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Crassula helmsii

Species description

New Zealand Pigmyweed (*Crassula helmsii*) is an aquatic perennial plant that can grow in submerged, amphibious and terrestrial forms. The species, native to Australia and New Zealand, was introduced to Europe, including Belgium, through horticultural trade as a popular oxygenating plant for aquarium and garden ponds. The first record of New Zealand Pigmyweed's presence in the environment in Belgium dates back to 1982. Disposal of aquarium and pond waste in water systems is probably at the origin of its escape into the wild. Today, New Zealand Pigmyweed represents a problematic aquatic invasive species in many countries worldwide but is not listed as an IAS of Union concern under the (EU) Regulation No 1143/2014. The species was therefore included in the LIFE RIPARIAS alert list. Its distribution on the Belgian territory probably remains underestimated notably due to its rapid spread as well as its submerged form which makes it hardly detectable.

Fig 1. *Crassula helmsii*. Photo: Q-Bank

Guide de gestion complet en version française

Volledige beheergids in Nederlandse versie

Photo: Jérémie Guyon

Crassula helmsii

New Zealand Pigmyweed thrives in a wide variety of habitats but mostly occurs in still or slow-moving waters such as ponds, rivers, wetlands or ditches. It can also be found on damp soils such as riverbanks or muddy edges of ponds. As a highly competitive invasive species, the plant has diverse environmental, social and economic impacts. This invader can form dense mats that completely cover the water surface. This has significant detrimental impacts on the ecosystem and biodiversity including through native plant community displacement, species richness reduction, severe water quality modifications causing fish kills and inadequate habitats for invertebrates and amphibians. Social and economic effects include drowning hazards as water bodies are mistaken as land, detrimental impacts on aquaculture and fisheries, restriction of recreational activities (angling, boating), and management related costs.

Fig 2. The submerged form reaching the water surface. Photo: Jérémie Guyon

Fig 3. Large pond completely invaded by the New Zealand Pigmyweed. Banks have also been colonised. Photo: Marie Patinet

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Biological characteristics, reproduction and spread

New Zealand Pigmyweed displays 3 different growth forms with its morphology varying depending on the growth form. While the species is able to establish itself as a submerged plant at depths of 3m, it can also develop an emergent form creating stands of crowded stems in shallow waters (around 50cm deep). The semi-terrestrial form consists in creeping or erected stems with leaves. New Zealand Pigmyweed is winter green and has the ability to grow throughout the whole year, with no dormant periods. In Belgium, flowering occurs from July to September.

Reproduction of New Zealand Pigmyweed in western Europe is mostly vegetative. When the plant breaks into fragments, either naturally or because of human activity, those small fragments (one node on a stem as small as 5 mm) can form a new plant, and therefore a new population, away from the initial invaded area. Fragments can remain viable for more than a year. In some regions of its introduced range (UK), the plant is also known to produce turions (shoots with short internodes) in autumn, which float on the water surface. It remains, however, unclear whether turions are produced in Belgium. While New Zealand Pigmyweed produces viable seeds in its native range, seed production is only occasionally observed in Europe. Whether persistent seedbanks are formed still remains unclear. Spread of New Zealand Pigmyweed mainly occurs through fragment drift within water systems or fragments attached to animals, boats, waders or any other water equipment. The species' high regeneration and dispersal abilities highlight the importance of the implementation of effective management measures.

Fig 4. The emergent form growing in shallow waters and forming large stands. Photo: Marie Patinet

Denys, L. *et al.* (2014) Dispersal of the non-native invasive species *Crassula helmsii* (Crassulaceae) may involve seeds and endozoochorous transport by birds. *New Journal of Botany,* 4(2), 104–106.

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General considerations about management

Various management options have been used to control or even eradicate the species, in somes cases. However, New Zealand Pigmyweed remains one of the most challenging species to manage, with its eradication considered hardly achievable, even for small infestations. Due to the considerable risk of spreading the species, management options are highly restricted. Management goals must, therefore, be assessed on a case by case basis, considering site specificities, and be thoroughly discussed within the management team.

