



Water hyacinth

Invasive Species Unit

Introduction

Water hyacinth (*Eichhornia crassipes*) is one of the world's worst aquatic weeds. It infests rivers, dams, lakes and irrigation channels on every continent except Antarctica. It devastates aquatic environments and costs billions of dollars every year in control costs and economic losses.

Water hyacinth is native to the Amazon basin in South America and was brought to Australia in the 1890s as an ornamental plant. The first record of water hyacinth in New South Wales (NSW) was in 1895. In 1897, the government botanist Mr J. H. Maiden noted that it had spread rapidly in the ponds in the Royal Botanic Gardens in Sydney. At that time, he warned that the plant should be kept away from the northern rivers where it 'may very rapidly become a serious pest'.

Unfortunately, this warning went unheeded and by the early 1900s it had spread along the east coast of Queensland and the north-eastern regions of NSW.



Figure 2. Water hyacinth has characteristic flowers.



Figure 1. Water hyacinth will cover the entire surface of a water body.

Distribution

Water hyacinth currently occurs along the east coast of Australia from Kiama in NSW to southern Cape York Peninsula in Queensland. In the early 1900s extensive infestations in the northern coastal rivers of NSW were a major hindrance to river navigation, and infestations still occur in all coastal river catchments, particularly the Macleay, Clarence and Richmond.

Large infestations were present in the Hawkesbury River during the 1990s, and remnant populations are still subject to annual control programs.

In inland NSW, water hyacinth was identified on the Gingham Watercourse near Moree in 1955. By 1976 it had become a major infestation covering 7000 ha. Despite management and control efforts since then, a significant seed bank still remains across the region, and the area of infestation has moved further west, threatening the Murray–Darling system.

Habitat

Water hyacinth grows in still or slow-flowing fresh water in tropical and temperate climates. Optimum growth occurs at temperatures of between 28°C and 30°C, and requires abundant nitrogen, phosphorus and potassium. Although this plant will tolerate a wide range of growth conditions and climatic extremes including frost, it is rapidly killed by sea strength salinity and will not grow in brackish water.

Where water levels have receded, plants can survive on damp soil for several months.

Impact

Water hyacinth is justifiably called the world's worst aquatic weed due to its ability to rapidly cover whole waterways.

In Australia, it forms dense, impenetrable mats over the water surface. Specific impacts include:

- blocking irrigation channels and rivers
- restricting livestock access to water
- destroying natural wetlands
- eliminating native aquatic plants
- reducing infiltration of sunlight
- changing the temperature, pH and oxygen levels of water
- reducing gas exchange at the water surface
- increasing water loss through transpiration (greater than evaporation from an open water body)
- altering the habitats of aquatic organisms

- restricting recreational use of waterways
- reducing aesthetic values of waterways
- reducing water quality from decomposing plants
- destroying fences, roads and other infrastructure when large floating rafts become mobile during flood events, and
- destroying pastures and crops when large floating rafts settle over paddocks after flood events.



Figure 3. Flood-stranded water hyacinth can destroy fences, roads and infrastructure.

Water hyacinth will rapidly take over an entire waterway. Under favourable conditions it can double its mass every 5 days, forming new plants on the ends of stolons. It also grows from seed which can remain viable for 20 years or longer. This enormous reproductive capacity causes annual reinfestation from seed and rapid coverage of previously treated areas, making ongoing control necessary.

Description

Water hyacinth is a free-floating perennial water plant that forms large, dense mats on the water surface. Each plant consists of several broad, leathery leaves, spongy inflated petioles (leaf stalks), a crown and a mass of fine, hairy roots. Water hyacinth shows considerable variation in both leaf and flower form.

Leaves

Leaves are smooth, hairless and glossy. They are generally a bright green colour and can be tinged a rusty yellow on their edges. There are two types of leaves.

- Leaves with non-bulbous petioles. Leaves are up to 60 cm long (including the petiole), narrow and erect – this leaf type is typical of plants in dense, crowded infestations.

