Appendix A

Harmonia\textsuperscript{+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):

<table>
<thead>
<tr>
<th>first name and family name</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Katarzyna Bzdęga</td>
<td></td>
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<tr>
<td>2. Alina Urbisz</td>
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<td>3. Barbara Tokarska-Guzik</td>
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<tr>
<th>degree</th>
<th>affiliation</th>
<th>assessment date</th>
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<tbody>
<tr>
<td>(1) dr</td>
<td>Faculty of Biology and Environmental Protection, University of Silesia in Katowice</td>
<td>26-01-2018</td>
</tr>
<tr>
<td>(2) dr hab.</td>
<td>Faculty of Biology and Environmental Protection, University of Silesia in Katowice</td>
<td>27-01-2018</td>
</tr>
<tr>
<td>(3) prof. dr hab.</td>
<td>Faculty of Biology and Environmental Protection, University of Silesia in Katowice</td>
<td>31-01-2018</td>
</tr>
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a02. Name(s) of the species under assessment:

<table>
<thead>
<tr>
<th>Polish name</th>
<th>Latin name</th>
<th>English name</th>
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<tbody>
<tr>
<td>Rdestowiec czeski (rdestowiec pośredni)*</td>
<td>Reynoutria \textit{x}bohemica Chrtek &amp; Chrtkova</td>
<td>Bohemian knotweed</td>
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NOTE: In the appendix to the Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment (Regulation 2011 – P) two Polish name for the species are given: “rdestowiec czeski” and “rdestowiec pośredni”; the latter name is currently preferred (Mirek at al. 2002 – P).

The Latin and Polish names are given according to the Flowering plants and pteridophytes of Poland - a checklist (Mirek et al. 2002 – P). In addition to the Latin synonyms given below, the species is described under many other names: *Fallopia sachalinensis* var. *intermedia* (Tatew.) Yonek. & H. Ohashi, *Polygonum sachalinense* var. *intermedium* Tatew., *Reynoutria ×mizushimae* Yokouchi ex T. Shimizu, *Reynoutria sachalinensis* var. *intermedia* (Tatew.) Miyabe & Kudô, *Reynoutria ×vivax* auct., non J. Schmitz & Strank (The Plant List 2013 – B).

The taxonomic affiliation and nomenclature of species commonly referred to as knotweeds has been subject to many changes depending on the state of knowledge and the authors’ approach (Schuster et al. 2011, 2015 – P). Currently, due to the similarity of their morphological, biological, ecological and other properties, invasive species of the genus *Reynoutria* (*Fallopia*): *R. japonica*, *R. sachalinensis* and their crossbreed *R. ×bohemica*, are often included as one group under the name *Reynoutria* spp., *Fallopia* spp. or *Fallopia complex* (e.g., Tiébré et al. 2007, Lamberti-Raverot et al. 2017 – P). The name Japanese knotweed s.l. is also often found – Asian (Japanese) knotweeds, which now includes all taxa (parent and hybrid species) along with hybrids resulting from backcrosses and crosses with other related species, including *Fallopia baldschuanica* (Bailey and Wisskirchen 2006, Bailey et al. 2009 – P).

<table>
<thead>
<tr>
<th>Polish name (synonym I)</th>
<th>Polish name (synonym II)</th>
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<tr>
<td>Rdest pośredni</td>
<td>Rdest czeski</td>
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<tr>
<td>Latin name (synonym I)</td>
<td>Latin name (synonym II)</td>
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<tr>
<td><em>Fallopia ×bohemica</em></td>
<td><em>Polygonum ×bohemicum</em></td>
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<tr>
<td>English name (synonym I)</td>
<td>English name (synonym II)</td>
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<tr>
<td>Hybrid knotweed</td>
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**a03. Area under assessment:**

**Poland**

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

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

**aconf01.** Answer provided with a level of confidence

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**aconf04.** Comments:

*Reynoutria ×bohemica* has the status of an invasive kenophyte in Poland (Tokarska-Guzik 2005 - P). In 2012, the species was included in the group of alien, established and invasive species (Tokarska-Guzik et al. 2012 – P, Tokarska-Guzik et al. 2015a and b – I, Tokarska-Guzik et al. 2017 – P). The *R. ×bohemica* hybrid in Poland is the least well-known of the *Reynoutria* group, as is indicated by the relatively small number of recorded sites of this
species (over 300). It should be emphasized that the distribution of the species requires further research, and the number of identifications quoted is certainly an underestimate, due to frequent difficulties in distinguishing the hybrid from the parent species (especially Japanese knotweed) (Tokarska-Guzik et al. 2015b – I).

Initially, the species was considered to be one of the varieties of R. japonica. Plants under this name were distributed from Botanical Gardens around the world. They were probably derived from hybrid seeds (CABI 2018 – B).

