

PCA Guidance Note

Management of Himalayan Balsam



November 2023



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Background

Himalayan Balsam, *Impatiens glandulifera*, was introduced into Britain in 1839 as an ornamental garden plant. It escaped from cultivation and has spread rapidly throughout the UK and Ireland, favouring moist and semi-shaded damp places, predominantly by slow-moving watercourses and waste land. It is an herbaceous annual plant with characteristic pale pink-purple flowers, matt/darkish-green finely serrated leaves, stout succulent hollow reddish translucent stems (up to 2.5 m in height) and very shallow roots.

While the species is reasonably easy to identify when mature (especially when flowering), the seedlings and last year's dead stems are more difficult to spot.

Aids to Himalayan Balsam identification can be found here:

<https://www.nonnativespecies.org/non-native-species/information-portal/view/1810>

Legislation

In the UK, legislation concerning Himalayan Balsam is provided by a number of instruments (Table 1). The primary aim of these instruments is to prevent the spread of Himalayan Balsam. In short, it is an offence to plant in or cause Himalayan Balsam to spread into the wild and, if transported offsite, there is a duty of care for any part of the plant that can facilitate growth (propagules) and any soils etc. containing propagules, i.e. such material must be treated as controlled waste. For further information see 'PCA Guidance Note on Legislation and policy for Invasive Non-native Plant Species including Japanese Knotweed'.



Control action should be carried out in conformity with any relevant legislation in a given geographic region, as updated.

Version History

Date Effective	Description of amendment	Author
April 2018	• Initial Document	
November 2023	• Minor changes to reflect updates to legislation • Updated References	Daniel Docking and members of the IWCG

Table 1: Summary of key legislative instruments relating to the management of Himalayan Balsam

Instrument	Relevant section	Summary of key aspects	Countries of UK covered
Wildlife and Countryside Act 1981 (as amended)	Section 14, Schedule 9.	It is illegal to plant or otherwise cause Himalayan Balsam to grow in the wild in the UK.	England and Wales.
Wildlife and Natural Environment Act 2011	Section 14.	It is illegal to plant or otherwise cause Himalayan Balsam to grow in the wild in Scotland.	Scotland.
Wildlife Order 1985	Section 15, Schedule 9.	It is illegal to plant or otherwise cause Himalayan Balsam to grow in the wild in Northern Ireland.	Northern Ireland.
Anti-social Behaviour, Crime and Policing Act 2014 and Community Protection Notices		Local councils and the police have the power to issue Community Protection Notices against "individuals who are acting unreasonably and who persistently or continually act in a way that has a detrimental effect on the quality of life of those in the locality" including for invasive non-native species like Himalayan Balsam. A notice could require an individual or organisation to make reasonable efforts to make good the problems arising as a result of Himalayan Balsam within a specified period of time and/or a requirement to take reasonable steps to prevent future occurrence of the problem. Breach of any requirement of a Community Protection Notice, without reasonable excuse, would be a criminal offence.	England and Wales.
Environmental Protection Act 1990	Sections 33 and 34.	If taken away from the site of origin, Himalayan Balsam and associated material, e.g. soil, becomes Controlled Waste and must be disposed of at a landfill site that is authorised to accept it. Himalayan Balsam waste that is disposed of at a landfill site must be accompanied by appropriate waste transfer documentation.	UK.
Environmental Protection (Duty of Care) Regulations 2014		Require people subject to those duties of care to make, keep and produce documents. In particular, they require the waste being transferred to be accompanied by a transfer note.	Scotland.
The Invasive Alien Species (Enforcement and Permitting) Order 2019	Schedule 2, and Table 1 of Schedule 1.	It is an offence to import, transport, purchase, sell, cultivate or otherwise cause to grow in the wild Himalayan Balsam without a licence or permit. Schedule 2 contains the list of plants covered by the Order. Table 1 of Schedule 1 contains a list of provisions.	England and Wales.