Due to the species' ability to reproduce vegetatively through fragmentation, precautionary measures must be implemented prior to management to prevent fragment spread within the managed area or to other water systems. As the risk of further spread when managing this species is particularly high, it is strongly recommended to fence the treated area to restrict access and prevent further spread by wildlife or people. Those fences must remain in place until eradication is achieved.

The harvested plant material must be safely disposed of far away from the water and is either incinerated or safely composted. Material that has been in contact with the plant (e.g. material, clothing, etc.) must be checked, cleaned and dried before being taken to another site. Exposing equipment to hot water (45°C) for 15 minutes has proven to be highly effective as it results in 90% mortality of plant material within 1 hour following treatment.

Managed areas and downstream sites must remain under enhanced surveillance with regular monitoring taking place every 3 to 6 months for at least 5 years after the last treatment.

van der Loop, J. *et al.* (2018) Effectiveness of eradication measures for the invasive Australian swamp stonecrop *Crassula helmsii*. *Management of Biological Invasions*, 9(3), 343–355.

van der Loop, J. *et al.* (2019) *Risk assessment of Australian swamp stonecrop* (Crassula helmsii) *in Europe*. Europe FLORON.

Varia, S. (2022) Crassula helmsii *(Australian swamp stonecrop), CABI Compendium*. https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.16463 [Accessed: 13th October 2022].

Light deprivation: terrestrial and benthic 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 only suitable for small populations and recently invaded areas

x This method is limited to stagnant waters and to areas that are free from obstacles

x The whole invaded area must be covered by the sheeting as re-colonisation will occur if infested places are overlooked

x The method is not selective and will have high 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 terrestrial plastic covers that both compress vegetation and exclude sunlight, causing the death of the plants. A blanket is placed over the whole invaded area and on the banks as the species also occurs on the edges of water systems. It is essential to cover the entire infestation to prevent recolonisation to occur after the removal of the sheeting. As New Zealand Pigmyweed displays a high tolerance to shade, it is 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. The blanket is then strongly secured to the bottom of the water system and to the bank. Blankets must be placed early in the season (April) and remain in place for minimum 3 months. A 6-month period is, however, recommended.

Fig 5. New Zealand Pigmyweed establishing itself around obstacles. Photo : Dr Morley Read/ Shutterstock

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Millane, M. and Caffrey, J. (2014) *Risk Assessment of* Crassula helmsii. Inland Fisheries Ireland and the National Biodiversity Data Centre.

van der Loop, J. *et al.* (2018) Effectiveness of eradication measures for the invasive Australian swamp stonecrop *Crassula helmsii. Management of Biological Invasions,* 9(3), 343–355.

van der Loop, J. *et al.* (2019) *Risk assessment of Australian swamp stonecrop* (Crassula helmsii) *in Europe.* Europe FLORON.

This method is only implemented in sites free from obstacles, as the species establishes itself around those obstacles, where the placement of the sheeting is impractical or impossible. Regular checks for potential damages that would allow light to pass through must be done. Once the sheeting is removed, all dead plant material is evacuated from the site with great care. Immediate manual removal must be implemented as a follow-up measure to remove remaining plants or regrowth. The treated area must be surrounded by physical barriers to prevent fragment spread.

Wilton-Jones, G. (2005) Control of New Zealand pygmyweed *Crassula helmsii* by covering with black polythene at the Lodge RSPB Reserve, Bedfordshire, England. *Conservation Evidence*, 2, 63-63.

Material

Management: The adequate quantity of light-blocking sheeting such as black polythene, pool covers or similar material. Rope, cable, star pickets or heavy weights. If damages occur to the sheeting, plastic zip ties can be used to join the blankets together.

More ecofriendly and biodegradable materials such as jute matting could potentially be used for the management of New-Zealand Pigmyweed. This material has successfully been used for the eradication of other invasive aquatic species such as *Lagarosiphon major*. Although there is limited information available on the use of jute matting as a management measure for New Zealand Pigmyweed, one trial in Ireland showed that low density infestations could be successfully treated with double layers of jute matting.

