UNIWERSYTET ŚLĄSKI
W KATOWICACH

INSTYTUT OCHRONY PRZYRODY PAN

Appendix A

# Harmonia+PL – procedure for negative impact risk assessment for invasive alien species and potentially invasive alien species in Poland

## QUESTIONNAIRE

## A0 | Context

Questions from this module identify the assessor and the biological, geographical & social context of the assessment.

**a01**. Name(s) of the assessor(s):

first name and family name

1. Katarzyna Bzdęga
2. Alina Urbisz
3. Barbara Tokarska-Guzik

acomm01. Comments:

| | degree | affiliation | assessment date |
|---|---|---|---|
| (1) | dr | Faculty of Biology and Environmental Protection, University of Silesia in Katowice | 26-01-2018 |
| (2) | dr hab. | Faculty of Biology and Environmental Protection, University of Silesia in Katowice | 26-01-2018 |
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**a02**. Name(s) of ***the species*** under assessment:

Polish name: Rdestowiec japoński (rdestowiec ostrokończysty)*

Latin name: ***Reynoutria japonica*** Houtt.

English name: Japanese knotweed

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| | |
|---|---|
| acomm02. | Comments: |

* 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 are given for the species: “rdestowiec japoński” and “rdestowiec ostrokończysty”; the second of these names is currently prefered (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). The most commonly used synonym of the Latin name is *Fallopia japonica* (Houtt.) Ronse Decr. The species is also described as: *Fallopia compacta* (Hook. f.) G.H.Loos & P. Keil, *Polygonum compactum* Hook.f., *Polygonum cuspidatum* Siebold & Zucc., *Reynoutria japonica* var. *compacta* (Hook.f.) Moldenke, *Reynoutria japonica* var. *hastata* (Nakai ex Ui) Honda, *Reynoutria japonica* var. *spectabilis*, (Noter) Moldenke, *Reynoutria japonica* var. *terminalis* (Honda) Kitag., *Reynoutria japonica* var. *uzenensis* Honda, *Reynoutria uzenensis* (Honda) Honda (The Plant List 2013 – B). Synonyms of English names include: Japanese bamboo, Donkey rhubarb, German sausage, gypsy rhubarb, Hancock's curse, crimson beauty, elephant-ear bamboo, fleece flower, japanese fleece flower, reynoutria fleece flower, pea-shooter plant, japanese polygonum, kontiki bamboo, mexican bamboo, sally rhubarb, wild rhubarb (Alberternst and Bohmer 2011, CABI 2018 – B). The synonyms for the Polish name are “rdestowiec japoński”, “rdest ostrokończysty”.

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 authors' approach (Schuster et al. 2011, 2015 – P). Currently, due to the similarity of 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 back crosses and crosses with other related species, including *Fallopia baldschuanica* (Bailey and Wisskirchen 2006, Bailey et al. 2009 – P).

| | |
|---|---|
| nazwa polska (synonim I)<br>Rdestowiec japoński | nazwa polska (synonim II)<br>Rdest ostrokończysty |
| nazwa łacińska (synonim I)<br>*Fallopia japonica* | nazwa łacińska (synonim II)<br>*Fallopia compacta* |
| nazwa angielska(synonim I)<br>Japanese bamboo | nazwa angielska(synonim II)<br>Donkey rhubarb |

**a03**. **Area** under assessment:

**Poland**

| | |
|---|---|
| acomm03. | Comments:<br>– |

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf01. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

| acomm04. | Comments: |
|---|---|
| | *Reynoutria japonica* has the status of an invasive kenophyte in Poland (Tokarska-Guzik 2005 – P). In 2012, it was included in the category of alien, established and invasive species (Tokarska-Guzik et al. 2012 – P, Tokarska-Guzik et al. 2015a – I). The total number of sites recorded so far for the species has reached about 7 000 (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). These data are probably inaccurate, as they may contain, at least in part, erroneous records which are actually for the *R. ×bohemica* hybrid. Nevertheless, among knotweeds found in the country, Japanese knotweed is the most widespread species in Poland (Tokarska-Guzik et al. 2015b – I). |

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

| | |
|---|---|
| **X** | the environmental domain |
| **X** | the cultivated plants domain |
| **X** | the domesticated animals domain |
| | the human domain |
| **X** | the other domains |

| acomm05. | Comments: |
|---|---|
| | Knotweeds directly affect the natural environment and pose 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 they compete effectively with native plant species, preventing their regeneration (Tokarska-Guzik et al. 2009, Aguilera et al. 2010, Toews 2012, Parepa et al. 2013, Chmura et al. 2015, Duqette et al. 2016 – P). It has been shown that cutting the shoots only temporarily limits *R. japonica* growth, causing displacement of nutrients into the rhizomes and resulting in the acceleration of their growth rate, effectively facilitating the dominance of the species (Aguilera et al. 2010 – P). The species limits and prevents the germination of seeds of many species of native plants due to the formation of a thick and slowly decaying layer of fallen leaves and stems (Gioria and Osborne 2010, Moravcová et al. 2011 - P), as well as by the release of allelopathic compounds inhibiting the growth of other plant species (Weston et al. 2005, Vrchotová and Šerá 2008, Fan et al. 2010, Murrell et al. 2011, Parepa et al. 2013 – P) and possibly having a negative impact on domesticated animals (CABI 2018 – B). Like other knotweeds, it changes the physical and chemical properties of the soil and affects the activity of soil microorganisms (Dassonville et al. 2011, Tharayil et al. 2013, Salles and Mallon 2014 – P), demonstrating allelopathic effects (Weston et al. 2005, Fan et al. 2010 – P). Japanase knotweed can negatively influence crop plants, among others, by growing over farmland which becomes inappropriate for cultivation (Onete i in. 2015 – P, Bzdęga 2017 – A). The mass presence of Japanese knotweed limits access to water, and the growing rhizomes destroy flood protection (Beerling 1991, Barney et al. 2006 – P, Tokarska-Guzik et al. 2015b – I), and in addition road surfaces and pavements; they can also cause cracks in the walls, and even penetrate into buildings (Beerling 1991 – P, Tokarska-Guzik et al. 2015b – 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 |

