



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. Dagny Krauze-Gryz
2. Jerzy Romanowski – external expert
3. Wojciech Solarz

acomment01.	Comments:	degree	affiliation	assessment date
(1)	dr		Faculty of Forestry, Warsaw University of Life Sciences - SGGW	31-01-2018
(2)	dr hab.		Faculty of Biology and Environmental Sciences, Cardinal Stefan Wyszyński University, Warsaw, Poland	25-02-2018
(3)	dr		Institute of Nature Conservation, Polish Academy of Sciences in Cracow	26-02-2018

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

Polish name: Burunduk
Latin name: ***Tamias sibiricus*** Laxmann, 1769
English name: Siberian chipmunk

acomm02.	Comments:		
	Polish name (synonym I)	–	Polish name (synonym II)
	Latin name (synonym I)	<i>Eutamias sibiricus</i>	Latin name (synonym II)
	English name (synonym I)	–	English name (synonym II)

a03. Area under assessment:

Poland

acomm03.	Comments:
	–

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

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

aconf01.	Answer provided with a	low	medium	high	level of confidence
				X	

acomm04.	Comments:
	So far, no Siberian chipmunks living at large in Poland have been identified. However, they are bred and sold in Poland (Kakadu 2018, Sprzedajemy.pl 2018 – I)

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

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

acomm05.	Comments:
	The Siberian chipmunk makes little impact on the natural environment as a potential predator and herbivore consuming, among others, tree seeds. In Europe, this species has most likely a limited impact on cultivation of crops (Long 2003 – P) and animal husbandry. The main hazard associated with its presence is the fact that it is one of the key reservoirs of the Lyme disease (Chapuis et al. 2009 – I) and rabies, which are dangerous to people and animals, including wild and bred mammals.

A1 | Introduction

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

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

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

aconf02.	Answer provided with a	low	medium	high X	level of confidence
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acommm06. Comments:
Siberian chipmunks live at large in Europe. For example, there are 10 introduced populations of this species in France (Chapuis 2005 after Bertolino 2009 - P). Wild Siberian chipmunks are present in France, Italy, Belgium, Germany, Netherlands, and Switzerland (Amori and Gippoliti 1995 - P, DAISIE 2006 - B, Chapuis et al. 2009 - I). Their presence was also identified in Denmark and England (DAISIE 2006 - B). However, their populations are the result of intentional introductions and not of spontaneous spread of the species (DAISIE 2006 - B). The species is present in countries neighbouring with Poland (Germany) but does not for populations there whose expansion, associated with the biological characteristics of the species (based on current knowledge), would be quick enough to reach the Poland's borders within approx. 15 years.

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

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

aconf03.	Answer provided with a	low	medium X	high	level of confidence
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acommm07. Comments:
The probability of introduction of the species is low. Its introductions worldwide were only the result of purposeful introductions or escapes of animals from breeding farms (Amori and Gippoliti 1995 - P, DAISIE 2006 - B, O'Rourke et al. 2014 - N).

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

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

aconf04.	Answer provided with a	low	medium X	high	level of confidence
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acommm08. Comments:
The species is sold and bred in Poland (Kakadu 2018, Sprzedajemy.pl 2018 - I). As a result, there is a real risk of intentional or accidental release of Siberian chipmunks to the natural environment. Such cases, as well as escapes of Siberian chipmunks from breeding farms and pet shops (including as a result of acts of vandalism) have resulted in establishment of the species in England (Baker 2008 - P) and other countries of Europe (Bertolino and Genovesi 2005 - P). In France, 10 introductions of the species have been recorded; all of them have resulted in formation of wild populations (Bertolino 2009 - P). Animals introduced into forests and parks have been abandoned by their owners when they became a problem, have been introduced on purpose as a natural attraction due to their nice appearance, or escaped from captivity (stores, breeding farms, zoos) (Verbeylen 2002 - P, DAISIE 2006 - B, Chapuis et al. 2009 - I). In Italy, several dozen pairs of Siberian chipmunks were introduced into the land of the Natura Vita zoo in the vicinity of Verona in the 1970's and formed a population living at large that in the early 1990's was composed of 100 animals, including young ones (Amori and Gippoliti 1995 - P).