Precautionary measures: Physical barriers using 5mm wire mesh are necessary to prevent fragment spread.

Fig 6. New Zealand Pigmyweed colonising the bank of the water body. Photo : Emmanuel Delbart

DID YOU KNOW?

Flooding with salt water

Flooding the invaded area with salt water has been found to be a very effective technique to achieve local eradication of New Zealand Pigmyweed populations.

This measure is, however, area-dependent as it can only be implemented in sites where water can be retained and with access to a source of saline water (e.g. near the coast). It is important to note that New Zealand Pigmyweed displays a certain tolerance to brackish water.

Mite to the rescue: a promising biological agent

Research has demonstrated that the gall-forming mite (*Aculus crassulae*), a host specific biological control agent, has the capacity to reduce New Zealand Pigmyweed reproductive success. In 2018, the mite was released in a few infested sites in the UK, and is still being closely monitored.

Nevertheless, the release of non-native biological agents in the environment involves serious risks with possible unintended consequences and damages such as attacks and indirect effects on non-target species, or spread of the biological agent to new areas. Thorough risk assessments must, therefore, be conducted before the release of such agents.

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Environmental management: ecosystem shift

Method description

v Local eradication can be achieved

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

x Ecosystem shift is not always feasible due to diverse practical constraints

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 involves drying out and refilling the water body with adequate substrate. It is recommended to fill the pond approximately 15% higher than the initial depth. This management measure is conducted in late winter (February or March). Planting or sowing native terrestrial plants is then implemented. 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.

Fig 7. Active revegetation is an essential approach to limit or prevent the re-establishment of invasive species and to successfully restore native plant communities. Photo : bolu84/Shutterstock

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van der Loop, J. *et al.* (2019) *Risk assessment of Australian swamp stonecrop (Crassula helmsii) in Europe.* Europe FLORON

A new pond can be dug up to compensate for habitat loss. In that case, it is important to prevent the introduction of the managed or new aquatic alien species in the new pond. Due to possible legal and practical constraints (e.g. sites with conservation, cultural, historical value) as well as 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, therefore, only suitable for already degraded water bodies where no species of interest remain and where New Zealand Pigmyweed has taken over most of the water system. Once the new ecosystem is in place, regular monitoring and checks should be conducted over a 3-year period to ensure that no regrowth occurs.

Material

Management: Excavators and large diggers and dumpers.