- Leaves with bulbous petioles. Leaves are thick stemmed, circular and up to 30 cm in diameter. The stems may be 50 cm long and contain variable amounts of air, which enable the plant to float. This leaf type is typical of plants in open water or on the open-water edge of large infestations.

Stems

There are two types of stems:

- erect stems up to 60 cm long, with flowers,
- horizontal vegetative stems (stolons) 10 cm long, which produce new daughter plants.

Seeds

Seeds are 1 to 1.5 mm long and roughly egg-shaped, with ridges from end to end. They are long-lived and may survive in mud for up to 20 years. Seeds have also remained viable over very long periods in dry soil.

Roots

Roots are fibrous and featherlike. In deep water they may trail below the plant and can be up to 1 m in length. In shallow water the roots may take hold in the substrate of mud or sediment.

Flowers

Flowers are 4 to 7 cm across, funnel-shaped, light bluish-purple or dark blue with a yellow centre and have six distinct petals. The upper petal is darker purple with a yellow mark in the centre. Flowers can self-fertilise and are formed on upright stems with between 3 and 35 (but commonly 8) flowers on each spike.

Life cycle

Water hyacinth reproduces from seeds and horizontal stems. Flowers open for only one or two days from mid to late summer before beginning to wither. When all the flowers on a spike have withered, the stalk gradually bends into the water and after two to three weeks the seeds are released and sink.

Autumn and winter frosts cause the leaves to die off but the crowns are able to overwinter. These will commence new growth in the following spring along with the germination of seeds.

Spread

Water hyacinth infestations increase most rapidly by the production of new daughter plants. During high water flows and flooding, infestations can break up and be moved to new locations.