**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
- [x] the other domains

**Comments:**

*Reynoutria ×bohemica* has a direct effect on the natural environment and poses a serious threat to it (Tokarska-Guzik et al. 2012 – P), through the formation of dense and extensive single-species populations, especially in habitats in river valleys where it effectively competes with native plant species, preventing their regeneration (Tokarska-Guzik et al. 2009, Toews 2012, Parepa et al. 2013, Chmura et al. 2015, Duquette et al. 2016 – P). The species limits and prevents the germination of seedlings of native plant species, creating a thick and slowly decaying layer of fallen leaves and stems (Gioria i Osborne 2010, Moravcová et al. 2011 – P), and also through the release of allelopathic substances inhibiting the growth of other plant species (Vrchotová and Šerá 2008, Murrell et al. 2011, Parepa et al. 2013 – P). Like the other knotweeds, it changes the physical and chemical properties of the soil and affects the activity of soil microorganisms (Siemens and Blossey 2007, Dassonville et al. 2011, Salles and Mallon 2014 – P). There are more and more cases of knotweed introduction into crops and unused fields, which may lead to difficulties or restrictions on the use of agricultural land (both through the physical and chemical effects on arable crops). To a limited extent, *Reynoutria ×bohemica* (similarly to its parent species) can affect animal breeding, causing wounds or digestive disorders. *Reynoutria ×bohemica* can negatively affect crops, among others by growing over arable fields that become unsuitable for cultivation (Onete et al. 2015 – P, Bzdęga 2017 – A). The mass presence of the species impedes access to water margins, limiting the possibilities of their economic and recreational use, leads to damage to hydrotechnical equipment and flood protection (Tokarska-Guzik et al. 2015a – I). The growing rhizomes destroy the surfaces of roads, and pavements and may cause cracks in walls, and even penetrate inside buildings (Tokarska-Guzik et al. 2015a – I).

**A1 | Introduction**

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

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

- [ ] low
- [ ] medium
- [x] high

**Answer provided with a**

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<tr>
<td>level of confidence</td>
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Reynoutria ×bohemica, analogously to its parental species, belongs to the group of strongly invasive plants in many European countries, including those neighbouring Poland, from where numerous populations have been confirmed (Tokarska-Guzik et al. 2015b – I, CABI 2018 – B). The species is already widespread in many parts of the country, but it can still migrate into Poland from the border areas with the Czech Republic, Slovakia and Germany along river valleys and spread mainly through the dispersion of rhizomes with water (especially with river flow in flood) (Tokarska-Guzik and in. 2015b, Duquette et al. 2016 – P). Because the plant is characterized by a high regeneration potential, even from small fragments of rhizomes, the probability of self-expansion is high.

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

- low
- medium
- high

Answer provided with a level of confidence

aconf03.

Comments:
Both seeds and rhizomes of knotweed can be dispersed due to unintended human actions. The main way of their introduction in this case is the transportation of "contaminated" soil over long distances (also with contaminated machines and equipment) and then its use in other places, e.g. in river valleys during works related to the strengthening of banks, during construction works related to e.g. the construction of roads, parking lots, or clearing or deepening of drainage ditches (Alberternst and Böhmer 2011 – B, Tokarska-Guzik et al. 2015a and b, – I, Bzdęga and Tokarska Guzik 2006-2017 – A). The rhizomes have the greatest importance in the introduction of the hybrid. This is the most probable route of hybrid introduction in many European countries, especially in the eastern, southern and northern parts of the European secondary range (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). There is also a likelihood for seeds to be brought along with road and rail transport, but this path does not play a significant role in knotweed spread.

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

- low
- medium
- high

Answer provided with a level of confidence

aconf04.

Comments:
Knotweeds (R. japonica Japanese knotweed and R. sachalinensis giant knotweed) due to their decorative qualities (plant form and size, striking inflorescences and aggregate fruits) were introduced to cultivation both in Europe and North America, initially to botanical gardens, and then also to home gardens (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). R. ×bohemica, the hybrid knotweed, was first described in the 1980s in the Czech Republic (Chrtek and Chrtková 1983 – P), and then confirmed from other European countries and beyond (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). Initially it was not distinguished from one of the parent species, R. japonica Japanese knotweed, the observed morphological differences suggesting that it fitted within the variability of this species. Considering that both R. japonica and R. sachalinensis were grown as ornamental plants in nurseries in Leiden in the Netherlands (Siebold’s Garden of Acclimatization), it can be assumed that a hybrid was formed right there, and was subject to distribution later on. In this way botanical gardens around the world, with collections
having the two above-mentioned species growing next to each other, disseminated seeds of a hybrid character, as Japanese knotweed. Studies on herbarium specimens carried out in the United Kingdom have also enabled the partial historical reconstruction of the spread of the hybrid outside of cultivation. Based on them, 1954 is considered to be the earliest date of the hybrid's emergence in wild conditions in the United Kingdom, in County Durham (Tokarska-Guzik et al. 2015b – I and literature cited therein). *Reynoutria ×bohemica*, along with the other species Japanese knotweed and giant knotweed, are included in the group of energy (biomass production) plants; all taxa (species and hybrid) have been recommended as melliferous plants and their utility is known, primarily as plants used in herbal medicine. These properties undoubtedly contributed to their intentional introduction by man. However, due to the threat they pose (Anioł-Kwiatkowska and Śliwiński 2009, Tokarska-Guzik et al. 2015b – I), their cultivation is strictly forbidden throughout the country (Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment – Regulation 2011 – P). However, *Reynoutria ×bohemica* grows in many places of its past and present cultivation (municipal and backyard gardens, cemeteries), from where it can "escape" as a result of improper care actions, e.g. depositing plant fragments outside the cultivation area (Tokarska-Guzik et al. 2015b – I). It is also impossible to completely exclude the introduction of the species into the environment due to deliberate human activities, especially in municipal areas (gardens, wastelands), from where the plants can spontaneously spread.

### A2 | Establishment

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

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

- [ ] non-optimal
- [ ] sub-optimal
- [x] optimal for establishment of the *species*

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

**acomm09.** Comments:

Within the borders of the natural range of the parental species, their hybrid *R. ×bohemica* knotweed, known from Europe since 1982, was first noticed as late as at the end of the twentieth century and was described under the name *Reynoutria × mizushimae* Yokouchi ex T. Shimizu (Bailey 2003 - P). Next, the presence of this taxon was confirmed in 1999 and 2000 by Bailey from the north-western part of the Honshu Island (Bailey 2003 - P). The maps illustrating the European reach of the two species – Japanese knotweed and giant knotweed – were published in the late 1970s (Jalas and Suominen 1979 – P), while for *R. ×bohemica*, only at the beginning of the 21st century (Bailey and Wisskirchen 2006 – P).