Regulation (EU) No 1143/2014 on Invasive Alien Species (IAS Regulations)		It is an offence to import into the EU, or transport within the EU. It is also an offence to purchase, sell, cultivate or otherwise cause to grow in the wild Himalayan Balsam without a licence or permit.	EU.
Town and Country Planning Act 1990 and Town and Country Planning Act (Scotland) 1997	Section 215 of the England and Wales Act and Section 63 of the Scottish Act.	Although these Acts do not make specific reference to specific weeds, they provide local authorities with power to serve notices on owners or occupiers of land to control weeds that may be harming the amenity of the surrounding area and if the owners and occupiers fail to remedy the situation, they may be liable to a fine or have to repay the costs of action taken by the local authority to control the weeds.	UK.
Regulatory Position Statement 178		Outlines requirements which will allow the disposal of invasive non-native plant material, and the substrate in which it is rooted, without the need for a permit.	England.
Treatment and disposal of invasive non-native plants in Wales: RD 58		Outlines requirements which will allow the disposal of invasive non-native plant material, and the substrate in which it is rooted, without the need for a permit.	Wales.
Common Law	EU.	There is provision within Common Law to take civil action against neighbouring landowners where the spread of Himalayan Balsam is considered to be a private or public nuisance.	UK.

Table correct up to November 2023

Life cycle and reproduction

Being an annual plant, Himalayan Balsam completes its entire life cycle in one growth season, reproducing from year to year solely by small spherical seeds, 2-4 mm in diameter. The highly viable seeds germinate early in the growing season (usually from March to June) with vigorous growth following. Plants will reach their full height by July/August. The plant can flower and set seed between July and October.

While the species does not spread by vegetative means, e.g. from fragments of root or stem, uprooted plants left in moist conditions can re-root from nodes on the stem. Additionally, plants that have been cut will re-sprout unless the primary stem is cut below the first node. When the stem is cut above the first node, the species will regrow extremely vigorously and potentially produce more flowers and seeds than it would have otherwise.

While Himalayan Balsam generally produces seeds once it has reached its full height, plants can seed at heights under 15 cm in certain conditions (particularly after disturbance).

A single plant germinating from a single seed could start a significant invasion.

Seed bank and dispersal

Himalayan Balsam seeds have historically been regarded to persist in the soil for approximately 18 months. However, a field trial in Czech Republic (Skálová 2019) found that seed can persist for up to four years, which was also reported in an eradication study in Switzerland (Saegesser 2016).

An individual plant can produce over 800 seeds, per year. The seeds are contained in exploding seed pods, usually up to 16 seeds per pod, which can propel/disperse seeds up to 7 metres from plants. Seeds can be spread over greater distances by various means including water flow (the seeds float) and through human activity (e.g. attached to vehicles, clothing and footwear). In order to germinate, the seeds require a period of cold stratification.

The seed bank characteristics of Himalayan Balsam are not well understood. However, it has been found that for most species seed movement in soil is slow and that deeper seeds are older, except in severely disturbed soils. There is also a strong correlation between species whose seeds are found at depth in the soil and those with extended seed longevity. The fact that Himalayan Balsam seeds are not long lived makes it very unlikely that they will be present at depths down to 0.5 metres in all but highly disturbed or cracked soils. As such, the depth and spread potential for seeds should be considered on a site by site basis.

Impacts

Himalayan Balsam can form dense colonies which shade out and suppress the growth of native plants reducing biodiversity. Potentially negative impacts of Himalayan Balsam include:

- outcompeting native plants with similar habitat preferences;
- leaving riverbanks exposed to erosion following winter dieback;
- increased risk of flooding in summer due to constricted water flow, siltation of water courses and increasing bank instability; and
- attracting pollinators away from native species.

It should be noted that clearing certain habitats, e.g. riverbanks, of Himalayan Balsam can increase the risk of erosion and potentially open up the area to invasion by even less desirable invasive species, such as Japanese Knotweed or Giant Hogweed. As such, cleared soils should be re-vegetated with suitable native species as part of any Management Plan.

Himalayan Balsam Management Plan

Note: Identification of vector routes and suitable management plans for this and many other non-native invasive species is included in PCA's book: *Practical Management of Invasive Non-native weeds in Great Britain and Ireland*.

Small localised infestations can be controlled reasonably easily. However, where the probability of re-infestation is high, e.g. the species is also present upstream from a site, a catchment level approach may be required to achieve long term control. Additionally, if the species is present on a neighbouring property within approximately 7 metres of the property boundary, seeds may be propelled back onto the site following local removal. An assessment of the re-infestation potential from the wider environment is critical. A single seed arriving on a site following control action could return the site to its original state rapidly. In the space of two years, one plant can become hundreds and then hundreds of plants can become thousands.