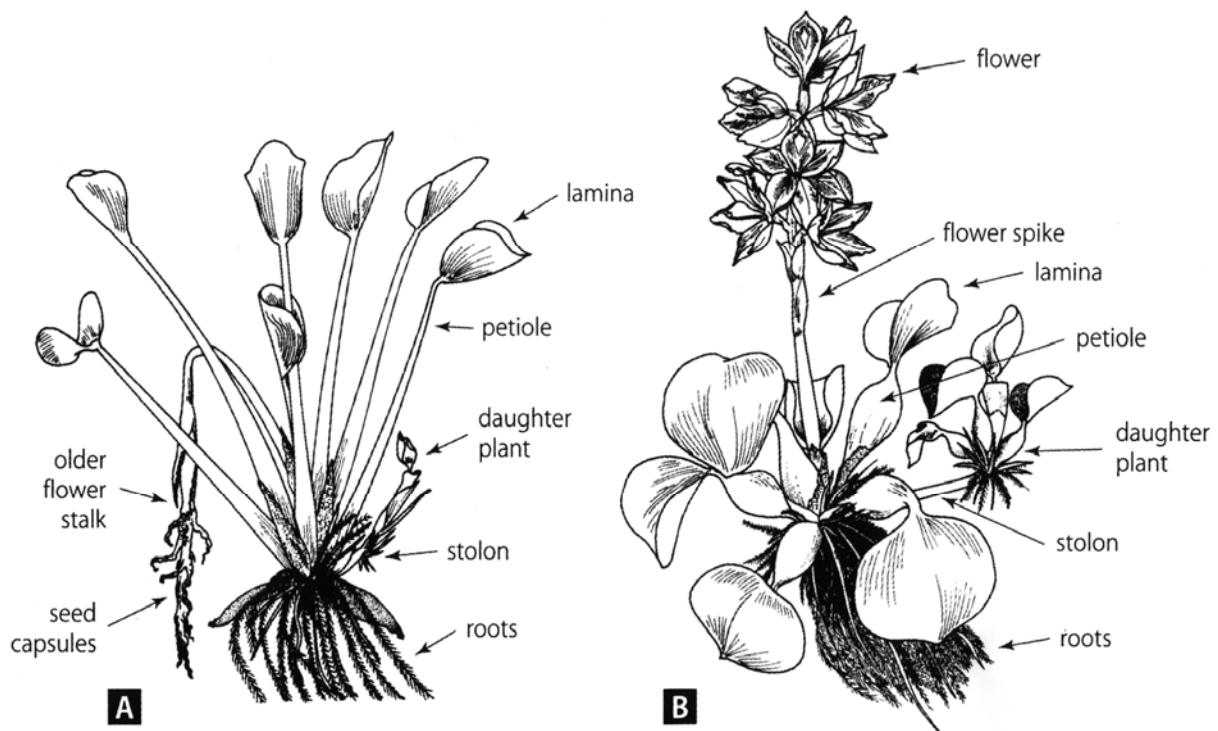


Figure 4. Water hyacinth can show variation in form depending on growth conditions (Julien, Griffiths & Wright 1999).

Most spread can be attributed to human activity such as the deliberate planting of water hyacinth in ornamental ponds or dams. Unwanted aquarium plants that are discarded into waterways are a major form of spread. Water hyacinth can also be spread by contaminated boating equipment.

Seeds are the main source of new infestations and are carried in water, mud (e.g. on machinery or boots) and by birds.



Figure 5. Illegal ornamental use of water hyacinth contributes to spread.

Control and management

Water hyacinth is difficult to control in all freshwater aquatic environments. When access is limited by the presence of the weed itself, control becomes more difficult. Early detection and rapid response offer the greatest likelihood of successful control and the opportunity for eradication. It is essential that any new infestations are controlled as soon as possible. If allowed to become established, the seed bank rapidly expands, increasing costs and massively increasing the duration of the control program.

In large, established infestations, the aim of a long-term control program should be to carry out annual control treatments in order to reduce the quantities of reproducing plants and restrict seed bank build-up over the long term.

Physical removal

Early control attempts concentrated on removing plants from the water with pitchforks, dumping the accumulated mass on land to die. Manually removing plants from small areas of water such as farm dams and drains is an effective form of controlling water hyacinth, but only when the rate of

removal is faster than the rate of regrowth. On a larger scale, manual removal is less likely to achieve control of water hyacinth.

There are instances where mechanical harvesting of large infestations has been effective, although costly. As a guide, it takes between 600 and 900 hours to harvest one hectare of dense water hyacinth – which should be undertaken prior to flowering and seed set. Fifty million tonnes of water hyacinth are removed from the White Nile annually, and the Panama Canal is kept clear of the weed by mechanical harvesting.

Chemical control

In NSW, a number of herbicides are registered for the control of water hyacinth. For specific information on registered herbicides see the *Noxious and Environmental Weed Control Handbook*, 4th Edition (see 'Publications available' below).

The most commonly used technique for applying herbicides to water hyacinth is high volume spraying with hose and handgun power sprays either from a boat or from the banks. In some situations large infestations have been aerielly sprayed.

Treatments with herbicides should be carried out early in the growing season (generally in spring).

Spraying an entire heavy infestation can cause the weed mat to sink and rot resulting in deoxygenation of the water, potentially killing fish. This can be avoided by spraying one third of the infestation at a time, or by physically removing as much of the weed as possible prior to spraying.

Biological control

Four insects from South America have been released by CSIRO since 1975 and are well established across NSW. There are two weevil species, *Neochetina eichhorniae* and *Neochetina bruchi*, and two moth species, *Niphograpta albiguttalis* and *Xubida infusellus*.

The *Neochetina eichhorniae* weevil has been successful in destroying large water hyacinth infestations in tropical northern areas of Australia. The adult is black, 5 mm long, and feeds on leaves, making small scars. Eggs are laid in the bulbous leaf stalks and the larvae tunnel through the plant tissue, which is then attacked by bacteria and fungi. This causes the plant to become waterlogged and death can occur under heavy attack. These weevils are inactive during winter.



Figure 6. Water hyacinth weevils. *Neochetina* spp.



Figure 7. Water hyacinth moth *Niphograptia albiguttalis*.