A2 | Establishment

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

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

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

aconf05.	Answer provided with a	low	medium	high X	level of confidence
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acomm09.	Comments: Siberian chipmunks tolerate a broad range of climate conditions in the natural area in the European part of Russia and in a large area in Asia (DAISIE 2006 - B). They are present in areas located at elevations from the sea level to high mountains, up to approx. 3,000 m a.s.l. (O'Rourke et al. 2014 - N). They tolerate temperatures from -65 to over 30 °C. The species tolerates extremely difficult environmental conditions in the winter by hibernating; in the summer it can hide in burrows, thus slowing down its metabolism when it is very hot (Chapuis 2005 - P). Wild Siberian chipmunks in secondary range are present in France, Italy, Belgium, Germany, Netherlands, and Switzerland (Chapuis et al. 2009 - I). For example, in France, 9 populations increase in number. In other cases, the numbers fluctuate or current data is missing. It can be assumed that the climate conditions in Poland are optimum for this species to be established.
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a10. Poland provides **habitat** that is

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

aconf06.	Answer provided with a	low	medium	high X	level of confidence
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acomm10.	Comments: Siberian chipmunks are present in coniferous and mixed forests with rich undergrowth and ground cover, as well as in open areas and steppes. In Europe, in secondary ranges, they are also present in parks. They are present from coasts to the upper boundary of the forest (DAISIE 2006 – B, Tsytulina et al. 2016 – B). Siberian chipmunks feed on both plants and animals. They prefer the green parts of plants, buds, berries, seeds of pine trees and other species, as well as mushrooms. The animals that Siberian chipmunks feed on include insects, snails, eggs, and nestlings of birds. They can forage both on the ground and on trees (Benassi et al. 2001 - P). In Korea, the majority of the main food hoarded by this species is seeds, e.g. of beech tree, chestnuts, and oak trees (Jo et al. 2014 - P). In Polish forests, the dominant tree is pine and over 50% of the surface is coniferous forest habitats (National Forests 2016 - I). Thus, availability of food in Poland is high. In France, Siberian chipmunks fed mostly on acorns and seeds of the hornbeam tree; also, they used hazelnuts and lime tree fruit. In the summer, they eat fruit (sweet cherries, almonds, and blueberries) (Chapuis et al. 2009 - I). Availability of this food, too, is high in Poland. Home ranges have the surface area of 0.7-1.8 ha; consequently, the species can live in landscapes with significant level of fragmentation, which are typical of Europe (Marmet et al. 2009 - P).
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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:

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

aconf07.	Answer provided with a	low	medium X	high	level of confidence
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acom11.	Comments: Dispersion from an individual source (Data type: A)/Expansion from the population (Data type: B) The introduced populations are stable in numbers or fluctuate (Belgium), and in some places in France the numbers of Siberian chipmunks increase (DAISIE 2006 - B). In the studied local populations in Western Europe there is no sharp increase of the range of the species based on dispersion from a single source. In Italy, after over 20 years after the introduction, one of the populations (in Rome) still remained in the early stage of colonization (Benassi et al. 2011 - P). The species is characterized by low ability for spontaneous spreading. Adult specimens cover small areas, live sedentary lives (Marmet et al. 2009 - P), and dispersion of young specimens occurs over short distances. Also, in Europe, Siberian chipmunks inhabit mostly small forests and parks, which are isolated areas, and the species has problems crossing barriers, such as open wetlands and roads (Chapuis et al. 2009 - I). The present location of the species in Europe is the outcome of individual cases of introduction and not of expansion of the population (O'Rourke et al. 2014 - N). The range of dispersion from a single source (data type: A) depends on the sex: young females live closer to the place of their birth (the maximum range of dispersion was equal to 527 and 469 m in successive years); the longest dispersion distance noted in the entire year was equal to 933 m (Marmet et al. 2011 - P). The speed of colonization of lands by Siberian chipmunks in France was evaluated as low (approx. 250 m/year) (Chapuis 2005 - P). In the initial stage of expansion of the population (data type: B), the species expanded its range by 200-250 m a year (Chapuis 2005 - P). On the other hand, there is data that indicates that Siberian chipmunks very quickly increase the range of their presence in Europe (Nentwig et al. 2010 - P).
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a12. The frequency of the dispersal of the species within Poland by **human actions** is:

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

aconf08.	Answer provided with a	low	medium X	high	level of confidence
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acom12.	Comments: Assuming that the species will become established in Poland, translocation into new areas is possible with intentional involvement of people, as a result of release or escape of specimens from private breeding farms. There is evidence that the species is sold and bred in Poland (Kakadu 2018, Sprzedajemy.pl 2018 - I); consequently, it was concluded that more than 1 but not more than 10 such cases per decade are expected.
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A4a | Impact on the environmental domain

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

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

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

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

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

aconf09.	Answer provided with a	low	medium X	high	level of confidence
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acomm13.	Comments: Siberian chipmunks feed on plants and animals. Predation: Siberian chipmunks eat animal food (insects, snails, eggs, and nestlings of sparrows) (Bertolino and Genovesi 2005 – P, Chapuis et al. 2009 – I). However, studies conducted in Belgium have not indicated Siberian chipmunks to have significant impact on birds (Chapuis et al. 2009 - I). Thus, it can be assumed that in Europe Siberian chipmunks cause at most small reductions of the sizes of populations of native species requiring particular care. As a part of its natural reach, the Siberian chipmunk is considered to be an important predator of the dusky warbler (<i>Phylloscopus fuscatus</i>), which influences breeding success of the species. Predation of the Siberian chipmunk may be responsible for as much as a half of failed breeding (Forstemeir and Weiss 2004 - P). Herbivorous diet: in Russia, Siberian chipmunks may reduce the forest nut production by a half (Long 2003 - P after GB non-native organism risk assessment scheme 2011 – B). There is no data concerning possible negative impact of the Siberian chipmunk on plant populations in Western Europe.
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a14. The effect of *the species* on native species, through **competition** is:

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

aconf10.	Answer provided with a	low X	medium	high	level of confidence
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acomm14.	Comments: There is no data available concerning the relationship between the Siberian chipmunk and native species in areas where it was introduced. Preliminary studies conducted in France demonstrated that the red squirrel (<i>Sciurus vulgaris</i>) was more numerous in locations where Siberian chipmunks were not present. However, this applied to forests where density of the red squirrel populations is naturally low (Dezires 2008, after Chapuis et al. 2009 - I). The species may potentially compete directly (competition for food resources) or indirectly (reduced competitive ability by spread of parasites) with native rodents (<i>Sciurus vulgaris</i> , as well with small forest rodents, mice, and bank voles) (DAISIE 2006 - B), causing at most small reductions in the size of their populations.
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a15. The effect of *the species* on native species, through **interbreeding** is:

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

aconf11.	Answer provided with a	low	medium	high X	level of confidence
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acomm15. Comments:
There are no grounds for concluding that the Siberian chipmunk may cross-breed with native species.