Due to the species preference for growth on riverbanks and in wet woodland, access can frequently be problematic. In such scenarios, control options may be limited (i.e. plants may not be accessible for hand pulling or herbicide treatment) and **all appropriate health and safety precautions must be taken**.

The aims of a Himalayan Balsam Management Plan should be clearly stated and will usually include killing the existing plants and eradicating the remaining seed bank. A number of methods are available to achieve both ends (see Table 2 and Control Methods section). The method chosen depends on many factors including the resources available, e.g. staff and money, and the target date for completion of control.

In order to control Himalayan Balsam *in situ* it must be prevented from producing seeds until the seed bank is exhausted (i.e. no viable seeds remain in the soil). The existing plants can be killed relatively quickly by hand pulling, cutting the stem below the first node or by applying herbicide (see below for further details).

As the seed bank is short lived (18 months to 4 years), two to four years of control action (taking place before plants set seed) should eradicate the species. Monitoring with follow up treatment, when necessary, should be maintained until at least four years has passed with no Himalayan Balsam growth.

Control carried out after the plants have set seed is unlikely to have long-term benefits; in fact, spread will likely be facilitated by carrying out control action when seed pods are present and mature. If plants containing seeds must be removed, great care should be taken not to facilitate seed dispersal by triggering off the expulsion of seeds from the seed pods, e.g. the seed heads must be bagged. However, care is needed with a bagging process as there is a risk this process may cause seed pods to explode and so disperse seeds. Removal, or herbicide treatment, of plants that have already shed their seeds is pointless, as the plants will die at the end of the growing season, however disturbance could further distribute the seeds.

It is likely, particularly in the first year of control, that new plants will sprout following the initial removal/treatment, either because shade suppression will be reduced or due to soil disturbance. As such, several additional visits will likely be required. The initial visit should occur in spring before the plant flowers but late enough to ensure the germinating seedlings have grown, normally May/June. Additional visits will probably be required as stated above if the ground is disturbed or suppression reduced. These additional visits could occur in July/August and September/October. Plants that germinate after September/October are very unlikely to have sufficient time to complete their life cycle and produce seeds. However, this will depend on the control method chosen (see below) and local environmental factors, so a cautionary approach is advisable.

If there is insufficient time to allow the seed bank to become exhausted, contaminated soil can be buried or removed quickly by excavation. Arisings should be retained onsite (e.g. banded or buried) whenever possible and only disposed of offsite as a last resort. **Disposal offsite is environmentally unsound** and expensive.

Keeping the contaminated material onsite and using a cheaper management option can be highly effective but would take several years and may require land to be set aside for the duration of the treatment.

When dealing with an existing infestation, where the control aims cannot be confidently met, serious consideration should be given to manual monitoring or delaying implementation as there would be potential for rapid return of the plant. This is because the plant will recover and often within a short period of time return to the initial state.

Alternative aims of a Management Plan could be to prevent an area currently free from Himalayan Balsam becoming infested or to limit the spread of plants from a known infestation. Aims should be:

- closely linked to the associated costs and/or the budget available for implementing the Management Plan;
- realistic with regards to time scale;
- realistic with regards to size for the issue (e.g. is there a catchment wide issue); and
- measurable to determine the degree or progress and/or success.

The project area within which control is proposed or from which it is planned to exclude the plant should be carefully selected or defined and documented in plans (map). The four stages for a control programme are:

- killing the growing plants to prevent any further seed production using one of the methods described below;
- follow up monitoring in the same growing season to deal with any regrowth (e.g. post-cutting) or plants missed in the initial treatment;
- physically remove the seed bank or undertake annual treatment of seedlings growing from the seed bank until it is completely destroyed; and

- measures to prevent re-infestation, such as encouraging suitable native plants to re-colonise the area, and/or catchment wide monitoring

Once control has commenced, serious consideration should be given if stopping or delaying implementation. This is because plants will recover and often within a short period of time return to the initial state, negating all work up to that time.

When deciding on a preferred treatment option (as set out in Table 2) consideration should be made to the following variables:

- cost;
- speed;
- environmental impact; and
- effectiveness.

It may be useful to discuss the options with the client to understand their priorities.

Control Methods

Hand pulling

Himalayan Balsam can be easily hand pulled as the species has very shallow roots growing to a depth of 10-15 cm. This method is particularly useful for smaller infestations and in high ecological value areas where the use of herbicides, or indiscriminate cutting, should be avoided. While hand pulling is time consuming, as other species can be easily avoided, the re-establishment of native vegetation should be facilitated by using this approach. However, when there is limited growth it is easy to miss a small shoot that is overgrown by surrounding vegetation, particularly if only one site visit is done in the year.

