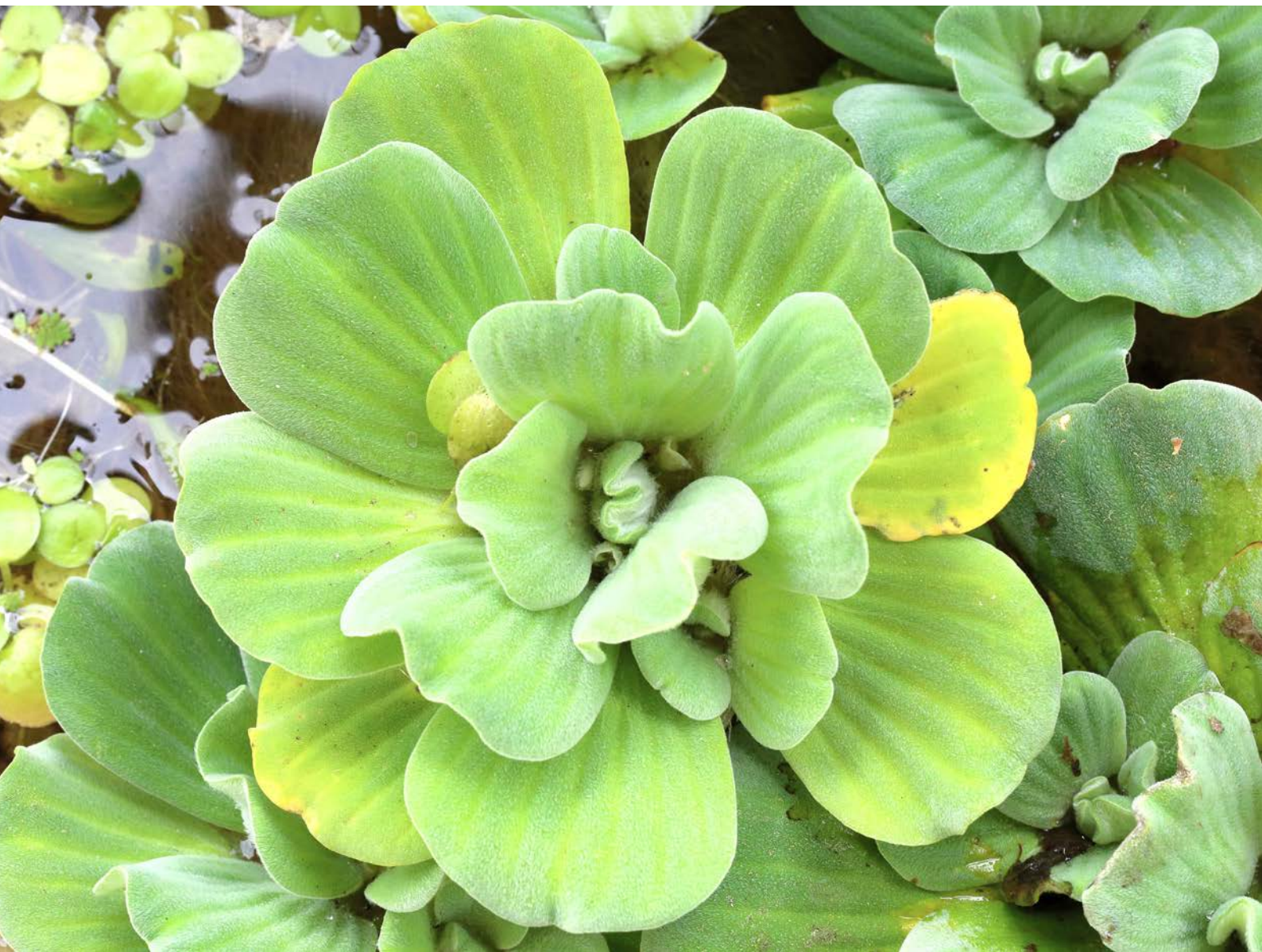


Water lettuce

Pistia stratiotes



Water lettuce is a free-floating aquatic weed that rapidly forms dense mats covering rivers, dams and irrigation canals. It can restrict water flow, increase water loss by evapotranspiration and can serve as a breeding ground for mosquitoes. It creates a dense cover on the water surface that prevents light penetration and exchange of gasses. This leads to a drop of oxygen in the water which is detrimental to the aquatic ecosystem.

Legal requirements

Water lettuce is a category 3 restricted invasive plant under the *Biosecurity Act 2014*. It must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.



Queensland
Government

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on water lettuce. Some of these actions may be required under local laws. Contact your local government for more information.