The *Neochetina bruchi* weevil is more active through the winter and is now well established from northern Queensland to Sydney, although both weevils are much less effective in subtropical and cooler areas of NSW.

The moth *Niphograptia albiguttalis* is well established in northern NSW and Queensland. Its larvae tunnel into the leaf stalks and buds, as do the larvae of *Xubida infusellus*. Both species are very damaging to young plants and luxuriant weed growth but their impact is often temporary and patchy.

Unfortunately biological control cannot be solely relied upon for effective control of water hyacinth in NSW. It will provide some reduction in flowering and growth rates of the plant and occasionally mat sinkage has occurred as a result of insect damage.

Control programs in NSW should view biocontrol as a useful addition to the other available control techniques. It is possible that some infestations exist which do not have biological control agents present. If in doubt, check with your local weeds officer.

Cultural control

As part of a control program, nutrient run-off into infested waterways should be minimised. Drainage or reduction of water levels can also reduce the area of water hyacinth plants, but it is important to note that seeds will remain viable in the soil and will germinate when the area refills with water.

In some situations salty water is able to be retained or naturally introduced to infested waterways.



Figure 8. Some die-back and sinkage can occur in NSW infestations due to biocontrol agents.

Managing flood-stranded infestations

Vast areas of land can become covered in stranded water hyacinth when floating mats become mobile during flood events. This creates major problems if the weed settles over roads, crops or pastures.

Earthmoving equipment can be used to remove hyacinth from roads and verges.

While crops will be damaged by the weed mass, pasture recovery can be enhanced by the use of windrowing or mulching as the plant mass can take up to 12 months to break down naturally.

Windrowing

In a situation where 70 acres of pasture were covered with hyacinth over 1 m deep, the weed mass was windrowed with a tractor-mounted blade. Two operators took one week to pile the weed into large windrows, immediately after the flood event. The windrows were then turned four times over a period of eight months to assist with the composting process, which resulted in well-decomposed, friable compost which was then spread back over paddocks. The pasture between the windrows recovered very quickly.

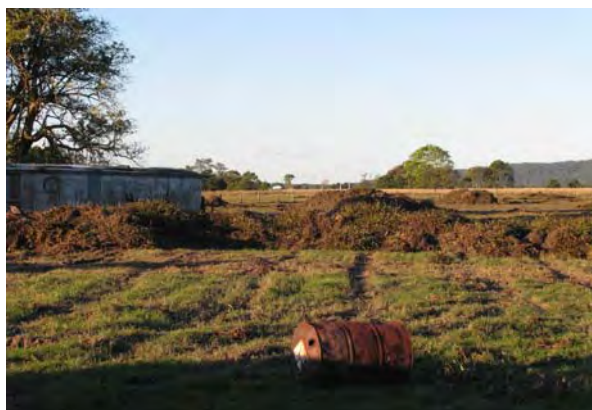


Figure 9. Seventy acres of flood-stranded water hyacinth was piled into large windrows and turned regularly.



Figure 10. After 8 months the plant material had broken down into a friable compost.

Mulching

In a situation where a 50 acre paddock was covered with hyacinth, the weed layer was mulched using a tractor-powered mulcher. The mulcher was contracted four weeks after the flood event, with pasture re-emerging within 4–5 months. Planting ryegrass or other suitable pastures directly into the mulch may also be successful in this situation.



Figure 11. Fifty acres of flood-stranded water hyacinth was mulched.



Figure 12. Pasture re-emerged after 4 months.

In both these situations it is necessary to watch for logs and other flood debris that have been deposited in the water hyacinth.