A gentle tug is usually enough to remove the entire root system. Multiple plants can be pulled simultaneously. Appropriate PPE should be worn, including gloves, steel toe cap boots and any other attire deemed necessary within a site specific risk assessment.

Hand pulling should ideally commence in May/June when plants can be easily found/identified and they will not have set seed. However, it can be carried out sooner (although identification can be tricky) and there will typically be more plants, as numbers reduce with time due to competition.

Repeat treatments will likely be required, see above.

Pulled plants should not be placed on soil or in damp areas as they can readily re-root. The plants can be allowed to dry out or be composted if seedless. Once dried, the remains can be left on site as they reduce to small amounts, if fully desiccated and seedless, disposed of as inert waste, or burnt,

Cutting/trimming

As with hand pulling, if the species is cut back prior to setting seed for four consecutive years control should be achieved. In order to prevent vigorous regrowth, plant stems should be cut below the first node, which is often very close to ground level. Cutting below the first node will be much easier once the plants have reached approximately 50cm in height in about May.

Compared to hand pulling, cutting/trimming will likely cause more collateral damage to other, potentially desirable, plant species.

Repeat treatments will likely be required, see above. Plant remains should be dealt with as above.

Mowing

As with cutting/trimming, if the species is mown for four consecutive years preventing seed production and seed setting, control can be achieved.

However, mowing is less likely to cut the stem below the first node than strimming and, as such, the potential for vigorous regrowth is increased. Consequently, mowing will likely require more treatments per year than strimming and/or hand pulling. Additionally, mowing may cause significant bushy regrowth and stimulate the growth of short, seeding plants (due to cutting above the first node), increasing the potential of seeds persisting from year to year.

As with cutting/strimming, mowing will likely cause collateral damage to other, potentially desirable, plant species.

Grazing

Cattle and sheep have been observed to eat young Himalayan Balsam. Grazing is unlikely to result in complete control but will likely reduce the density of the infestation and reduce the potential for range expansion.

Grazing could be of particular relevance in rural situations where there is no urgency to remove the Himalayan Balsam straightaway and the area concerned is relatively large.

Biosecurity control for livestock can be complicated, and could result in seed disturbance / movement.

Herbicide control

Incorrect herbicide use can cause serious harm and damage. Always read the label and product information before use. Use of herbicide near water or other designated site (e.g. SSSI) may require the prior approval of the relevant authority, and recognised training.

Where *in situ* physical removal is not feasible, potentially due to stand density/size or location/inaccessibility, the species can be successfully treated with herbicide.

Several herbicides have been shown to be effective at killing Himalayan Balsam and often just one application is sufficient. Nevertheless, re-application in the same season should be planned for, as new growth from seed is likely (see above).

Herbicide application should be carried out during periods of active growth, before flowering but late enough to ensure that germinating seedlings have grown up sufficiently to be adequately covered by the herbicide (e.g. plants 50+ cm in height would be suitable). The initial application should ideally be carried out in May/June with subsequent treatments/monitoring likely being required in July/August and September/October, as above.

Due to Himalayan Balsam's preference for habitats near water, this is very likely to limit herbicide selection to products approved for use near water.

The herbicide can be applied as a spot treatment to individual plants, using hand-held equipment, or as an overall spray using machine-mounted spray booms. In the latter instance, total weed control of all vegetation will occur, increasing the requirement for revegetation (see the Revegetation section below).

Where accessibility is problematic, e.g. riverbanks, a long lance sprayer is useful. Weed wiping reduces the risk of damaging surrounding vegetation but is only feasible for relatively small infestations.

Herbicide application should be undertaken within a controlled, targeted, and sustainable manner, in alignment with the Official Controls Regulations 2020.

For additional information on the use of herbicide to control invasive species see PCA's 'Japanese Knotweed Control: Guidance Notes for Herbicide Treatment'.

Excavation

Where immediate eradication is required, for example in a location that is shortly to be developed, the most appropriate solution is likely to be excavation.

Following excavation, if possible, contaminated soil should be retained onsite, e.g. stockpiled elsewhere on the site and regrowth treated as above. This stockpile area should be cordoned off from the rest of the site with appropriate signage put in place. Once control is achieved, the soil will be suitable for use as backfill or in landscaping.