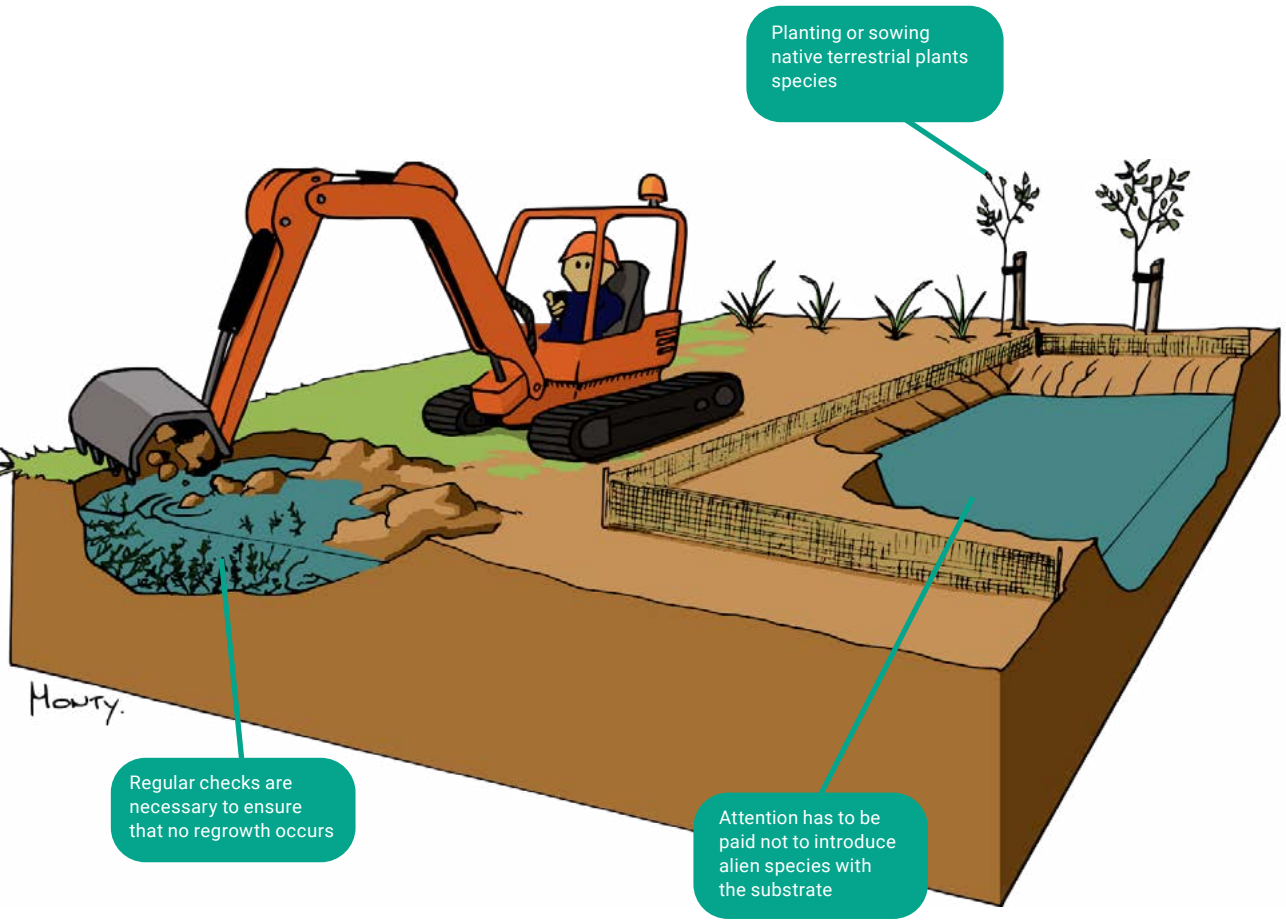

Fig 8. Ecosystem shift requires to refill the pond with substrate

DID YOU KNOW?

The ecosystem resilience approach

The complete eradication of the New Zealand Pigmyweed is extremely challenging and, in most cases, unachievable. Alternative control approaches now concentrate on preventing or limiting the plant regrowth by reinforcing and restoring the native ecosystem. Restoring abiotic conditions and introducing native species that will strongly compete with the New-Zealand Pigmyweed or create shade can break the dominance of the invasive plant and limit its development.

The ecosystem resilience approach, notably studied and promoted by the LIFE Resilias project, is increasingly being adopted and favoured over the very time-consuming, expensive and often ineffective "traditional" control measures such as manual or mechanical removal. This management technique can also be applied to control other invasive alien plant species such as *Myriophyllum* spp.

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Fig 9. The invasive *Myriophyllum aquaticum* may be outcompeted by native vegetation through light deprivation and nutrient limitation. Photo : Etienne Branquart

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.