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

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

aconf12.	Answer provided with a	low	medium	high X	level of confidence
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acomm16. Comments:
A total of 27 pathogen taxons and diseases are associated with the Siberian chipmunk, including 7 species of flatworms and nematodes (endoparasites), ectoparasites, including 5 species of ticks, 2 species of fleas, and 1 louse species, as well as 6 species of bacteria, 3 species of viruses, and 1 protozoan species (Najberek 2018 - N). The Siberian chipmunk can be the carrier of rabies (OIE list) which is a deadly disease and may be transmitted to other animals. Identification of a hantavirus in a Siberian chipmunk (Najberek 2018 - N) indicates that the species may, together with other domestic small rodents, play the role of a reservoir of this virus. Siberian chipmunks may be the hosts of microparasites (one louse species - *Enderleinellus tamiasis* (Durden and Musser 1994 a,b - P) and of about 20 different fleas (Chapuis et al. 2009 - I). They are also a reservoir of Lyme disease (Chapuis et al. 2009 - I), as estimated in France, more important than the native rodent species (Marsot et al. 2013 - P). Siberian chipmunks are attacked by ticks to a greater extent than native rodents (Pisanu et al. 2010 - P). Within the introduction range, Siberian chipmunks are hosts of macroparasites brought with them from Korea (lice *E. tamiasis*, two nematodes *Brevistriata skrjabini* and *Strongyloides callosciureus*, as well as saprophytes from the Listrophoridae family) (Pisanu et al. 2007 - P, Chapuis et al. 2009 - I). Studies of one of Frances population of Siberian chipmunks demonstrated that they had similar ectoparasites (fleas) as red squirrels. It was not demonstrated that new species of fleas appeared with Siberian chipmunks; on the contrary, they became the hosts of fleas that live on the native squirrels (Pisanu et al. 2008 - P). However, together with Siberian chipmunks, two new species of endoparasites appeared (*Brevistriata skrjabini* and *Strongyloides callosciureus*). Studies have also demonstrated that Siberian chipmunks were hosts of a small number of parasite worms compared to native murids species. This can be explained by the fact that the development cycle of the worms is specific for taxonomically similar hosts. Thus, transmission of parasites between Siberian chipmunks and red squirrels, which are much closer related to them than mice, cannot be excluded (Pisanu et al. 2009 - P).

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

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

aconf13. Answer provided with a

low	medium X	high
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 level of confidence

acomm17. Comments:
There is no data available about the impact of the Siberian chipmunk on the integrity of the ecosystem by disturbing its abiotic factors.

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

low
 medium
 high

aconf14. Answer provided with a

low	medium X	high
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 level of confidence

acomm18. Comments:
It appears that the impact of the Siberian chipmunk on the integrity of ecosystems by disturbing biotic factors in the areas of introduction in Europe is limited (Chapuis et al. 2009 - I). Potentially, Siberian chipmunks may affect renewal of forests by feeding on seeds. For example, in Russia, Siberian chipmunks can reduce the forest nut production by a half (Long 2003 - P after GB non-native organism risk assessment scheme 2011 – B); however, there is no such data available for Europe.

A4b | Impact on the cultivated plants domain

Questions from this module qualify the consequences of *the species* for cultivated plants (e.g. crops, pastures, horticultural stock).

For the questions from this module, consequence is considered ‘low’ when presence of *the species* in (or on) a population of target plants is sporadic and/or causes little damage. Harm is considered ‘medium’ when *the organism’s* development causes local yield (or plant) losses below 20%, and ‘high’ when losses range >20%.

a19. The effect of *the species* on cultivated plant targets through **herbivory or parasitism** is:

inapplicable
 very low
 low
 medium
 high
 very high

aconf15. Answer provided with a

low	medium X	high
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 level of confidence

acomm19. Comments:
There are no publications that identify the Siberian chipmunk as a pest of crops in Western Europe. As a part of their natural range, they are pests of cereals (Bertolino and Genovesi 2005 – P, DAISIE 2006 – B, Chapuis et al. 2009 – I). For example, in Russia, Siberian chipmunks are serious pests of crops - mainly wheat and maize; they can also cause damage in orchards and gardens (Long 2003 - P). However, there is not data indicating that damage caused to crops in Europe is economically significant (Chapuis et al. 2009 - I). In their natural range (Amur-Zea Plateau), they are also one of the greatest pests in forests as they feed on oak trees and hazelnuts. In the forests of the Sayon mountains, Siberian chipmunks eat a half of seeds produced by cedar trees (Long 2003 - P). Consequently, it was concluded that the impact of this species on crops, due to their herbivorous diet, assuming that it is widespread in Poland, can be at most moderate (probability – low, effect – high).