The area where *Reynoutria ×bohemica* hybrid knotweed is present in Europe has not been precisely recognized. Until now, this taxon was most frequently recorded in northern and central Europe (Bailey 2003 – P), including, for the first time, from the Czech Republic (Chrték and Chrtková 1983 – P), and then from the United Kingdom (Bailey et al. 1995 – P), Germany (Keil and Alberternst 1995 – P), Hungary (Balogh 1998 – P), as well as from Poland (Fojcik and Tokarska-Guzik 2000 – P). The previous data in the literature describe its contemporary range on the European continent as being between 43°S and 67°N, as well as between 10°W and 25°E (Balogh 2008 – P). The maps partly illustrating the extent of *R. ×bohemica* were published for Europe by Bailey and Wisskirchen (2006 – P) and for the Czech Republic by Mandák et al. (2004 – P). However, its range is gradually expanding, reaching the Mediterranean region (where it is also found in cultivation, e.g. on the Istrian
Peninsula in Croatia, Tokarska-Guzik 2006-2017 – A). Outside of Europe, it is also present in North America, both in Canada and the USA (CABI 2018 – B). Similarly to the parental species, knotweed reproduces primarily vegetatively via the rhizomes, allowing quick and effective area occupation. Both rhizomes and shoots are characterized by fast growth rates and high regenerative abilities. A new plant may develop from a small fragment of a rhizome or a shoot segment containing a single node placed in soil or water (CABI 2018 – B). As in the case of the parent species, sexual reproduction in the hybrid is not common, and seedlings rarely form as a result of backcrossing with one of the parental forms (Tokarska-Guzik et al. 2015a and b – I, CABI 2018 – B). According to Bailey et al. (2009) knotweed seedlings are rare in Europe's climatic conditions. It has been confirmed that their dieback is associated with too little water, and a temperature of -5°C present for longer than for two days eliminates half of them (Funkenberg et al. 2012 – P). Based on the history of the origin and the spread of the hybrid within the limits of the European secondary range and its observed tendencies to expand its range (including increasingly frequent seedling listings) it should be assumed that the climatic conditions in Poland are optimal. *Reynoutria ×bohemica* prefers a temperate, mesothermic climate, with two rainy seasons and two dry periods, with the mean temperature of the coldest month in the range between 0°C and 18°C, and with the mean temperature of the warmest month exceeding 10°C (CABI 2018 – B). Poland provides habitat that is

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

Answer provided with a level of confidence

| low | medium | high |

**Reynoutria ×bohemica** in the secondary range demonstrates a wide ecological amplitude and habitat spectrum. Its requirements for soil type, pH or humidity do not differ significantly from those preferred by the parent species (CABI 2018 – B). The hybrid, like *R. japonica*, demonstrates a clear tolerance to salinity (CABI 2018 - B) which is confirmed by its present in salt marsh habitats in the USA (Richards et al. 2008 – P). *Reynoutria ×bohemica* also dominates other habitats analogous to those occupied by *R. japonica*, especially riverside (riparian) and ruderal ones, e.g. roadsides, railway embankments or urban wastelands (Fojcik and Tokarska-Guzik 2000 – P, CABI 2018 – B). The hybrid is also often found in the close vicinity of fresh water, such as rivers and streams, as well as in habitats typical for urban and suburban zones (CABI 2018 – B). The hybrid is more and more often recorded in agricultural areas, e.g. in maize (Tokarska-Guzik et al. 2009 – P, Bzdęga 2017 own observation – A).

**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).

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

| very low | low | medium |

Comments:

*Reynoutria ×bohemica* in the secondary range demonstrates a wide ecological amplitude and habitat spectrum. Its requirements for soil type, pH or humidity do not differ significantly from those preferred by the parent species (CABI 2018 – B). The hybrid, like *R. japonica*, demonstrates a clear tolerance to salinity (CABI 2018 - B) which is confirmed by its present in salt marsh habitats in the USA (Richards et al. 2008 – P). *Reynoutria ×bohemica* also dominates other habitats analogous to those occupied by *R. japonica*, especially riverside (riparian) and ruderal ones, e.g. roadsides, railway embankments or urban wastelands (Fojcik and Tokarska-Guzik 2000 – P, CABI 2018 – B). The hybrid is also often found in the close vicinity of fresh water, such as rivers and streams, as well as in habitats typical for urban and suburban zones (CABI 2018 – B). The hybrid is more and more often recorded in agricultural areas, e.g. in maize (Tokarska-Guzik et al. 2009 – P, Bzdęga 2017 own observation – A).
Answer provided with a level of confidence:

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Comments:

Similarly to the parental forms, the hybrid also spreads primarily in a vegetative way by multiplying rhizomes, which enables quick and effective takeover of new areas. Rhizomes and shoots are characterized by fast growth rates and high regenerative abilities, and new plants can develop from small fragments of either (Tokarska-Guzik et al. 2015a and b – I, Tokarska-Guzik et al. 2017 – P and literature quoted therein). Winged fruits - nuts (formed in the so-called mixed populations in which parental species occur side by side. Note that a wider description of sexual reproduction and the possibility of hybrid seed formation can be found in the study by Tokarska-Guzik et al. 2015b – I), falling mostly near the parental plants can be transferred to new areas by wind (so-called anemochory) and water (so-called hydrochory), but their role in establishment in new places is limited (Tiébré et al. 2007 – P). At the same time propagation by seeds in Reymoutria ×bohemica is considered to be the main factor determining its invasive character, through the strategy of forming new more invasive genotypes (Buhk and ThielSch 2015, Strgulc and Dolenc 2015 – P, Bzdég and Tokarska-Guzik 2010-2017 – A).