| aconf02. | Answer provided with a | low | medium | high X | level of confidence |
|---|---|---|---|---|---|

acomm06. Comments:

*Reynoutria japonica*, like *R. sachalinensis* and *R.* × *bohemica*, is one of the most highly invasive and troublesome plants in many countries (Tokarska-Guzik et al. 2012 – P, Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P and literature cited therein). The species is already widespread in Poland, but it can still migrate into Poland from the border areas, from the direction of the Czech Republic and Slovakia, as well as from Germany, along river valleys, and spreads mainly through the dispersion of rhizomes with water (especially during river flooding) (Pyšek and Prach 1993 – P, Tokarska-Guzik et al. 2015b – I, Duqette et al. 2016 – P). Even a small, few millimetre rhizome fragment with a single bud can give rise to a new plant.

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

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

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

acomm07. Comments:

*Reynoutria japonica* can be introduced into the natural environment due to unintentional human activities along with the transport of soil containing plants fragments (usually rhizomes), which is then used e.g. during works related to the strengthening of river banks, construction of roads, parking lots or even as land for gardens, etc. (Alberternst and Böhmer 2011 – B, Śliwiński and Czarniecka 2011 – P, Tokarska-Guzik et al. 2015b – I, Bzdęga and Tokarska-Guzik 2006-2017 – A). There is also a legal possibility of seed introduction via road and rail transport, which, however, 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 |
| X | high |

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

acomm08. Comments:

Due to its decorative qualities (the form and size of the plants, the striking inflorescences and fruits), Japanese knotweed can increase the attractiveness of unused lands in the urban environment. Together with the other species of *Reynoutria*, Sakhalin knotweed and Bohemian knotweed, it belongs to the group of energy (biofuel) crop plants, all taxa (two species and the hybrid) have been recommended as plants for honey production, their functional advantages are well-known, above all as plants used in herbalism. These properties may contribute to their intentional spread. However, due to the danger posed by invasive knotweeds (Anioł-Kwiatkowska and Śliwiński 2009 – P), their cultivation is strictly forbidden throughout the country (Regulation 2011 – P, Tokarska-Guzik et al. 2015b – I). At the moment, Japanese knotweed is not commonly introduced into cultivation, although it is still maintained in home gardens, botanical gardens and arboreta (Botanical Gardens employees...2018 – N). Despite this, it cannot be ruled out that the species is intentionally introduced by humans, especially in the urban environment (gardens, wastelands), from where it can spread spontaneously (mainly vegetatively). There is also growing interest in

| | |
|---|---|
| | the plant as a source of raw material used for medicinal purposes (this mainly concerns *R. sachalinensis*). |

## 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<br>**X** | level of confidence |

| | |
|---|---|
| acomm09. | Comments:<br>The native range of the Japanese knotweed extends from the southern parts of Sakhalin and the Kuril Islands located on the territory of Russia, through Japan (Honshu, Kyushu – where it is widespread – and Shikoku), Korea, southwest China, Taiwan and Vietnam (Bailey 2003, Balogh 2008 – P, Alberternst and Böhmer 2011 – B). Under its natural range conditions, this species is present from sea level to a height of 2,800 m above sea level. (Japan) and up to 3,800 m above sea level. (Taiwan) (Shaw and Seiger 2002, Balogh 2008 – P). On the other hand, the secondary range of *R. japonica* is now much wider compared with the native one (Tokarska-Guzik et al. 2017 – P). Japanese knotweed has been confirmed in many European countries, covering an area between 42° and 63° (70°) north latitude. Currently, it occurs in almost all of the British Isles, in many regions of the European continent, reaching Baltic countries and Scandinavia in the north and Russia and Ukraine in the east; in the south of Europe, its southerly limits have yet to be confirmed. It is also present in North America – in Canada and the USA (from Alaska to Georgia), in Australia and New Zealand; it has also been confirmed in South America (Chile) (Tokarska-Guzik et al. 2017 – P and literature quoted therein).<br>The invasive species of knotweed have their colonization success associated with vegetative reproduction through rhizomes which usually grow several metres around the mother plant and are characterized by rapid growth and high regenerative abilities. Sexual reproduction does not play a key role in occupying new sites (Tokarska-Guzik et al. 2015b – I). In the climatic conditions of Europe, knotweed seedlings are relatively rare and require favourable conditions (Bailey et al. 2009, Tokarska-Guzik et al. 2017 – P). Plant growth may be influenced by factors such as too late a spring, droughts in summer or early autumn frosts (Beerling et al. 1994 – P, Tokarska-Guzik et al. 2015b – I). The reason for the complete dieback of seedlings is too little water, and a temperature of -5 °C that lasts for two days eliminates half of them (Funkenberg et al. 2012 – P). *Reynoutria japonica* prefers relatively wet summers, regular frosts, at least one short period with an average temperature below 0°C, and a long and mild vegetative growth period of about 210 days, with an average temperature above 5°C (Balogh 2008 – P).<br>The similarity between the climate of Poland and the climate of both the natural and the secondary range of Japanese knotweed ranges from 94 to 100%, which means that the climatic requirements of the species are met in Poland and do not constitute a significant obstacle to the spread of the species throughout the country, confirming the current range of this species in the country (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). |