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

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

aconf16. Answer provided with a

low	medium	high
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 level of confidence

acomm20. Comments:
The species is not a plant.

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

- inapplicable
- no / very low
- low
- medium
- high
- very high

aconf17. Answer provided with a

low	medium	high
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 level of confidence

acomm20. Comments:
The species is not a plant.

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

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

aconf18. Answer provided with a

low	medium	high
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 level of confidence

acomm22. Comments:
There is no data indicating that the Siberian chipmunk may affect integrity of crops.

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

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

aconf19. Answer provided with a

low	medium	high
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 level of confidence

acomm23. Comments:
There is no data from Europe for concluding that the Siberian chipmunk may be the host or the vector of pathogens and parasites harmful to 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:

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

aconf20. Answer provided with a

low	medium X	high
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 level of confidence

acomm24. Comments:
There are no reports indicating that the predation of the Siberian chipmunk has any influence on farm animals or pets.

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

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

aconf21. Answer provided with a

low	medium X	high
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 level of confidence

acomm25. Comments:
There are no reports indicating that Siberian chipmunks could be dangerous to farm animals or pets by having properties that constitute danger during direct contact. In unusual situations, like being attacked, may bite on other animals.

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

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

aconf22. Answer provided with a

low	medium X	high
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 level of confidence

acomm26. Comments:
A total of 27 pathogen taxons and diseases are associated with the Siberian chipmunk, including 7 species of flatworms and nematodes (endoparasites), ectoparasites, including 5 species of ticks, 2 species of fleas, and 1 louse species, as well as 6 species of bacteria, 3 species of viruses, and 1 protozoan species (Najberek 2018 - N). Together with other rodents, the Siberian chipmunk forms an important reservoir of Lyme disease and may also be the carrier of rabies, a deadly disease (OIE 2018 - I) and hantaviruses, which may be transmitted to other farm animals and pets.

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:

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

aconf23.	Answer provided with a	low	medium	high	level of confidence
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acomm27. Comments:
The Siberian chipmunk is not a parasite.

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

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

aconf24.	Answer provided with a	low	medium	high	level of confidence
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acomm28. Comments:
Like other rodents, including squirrels, Siberian chipmunks may bite (Critter Control 2018, Chipmunks do bite 2018 - I); however, their bites should not be too severe. Assuming that this species spreads in Poland, it can be guessed that the likelihood of such events will be in on the level of 1 to 100 cases per 100,000 people a year (probability – average); however, the bites will not cause work absence and will not result in any permanent disabilities (effect – low).

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

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

aconf25.	Answer provided with a	low	medium	high	level of confidence
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acomm29. Comments:
Siberian chipmunks may potentially be carriers of diseases that are dangerous to people, caused by hantaviruses, and of rabies, which is deadly to people. Moreover, the Siberian chipmunk plays an important role as a reservoir of Lyme disease (Chapuis et al. 2009 - I) which causes numerous neurological, cardiologic, and joint and muscle problems. It is estimated that Siberian chipmunks contributes to the risk of spread of Lyme disease to a greater extent than native rodents (Marsot et al. 2013 - P).

A4e | Impact on other domains

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

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

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

aconf26. Answer provided with a

low	medium	high
	X	

 level of confidence

acomm30. Comments:
Siberian chipmunks may cause damage by biting cables and building nests in buildings (Pest Strategies 2017 - I). However, there is no data from Europe about this type of damage and its size. Assuming that this species becomes widespread in Poland, it is estimated that there will be more than 1 but no more than 100 such cases per 100 000 buildings a year (probability – low) and that they will be fully reversible (effect – low).