Dispersion from a single source (type A data). It can be assumed that in case of Reymoutria ×bohemica, as in the parental forms, there is the possibility of spreading seeds within a dozen or so metres beyond the parent population. In case of R. japonica, this distance is up to 16 m (dispersion is very low) away from the parent population (Tiébré et al. 2007 – P). Rhizomes may grow a few or several metres from the mother plant. These distances can be increased by strong winds (seeds) or water; both seeds and rhizomes can be transported by water over long distances, especially with flood waters (very high dispersion).

Population expansion (type B data). Based on the data so far collected, it is difficult to assess the rate of expansion of the R. ×bohemica range. A small number of the records of the hybrid in Poland probably still result from problems with distinguishing it from the parental species (Tokarska-Guzik et al. 2015b – I). For example, such mistakes were confirmed during the revision of herbarium material originating from Montenegro, Croatia and Bulgaria, in which it was confused with giant knotweed (Širka et al. 2013 – P), as well as in herbarium materials from Poland (Tokarska-Guzik et al. 2015b – I). Gradually, data about the presence of Reymoutria ×bohemica p are supplemented, confirming that its distribution is wider than previously expected.

Estimation (type C data). A determination of the ability of Bohemian knotweed to increase the area it inhabits based on an estimation of its biological mobility indicates an extremely high capability for the hybrid to spread without human involvement. Like the parental species, the hybrid is characterized by enormous possibilities for vegetative reproduction. The new plant may develop from a 1 cm rhizome section weighing not more than 0.7 g, as well as from a small section of the shoot containing a single node, placed in soil or in water (Bailey et al. 2009 – P, Alberternst and Böhmer 2011 – B). Bimová and others (2003 - P) indicated differences in the ability and speed of regeneration of individual taxa depending on the conditions (water/soil). Reymoutria ×bohemica presents the highest regeneration rate when compared with the parent species (61%). The share of sexual reproduction in spread is also increasing (Bzdég et al. 2016 – P).
The conscious introduction of the invasive knotweeds, including *Reynoutria ×bohemica*, into a new environment is not allowed (Regulation 2011 – P, Tokarska-Guzik et al. 2015b – I), however, due to the decorative qualities of the plant (including the large decorative leaves, the late blooming), it is not possible to exclude intentional introduction of the species by humans, especially in the urban environment (home gardens, wastelands), from where it can spread to adjacent areas spontaneously.

It is possible to consciously introduce *Reynoutria ×bohemica* to use its biomass for energy purposes (Pude and Franken 2001 – P), including for the production of biogas (Strašil and Kára 2010 – P). The high productivity of *Reynoutria ×bohemica* biomass and its suitability in the process of co-fermentation with maize and apple pomace has been demonstrated, creating the potential for using the plant as an alternative source of biogas (Kupryś-Caruk et al. 2014 – P). However, this is another source of potential threat to the environment, therefore knotweed cultivation is absolutely undesirable throughout the country. All knotweeds can also be used as heating material, yet obtaining it from places where it already exists should be recommended (Tokarska-Guzik et al. 2009 – P). Knotweeds can present great importance in the human economy as a raw material (a valuable source of resveratrol) obtained from both natural and controlled crops, intended for use in the pharmaceutical industry and for applications in herbal medicine (Tokarska-Guzik et al. 2015b – I). Experimental cultivars of *Reynoutria ×bohemica* indicate the possibility of obtaining 2.6 t from dry matter and 8.5 kg of stilbene from 1 hectare (Kovářová et al. 2010 – P) which is used in the chemical industry.

The quite frequent (yet still insufficiently documented) *Reynoutria ×bohemica* presence in many regions of the country, in various habitat types, creates a high probability of further spreading of fragments of the hybrid during various types of earthworks (e.g. construction of roads, power lines) and regulatory works (regulation of river channels, strengthening flood embankments), along with soil, water and with equipment being used (including in winter, when snow ploughs are used for snow removal). The frequency of spread is also influenced by improperly performed treatments for the elimination and utilization of both above-ground and underground parts of plants.

### A4a | Impact on the environmental domain

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

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

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

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

- **X** inapplicable
- low
- medium
- high

Answer provided with a [level of confidence]
The species is a non-parasitic plant, it does not cause this type of interactions.

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

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**a10. Comments:**

**aconf10.**

**a14. Comments:**

*Reynoutria ×bohemica*, like the other two parental species present in Poland, effectively competes with native plant species, often preventing them from growing and regenerating (Tokarska-Guzik et al. 2009, Toews 2012, Parepa et al. 2013, Chmura et al. 2015, Duquette et al. 2015 – P, Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). Due to the dense setting of the large leaves on the stems, it achieves a competitive advantage over native plants by limiting their access to light (Siemens and Blossey 2007 – P). Plants form a thick and slowly decaying layer of fallen leaves and stems. This litter limits the development of species specific to the habitat (Chmura et al. 2015 – P, Tokarska-Guzik et al. 2015b – I). Also, allelopathic effects or interaction of the hybrids with soil microorganisms may contribute to the crowding out of native species at sites occupied by *R. ×bohemica* populations (Siemens and Blossey 2007 – P). Among the undesirable interactions, the most harmful includes *Reynoutria ×bohemica* penetration into protected areas, including riverside areas, including the Natura 2000 area - „Graniczne Meandry Odry” [“Border Meanders of the Oder”] (Koszela and Tokarska-Guzik 2008, Bzdęga and Tokarska-Guzik 2006-2017 – A). The latest data provided by Kampinoski National Park and Pieniński National Park confirm the presence of *Reynoutria ×bohemica* in the area of the parks and in their buffer zones (Tokarska-Guzik et al. 2015b – I). All species of knotweeds have a significant effect on the biodiversity of natural and semi-natural habitats, and in particular on riparian ecosystems, posing a threat to native plants and invertebrates (Gerber et al. 2008 – P).