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

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

| aconf06. | Answer provided with a | low | medium | high<br>X | level of confidence |
|---|---|---|---|---|---|

acomm10. Comments:

In its homeland, *Reynoutria japonica* prefers open and damp areas, where it usually grows on sunny hill slopes and forest edges, it is also found on the banks of ditches and roadsides. It is a pioneer plant, colonizing volcano slopes (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P).

In its secondary range, *Reynoutria japonica* exhibits a wide ecological amplitude and habitat spectrum. It performs well on various soil types (silts, clays, sands, limestone substrates) with different pHs from acidic to slightly alkaline (3.5-7.4) (Shaw and Seiger 2002 – P, Alberternst and Böhmer 2011 – B). The species shows tolerance to high temperature, drought, salinity and periodic floods (Shaw and Seiger 2002 – P) and also demonstrates high resistance to soil pollution, e.g. with high concentration of sulphur compounds (Child and Wade 1999 – P). It is present both in anthropogenic habitats (roadsides, railway embankments, urban and post-industrial wastelands, parks, cemeteries and home gardens), as well as in natural ones (riverbanks, forest margins and scrub vegetation). The species penetrates into forests, especially alluvial forests, and rarely occurs in agricultural areas (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P and literature cited therein).

## A3 | Spread

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

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

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

| | |
|---|---|
| | very low |
| | low |
| | medium |
| | high |
| X | very high |

| aconf07. | Answer provided with a | low | medium | high<br>X | level of confidence |
|---|---|---|---|---|---|

acomm11. Comments:

Dispersion from a single source (type A data). The effectiveness of knotweed spread depends on the amount of seeds and vegetative parts that could initiate the development of the next generation, as well as the frequency and intensity of anthropogenic factors favouring the colonization of new locations. Winged fruits that fall near the mother plants can be transferred to new areas by wind (so–called anemochory) and water (so–called hydrochory), but their role in the establishment of the plant in new places is limited. The results obtained so far indicate the possibility of spreading seeds to a distance of up to 16 m (dispersion very low) away from the parent population (Tiébré et al. 2007 – P). However, the key propagation vector for knotweed includes the fragmentation and dispersion of rhizomes by water, by which means the plant can be transported over long (over 50 km) distances, particularly during flood periods (very high dispersion) (Tokarska-Guzik et al.

| | |
|---|---|
| | 2015b – I, Duqette et al. 2016 – P). 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). Knotweed rhizomes, including those of *R. japonica* are characterized by rapid growth, growing 5-7 m around the mother plant, although rhizomes of up to 20 m in length have been reported (Fuchs 1957 – P). Their size may increase by 2.5 m in a single vegetation season (Kretz 1994 – P).<br>Population expansion (type B data). Indirect conclusions can be drawn on the subject of migration and its pace, based on the increasing number of *R. japonica* sites, but it should be taken into account that the results obtained so far mainly reflect the current extent of the examination of its distribution (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). In Poland, the first references to "wild" (outside cultivation) stands of Japanese knotweed are from the second half of the 19th century from Greater Poland (Gniezno), Lower Silesia (Wrocław) and the Baltic Sea Coast, and then from Upper Silesia (Tokarska-Guzik 2005 – P ). In subsequent periods, the number of known sites increased from 3 (by 1900), 63 (by 1950) to over 3000 (in 2000) (Tokarska-Guzik 2005 – P). The second half of the twentieth century is a period of intense increase in the number of sites, which is still continuing today. Data collected up to the year 2000 indicate that the highest density of *R. japonica* sites were in the southern and in the south-western part of the country (Tokarska-Guzik 2005 – P). Supplementing data on species distribution 15 years later has more than doubled the number of sites, to nearly 7,000 (Tokarska-Guzik et al. 2015b – I). |

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

| | |
|---|---|
| | low |
| | medium |
| **X** | high |

| | | | | | |
|---|---|---|---|---|---|
| aconf08. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

| | |
|---|---|
| acomm12. | Comments:<br>The conscious introduction of invasive knotweeds, including *Reynoutria japonica* into the environment is not allowed (Regulation 2011 – P, Tokarska-Guzik et al. 2015b – I). However, the decorative and utility qualities of the plant (its attractive appearance, large size, late flowering – benefit for bees) make it impossible to exclude deliberate introduction by humans, especially in urban environments (gardens, wastelands), from where the species can spread spontaneously. It is also possible to consciously introduce Japanese knotweed to use its biomass for energy purposes (Pude and Franken 2001 – P) including for the production of biogas (Strašil and Kára 2010 – P). The species has also been used to strengthen dunes and heaps, also as cattle feed (Bailey and Conolly 2000, Tokarska-Guzik 2005 – P) and in phytoremediation for the treatment of soils contaminated with heavy metals (Alberternst and Böhmer 2011 – B). Until recently, the species was planted in urban areas as a decorative plant along sound-absorbing screens due to its rapid growth and low habitat requirements. Currently, shoots and leaves of the plant are used in flower arranging, i.e. 'floristry' (not particularly recommended using fresh material, due to the possibility of creating new sites of introduction). However, due to the danger posed by the knotweeds their cultivation is absolutely undesirable throughout the country. Knotweed is spreading in many parts of the country, in different types of habitats, creating a high probability of further species spread during various types of earthworks (e.g. construction of roads, power lines) and regulatory works (regulation of river channels, strengthening flood embankments) together with the soil, water, and equipment being used. 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 |