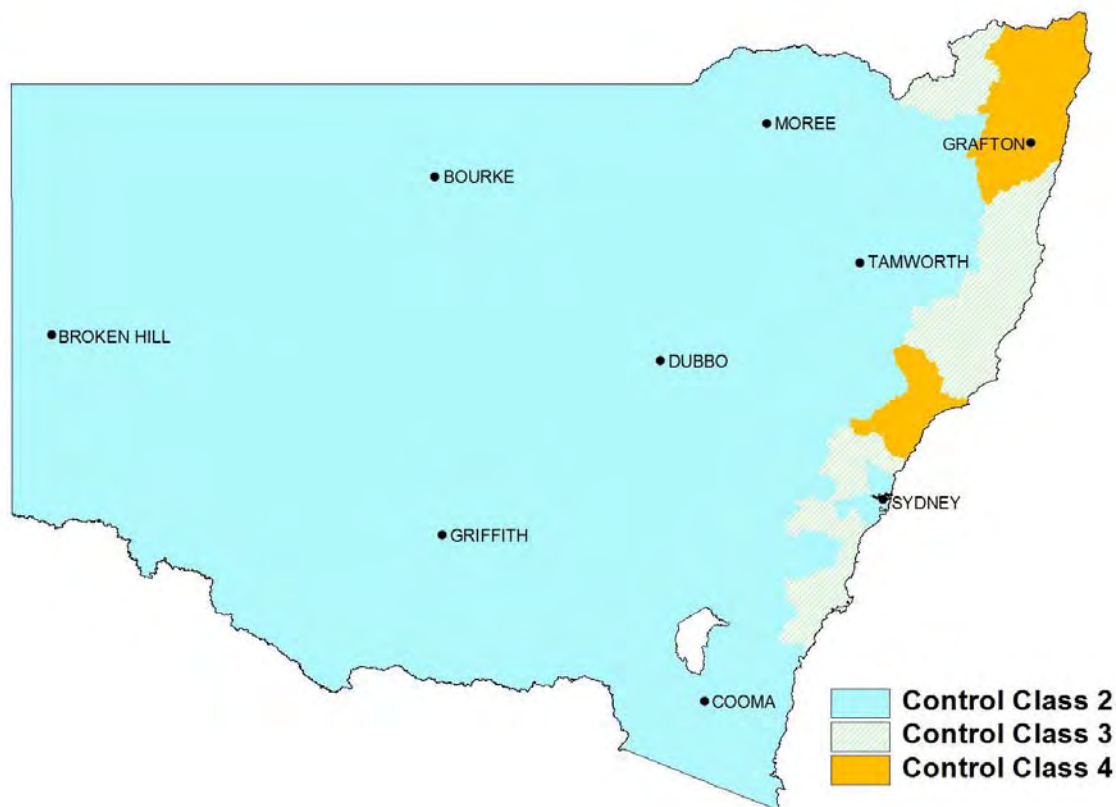


Figure 13. Declaration of water hyacinth in NSW.

Legislation

In various control areas of NSW water hyacinth is declared a Class 2, 3 or 4 noxious weed under the *NSW Noxious Weeds Act 1993*. The declaration class defines how the weed needs to be treated in your area. Contact your local weeds officer or refer to the Industry & Investment NSW website www.dpi.nsw.gov.au/weeds for further details.

The responsibility for the control of noxious weeds on private land rests with the land owner or occupier of the land. This responsibility extends to the middle line of any adjacent watercourse, river or inland water (tidal or non-tidal).

A full list of noxious weeds and requirements under the NSW Noxious Weeds Act can be found at www.dpi.nsw.gov.au/weeds.

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Images

Figure 1. Paul Sullivan, I&I NSW

Figure 2. Paul Sullivan, I&I NSW

Figure 3. Elissa van Oosterhout, I&I NSW

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Figure 10. Elissa van Oosterhout, I&I NSW

Figure 11. Elissa van Oosterhout, I&I NSW

Figure 12. Elissa van Oosterhout, I&I NSW

Figure 13. Produced by Alan Maguire, I&I NSW

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Publications available

Ensbey, R. (2009), *Noxious and Environmental Weed Control Handbook*, 4th edn, Industry & Investment NSW, Orange. Copies are available from the Industry & Investment NSW Bookshop, Orange. Phone 1800 028 374 or online at www.dpi.nsw.gov.au/weeds

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