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Myriophyllum aquaticum

Species description

Parrot's feather (*Myriophyllum aquaticum*) is a perennial aquatic or semi-aquatic plant that has both a submerged and an emergent form. The species, native to South America, was introduced to Europe, including Belgium, through the aquarium industry as a popular plant for aquarium and garden ponds. The first record of the parrot's feather's presence in the environment in Belgium dates back to 1983. Disposal of aquarium and/or pond waste in water systems is probably at the origin of its escape in the wild. Today, parrot's feather is recognised as a problematic aquatic invasive species in many countries worldwide and is now listed as IAS of Union concern under the (EU) Regulation No 1143/2014. The species can be confused with other plant species such as its close relative *Myriophyllum rubricaule*. Its presence on the Belgian territory probably remains underestimated, especially due to its presence in private gardens.

Fig 1. *Myriophyllum aquaticum.* Photo: Q-Bank

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Photo: Dido Gosse

Myriophyllum aquaticum

Parrot's feather mostly thrives in nutrient-rich stagnant freshwater and grows best in shallow and muddy water bodies such as ponds, ditches and marshes. The species can also colonise wet banks. As a highly competitive invasive species, the plant has diverse environmental, social and economic impacts. It has the ability to form dense mats that completely cover the water surface, which has significant detrimental effects on the ecosystem and biodiversity. These impacts include light exclusion, native plant community displacement, water quality degradation and higher siltation. Social and economic effects include restriction of recreational activities (angling, boating), and management related costs.

Biological characteristics, reproduction and spread

Parrot's feather grows from overwintering rhizomes that produce long shoots creeping over the sediment and reaching the water surface as temperature increases. Emergent stems can extend up to 30 centimeters above the water surface. As the season progresses, emergent leaves tend to dry out. The plant dies back to the rhizomes (the roots remain alive) in fall and survives mild winter conditions such as infrequent and short periods of frost. The plant however does not seem to tolerate harsh winter conditions.

Parrot's feather is a dioecious species which reproduction in Western Europe is exclusively vegetative via female plants only. When the plant breaks into fragments, be it naturally of because of human activity, those fragments, as small as a few millimeters, can form a new plant, and therefore a new population, away from the initial invaded area. Spread of parrot's feather can happen through flooding events, fragments attached to boats or other water equipment. Fragments can regenerate within a few weeks and can remain viable for 1 year under moist conditions. Those high regeneration and dispersal abilities highlight the importance of the implementation of effective management measures.

Fig 2. Parrot's feather invading different parts of the pond due to the spread of fragments. Photo: Dido Gosse

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General considerations about management

A wide range of management options have been used to control or eradicate this species. Local eradication of large and even small parrot's feather infestations is considered hardly achievable due to the species ability to regenerate from small fragments and colonise both aquatic and wet terrestrial environments, making management extremely difficult. The eradication feasibility of this species must, therefore, always be assessed on a case-by-case basis, considering site specificities and population size, and be thoroughly discussed within the management team.

Due to the species' ability to reproduce vegetatively by fragmentation, precautionary measures must be implemented prior to management to prevent teh spread of fragment within the managed area or to other water systems. Managed areas are, therefore, isolated by physical barriers.

The harvested plant material must be safely disposed of away from water systems. It can be either dried and incinerated, buried (on dry land), or composted off-site. It is recommended to dry the harvested material on a tarpaulin to avoid leaving the plant material in contact with the ground. If transported to disposal facilities, plant material must be placed in secured and thick bags. Material that has been in contact with the plant (e.g. machinery, clothing) should be checked, cleaned and dried before being taken to another site. It is also recommended to restrict public access to the managed area to isolate the infestations as much as possible and limit the risk of spread.

Managed and downstream sites must remain under enhanced surveillance for a 5-year period after the implementation of the last treatment. As the parrot's feather is shade-intolerant, promoting environmental shading through revegetation with native plant can help prevent the (re)establishment of this invasive species.