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

acomm13. Comments:

The species is a plant, it does not demonstrate these types of interaction.

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf10. | Answer provided with a | low | medium | high<br>X | level of confidence |

acomm14. Comments:

*Reynoutria japonica* effectively competes with native plant species, often hindering their growth and regeneration (Tokarska-Guzik et al. 2009, Aguilera et al. 2010, Toews 2012, Parepa et al. 2013, Chmura et al. 2015 – P, Tokarska-Guzik et al. 2015b – I, Duqette et al. 2016 – P). First and foremost, it limits the access to light due to the formation of dense patches and the dense setting of the foliage on the shoots (Vrchotová and Šerá 2008, Dommanget et al. 2013 – P). It prevents germination of seedlings of many native species, because it forms a thick and slowly decaying layer of fallen leaves and stalks. It has been shown experimentally that a greater inhibitory allelopathic effect limiting the germination of seedlings of other plants, characterizes extracts from aerial parts of knotweeds, as opposed to extracts from rhizomes (Vrchotová and Šerá 2008 – P). It was found that *R. japonica* locally affects the pool of organic matter of the soil and exerts a serious negative effect on crops growing on wastelands, where the presence of the species excludes and/or severely reduces the cover of many plant species (and their biomass) through competition (Maurel et al. 2010 – P). Among the undesirable interactions, the penetration of knotweed into protected areas is the most harmful one. So far, the presence of Japanese knotweed has been recorded in 15 Polish national parks (Bomanowska et al. 2014 – P, Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). Invasive knotweeds significantly affect the biodiversity of natural and semi-natural habitats, riparian ecosystems in particular, posing a threat to amphibians, reptiles, birds and mammals whose basic food includes invertebrates (arthopods) (Marigo and Pautou 1998, Maerz et al. 2005, Kappes et al. 2007, Gerber et al. 2008 – P).

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

| | |
|---|---|
| X | no / very low |
| | low |
| | medium |
| | high |
| | very high |

| | | | | | |
|---|---|---|---|---|---|
| aconf11. | Answer provided with a | low | medium | high<br>X | level of confidence |

acomm15. Comments:

There are no native species in Poland with which knotweed could hybridize. *Reynoutria japonica* crosses with the other two invasive species of the *Reynoutria* genus: *R. sachalinensis* and *R. ×bohemica* which are present in the country, creating hybrid swarms. From the secondary range, the intra-species hybrid *Reynoutria* (*Fallopia*) *japonica* var. *japonica* × *Reynoutria* (*Fallopia*) *japonica* var. *compacta* is also known, found in the British Isles and in Germany (Beerling et al. 1994 – P), as well as the intra-species or intergeneric hybrid (depending on the definition): *Fallopia ×conollyana* J.P. Bailey – *Fallopia* (*Reynoutria*) *japonica* × *Fallopia baldschuanica*, which has been found so far in several places in the British Isles (Bailey and Conolly 1984, Bailey 1992, 2001 – P).

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

| | |
|---|---|
| | very low |
| X | low |
| | medium |
| | high |
| | very high |

| | | | | | |
|---|---|---|---|---|---|
| aconf12. | Answer provided with a | low | medium<br>X | high | level of confidence |

acomm16. Comments:

For *Reynoutria japonica*, many natural enemies have been found in the native range, as opposed to very few found in the secondary range (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). 186 species of insects and more than 30 fungal pathogens associated with this plant species were recognized in the natural range of *R. japonica* (Japan) (Djeddour et al. 2008, Shaw et al. 2009 – P). *Gallerucida nigromaculata* (= *G. bifasciata*) originating from Japan and feeding on the leaves is a natural enemy for the species, Another one includes *Aphalara itador* Japanese knotweed psyllidi, feeding on the leaves and shoots of both *R. japonica* and *R. sachalinensis* (Tokarska-Guzik et al. 2015b, CABI 2018 – B). Japanese knotweed plants are often destroyed by *Otiorrhynchus sulcatus* black vine weevil, the larvae of which feed on rhizomes and roots, with adults feeding on the leaves (Beerling et al. 1994 – P). Knotweed is also a host for *Ostrinia ovalipennis* insects, *Ametastegia polygoni* and *Lixus impresiventris* (Djeddour et al. 2008 – P).