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

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</table>

**a11. Comments:**

In Poland there are no native species with which the knotweed could interbreed. *Reynoutria ×bohemica* interbreeds with the other two invasive species of the *Reynoutria* genus, *Reynoutria japonica* and *R. sachalinensis*, present in the country. In addition to the hybrid described under the name *Reynoutria ×bohemica* resulting from the crossing of *R. japonica* and *R. sachalinensis*, two back hybrids have been described so far: *Reynoutria japonica* var. *japonica × Reynoutria ×bohemica* and also *Reynoutria ×bohemica × Reynoutria R. sachalinensis* – found in Wales (Bailey 2003 – P). One cannot exclude the presence of hybrids originating from backcrossing also in Poland (Bzdęga and Tokarska-Guzik 2010-2017 – A).
a16. The effect of the species on native species by hosting pathogens or parasites that are harmful to them is:

<table>
<thead>
<tr>
<th>Level</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>X</td>
</tr>
<tr>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td></td>
</tr>
<tr>
<td>very high</td>
<td></td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence

Comments:
For *Reynoutria ×bohemica*, there is no detailed data on the effect on native species by transferring pathogens or parasites harmful to them (Balogh 2008 – P), which may also be due to the problems with its identification. It can be expected that a significant portion of those found in *R. japonica* are also present in the hybrid (CABI 2018 – B). However, in this case, there is no more detailed data on pathogen or parasite transfer to native species.

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td></td>
</tr>
<tr>
<td>medium</td>
<td>X</td>
</tr>
<tr>
<td>high</td>
<td></td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence

Comments:
*Reynoutria ×bohemica*, like the other species of knotweed, negatively affects the integrity of ecosystems by disturbing the abiotic factors. The presence of the hybrid causes changes in the physical and chemical properties of the soil and the activity of soil microorganisms (Dassonville et al. 2011 – P). Analogously with the other knotweeds, the hybrid knotweed can directly regulate the amount of available nitrogen resources by inhibiting the process of biological denitrification by soil bacteria, which leads to the accumulation of nitrate resources in the soil and thus enables the plants to grow their biomass intensely and thus to facilitate effective invasion (Salles and Mallon 2014 – P). Invasion of *Reynoutria ×bohemica* is accompanied by a significant increase in biomass both above and below ground, which in turn may lead to changes over the course of biogeochemical cycles, as well as cycle of water and its availability. The dangerous effects of river and stream banks being dominated by any knotweed species includes the uprooting of large patches of these plants during rapid floods which contributes to the erosion of embankments (Bergstrom et al. 2008 – P). Effects also includes the accumulation of a large volume of biomass on hydrotechnical equipment, which may lead to damage to their structure, as well as being the cause of local submersions and floods (Tokarska-Guzik et al. 2015b – I). Limiting the access to light, especially for herbaceous species is an important factor affecting the integrity of the ecosystem. Mass presence of *Reynoutria ×bohemica* can cause practically irreversible changes in the processes occurring in habitats requiring special care (including, in particular, the hydrophilious tall herb fringe communities of plains and of montane to alpine levels – 6430, Tokarska-Guzik et al. 2015b – I).

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td></td>
</tr>
<tr>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td>X</td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence
Reynoutria ×bohemica is considered to be a more invasive species compared with the parental forms (GB NNSS 2018 – I), characterized by a greater potential for creating dense patches (as a result of vegetative propagation) in large sunlit, nitrogen-rich and humid areas (GB NNSS 2018 – I). The plants cause major changes in the structure and species composition of local ecosystems, including riparian forests, willow shruberies and riparian herbaceous vegetation. They compete effectively with native plant species, preventing their regeneration (Tokarska-Guzik et al. 2009, Chmura et al. 2015 – P). Allelopathic chemical substances produced by knotweeds inhibit the germination and growth of other plants (Vrchotová and Šerá 2008, Tokarska-Guzik et al. 2015b – I). The species can compete with native plants for pollinators, however on account of its late flowering this phenomenon is limited to native plants flowering in late summer. The penetration of the species into protected areas should be also listed among the adverse effects (Tokarska-Guzik et al. 2015a and b – I, Bzdęga and Tokarska-Guzik 2006-2017 – A). The species has a negative effect on Natura 2000 natural habitats, including mainly: alpine rivers and their ligneous vegetation with Salix elaeagnos (3240), alpine rivers and their ligneous vegetation with Myricaria germanica (3230), hydrophilous tall herb fringe communities of the plains and of montane to alpine levels (6430), alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Pandion, Alnion incanae, Salicion albae) (91E0), riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along major rivers (Ulmenion minoris) (91F0) (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). In the Czech Republic, a negative influence of the knotweed on an endangered species was found in the case of Myricaria germanica German tamarisk, which is present on gravel sites along mountainous rivers with periodic floods. Reynoutria ×bohemica penetrates this type of habitats and completely eliminates the communities of willow-tamarisk shrubs, including M. germanica (CABI 2018 – B). Due to its large size and rapid growth in the initial period of the vegetation season, Reynoutria ×bohemica significantly reduces the number of native species in locations where it is present. Its dense populations transform the native soil seed bank (Bzdęga and Tokarska-Guzik 2006-2017 – A). This manifests itself in the depletion of the species composition typical for specific communities. The dense knotweed patches can also provide a refuge for many animal species.

