed data (EPPO 2008 – B), the species can be a host of the Tobacco ringspot virus (TRSV), which infects not only various wild and cultivated plant species, but also bees (Li et al. 2014 – P). The related potential negative effect on food production and other biological resources would have to be documented.

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

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

aconf28.	Answer provided with a	low	medium	high	level of confidence
			<b>X</b>		

acommm32.	Comments:
	The species is sometimes introduced into devastated areas, which are subject to rehabilitation, where it participates in the regulation of soil processes and soil formation. In river valleys, dense groups of dogwood can modify the flow of floe in the same way as clusters of native willow species.

**a33.** The effect of *the species* on **cultural 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

aconf29.	Answer provided with a	low	medium	high	level of confidence
				<b>X</b>	

acommm33.	Comments:
	The species is an ornamental plant, recommended for parks and river valleys, ponds, lakes and other water reservoirs (Bugala 2000 – P), and also as a green background, shield, screen (Seneta and Dolatowski 2011 – P). The broad clusters that grow freely on large grassy areas look most appealing. This is one of the few shrubs with white fruit. The bushes look very attractive when they are leafless, thanks to the bright, burgundy colour of the shoots. Under certain conditions, e.g. in large parks, urban green areas and river valleys, the

clusters of dogwood shrubs can create positive colour accents, enhancing the visual and recreational qualities of the landscape.

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

Below, each of the Harmonia<sup>+PL</sup> 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 <b>X</b>	high
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 level of confidence

acomm34. Comments:  
The species is widely cultivated, acclimatized and established in Poland in its wild form. It is a frost-resistant plant. Although there is no reliable data on the dynamic trends of the species associated with the predicted climate change, it can be assumed that it will not overcome further barriers related to breeding or cultivation.

**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 <b>X</b>	high
-----	--------------------	------

 level of confidence

acomm35. Comments:  
The species is already established and spreading in its wild form. It is a frost-resistant plant and its range is not limited by thermal requirements. Although there is no reliable data on the dynamic trends of the species related to the predicted climate change, it can be assumed that it will not increase its survival and reproductive rates.

**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 <b>X</b>	high
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 level of confidence

acomm36. Comments:  
The species is already established and spreads in its wild form, mainly thanks to the birds who like to eat its fruits. It is a frost-resistant plant and its range is not limited by thermal requirements. It is reasonable to believe that climate change will not increase the survival, dispersion and reproduction.

**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 <b>X</b>	high
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 level of confidence

acomm37. Comments:  
In the current climate in Poland, the species has optimal conditions for its development. Its impact on habitats and ecosystems is unlikely to change as a result of climate change.

**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 <b>X</b>	high
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 level of confidence

acomm38. Comments:  
The predicted climate change is unlikely to change the impact of the species on crops and thus on crop production.

**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 <b>X</b>	high
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 level of confidence

acomm39. Comments:  
It is assumed that the predicted climate change will not change the impact of the species on animal husbandry.

**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 <b>X</b>
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 level of confidence

acomm40. Comments:  
The plant does not significantly affect humans and the predicted climate change will not alter the impact of the species on humans.

**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 <b>X</b>
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 level of confidence

acomm41. Comments:  
The species has no significant impact on infrastructure facilities and this will not change with climate change.

## Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	1.00	1.00
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.88	0.50
Environmental impact (questions: a13-a18)	0.50	0.70
Cultivated plants impact (questions: a19-a23)	0.05	0.90
Domesticated animals impact (questions: a24-a26)	0.00	0.75
Human impact (questions: a27-a29)	0.00	1.00
Other impact (questions: a30)	0.00	0.50
Invasion (questions: a06-a12)	0.96	0.83
Impact (questions: a13-a30)	0.50	0.77
Overall risk score	0.48	
Category of invasiveness	potentially invasive alien species	

## A6 | Comments

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

acomm42. Comments:  
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