In terms of fungal pathogens, mention should be made of *Mycosphaerella polygonium-cuspidatii*, which is specific to species of the *Reynoutria* genus, including *R. japonica*, and parasitises their leaves (Kurose et al. 2006, Djeddour et al. 2008 – P), as well as *Puccinia polygoni-amphibii* var. *torariae*, a fungus from the *Basidiomycota* group that infects *R. japonica* and *R. sachalinensis* leaves, and the species of the genus *Geranium* (Walker 2010 – P, CABI 2018 – B). In the European part of the range, *R. japonica* is attacked by the beetle *Gastrophysa viridula*, when its main host – species of the *Rumex* genus, have been consumed, and the populations of the beetles are characterized by high numbers (CABI 2018 – B). The first mention of *Candidatus Phytoplasma aurantifolia* phytoplasma bacterium infecting *R. japonica* comes from the United Kingdom (Reeder et al. 2010 – P). The bacterium causes a strong inhibition of the growth of the species, which significantly affects its competitive ability (infected plants being overgrown by *Urtica dioica* nettle)

| | |
|---|---|
| | (Reeder et al. 2010 – P). However, there is no more detailed data on the transmission of pathogens or parasites to native species. |

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

| | |
|---|---|
| | low |
| | medium |
| **X** | high |

| | | | | | |
|---|---|---|---|---|---|
| aconf13. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

acomm17. Comments:

*Reynoutria japonica*, like other invasive knotweed species, causes changes in the physical and chemical properties of the soil, and thus the activity of soil microorganisms (Maurel et al. 2010, Dassonville et al. 2011, Tharayil et al. 2013 – P). 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 to facilitate effective invasion (Salles and Mallon 2014 – P). Dense populations and those forming extensive fields impair the light conditions of the ecosystem (Siemens and Blossey 2007, Vrchotová and Šerá 2008, Dommanget et al. 2013 – P) and cause changes in the rate of matter accumulation (Lecerf et al. 2007, Aguilera et al. 2010 – P). By growing on the banks of the watercourses, they can contribute to coastal erosion and changes in water flow. These interactions can cause almost irrreversible changes in the processes occurring in habitats requiring special care, such as the hydrophilous tall herb fringe communities of plains and of montane to alpine levels (code 6430), in which knotweed is noted particularly often (Tokarska-Guzik et al. 2012 – P, 2015b – I).

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

| | |
|---|---|
| | low |
| | medium |
| **X** | high |

| | | | | | |
|---|---|---|---|---|---|
| aconf14. | Answer provided with a | low | medium | high<br>**X** | level of confidence |

acomm18. Comments:

Japanese knotweed plants effectively compete with native plant species, often preventing their regeneration (Tokarska-Guzik et al. 2009, Chmura et al. 2015 – P). Allelopathic chemical substances produced by the species inhibit germination and growth of other plants (Vrchotová and Šerá 2008, Tokarska-Guzik et al. 2015b – I, 2017 – P). 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 species has a negative effect on Natura 2000 natural habitats, including mainly: alpine rivers and their woody vegetation with *Salix elaeagnos* (3240), alpine rivers and their woody vegetation with *Myricaria germanica* (3230), hydrophilous tall herb fringe communities of 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).

Plant species occurring on river alluvia, in woodland margin and forest communities are the most affected by knotweed influence. Knotweeds form dense, single-species phytocoenoses, often occupying large areas of the habitats of willow riparian forests and willow thickets, causing long-term changes in the structure and functioning of riverside ecosystems (Tokarska-Guzik et al. 2006; Bradford et al. 2007, Dassonville et al. 2007; Lecerf et al. 2007, Hejda et al. 2009, Urgenson et al. 2009, Aguilera et al. 2010 – 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:

| | |
|---|---|
| | inapplicable |
| **X** | very low |
| | low |
| | medium |
| | high |
| | very high |

| | | | | | |
|---|---|---|---|---|---|
| aconf15. | Answer provided with a | low | medium | high **X** | level of confidence |

acomm19. Comments:

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

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

| | |
|---|---|
| | inapplicable |
| | very low |
| **X** | low |
| | medium |
| | high |
| | very high |

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

acomm20. Comments:

Invasive knotweed can negatively affect crops, among others by growing over arable fields which as a result become unsuitable for cultivation (Onete et al. 2015 – P, Bzdęga 2017 – A). *Reynoutria japonica* extract also shows a positive effect by inhibiting the development of fungal pathogens of the *Plasmopara* genus, which attack pepper and tomato crops (Latten and Scherer 1994, Schmitt 1995 – P).

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

| | |
|---|---|
| | inapplicable |
| | no / very low |
| **X** | low |
| | medium |
| | high |
| | very high |

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

acomm21. Comments:

*Reynoutria japonica* does not hybridize with cultivated plant species. It may indirectly affect the condition and yield of crops by hybridizing with the closely related *R. sachalinensis*, creating self-sustaining and even more invasive *R.* ×*bohemica* crossbred populations

| | |
|---|---|
| | (Forman and Kesseli 2003 – P, CABI 2018 – B). Backcrosses of hybrids with parental species are also observed, including with *R. japonica* (so-called introgression) (Engler et al. 2011, Bailey et al. 2009, Bailey 2013, Strgulc and Dolenc 2015 – P, Bzdęga and Tokarska-Guzik 2006-2017, own research – A). Japanese knotweed and Sakhalin knotweed, similarly the hybrids formed with their involvement, may adversely affect crop plants, among others by growing over arable fields and meadows which then become unsuitable for cultivation (Onete et al. 2015 – P, Bzdęga 2017 own observation – A).<br>From the secondary range an intra-species or intergeneric hybrid (depending on the definition): *Fallopia conollyana* J.P. Bailey – *Fallopia* (*Reynoutria*) *japonica* × *Fallopia baldschuanica* (a creeper available in landscape gardening, used for clothing acoustic screens along communication routes) is also known, and has been found so far in several places in the British Isles (Bailey and Conolly 1984, Bailey 1992, 2001 – P). |