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
- moderately positive
- significantly positive

aconf27. Answer provided with a

low	medium	high
	X	

 level of confidence

acomm31. Comments:
Given the fact that, within their natural range, the Siberian chipmunk is considered to be a serious pest of agricultural crops (cereals), it cannot be excluded that, once widespread, it will affect agricultural production. Moreover, as a potential vector of, among others, Lyme disease, hantaviruses, and rabies, it may have a negative impact on breeding of animals as a result of transmission of pathogens.

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

- significantly negative
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf28. Answer provided with a

low	medium X	high
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 level of confidence

acommm32. Comments:
Due to transmission of pathogens (including Lyme disease, hantaviruses, and rabies), the Siberian chipmunk may have a negative impact on biological regulation (regulation of zoonoses).

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

- significantly negative
- moderately negative
- neutral
- moderately positive
- significantly positive

aconf29. Answer provided with a

low	medium	high X
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 level of confidence

acommm33. Comments:
The Siberian chipmunk evokes friendly feelings due to its appearance and may be considered as an interesting and attractive element of parks and gardens. On the other hand, being an alien element in the domestic fauna that may have a potential negative impact on biodiversity and be a vector of pathogens, it may raise concern in the public.

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

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

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

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

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

aconf30. Answer provided with a

low	medium	high X
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 level of confidence

acommm34. Comments:
Climate changes will not have an impact on the probability of introduction of the species in Poland, as the species has adapted to different climate conditions. The natural range of the Siberian chipmunk is very broad and extends across the entire Asia; introduced populations are present in central, northern, and southern Europe.

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

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

aconf31. Answer provided with a

low	medium X	high
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 level of confidence

acomm35. Comments:
It is expected that the range of presence of the Siberian chipmunk in Europe will decrease (Di Febbraro 2016 - P). However, establishment of the Siberian chipmunk, which is a species adapted to a broad climate spectrum, will be possible mostly due to intentional actions of people, independent of climate changes.

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

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

aconf32. Answer provided with a

low	medium X	high
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 level of confidence

acomm36. Comments:
Spread of the Siberian chipmunk, which is a species adapted to a broad climate spectrum, will be possible mostly due to intentional actions of people, independent of climate changes.

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

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

aconf33. Answer provided with a

low	medium X	high
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 level of confidence

acomm37. Comments:
There are no grounds to believe that climate changes will increase the impact of the Siberian chipmunk on plants, animals, habitats, and ecosystems in Poland.

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

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

aconf34. Answer provided with a

low	medium X	high
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 level of confidence

acomm38. Comments:
There are no grounds to believe that climate changes will increase the impact of the Siberian chipmunk on crops and plant production in Poland.

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

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

aconf35. Answer provided with a

low	medium X	high
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 level of confidence

acomm39. Comments:
There are no grounds to believe that climate changes will increase the impact of the Siberian chipmunk on farm animals and pets, and on animal production in Poland.

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

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

aconf36. Answer provided with a

low	medium X	high
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 level of confidence

acomm40. Comments:
There are no grounds to believe that climate changes will increase the impact of the Siberian chipmunk on people in Poland.

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

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

aconf37. Answer provided with a

low	medium X	high
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 level of confidence

acomm41. Comments:
There are no grounds to believe that climate changes will increase the impact of the Siberian chipmunk on other objects in Poland.