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:

<table>
<thead>
<tr>
<th></th>
<th>inapplicable</th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>very high</th>
</tr>
</thead>
</table>

Answer provided with a level of confidence

X

aconf15.

Comments:

The species is a plant, it also has no parasitic properties.
a20. The effect of the species on cultivated plant targets through competition is:

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

Answer provided with a low medium high level of confidence

Comments:
Like other invasive knotweed, *Reynoutria × bohemica* may adversely affect crop plants, including by entering fields and meadows which then become unsuitable for cultivation (Onete et al. 2015 – P, Bzdęga 2017 – A). Allelopathic chemicals produced by the species, as in other knotweeds, inhibit the germination and growth of other plants (Vrchotová and Šerá 2008 – P, Tokarska-Guzik et al. 2015b – I). These phenomena are not common yet, while the chemical interactions require further study and monitoring. It is estimated that the effect will influence less than 1/3 of crops being invaded (low probability) and in the worst case the condition of plants or an individual crop yield is reduced by about 5% (low effect).

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

Answer provided with a low medium high level of confidence

Comments:
*Reynoutria × bohemica*, as a hybrid of two species from the genus Reynoutria: *R. japonica* and *R. sachalinensis*, may indirectly affect the condition and yield of crop plants by creating difficult to control populations (CABI 2018 – B). There are also known backcrosses with parental species, e.g. with *R. sachalinensis* (so-called introgression) (Bailey et al. 2009, Bailey 2013 – P). The hybrid, similarly to the parental forms, as well as the hybrids formed with their participation, may negatively affect crops, e.g. by growing over arable fields and meadows which then become unsuitable for cultivation (Onete et al. 2015 – P, Bzdęga 2017 – A). However, *Reynoutria × bohemica* does not interbreed with plants commonly cultivated 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

Answer provided with a low medium high level of confidence

Comments:
The presence of all species from the *Reynoutria* genus, including *R. × bohemica*, limits the agricultural use of land (Tokarska-Guzik et al. 2009, Onete et al. 2015 – P, Bzdęga 2017 – A).
Knotweeds are found on agricultural wastelands, but over the recent years, they have become more frequent and abundant in crops, e.g. in Switzerland (Bohren 2011 – P). Analogously, as with the effect of these taxa on disturbing ecosystem integrity, it can be assumed that they can affect the condition or yield of crops via changes in the agroecosystem properties. These phenomena are not common yet and require further study and monitoring.

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
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<tr>
<td>low</td>
<td>medium</td>
</tr>
<tr>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>high</td>
<td>very high</td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence

Comments:
There is insufficient data on the effect of the hybrid on crops associated with the fact that it is a host or vector of pathogens and parasites harmful to these plants.

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:

<table>
<thead>
<tr>
<th>Level</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>inapplicable</td>
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<td>low</td>
<td>medium</td>
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<tr>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>high</td>
<td>very high</td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence

Comments:
The species is a plant.

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
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<tr>
<td>medium</td>
<td>high</td>
</tr>
<tr>
<td>high</td>
<td>very high</td>
</tr>
</tbody>
</table>

Answer provided with a low medium high level of confidence

Comments:
Dry and sharply broken shoots of R. japonica, as well as R. sachalinensis, can cause cuts to grazing animals such as sheep (Kirpluk 2016 – P). No adverse effects were found in cattle,
although animals feeding on giant knotweed demonstrated temporary anorexia and hypothermia (CABI 2018 – B). Presumably, this situation may also apply to Reynoutria × bohemica.

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

<table>
<thead>
<tr>
<th></th>
<th>inapplicable</th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**aconf26.** Answer provided with a level of confidence

**accom26.** Comments:
The species is a plant. Plants are not hosts nor vectors of animal parasites/pathogens.

### A4d | Impact on the human domain

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

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

<table>
<thead>
<tr>
<th></th>
<th>inapplicable</th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>vert high</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**aconf27.** Answer provided with a level of confidence

**accom27.** Comments:
The species is not a parasitic organism.

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

<table>
<thead>
<tr>
<th></th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**aconf28.** Answer provided with a level of confidence

**accom28.** Comments:
A negative effect of Reynoutria japonica and R. sachalinensis on human health has not been demonstrated (Alberternst and Böhmer 2011 – I). It should be assumed that a similar situation applies in the case of the hybrid. However, knotweed populations on river and stream banks can cause difficulties in access for hikers and anglers. Rhizomes of plants may also cause a risk of tripping, for example on pavements and footways (GB NNSS 2018 – P).
a29. The effect of the species on human health, by hosting pathogens or parasites that are harmful to humans, is:

<table>
<thead>
<tr>
<th></th>
<th>inapplicable</th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>very high</th>
</tr>
</thead>
</table>

X

**Answer provided with a low medium high level of confidence**

**acomm29. Comments:**
The species is a plant. Plants are not hosts or vectors of human parasites/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:

<table>
<thead>
<tr>
<th></th>
<th>very low</th>
<th>low</th>
<th>medium</th>
<th>high</th>
<th>X very high</th>
</tr>
</thead>
</table>

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

**acomm30. Comments:**

*Reynoutria ×bohemica*, as with the parental species, *R. japonica* and *R. sachalinensis*, is a serious threat in river valleys, as it can destroy flood protection and hydrotechnical constructions. Dead matter remaining above ground and underground plants can significantly limit or inhibit water flow. The hybrid, like the other knotweeds, occurs in areas with housing and economic infrastructure. As in the case of the other species, it can cause damage by the growth of the rhizomes. By penetrating the ground (intensive annual growth), *Reynoutria ×bohemica*, rhizomes can damage foundations, building walls and drainage channels, road surfaces, pedestrian walkways or car parks (Beerling 1991 – P, Alberternst and Böhmer 2011 – B, Tokarska-Guzik et al.). 2015a and b, GB NNSS 2018 – I).