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

| | |
|---|---|
| | very low |
| | low |
| **X** | medium |
| | high |
| | very high |

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

| | |
|---|---|
| acomm22. | Comments:<br>The presence of Japanese knotweed limits the agricultural use of lands (Tokarska-Guzik et al. 2009, Onete et al. 2015 – P, Bzdęga 2017 – A). Large patches of Japanese knotweed growing in the neighbourhood of fields can affect properties of the cultivation system, including the circulation of nutrients and hydrology. It is predicted that the influence will be of concern beneath 1/3 of cultivations of plants affected by the invasion (probability = low) and that the reduction in condition of plants or the crop will not exceed 20% (effect = medium). Recently, species from the *Reynoutria* genus have become more frequent on farm wastelands, and more abundant in crops, e.g. in Switzerland (Bohren 2011 – P). |

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

| | |
|---|---|
| **X** | very low |
| | low |
| | medium |
| | high |
| | very high |

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

| | |
|---|---|
| acomm23. | Comments:<br>There is insufficient data on the effect of the species on crops associated with the fact that it is a host or vector of pathogens and parasites harmful to these plants. Recent studies have shown that *R. japonica* may be the host of *Phytoplasma aurantifolia*, a bacterium that can cause significant damage to key lime (*Citrus aurantifolia*) (key lime is also used as a potted plant) (EPPO 2018 – B, Najberek in preparation – N). |

# A4c | Impact on the domesticated animals domain

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

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

| | |
|---|---|
| X | inapplicable |
| | very low |
| | low |
| | medium |
| | high |
| | very high |

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

acomm24. Comments:

The species is a plant.

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

| | |
|---|---|
| | very low |
| X | low |
| | medium |
| | high |
| | very high |

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

acomm25. Comments:

Dried and sharply broken shoots of *R. japonica* can cause cuts to grazing animals such as sheep (Kirpluk 2016 – P). Presumably, this may also apply to goats and cattle, but if the grazing takes place in spring, animals eat mainly freshly sprouted knotweed shoots (CABI 2018 – B). No diseases were found in cattle, however animals feeding on knotweeds (confirmed in the example of giant knotweed) demonstrated temporary anorexia and hypothermia (CABI 2018 – B).

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

| | |
|---|---|
| X | inapplicable |
| | very low |
| | low |
| | medium |
| | high |
| | very high |

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

acomm26. Comments:

The species is a plant. 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:

| | |
|---|---|
| **X** | inapplicable |
| | very low |
| | low |
| | medium |
| | high |
| | vert high |

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

acomm27. 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:

| | |
|---|---|
| **X** | very low |
| | low |
| | medium |
| | high |
| | very high |

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

acomm28. Comments:

*Reynoutria japonica* has not been shown to have a negative effect on human health (Alberternst and Böhmer 2011 – B).

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

| | |
|---|---|
| **X** | inapplicable |
| | very low |
| | low |
| | medium |
| | high |
| | very high |

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

acomm29. Comments:

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:

| | |
|---|---|
| | very low |
| | low |

| | |
|---|---|
| | medium |
| | high |
| X | very high |

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

acomm30. Comments:

Destruction caused by the growing rhizomes of knotweed is observed in areas with housing and economic infrastructure. By penetrating the ground (intensive annual growth), the species can damage foundations, building walls and drainage channels, road surfaces, pedestrian walkways and car parks (Beerling 1991 – P, Alberternst and Böhmer 2011 – B, Tokarska-Guzik et al. 2015a and b, Wise Knotweed 2018 – I). The species is also a serious threat in river valleys, as it breaches flood protection and hydrotechnical constructions. Dead matter remaining on the above-ground and underground parts hinders water flow. Shoots, rhizomes, and entire clumps of plants may be deposited on the branches of the wind-throws in the river bed which is a particularly dangerous phenomenon during floods and may be the cause of local temporary submersion or flooding (Tokarska-Guzik et al. 2015b – I, Tokarska-Guzik et al. 2017 – P). Japanese knotweed petals occurring massively along roads may limit visibility on road curves, obscure road signs or restrict 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:

| | |
|---|---|
| | significantly negative |
| | moderately negative |
| | neutral |
| X | moderately positive |
| | significantly positive |

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

acomm31. Comments:

The presence of the Japanese knotweed can be perceived as beneficial, e.g. by owners of apiaries due to the melliferous properties of the plant and its late blooming. The species has been considered as an energy (biofuel) crop. The biomass yield is approx. 30 t/ha of dry matter, i.e. 583.32 GJ/ha (Brunerova et al. 2017 – P). The gross calorific value is comparable to the value of wood, 18.4 GJ/t (Kovářová et al. 2011 – P). Because of that, the biomass of the knotweed, similarly that of other species of this type, can be used for energy purposes (Pude and Franken 2001, Hutla et al. 2005, Lisowski et al. 2008, Cyrankowski et al. 2011 – P). The presence of Japanese knotweed limits the agricultural use of lands (Onete et al. 2015 – P, Bzdęga 2017 – A). Studies by Latten and Scherer (1994 – P) and Schmitt (1995 – P) demonstrated that the plant also contains compounds that are useful for combating fungal pathogens, *R. japonica* extract inhibits the *Plasmopara viticola* effect on pepper and *Phytophtora infestans* effect on tomatoes.