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Fig 3. Parrot's feather produces long creeping shoots. Photo: Etienne Branquart

Fig 4. Parrot's feather colonising the bank. Photo: Marie Patinet

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Manual removal

- v Local eradication can be achieved
- v Good control can be expected
- v Manual removal is highly selective and will have minimal impact on ecosystems and other organisms
- x The method is only suitable for small and early-detected infestations
- x There is a risk to create and spread fragments to uninvaded areas
- x Manual removal is time-consuming, labor intensive and requires skilled operators

Method description

The principle is to remove the whole plant from the ecosystem. Plants are carefully pulled out by operators walking in the water, from the bank or from a small boat. Operators must pay great attention to minimise shoot fragmentation as much as possible. Manual removal is only implemented in recently invaded sites or in areas with low vegetative abundance, and in shallow waters. It is strongly recommended to repeat the operation shortly after the initial manual removal, once sediments have settled, to ensure that no plants have been overlooked. This management strategy is conducted between March and October. It is repeated every 6 weeks during spring, summer, and fall for the first year of the management programme. A 5-year manual aftercare is then necessary to eliminate regrowth. Operators must remove all or most of the plant material, including rhizomes, to ensure the effectiveness of this method.

Material

Management: Professional operators, small boats, waders, rakes

Transport and stocking: Buckets or mesh bags

Precautionary measures: Hand net (to collect floating fragments), retention nets. A hardware cloth screen must also be placed at the upstream and downstream parts of the managed area, and remain in place for 5 days following the operation.

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Substrate removal: mechanical dredging

- v This is one of the fastest methods to achieve good levels of control
- v This method is suitable for large infestations
- v Mechanical dredging can be implemented when maintenance dredging of the water body needs to be done
- x High costs are expected due to use of machinery and the need to move sediments to dedicated disposal sites
- x Disposal sites must be identified for the storage of contaminated sediments before the start of the work
- x This method can only be implemented in sites where the whole area is accessible to the machines and where drawdown can be implemented
- x Dredging can generate a large number of plant fragments which increases the risk to spread the species to uninvaded areas
- x This method can have high negative impacts on aquatic living organisms

Method description

The principle is to remove the bottom sediments contaminated with all parts of the invasive plant such as roots, rhizomes and stems. Excavators equipped with cleaning bucket thumb are used for excavation and must remove at least 15 to 25 cm of sediment to prevent regrowth. This method is preceded by a water drawdown (< 0.5 m) or a complete drainage (if possible), during which care should be taken not to spread plant fragments to other areas via the sewage systems. Mechanical dredging is preferably conducted from spring to early summer.

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The ideal management timing is when the plant is visible, and therefore easy to detect, but before the start of its high development phase. Operators must be extremely careful to minimise plant fragmentation and to remove as much plant material as possible. Follow-up methods such as repeated manual removal to progressively eliminate regrowth or the placement of light-blocking sheeting over the substrate, are implemented.