Summary

Module	Score	Confidence
Introduction (questions: a06-a08)	0.33	0.67
Establishment (questions: a09-a10)	1.00	1.00
Spread (questions: a11-a12)	0.50	0.50
Environmental impact (questions: a13-a18)	0.33	0.58
Cultivated plants impact (questions: a19-a23)	0.17	0.50
Domesticated animals impact (questions: a24-a26)	0.33	0.50
Human impact (questions: a27-a29)	0.63	0.50
Other impact (questions: a30)	0.25	0.50
Invasion (questions: a06-a12)	0.61	0.72
Impact (questions: a13-a30)	0.63	0.52
Overall risk score	0.38	
Category of invasiveness	moderately 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 is regularly repeated.

acomment42.

Comments:

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Data sources

1. Published results of scientific research (P)

Amori G, Gippoliti S. 1995. Siberian chipmunks *Tamias sibiricus* in Italy. *Mammalia* 59: 288-289

Baker SJ. 2008. Escapes and introductions. In: Harris S, Yalden DW. (eds.). *Mammals of the British Isles: Handbook*. Mammal Society.

Benassi G, Bertolino S. 2011. Distribution and activity of the introduced *Tamias sibiricus* (Laxmann 1769) in an urban park in Rome, Italy. *Mammalia* 75: 87-90.

Bertolino S. 2009. Animal trade and non-indigenous species introductions: the world-wide spread of squirrels. *Diversity and Distribution* 15: 701-708.

Bertolino S, Genovesi P. 2005. The application of the European strategy on invasive alien species: an example with introduced squirrels. *Hystrix Italian Journal of Mammalogy* 16: 59-69.

Chapuis J-L. 2005. Distribution in France of a naturalized companion animal, the Siberian Chipmunk (*Tamias sibiricus*). *Revue d'Ecologie (Terre Vie)* 60: 239-253.

Di Febbraro M, Martinoli A, Russo D, Preatoni D, Bertolino S. 2016. Modelling the effects of climate change on the risk of invasion by alien squirrels. *Hystrix Italian Journal of Mammalogy* 27(1): DOI10.4404/hystrix-27.1-11776

- Durden LA, Musser GG. 1994a. The mammalian hosts of the sucking lice (Anoplura) of the world: a host-parasite list. *Bulletin of the Society for Vector Ecology* 19: 130-168
- Durden LA, Musser GG. 1994b. The sucking lice (Insecta, Anoplura) of the world: a taxonomic checklist with records of Mammalian hosts and geographical distribution. *Bulletin of the American Museum of Natural History* 218: 1-90
- Forstmeier W, Weiss I. 2004. Adaptive plasticity in nest-site selection in response to changing predation risk. *Oikos* 104: 487-499.
- Jo Y-S, Seomum H, Baccus JT. 2014. Habitat and food utilization of the Siberian chipmunk, *Tamias sibiricus*, in Korea. *Acta Theriologica* 59: 589-594
- Long J. 2003. *Introduced Mammals of the World: Their History, Distribution and Influence*. CSIRO Publishing
- Marmet J, Pisanu B, Chapuis J-L. 2009. Home range, range overlap, and site fidelity of introduced Siberian chipmunks in a suburban French forest. *European Journal of Wildlife Research* 55: 497-504
- Marmet J, Pisanu B, Chapuis J-L. 2011. Natal dispersal of introduced Siberian chipmunks, *Tamias sibiricus*, in a suburban forest. *Journal of Ethology* 29: 23-29
- Marsot M, Chapuis J-L, Gasqui P, Dozieres A, Massegli S, Pisanu B, Ferquel E, Vourc'h G. 2013. Introduced Siberian chipmunks (*Tamias sibiricus barberi*) contribute more to Lyme boreliosis risk than native reservoir rodents. *PLoS ONE* 8: e55377
- Nentwig W, Kühnel E, Bacher S. 2010. A generic impact-scoring system applied to alien mammals in Europe. *Conservation Biology* 24: 302-311
- Pisanu B, Jerusalem C, Huchery C, Marmet J, Chapuis J-L. 2007. Helminth fauna of the Siberian chipmunk, *Tamias sibiricus* Laxmann (Rodentia, Sciuridae) introduced in suburban French forests. *Parasitology Research* 100: 1375-1379
- Pisanu B, Lebailleur L, Chapuis J-L. 2009. Why do Siberian chipmunks *Tamias sibiricus* (Sciuridae) introduced in French forests acquired so few intestinal helminth species from native sympatric murids? *Parasitology Research* 104: 709-714
- Pisanu B, Marmet J, Beaucournu J-C, Chapuis J-L. 2008. Fleas community in introduced Siberian chipmunks (*Tamias sibiricus* Laxmann) in Forest of Senart, France. *Parasite* 15: 35-43
- Pisanu B, Marsot M, Marmet J, Chapuis J-L, Reale D, Vourc'h G. 2010. Introduced Siberian chipmunks are more heavily infested by ixodid ticks than area native bank voles in a suburban forest in France. *International Journal for Parasitology* 40: 1277-1283
- Verbeyelen G. 2002. Asian chipmunks in De Panne (Belgium): is a population explosion likely? *Bulletin de l'Institut royal des Sciences naturelles de Belgique* 72-suppl.: 239-240