If material is stockpiled, it is very important to monitor and carryout control prior to plants setting seed, or new areas of the site can be infested. Stockpiles should be at least 7 metres from the property boundary, 50 meters from watercourses, ditches or protected areas.

Arising can also be buried. As per RPS 178 (2019) guidance, soil containing Himalayan Balsam seeds should be buried at a depth of at least two metres. Burial at this depth is sufficient to prevent regrowth. Prior to the burial of invasive plant waste the appropriate authority (e.g. the Environment Agency in England) must be contacted and approval granted. Himalayan Balsam seeds do not contain sufficient energy reserves to allow them to germinate and grow up through hard substrates; as such, burial immediately beneath hardstanding (e.g. poured concrete) is appropriate.

Current requirements under RPS 178 (2019)

- You must not bury a total volume of more than 1,000 tonnes.
- The burial area should be over 7m away from a site boundary, and you should be able to demonstrate the material will not contaminate the groundwater (i.e. chemical soil analysis will be required of the burial material before it is buried).
- A stockpile for material cannot be kept for more than 12 months before it is buried, treated or disposed.

Where offsite disposal is unavoidable, you should try to minimise the amount of waste you generate that contains the plants or their seeds. Providing the methodology is less than the previously stated limits, can define and justify the area of soil removal, it should allow the Himalayan Balsam infested soil to be removed as controlled waste, providing no other pollutants are present. Any contaminated waste that is taken offsite must be taken by a licensed waste carrier and must go to a suitably authorised landfill site (as per the Environmental Protection Act; see Table 1).

An experienced clerk of works should supervise excavation and disposal ensuring that the work is undertaken under controlled conditions (including adequate biosecurity measures; see [see PCA Guidance Note: Safe and Effective Excavations](https://www.property-care.org/resources/safe-effective-excavation-burial)) <https://www.property-care.org/resources/safe-effective-excavation-burial> and that appropriate health and safety measures are implemented.

Burial

If there is land raising planned for the area, it may be appropriate to bury the Himalayan Balsam without prior excavation.

The same biosecurity and legal controls detailed for the excavation option, above, should be employed.

Monitoring

Monitoring (with control action when necessary) should be carried out for four full growth seasons subsequent to the last time the plants could have produced seeds.

The follow-up treatment/monitoring can include hand pulling and/or herbicide applications.

Where reintroduction is likely, i.e. the species is present upstream, an annual monitoring/control programme should be implemented, ideally along with a catchment level management programme.

Revegetation

Bare ground is often associated immediately after successful Himalayan Balsam control. This exposes the soil to erosion, e.g. overwinter and/or along a watercourse, and to re-invasion by Himalayan Balsam and/or other undesirable plant species. The revegetation of such bare areas provides an opportunity to re-establish biodiverse habitat. A dense grass sward tends to discourage Himalayan Balsam seed germination.

The nature of the revegetation will depend on the short, medium and long-term objectives, e.g. rapid soil stabilisation along a riverbank or reinstating an amenity area such as part of a playfield field. The use of residual herbicides could inhibit revegetation (e.g. of broadleaved species); as such, the use of non-persistent herbicides will likely be more appropriate. Further details are available in PCA's Guidance Note: [PCA's Guidance Note: Revegetation of small areas following invasive non-native weed management](https://www.property-care.org/resources/revegetation-following-invasive-non-native-weed-management): <https://www.property-care.org/resources/revegetation-following-invasive-non-native-weed-management>

Table 2. Summary of the main features of the different methods available for Himalayan Balsam control