Material

Management: Excavators with cleaning bucket, light-blocking covers

Transport and stocking: Buckets, dumpers, wheelbarrows, trucks, containers

Precautionary measures: Hand net, containment nets, biofilters

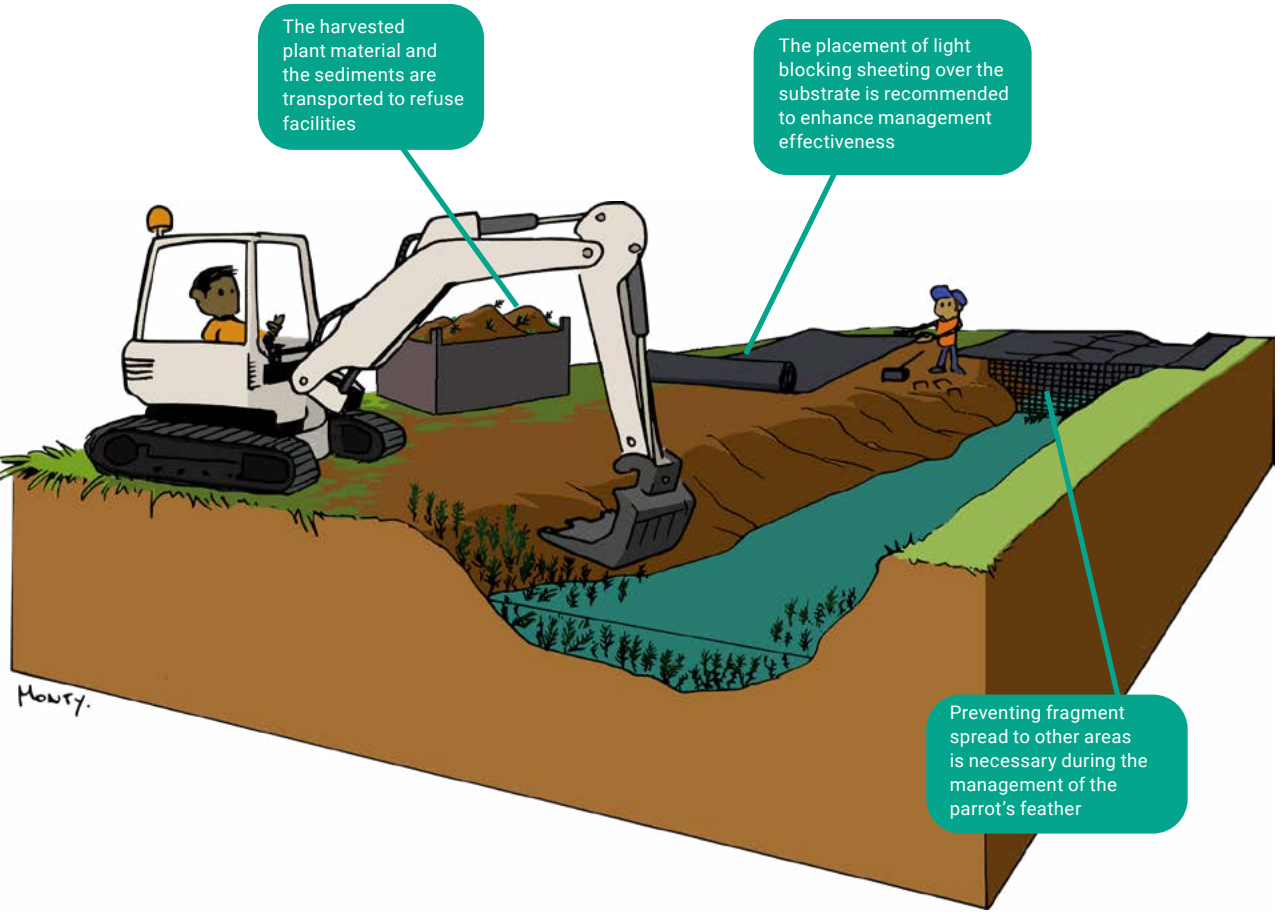

Fig 5. Mechanical dredging of parrot's feather

Light deprivation: benthic and bank plastic cover

v Local eradication or really good control can be achieved

v The material is solid and durable and, can be reused in other sites

x The method is suitable for small populations and recently invaded areas

x The use of this method is only limited to stagnant waters and areas free of obstacles

x The whole infestation must be covered as re-colonisation will occur if invaded places are overlooked

x The method is not selective and will have an impact on other living organisms

x This method is likely to be detrimental to benthic organisms and affect fish spawning

Method description

The principle is to install bottom and bank covers that both compress vegetation and exclude sunlight, causing the death of the plants. Sheets are manually placed by operators on the bottom of shallow water bodies. It is really important that no light reaches the plants from any adjacent area, gaps or at the edges of the sheeting. Operators must ensure the adequate placement of the benthic cover and that sheets overlap correctly on the bottom. The use of large continuous pieces of sheeting is therefore recommended whenever possible. They must also ensure that banks are well covered by the sheeting as the species also occurs on the edges of water systems. The material must, then, be secured to the bottom and to the banks. As gases can accumulate when using non-permeable material, maintaining the sheet with heavy weights or using timber frames to leave a small gap between the bottom and the blanket is required. Benthic covers are placed during winter, when the plants are prostrate and left in place for 4 to 12 months. Regular checks for potential damages that would allow light to pass through must be done. The sheeting must be removed when local eradication or really good control is achieved. Manual removal is immediately implemented as a follow up measure to remove remaining plants and is repeated throughout the years until no regrowth is observed.