Description

As the name suggests, the entire plant resembles a small, floating, open head of lettuce. The fan-shaped leaves are pale green, have marked parallel veins, are spongy and covered with hairs and form a floating rosette. The spongy tissue and the air that gets trapped by the hairs give the plant its buoyancy. It has a tuft of unbranched, fibrous roots up to 80 cm long.

Mature plants produce a large number of small, pale white to green, inconspicuous flowers hidden at the base of the leaves of the rosette. A membrane separates the male and female flowers. The fruit is a berry 5–8 cm across with oblong seeds about 2 mm long, tapered at each end.

Life cycle

Active growth of plants begins with increasing temperatures in spring. Flowering commences early in the plant's life—about the fourth or fifth leaf stage; high plant densities trigger flowering. After flowering, seeds drop to the muddy bottom and form a persisting seed bank. The plants can produce large number of seeds over a season (several thousands per meter square). Seeds germinate in late November to early December the next season and float to the surface as seedlings.

Plants reproduce vegetatively throughout the growth season. Each mother plants generates several daughter plants that row on stolons (up to 20 cm long). Water lettuce is sensitive to frost.

Methods of spread

Water lettuce spreads both by vegetative reproduction and by seeds.

Habitat and distribution

The origin of water lettuce remains unclear and was introduced to Australia as an aquarium and water garden specimen. As a result of flooding and abandonment, the plant is now found in a number of areas throughout eastern Queensland. The plant prefers stationary or slow-moving streams and could become established in most areas of the state. Water lettuce thrives in water with high nutrient concentrations.

Like other floating plants, water lettuce can survive for long periods when stranded on mud banks or in other damp situations (such as a roadside culvert where it may even take root).

Impacts

Under tropical conditions, growth is rapid; dense mats form, often covering rivers, dams and irrigation canals. These mats, with their long roots, can restrict the flow of water, increase water loss through evapotranspiration and reduce light penetration that is necessary for

photosynthesis in submerged aquatic plant life. The lack of oxygen and the shading significantly impact on native aquatic animals and plants.

The presence of water lettuce is especially undesirable in the Murray–Darling system as it could possibly spread into inland New South Wales, Victoria and South Australia where it is currently not established.

Control

Managing water lettuce

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by water lettuce. This fact sheet provides information and some options for controlling water lettuce.

In most cases the best management approach combines herbicide, mechanical, fire and biological control methods with land management changes. It is essential to choose control methods that suit the specific weed and the particular situation.

Prevention and early detection

New infestations may become established when plants are brought into new areas by flooding or accidental transport, i.e. through boating. Surveillance and physical removal at such times may prevent infestation. Public education to prevent disposal of plants from domestic situations is necessary.

Mechanical control

Water lettuce removal by hand or racking is a practical control method often used for small areas or when numbers are low. The use of water weed harvesters may also be used in larger areas.

Physical removal is most effective for small infestations and should be made before flowering and seeding.

Mechanical control of water lettuce can help take advantage of flooding or water flushes that deposit water lettuce in dams, lagoons and calm water areas of rivers and creeks. When using this approach it is essential water lettuce is removed before its rapid growth commences. Water lettuce can survive if it is deposited or left on moist banks. To help prevent the reintroduction of water lettuce into the watercourse, it is essential it is moved from the water's edge.

Biological control

A weevil (*Neohydromonus affinis*) has been introduced and exert good control in some areas.

The weevils have proved effective on dams from Bundaberg to Brisbane. The life cycle of the weevil takes about three months. Eggs are laid in the fleshy leaves and the larvae tunnel through the plant tissue. The openings assist the entry of fungi and bacteria, causing the tissue to rot.

Biological control is most effective on large infestations, but it may take several years to achieve satisfactory control if used in isolation from other methods. To establish an effective breeding population of biological

control agents, infested plants should be placed in an area where the water lettuce is concentrated.

Your local government or Biosecurity Queensland can assist you with protocols and information on the collection site nearest to you.

Herbicide control

Before using any herbicide always read the label carefully. Apply all herbicides strictly in accordance with the directions on the label. When treating water which is used for irrigation purposes, the withholding period should be followed in accordance with the label recommendations.

Spraying with herbicides is often the only practical method for large infestations. Autumn applications tend to be more effective than summer ones. Table 1. details the herbicides for control of water lettuce.

Integrated control

Integrated control is a sensible strategy that includes a combination of mechanical, biological and herbicide methods that complement each other.

First make certain that the weevils are established on the infestation, and then carry out mechanical control or a spray program using a selective herbicide. Selectively controlling strips of the water lettuce mats helps concentrate the biological control insects onto the remaining weed to increase damage.

Mechanical removal of dead plants will avoid water quality degradation by masses of rotting weed.