Knotweeds are currently becoming popular in herbal medicine (Kowalczyk 2009; Hromádková et al. 2010 – P). So far, over 60 chemical compounds have been isolated from the organs of these plants: from leaves, shoots and, above all, from rhizomes (Peng et al.

| | |
|---|---|
| | 2013 – P and literature quoted therein). The herbal raw material includes the knotweed rhizome with roots – *Rhizoma cum radicibus Reynoutriae japonicae* (*Rhizoma Polygoni cuspidati*). The fresh rhizome - which can be used to produce an alcoholature, a water macerate, and a glycerin-ethanol extract - is also utilized for medical purposes. A much narrower range of medical properties is demonstrated by knotweed herb - *Herba Reynoutriae japonicae* (*Herba Polygoni cuspidati*) (Kowalczyk 2009 – P). As early as in traditional Chinese medicine, extracts from rhizomes were used as analgesics, antipyretics, diuretics and expectorants. They were used to treat many diseases, e.g. asthma, atherosclerosis, hypertension, inflammation, heart diseases, bacterial and fungal infections (Cassidy et al. 2000, Fremont 2000, Huang et al. 2008, Peng et al. 2013 – P). They contain many biologically active compounds, including resveratrol – an antioxidants chemical compound (Chen et al. 2013, Peng et al. 2013). To sum up one can acknowledge that the influence of the species on provisioning services is moderately positive. |

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

| | |
|---|---|
| X | significantly negative |
| | moderately negative |
| | neutral |
| | moderately positive |
| | significantly positive |

| | | | | | |
|---|---|---|---|---|---|
| aconf28. | Answer provided with a | low | medium | high<br>X | level of confidence |

| | |
|---|---|
| acomm32. | Comments: |
| | *Reynoutria japonica*, similar to other invasive species of knotweed, has a negative effect on regulatory services through, e.g. changes in physical and chemical properties of soil, and thus soil microorganisms (Dassonville et al. 2011, Bardon et al. 2014, 2016 – P, Tokarska-Guzik et al. 2015b – I) and inhibition of the process of biological denitrification of soil bacteria, which promotes the intensive growth of knotweed biomass, facilitating effective invasion (Salles and Mallon 2014 – P). In addition, these plants erode river banks and streams (Bergstrom et al. 2008 – P), and may also damage the construction of flood banks and thus contribute to local submersion and flooding (Tokarska-Guzik et al. 2015b – I). Allelopathic chemical compounds produced by *R. japonica* inhibit seed germination and growth in other plants (Vrchotová and Šerá 2008, Tokarska-Guzik et al. 2015b – I). The demonstrated ability of the knotweeds to accumulate heavy metals in above-ground parts, while simultaneously producing a huge amount of biomass, allows them to be classified as useful plants for the recultivation and phytoremediation of industrial wastelands and those contaminated with heavy metals (e.g. Nishizono et al. 1989, Barney et al. 2006, Berchová-Bímová et al. 2014, Rahmanov et al. 2014 – P). Nevertheless, the final assessment, summarizing the *R. japonica* effect on regulatory services, remains significantly negative. |

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

| | |
|---|---|
| | significantly negative |
| | moderately negative |
| X | neutral |
| | moderately positive |
| | significantly positive |

| | | | | | |
|---|---|---|---|---|---|
| aconf29. | Answer provided with a | low | medium | high<br>X | level of confidence |

| | |
|---|---|
| acomm33. | Comments: |
| | Japanese knotweed forms compact, extensive patches, often occupying large spaces, e.g. in recreational and tourist areas (e.g. on the banks of rivers and water reservoirs, limiting access to the water (Tokarska-Guzik et al. 2006 – P, Bzdęga and Tokarska-Guzik 2006-2017, own observations – A). The presence of the tall plants along roads may reduce visibility and |

| | |
|---|---|
| | cause a threat to road safety (Tokarska-Guzik et al. 2015b – I).<br>At the same time, the plant has decorative and utility values. Knotweed stalks and leaves are used as a decorative element in floristry (Tokarska-Guzik et al. 2015b – I, Bzdęga and Tokarska-Guzik 2006-2017, own observations – A). In addition, knotweed use as a food plant (vegetable) is known in its natural range (Jeong et al. 2010 – P), as well as beyond it, e.g. in North America (Barney et al. 2006 – P), and even in Poland (Łuczaj 2004, Pirożnikow 2012 – P). Raw shoots or cakes made from "wild rhubarb" (a term used to describe knotweed) are locally eaten to this day (Pirożnikow 2012 – P). Leaves and stems have a sour taste, similar to sorrel and rhubarb. In Japan, in addition to young, salted stalks cut into slices, rhizomes are also eaten after soaking and boiling (Łuczaj 2004 – P). Japanese knotweed is described as a valuable melliferous plant (Barney et al. 2006 – P). Some compounds obtained from knotweed exhibit antitumor activity (Kimura and Okuda 2001, Ulrich et al. 2005, Janeczko et al. 2009, Hwangbo et al. 2012 – P). The latest research on their use in the treatment of addiction is also promising (Judd and Miller 2014 – P). To sum up it has been recognised, that the negative and positive influence of the species for cultural services is neutral. |