Material

Management: The adequate quantity of light-blocking sheeting such as woven synthetics, geotextile, black plastic sheets and nylon tarp or similar material. Heavy weights, rocks, concrete blocks or sandbags.

If damages occur to the sheeting, plastic zip ties can be used to join the blankets together.

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DID YOU KNOW?

What about jute matting?

While plastic materials have commonly been used for the management of parrot's feather, more ecofriendly and permeable materials such as hessian fabrics could potentially replace those materials. Indeed, jute matting has successfully been used for the eradication or good control of other invasive aquatic species such as *Lagarosiphon major*.

However, really few cases refer to the use of jute matting as a successful mean to control or eradicate parrot's feather populations. While it could be argued that jute matting is likely to help for the control of many aquatic invasive plant species, concerns remain over possible recolonization from individuals rooted in the bank which would question the effectiveness of this method for this particular species.

Fig 6. Jute matting. Photo: Auckland Museum

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Environmental management: ecosystem shift

v Local eradication can be achieved

v Rapid results are expected

x This method is only suitable for small or medium water bodies, with low conservation value

x The method involves the complete replacement of an ecosystem by another, resulting in highly modified and vulnerable environments

References

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Method description

The principle is to transform the existing aquatic ecosystem into another ecosystem that is unsuitable for the survival or establishment of the aquatic plant. This requires drying out and refilling the water body with adequate substrate, using machinery, and planting or sowing native terrestrial plants. The selection of the new ecosystem should take into account local conditions, plant availability, and regional conservation objectives to mitigate the loss of biodiversity. Discussions with stakeholders such as conservationists and local authorities can help to guide the decision-making process toward the most suitable new ecosystem. During the process, it is crucial to avoid introducing alien species with the substrate, and ideally, the substrate should be taken from the same site to minimise those risks. A new pond, near the previous one, can be dug up to compensate for habitat loss. In that case, it is important to prevent the introduction of the aquatic alien species in the new pond. Due to the possible legal and practical constraints (e.g. sites with conservation, cultural, historical value), the major impacts on aquatic organisms and the potential risks of introducing terrestrial invasive species, this method should only be considered after all the other management possibilities have been rejected. Ecosystem shift is only suitable for already degraded water bodies where no species of interest remain and where parrot's feather has taken over the whole water system. Once the new ecosystem is established, regular monitoring and checks should be conducted over a 3-year period to ensure that no regrowth occurs.

Material

Management: Excavators or large diggers and dumpers.

The impact of management actions on ecosystem services

While the adverse effects of IAS are well-known and provide strong incentives for implementing management actions, the impacts of these management actions on ecosystems and the services they provide are less considered. The matrices are the result of expert assessments of the evolution of relevant ecosystem services (ES) from a highly invaded situation towards a managed situation. ES evolution is considered over 2 given periods of time: 1 year and 5 years after the initiation of management.