More information

For more information contact your local government or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of water lettuce

Situation	Herbicide	Rate	Comments
Waterways, non potable water, drains, dams, margins lakes and streams	2,4-D acid 300 g/L (e.g. Affray 300)	50 mL/10 L water or 500 mL/100 L water	Knapsack: coverage 10 L spray solution/100 m ² Hand gun: coverage 200 L spray solution/100 m ² Avoid causing submersion of sprayed plants.
		1 L/20 L water	Sprinkler sprayer ¹ Coverage: 20 L spray solution/1000 m ²
		5 L/200 L water/ha	Boom application by helicopter. Raindrop D8 nozzles angled back at 45° to minimise spray drift
Aquatic areas	Diquat 200 g/L (e.g. Diquat 200 (various brands) Reglone®)	5–10 L/ha	Add wetting agent (adjuvant) Higher rate for denser infestations. Overall spray, thoroughly wetting foliage. Use higher rate for heavy infestations (consult label). Do not use water for 10 days after application for human consumption.
	Diquat 200 g/L (e.g. Diquat 200 {various brands}, Reglone®)	400 mL/100 L water + Manta Ray or Nemo adjuvant	Small areas Thoroughly saturate About 1 mL of product (250 mL of spray mix) should be sufficient to treat 1 m ² Do not use water for 10 days for human consumption after application
Aquatic areas (drains, channels, margins of streams, lakes and dams)	Calcium dodecyl benzenesulphonate (e.g. Apparent Immerse)	1:19 with kerosene Apply 1 L of mixture per 100 m ²	Sprinkle onto free floating plants and adjacent water surface lightly, just enough to change their normal colour Don't spray dense solid mats with no visible water surface
Control of floating invasive plants in enclosed water bodies and margins of larger open aquatic systems	CLIPPER herbicide (Flumioxazin, 15 g/tablet)	Direct tablet application High concentration Apply one tablet for every 37.5 m ³ of water to achieve active 400 parts per billion	Refer to general instructions and application on the product label to determine the appropriate application type depending on treatment area and water depth
		Low concentration Apply 1 tablet for every 75 m ³ of water to achieve active 200 parts per billion	The choice of dose will depend on the pH of the water and the density of the target plant. Most of the times the low concentration will be sufficient for good control as the water lettuce is very sensitive to flumioxazin.

Table 1. Herbicides for the control of water lettuce (continued)

Situation	Herbicide	Rate	Comments
Control of floating invasive plants in enclosed water bodies and margins of larger open aquatic systems	CLIPPER herbicide (Flumioxazin, 15 g/tablet)	Surface spray Including foliar application, spot spraying and clean-up sprays to control survivors from previous applications	Refer to general instructions and application on the product label to determine the appropriate application type The choice of dose will depend on the density of the target plant. Most of the times the low concentration will be sufficient for good control as the plant is very sensitive to the active.
		High concentration One tablet in 50 L of spray solution plus approved aquatic adjuvant/surfactant; apply 12–15 L of spray solution per 100 m ² (360–450 g a.i. per ha)	Nemo aquatic surfactant or ProForce Manta Ray surfactant can be used with Clipper aquatic herbicide. Follow adjuvant label for rates.
		Low concentration One tablet in 100 L of spray solution plus approved aquatic adjuvant/surfactant; apply 12–15 L of spray solution per 100 m ² (180–225 g a.i. per ha)	
Aquatic areas	Glyphosate 360 g/L (e.g. Ken-Up Aquatic 360, Weedmaster Duo) and other formulations registered for use in aquatic areas (numerous products)	1–1.3 L/ 100 L water or 150–200 mL/15 L knapsack (for other formulations consult labels for correct rates)	Best results are obtained from mid-summer through to winter Use higher rate on dense infestations

Notes

There are multiple formulations of glyphosate, but only some are registered for use in aquatic situations. Formulations that are not registered for aquatic use may contain ingredients that are harmful for non-target aquatic organisms and must not be used.

Diquat and Flumioxazin are registered for use in water storage areas used for human consumption. Do not use treated water for human consumption, livestock watering or irrigation purposes for 10 days after application of diquat. Glyphosate products registered for aquatic situations are registered for use in drinking water. DO NOT apply this product within 0.5 km up-stream of potable water intake in flowing water (ie river or stream, etc) or within 0.5 km of a potable water intake in a standing body of water such as a lake, pond or reservoir. Always read the label before deciding whether to use a product in drinking water.

¹A sprinkler sprayer consists of a micro sprinkler connected to a hollow fibreglass rod attached to a pneumatic knapsack sprayer. It is used at low pressure (50 to 200 kPa) with a slow sweeping action over the top of the plants to ensure an even coverage of the leaves.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