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

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

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

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf30. | Answer provided with a | low | medium<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm34. | Comments:<br>The range of species tolerance with regard to its preferred climatic parameters is given by (CABI 2018 – B). However, there are reports that in case of *R. japonica* and *R. sachalinensis*, one should not expect a significant extension of the limits of their distribution in the secondary range – unless there are climate changes, when, an increase in frequency is more likely (Balogh 2008 – P). The assessment of potential *R. japonica* distribution based on bioclimatic variables (mean temperature in the coldest month, mean annual temperature >5°C and the real to potential evapotranspiration ratio) assumes two alternative scenarios: the probability of significant species spread to higher latitudes or the possibility of species removal from Central Europe (Beerling et al. 1995 – P). Assuming that in the future the temperature will increase by 1-2°C, the probability is, that the species will overcome subsequent barriers related to its occurrence in Poland, which will not change. |

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

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

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

acomm35. Comments:

Assuming that in the future the temperature will increase by 1–2°C, the probability that the species will overcome additional barriers related to subsistence and reproduction in Poland will not change. *Reynoutria japonica* prefers the wet years, regular frost, an at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B).

**a36**. SPREAD – Due to climate change, the probability for *the species* to overcome barriers that have prevented its spread in Poland will:

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

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

acomm36. Comments:

Assuming that in the future the temperature will increase by 1-2°C, the probability that the species will break existing barriers - which so far have prevented it from spreading in Poland - will not change. *Reynoutria japonica* prefer the wet years, regular frost, an at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B).

The above-ground parts of plants are sensitive to low temperatures (Bourchier and Van Hezewijk 2010, Baxendale and Tessier 2015 – P), while rhizomes can survive a temperature of minus 42°C (Beerling 1993 – P). Due to global warming, the secondary range of the species may widen to the north.

**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 **X** | high | level of confidence |
|---|---|---|---|---|---|

| | |
|---|---|
| acomm37. | Comments:<br>It is assumed that due to climate change the effect of the described species on wild plants and animals - as well as habitats and ecosystems in Poland - will not change. *Reynoutria japonica* prefer the wet years, regular frost, an at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B). |

**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 |
| **X** | not change |
| | increase moderately |
| | increase significantly |

| | | | | | |
|---|---|---|---|---|---|
| aconf34. | Answer provided with a | low | medium<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm38. | Comments:<br>It is assumed that due to climate change the effect of the described species on crops or plant production in Poland will not change. *Reynoutria japonica* prefer the wet years, regular frost, an at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B). |

**a39**. IMPACT ON THE DOMESTICATED ANIMALS DOMAIN – Due to climate change, the consequences of *the species* on domesticated animals and animal production in Poland will:

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

| | | | | | |
|---|---|---|---|---|---|
| aconf35. | Answer provided with a | low | medium<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm39. | Comments:<br>It is assumed that due to climate change, the impact of the described species on livestock and household animals as well as animal production in Poland will not change. *Reynoutria japonica* prefer the wet years, regular frost, at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B). |

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf36. | Answer provided with a | low | medium<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm40. | Comments:<br>It is assumed that due to climate change the effect of the described species on people in Poland will not change. *Reynoutria japonica* prefer the wet years, regular frost, at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B). |

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

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

| | | | | | |
|---|---|---|---|---|---|
| aconf37. | Answer provided with a | low | medium<br>**X** | high | level of confidence |

| | |
|---|---|
| acomm41. | Comments:<br>It is assumed that due to climate change the effect of the described species on other objects in Poland will not change. *Reynoutria japonica* prefer the wet years, regular frost, at least one short stretch with the average temperature below 0 °C, moreover a long and mild period with the average temperature above 5 °C (Balogh 2008 – P). The range of species tolerance with regard to preferred climatic parameters is also given by CABI (2018 – B). |

## Summary

| **Module** | **Score** | **Confidence** |
|---|---|---|
| Introduction (questions: a06-a08) | 1.00 | 1.00 |
| Establishment (questions: a09-a10) | 1.00 | 1.00 |
| Spread (questions: a11-a12) | 1.00 | 1.00 |
| Environmental impact (questions: a13-a18) | 0.65 | 0.90 |
| Cultivated plants impact (questions: a19-a23) | 0.15 | 0.70 |
| Domesticated animals impact (questions: a24-a26) | 0.25 | 1.00 |
| Human impact (questions: a27-a29) | 0.00 | 1.00 |
| Other impact (questions: a30) | 1.00 | 1.00 |
| Invasion (questions: a06-a12) | 1.00 | 1.00 |
| Negative impact (questions: a13-a30) | 1.00 | 0.92 |
| Overall risk score | 1.00 | |
| Category of invasiveness | very 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:<br>The assessment of the degree of *Reynouria japonica* invasiveness performed in 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 to classify the species into 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 animals impact' (0.25, questions: a24-a26).<br>The obtained score confirms the assessment of the negative effect of this species performed in other regions of the secondary range of the species (including Kumschick et al. 2015, Carboneras et al. 2018 – P). Making a decision on the method of dealing with the species should be considered in relation to the current score of the invasion process assessment (question a06-a12), which is very high (1.00). Due to the fact that this species is widespread in Poland and presents a 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. |

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