With its presence along roads, *Reynoutria ×bohemica* can limit visibility and obscure road signs. In addition, the massive presence of the plant also limits access to water reservoirs, e.g. for anglers (Tokarska-Guzik et al. 2015b – I).

### 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:

<table>
<thead>
<tr>
<th></th>
<th>significantly negative</th>
<th>moderately negative</th>
</tr>
</thead>
</table>

- 15 -
Reynoutria ×bohemica, similarly to Japanese knotweed and giant knotweed, can be perceived as a useful plant, the biomass of which could be used for energy needs. However, there is no detailed literature data on the efficiency of its biomass for this purpose. Presumably, the caloric value is close to R. japonica, at around 18.4 GJ/t (Kovářová et al. 2011 – P). The suitability of Reynoutria ×bohemica for biogas production is also reported (Kupryś-Caruk et al. 2014 – P).

The presence of Reynoutria ×bohemica in the environment can be perceived as beneficial, e.g. by owners of apiaries due to the melliferous properties of the plant and its relatively late flowering providing benefits to bees in late summer. Knotweed shoots are also used in floristry (flowering).

Reynoutria ×bohemica, like the other species, is used in phototherapy. It contains many biologically active compounds, including resveratrol – a chemical compound belonging to the antioxidant group (Chen et al. 2013, Peng et al. 2013 – P).

At the same time, Reynoutria ×bohemica may adversely affect crops, e.g. by entering fields and meadows which then become unsuitable for cultivation. Allelopathic chemicals produced by the species, as with the other knotweeds, inhibit germination and growth of other plants (cf question a20). These phenomena are not common yet, while the chemical interactions require further studying and monitoring.

To sum up one can acknowledged that the influence of the species on providing services is moderately positive.

Reynoutria ×bohemica affects regulatory services. Its large populations cause changes in the physical and chemical properties of soil (including the availability of nitrogen) and in the activity of soil microorganisms (cf question a17). Invasion of Reynoutria ×bohemica is accompanied by a significant increase in biomass both on and below the ground surface, which in turn may lead to changes over the course of biogeochemical cycles, as well as cycle of water and its availability. The dangerous effects of the river and stream banks being dominated by any of the knotweed species includes the uprooting of large patches of these plants during rapid floods which contributes to the erosion of embankments (Bergstrom et al. 2008 – P). They can also damage the structure of floodbanks and contribute to local and wider flooding (Tokarska-Guzik et al. 2015 b - I). The plants cause major changes in the structure and species composition of local ecosystems, including riverside ones. They effectively compete with native plant species, preventing their regeneration. The allelopathic chemicals produced by knotweed inhibit the germination and growth of other plants (compare question 18).

All knotweed taxa, due to their biological characteristics, may have impact on other potential regulatory services, which are not based on specific tests such as: air quality regulation (dust retention and pollution absorption), air exchange, wind protection, noise reduction, etc.
The effect of the species on cultural services is:

- significantly negative
- moderately negative
- neutral **X**
- moderately positive
- significantly positive

Answer provided with a level of confidence **X**

Comments:

The plant has decorative and utility qualities. It is an attractive plant, the shoots of which resemble bamboo, hence it is still kept in gardens. The stems and seedlings of *Reynoutria ×bohemica* are used in floristry, where caution is recommended in these cases with regard to the use of fresh material, due to the possibility of creating potential new introductions (Tokarska-Guzik et al. 2015b – I, Bzdęga and Tokarska-Guzik 2006-2017 – A).

In case of all knotweed taxa, due to their biological features, one can draw attention to the following potential cultural services, which are not based on specific research: effects on spatial aesthetics, both positive (masking aesthetically unpleasing elements, Gilbert 1992 - P) and negative (wastelands covered with knotweeds are not aesthetically pleasing, particularly in winter, especially in urban and recreational zones, also these usually constitute places with additional litter); positive effect on health (regulation of humidity and air quality); business benefits (cultivation for decorative and utility purposes).

*Reynoutria ×bohemica* forms dense, extensive patches in large spaces, including recreational and tourist areas (e.g. on the banks of rivers and water reservoirs, limiting access to water (Tokarska-Guzik et al. 2006 – P, Bzdęga and Tokarska-Guzik 2006-2017 – A). The presence of tall plants along roads may reduce visibility and cause a threat to road safety (Tokarska-Guzik et al. 2015b – P). Dry knotweed shoots can be a hazard in winter. *Reynoutria ×bohemica* can however also be considered valuable in the reclamation of heavily polluted areas, etc.

To sum up it is recognised that negative and positive influence of species for cultural services give an overall neutral assessment.

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

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

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

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

- decrease significantly
- decrease moderately **X**
- not change
- increase moderately
- increase significantly

Answer provided with a level of confidence **X**
a35. ESTABLISHMENT – Due to climate change, the probability for the species to overcome barriers that have prevented its survival and reproduction in Poland will:

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

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
- X increase moderately
- increase significantly

a37. IMPACT ON THE ENVIRONMENTAL DOMAIN – Due to climate change, the consequences of the species on wild animals and plants, habitats and ecosystems in Poland will:

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

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

acomm37. Comments:
It is assumed that due to climate change the effect of the described hybrid on wild plants and animals - as well as habitats and ecosystems in Poland - will not change. Reynoutria ×bohemica prefers a temperate climate with the mean temperature of the coldest month in the range between 0°C and 18°C, and with mean temperature of the warmest month exceeding 10°C (CABI 2018 – B) (cf the comment in question a09).