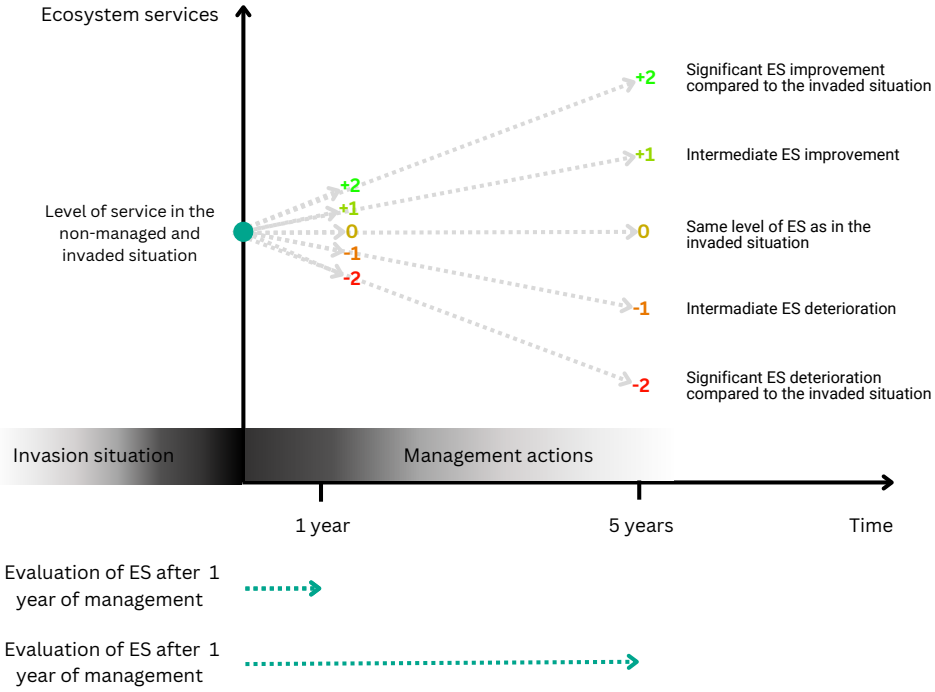

Fig 10. Representation of the survey process

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.