Control method	Use	Positives	Negatives	Eradication timescale	Cost
Hand-pulling	Small stands, particularly in sensitive areas.	Prevents damage to other species and/or habitats. Avoids herbicide use.	Labour intensive. Easy to miss small shoots hidden by surrounding vegetation. Disposal (or management) of collected plants).	Kills adult plants immediately. Follow-up treatment for seed bank of 4 years.	Moderate.
Cutting/ strimming	Medium sized stands, or large stands on uneven ground.	Avoids herbicide use.	Collateral damage to other species is difficult to avoid.	Kills adult plants immediately. Follow-up treatment for seed bank of 4 years.	Moderate.
Mowing	Large stands where herbicide applications are inappropriate.	Avoids herbicide use.	Collateral damage to other species. Can stimulate bushy growth and enhance seed production. Unsuitable for uneven ground, and woodlands.	Better suited to containment.	Low.
Grazing	Farmland and others where livestock can gain long term access.	Avoids herbicide use.	Livestock need managing.	Better suited to containment.	Low.
Herbicide treatment	Individual plants to large stands.	Easier and quicker than physical removal and can be used on difficult to reach stands.	Herbicides can damage the environment. Use restricted in some areas.	Kills adult plants immediately. Follow-up treatment for seed bank of 4 years.	Low.
Excavation and onsite bunding	Small to medium sized stands on non-sensitive area(s).	Immediate removal of seed bank. Offsite disposal not required.	High level of disturbance. Expensive. Bunds need to be carefully located.	Immediate in infestation area. Treatment must commence within 12 months of bund. Follow-up treatment for bund of 4 years.	High.
Excavation and / or onsite burial	Small to medium sized stands on non-sensitive area(s).	Immediate removal of seed bank. Offsite disposal not required.	High level of disturbance. Expensive. EA Approval needed.	Immediate. Follow-up monitoring to ensure all seed bank removed of 4 years.	High.
Excavation and disposal to landfill	Small to medium sized stands on non-sensitive area(s).	Immediate kill of adults and removal of seed bank.	High level of disturbance. Environmentally unsound. Very expensive.	Immediate. Follow-up monitoring to ensure all seed bank removed of 4 years.	Very high.

References

- Baker, H. (1989) Some aspects of the natural history of seed banks. Pp. 9–21 in M. Leck, V. Parker and R. Simpson, eds. Ecology of soil seed banks. Academic Press, San Diego.
- Bekker, R. M., J. P. Bakker, U. Grandin, R. Kalamees, P. Milberg, P. Poschlod, et al. (1998). Seed size, shape and vertical distribution in the soil: indicators of seed longevity. *Funct. Ecol.* 12:834–842.
- Environment Agency (2019) Regulatory Position Statement (RPS). The Treatment and disposal of invasive non-native plants: RPS 178. <https://www.gov.uk/government/publications/treatment-and-disposal-of-invasive-non-native-plants-rps-178>
- Espinar, J. L., K. Thompson, and L. V. Garcia. (2005) Timing of seed dispersal generates a bimodal seed bank depth distribution. *Am. J. Bot.* 92:1759–1763.
- Harper, J. (1977) The population biology of plants. Academic Press, London.
- Helmisaari, H (2010): NOBANIS – Invasive Alien Species Fact Sheet – *Impatiens glandulifera*. – Form. Online database of the European Network on Invasive Alien Species – NOBANIS www.nobanis.org.
- Leck, M. A., T. Parker, and R. L. Simpson. (1989) Ecology of soil seed banks. Academic Press, New York.
- Property Care Association (2019) PCA Guidance Note on Legislation and policy for Invasive Non-native Plant Species including Japanese Knotweed. (available to download from www.property-care.org).
- Property Care Association (2019) 'Japanese Knotweed Control: Guidance Notes for Herbicide Treatment. (available to download from www.property-care.org).
- Property Care Association (2018) Guidance Note on 'Safe and Effective Excavations' (available to download from www.property-care.org).
- Property Care Association (2019) 'Re-vegetation of small areas following Invasive non-native weed management'. (available to download from www.property-care.org).
- Property Care association (2018) 'Practical Management of Invasive non-native weeds in Great Britain and Ireland' (copies can be ordered here). Packard Publishing Ltd. ISBN 978-1-85341-165-6
- Saegesser J, Fischer D, Fischer K (2016) Long-term control of *Impatiens glandulifera* in a Swiss Forest: does zero-tolerance pay off? Biological invasions: interactions with environmental change. In: Ries C, Krippel Y (Eds) Book of abstracts. Neobiota 2016 – 9th International Conference on Biological Invasions. Fondation fauneflore, Vianden, 69.
- Skálová H, Moravcová L, Čuda J, Pyšek P (2019) Seed-bank dynamics of native and invasive *Impatiens* species during a five-year field experiment under various environmental conditions. *NeoBiota* 50: 75–95. <https://doi.org/10.3897/neobiota.50.34827>.
- Thompson, K., J. P. Bakker, and R. M. Bekker. (1997). The soil seed banks of north west Europe: methodology, density and longevity. Cambridge University Press, Cambridge.
- Vitousek, P.M. (1994) Beyond global warming: ecology and global change.



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