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:

<table>
<thead>
<tr>
<th></th>
<th>decrease significantly</th>
<th>decrease moderately</th>
<th>X not change</th>
<th>increase moderately</th>
<th>increase significantly</th>
</tr>
</thead>
</table>

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

acomm38. Comments:
It is assumed that due to climate change the effect of the described hybrid on crops or plant production in Poland will not change. Reynoutria ×bohemica prefers a temperate climate with the mean temperature of the coldest month in the range between 0°C and 18°C, and with mean temperature of the warmest month exceeding 10°C (CABI 2018 – B) (cf the comment in question a09).

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:

<table>
<thead>
<tr>
<th></th>
<th>decrease significantly</th>
<th>decrease moderately</th>
<th>X not change</th>
<th>increase moderately</th>
<th>increase significantly</th>
</tr>
</thead>
</table>

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

acomm39. Comments:
It is assumed that due to climate change, the impact of the described hybrid on livestock and household animals as well as on animal production in Poland will not change. Reynoutria ×bohemica prefers a temperate climate with the mean temperature of the coldest month in the range between 0°C and 18°C, and with mean temperature of the warmest month exceeding 10°C (CABI 2018 – B) (cf the comment in question a09).

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

<table>
<thead>
<tr>
<th></th>
<th>decrease significantly</th>
<th>decrease moderately</th>
<th>X not change</th>
<th>increase moderately</th>
<th>increase significantly</th>
</tr>
</thead>
</table>
Answer provided with a low medium high level of confidence

Comments:
It is assumed that due to climate change the effect of the described species on people in Poland will not change. *Reynoutria ×bohemica* prefers a temperate climate with the mean temperature of the coldest month in the range between 0°C and 18°C, and with mean temperature of the warmest month exceeding 10°C (CABI 2018 – B) (cf the comment in question a09).

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

- [ ] decrease significantly
- [x] decrease moderately
- [x] not change
- [ ] increase moderately
- [ ] increase significantly

Answer provided with a low medium high level of confidence

Comments:
It is assumed that due to climate change the effect of the described species on other objects in Poland will not change. *Reynoutria ×bohemica* prefers a temperate climate with the mean temperature of the coldest month in the range between 0°C and 18°C, and with mean temperature of the warmest month exceeding 10°C (CABI 2018 – B).

### Summary

<table>
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</thead>
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<tr>
<td>Introduction (questions: a06-a08)</td>
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<td>1.00</td>
</tr>
<tr>
<td>Establishment (questions: a09-a10)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Spread (questions: a11-a12)</td>
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<td>1.00</td>
</tr>
<tr>
<td>Environmental impact (questions: a13-a18)</td>
<td>0.65</td>
<td>0.80</td>
</tr>
<tr>
<td>Cultivated plants impact (questions: a19-a23)</td>
<td>0.15</td>
<td>0.70</td>
</tr>
<tr>
<td>Domesticated animals impact (questions: a24-a26)</td>
<td>0.25</td>
<td>0.50</td>
</tr>
<tr>
<td>Human impact (questions: a27-a29)</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Other impact (questions: a30)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Invasion (questions: a06-a12)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Negative impact (questions: a13-a30)</td>
<td>1.00</td>
<td>0.80</td>
</tr>
<tr>
<td>Overall risk score</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Category of invasiveness</td>
<td>very invasive alien species</td>
<td></td>
</tr>
</tbody>
</table>
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 be repeated.

Comments:
The assessment of the degree of *Reynoutria ×bohemica* invasiveness performed in the case of Poland confirms its status as a "very invasive alien species". The maximum score (1.0) was obtained in the module 'Impact on other objects' (a30). The score for the 'Environmental impact' module (questions a13 – a18) amounted to 0.65, which entitles us to place the species in the "high" impact category (0.61–0.80). At the same time, the species scored zero in the 'Human impact' module (questions: a27-a29), and had low scores in modules: 'Cultivated plants impact' (0.15, questions: a19-a23) and 'Domesticated animal impact' (0.25, questions: a24-a26).

The obtained result is analogous to that of *Reynoutria japonica* Japanese knotweed, yet it should be emphasized that *Reynoutria ×bohemica* is considered to be a taxon with even higher invasive potential compared with its parent species.

Due to the fact that this hybrid is widespread in Poland and presents great ability to spread, and that the current methods of elimination are characterized by low effectiveness at high costs, actions to limit the negative effect of the species on valuable natural areas and further studies leading to the development of more effective methods of combating should be recommended.

Data sources

1. Published results of scientific research (P)
   
   
   
   
   
   
   
   
   
   


doi:10.1371/journal.pone.0161854


Funkenberg T, Roderus D, Buhk C. 2012. Effects of climatic factors on *Fallopia japonica* s.l. seedling establishment: evidence from laboratory experiments. Plant Species Biology 27(3): 218-225


Regulation 2011. Regulation of the Minister of the Environment of 9 September 2011 on the list of plants and animals of alien species that could be a threat to native species or natural habitats in case of their release into the natural environment (Journal of Laws No 210, item 1260).


Toews HPC. 2012. Introduction of native tree species in sites invaded by Japanese Knotweed Taxa and a study of its affect of the seedbank, Biology. 41 State University of New York Fredonia, Fredonia.


2. Databases (B)

3. Unpublished data (N)
-

4. Other (I)

5. Author’s own data (A)
Bzdęga K. 2017. Own observations
BzdęgaK, Tokarska-Guzik B. 2006-2017. Own observations