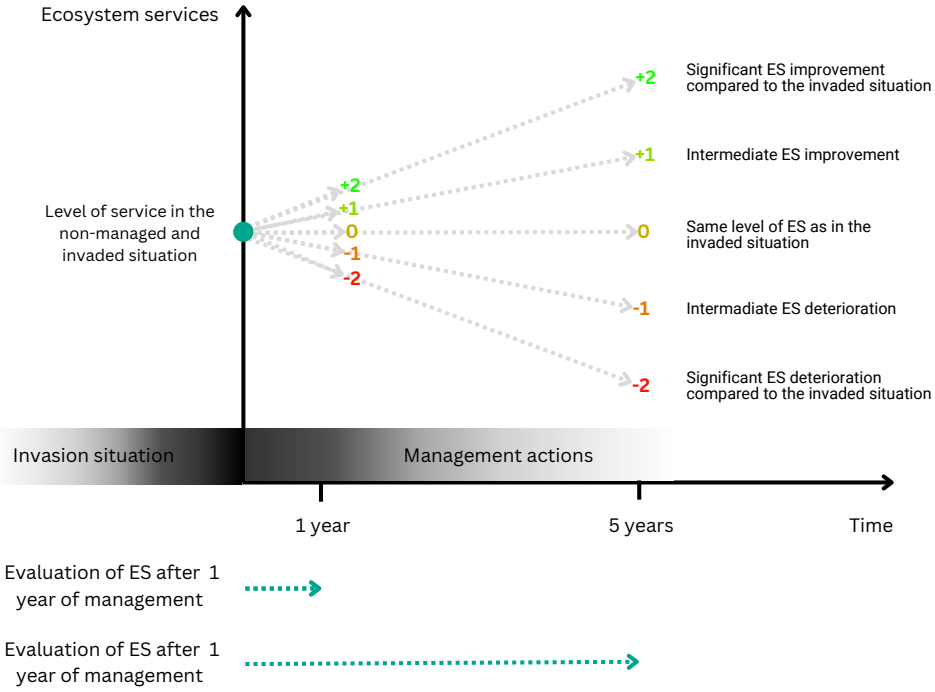

Fig 7. Representation of the survey process

Each matrix displays the average impact scores of management methods on ecosystem services. These scores have been associated to colours to facilitate the visualization of the impacts of every method on every relevant ecosystem service. Green indicates a significant improvement in the ecosystem services (ES) due to management, orange represents no or minimal effect, and red signifies a negative impact of the method on the ES.