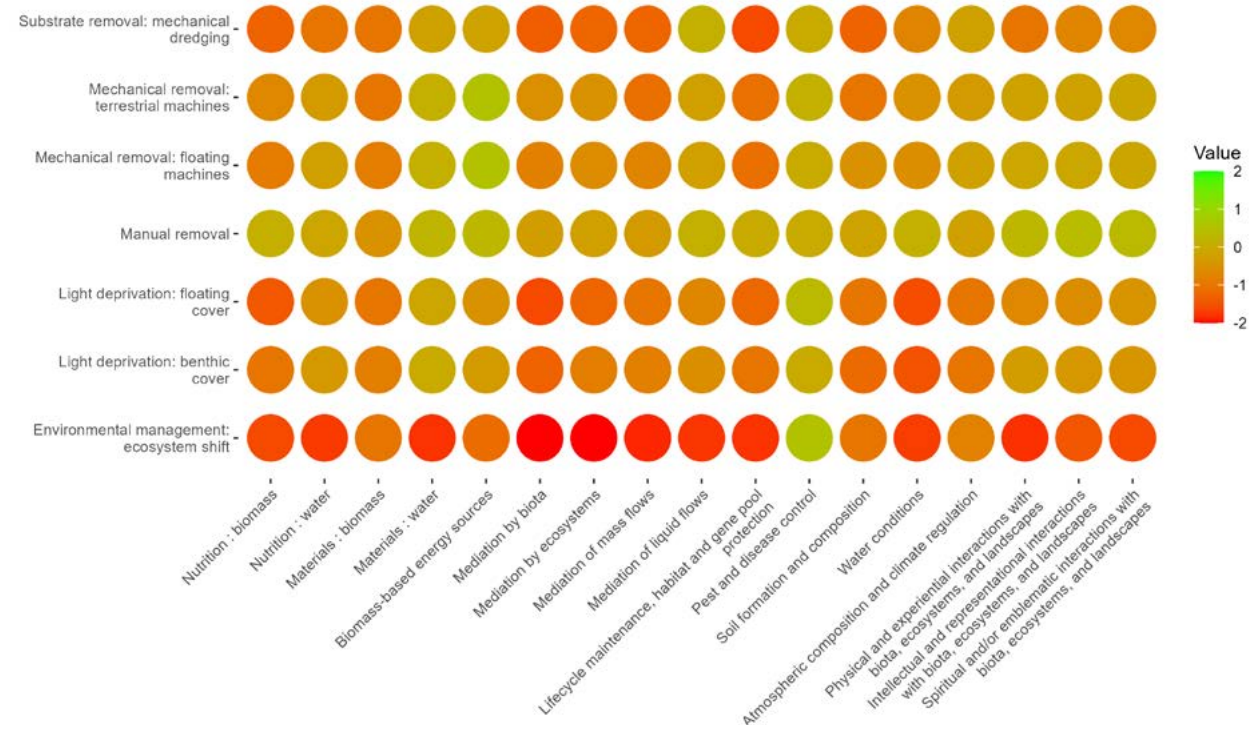

Fig 11. Matrix displaying the impact of management methods for aquatic plant species on ecosystem services after 1 year

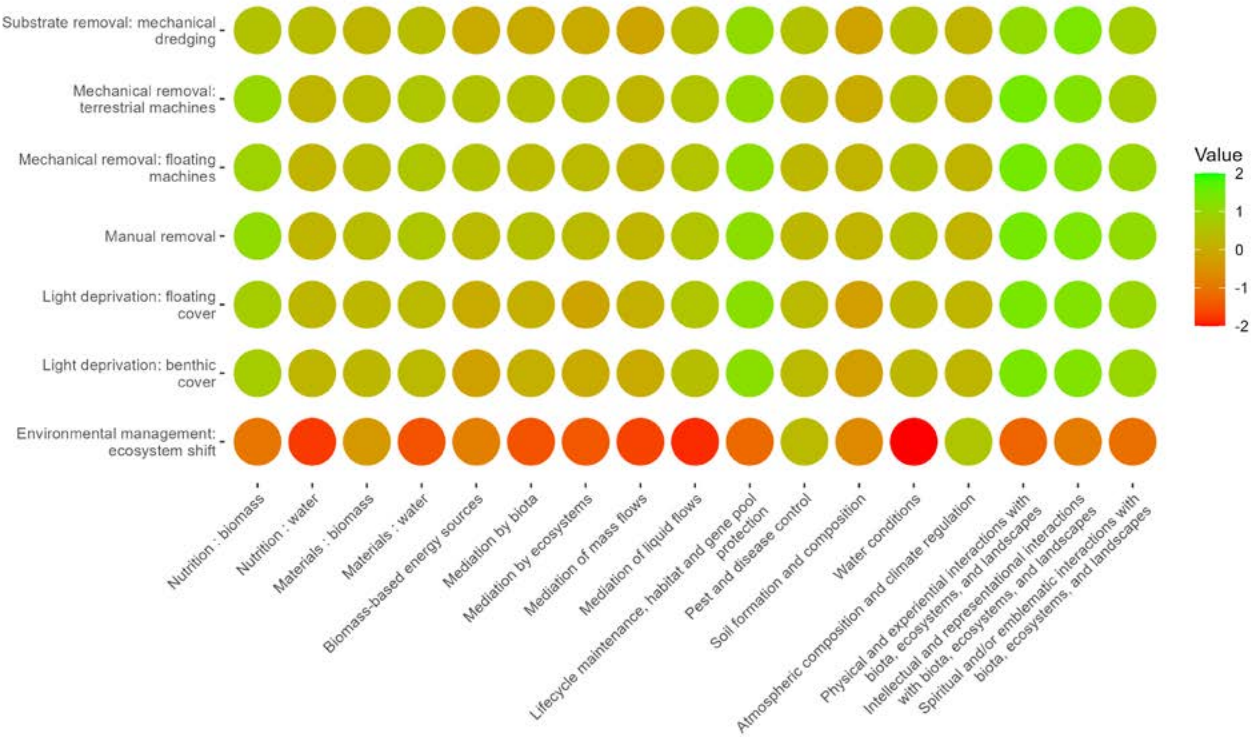

Fig 12. Matrix displaying the impact of management methods for aquatic plant species on ecosystem services after 5 years

LIFE RIPARIAS

Reaching Integrated and Prompt Action in Response to Invasive Alien Species

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