2. Databases (B)

- DAISIE 2006. *Tamias sibiricus*. Species factsheet. (<http://www.europe-alien.org/speciesFactsheet.do?speciesId=52906>) Date of access: 2018-02-07
- GB non-native organism assessment scheme 2011. *Tamias sibiricus* – Siberian chipmunk Kaxmann (1769). (<http://www.nonnativespecies.org/>) Date of access: 2018-02-10
- Tsytsulina K, Formozov N, Shar S, Lkhagvasuren D, Sheftel B. 2016. *Eutamias sibiricus* (errata version published in 2017). The IUCN Red List of Threatened Species 2016: e.T21360A115161465. (<http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T21360A22268598.en.>) Date of access: 2018-02-01

3. Unpublished data (N)

- Najberek K. 2018. (in preparation). Pathogens, parasites and diseases of invasive alien species in European concern
- O'Rourke E, Kelly J, O'Flynn C. 2014. Risk Assessment of *Tamias sibiricus*, pp. 1-24. National Biodiversity Data Center (<http://nonnativespecies.ie/wp-content/uploads/2014/03/Tamias-sibiricus-Siberian-chipmunk.pdf>) Date of access: 2018-03-01

4. Other (I)

- Chapuis J-L, Obolenskaya E, Pisanu B, Lissovsky A. 2009. *Tamias sibiricus* (Siberian chipmunk). *Invasive Species Compendium* (<https://www.cabi.org/isc/datasheet/62788>) Date of access: 2018-01-30
- Chipmunks do bite 2018. (https://www.youtube.com/watch?v=QKCSZhp_ivU). Date of access: 2018-03-18

Critter Control 2018. Chipmunk bites. Critter Control. Protecting People, Property and Wildlife® Since 1983. (<https://www.crittercontrol.com/services/chipmunks/chipmunk-bites>) Date of access: 2018-02-18.

Kakadu 2018. Burunduk (<http://kakadu.pl/burunduk/>) Date of access: 2018-04-20

Lasy Państwowe. 2016. Polskie Lasy. Lasy Państwowe. (<http://www.lasy.gov.pl/pl/nasze-lasy/polskie-lasy>) Date of access: 2018-02-01

OIE 2018. OIE-Listed diseases, infections and infestations in force in 2018 (<http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2018/>) Date of access: 2018-02-18

Pest Strategies. 2017. How To Get Rid of Chipmunks (Complete Removal Guide). (<https://www.peststrategies.com/pest-guides/chipmunk-guides/>) Date of access: 2018-02-10

Sprzedajemy.pl 2018. Burunduk wiewiórka syberyjska para (<https://sprzedajemy.pl/burunduk-wiewiorka-syberyjska-para-tarnow-opolski-2461c4-nr48828687>) Date of access: 2018-01-30

5. Author's own data (A)

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