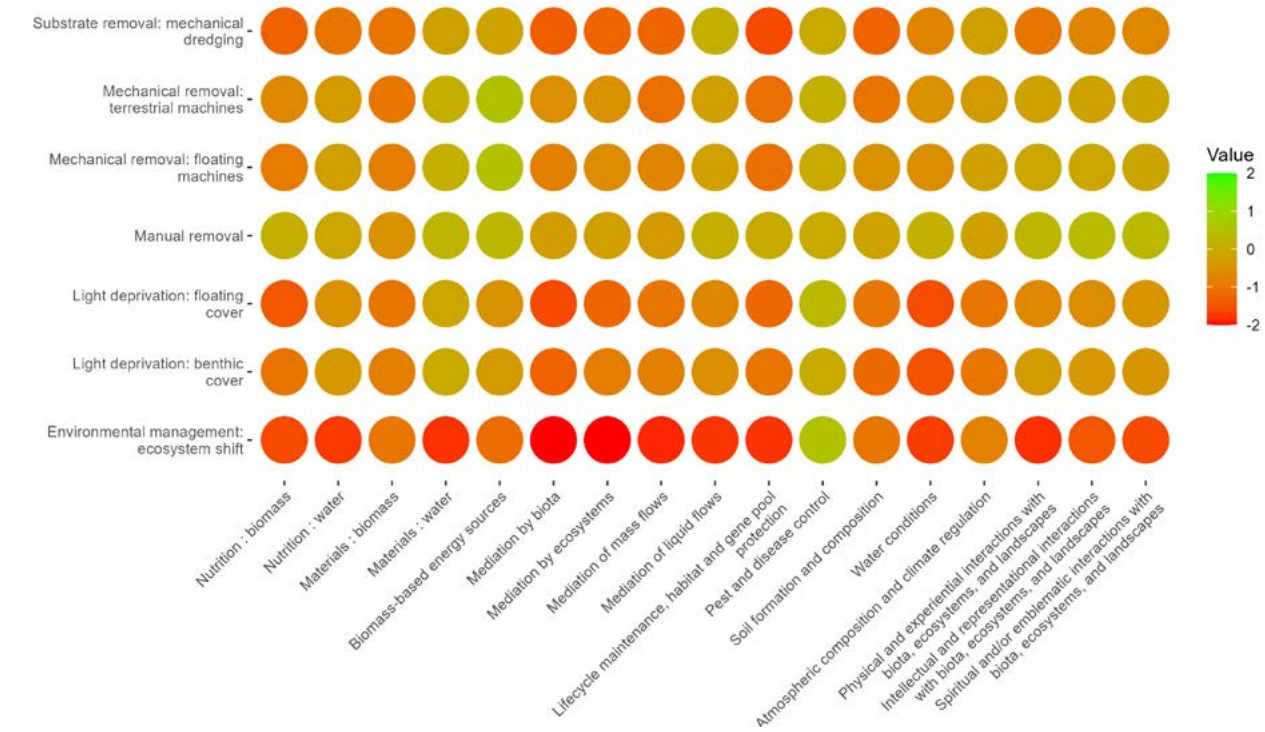

Fig 8. Matrix displaying the impact of management methods for aquatic plant species on ecosystem services after 1 year

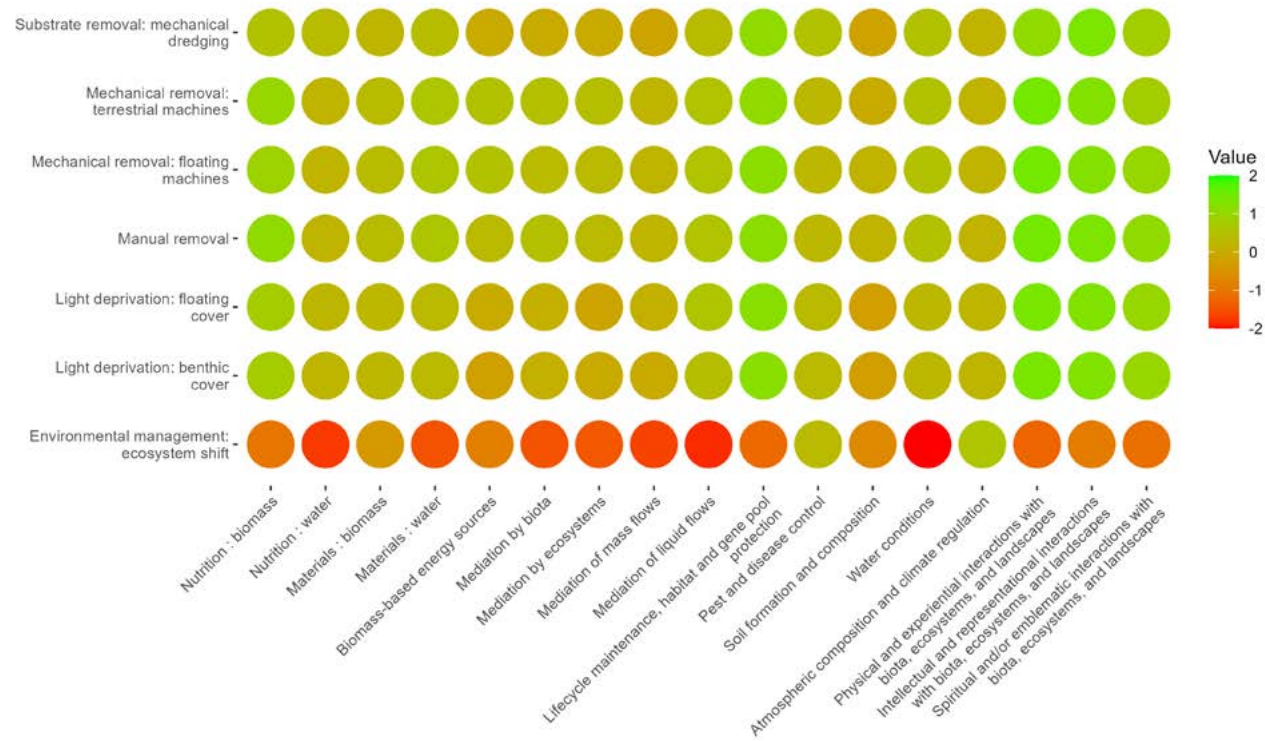

Fig 9. Matrix displaying the impact of management methods for aquatic plant species on ecosystem services after 5 years

LIFE RIPARIAS

Reaching Integrated and Prompt Action in Response to Invasive Alien Species

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