

WETLAND PLANTS OF THE TOWNSVILLE – BURDEKIN FLOOD PLAIN



Dr Greg Calvert & Laurence Liessmann (RPS Group, Townsville)
For Lower Burdekin Landcare Association Incorporated (LBLCA)
Working in the local community to achieve sustainable land use

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Foreword

Standing beside a wetland, filled by wet season rain and bursting with life, it is all too easy to be consumed by your surroundings and distracted from the biological complexity that is a wetland. Wetland plants are an important part of this ecological marvel but, although often the most visible or the most colourful or the most emblematic of wetland inhabitants, they can be overlooked for the water birds and fish as part of the scenic background. This field guide will change readers' perception, unconscious or otherwise, with a convenient and accurate description of exactly which wetland plants are right before your eyes.

For almost three decades as a wetland ecologist, I have carried an array of field guides and keys with me on my visits to wetlands and rivers around Australia. From fish to frogs and birds and insects, I have always been comforted that nothing will go unnamed or be misunderstood while I have my backpack. Unfortunately, wetland plants have not been as common a focus for books of this sort. For the many years I have known Greg and Laurence, they have searched for, collected and catalogued wetland plants with enthusiasm and dedication. This passion, and an intimate knowledge of the ecology of the Townsville–Burdekin flood plain region, is the foundation for this book. I suspect that relatively few users of this book will appreciate just how much time and effort has been spent, not only in searching for the wetland plants, but also in describing them, photographing them and confirming their local and regional distributions and all this before the book was even written!

This book is not only important because it has a long-awaited focus on wetland plants in the Townsville and Burdekin regions. It is also a vital tool in monitoring the presence and absence

of different species and, by extension, is critical to the management and protection of wetland plant populations and their habitats. As a clear and concise illustrated guide, this book means that wetland plant information is now accessible to all stakeholders: students, landholders, ecologists and limnologists alike. In 1735, Carolus Linnaeus wrote,

"The first step in wisdom is to know the things themselves; this notion consists in having a true idea of the objects; objects are distinguished and known by classifying them methodically and giving them appropriate names. Therefore, classification and name-giving will be the foundation of our science" (Linnaeus 1735).

This book provides a foundation and it encourages others to observe and monitor part of Australia's rich wetland flora. I have no doubt that it will lead to better natural resource management outcomes for wetlands and better conservation outcomes for wetland plants. I think Carolus (Carl) would be pleased with Greg and Laurence's book.

Dr Paul D. Clayton – *BSc(Hons), PhD, Dip Bus.*
Limnologist/Wetland Ecologist
RPS Technical Director – Environment and Water

Water is the most valuable resource we have in the Townsville–Burdekin region, being the lifeblood of our towns and cities, agriculture, industry and environment. Yet our natural wetland resources are too often overlooked, and we have only recently begun to understand the importance and value of these complex ecosystems that were once regarded as useless swamps. We hope this book will go some way towards achieving a better appreciation of the role, value and complexity of wetland communities.



Wetlands of the Townsville–Burdekin flood plain

The freshwater wetlands of the Townsville–Burdekin flood plain consist of a diverse range of artificial and natural wetlands systems which are inundated permanently or intermittently. The flood plain rivers of the Townsville–Burdekin region have strong connectivity to the wetland systems, which are naturally characterised by a distinct seasonal flow regime and irregular flooding. High flows experienced during the wet season inundate the freshwater wetlands, where standing freshwater persists periodically throughout the year. However, the Townsville–Burdekin flood plain has been extensively modified from its natural state, largely due to the construction of dams and weirs, intensive production of sugarcane in the Burdekin region and the development of the Burdekin–Haughton Water Supply Scheme. The supplementation of irrigation water and the construction of bund walls throughout the flood

plain has significantly altered the seasonality of flows, excluded tidal influence, and resulted in perennial and constant water levels with high nutrient inputs within some areas.

Although the Townsville–Burdekin flood plain has been modified in varying degrees, due to rural (irrigated cropping, grazing) and urban land use, its associated wetlands are still of significant value. The Townsville–Burdekin flood plain contains the nationally important Burdekin–Townsville coastal wetland aggregation (Blackman *et al.* 1992), which is listed in the *Directory of important wetlands in Australia* (DIWA) (Environment Australia 2001) and the internationally important Ramsar wetland, Bowling Green Bay. The Townsville–Burdekin coastal wetland aggregation occurs upon a large low-gradient coastal flood plain and forms a continuous complex wetland aggregation from the shallow marine waters of the coastal zone, inland to permanent and seasonal freshwater lakes on the adjoining coastal plain (Spain and Blackman 1992). Bowling Green Bay supports very large and mostly intact mosaic of coastal wetlands which contain coastal mangrove communities, highly saline communities of salt pans, and brackish and freshwater wetlands on the low-lying coastal plain. The site is internationally important for the migration of marine turtles, shorebirds and terns, and for several threatened species, including marine turtles and water birds (Wetland Info 2009).

The wetlands within the Townsville–Burdekin flood plain have a variety of significant values to the natural environment and community; including environmental and biodiversity values, cultural values, industry, education and recreation values. A full list of wetland values is available in the Summary Information section of

Wetland Info at www.wetlandinfo.ehp.qld.gov.au/wetlands/management/wetland-values/.

The freshwater wetlands in the Townsville–Burdekin flood plain contain a number of systems, including palustrine (marsh or swamp), lacustrine (lakes and dams) and riverine (rivers or deepwater habitats in a channel), and are shown on Figures 1 and 2. Freshwater wetland maps are also available in the Facts and Maps section of Wetland Info at www.wetlandinfo.ehp.qld.gov.au/wetlands/facts-maps/.



Values of wetlands and wetland plants

Wetlands of the Townsville–Burdekin flood plain have high cultural and spiritual significance to the Wulgurukaba, Bindal and Juru Traditional Owners, who have inhabited the area for thousands of years. The wetlands supported a rich diversity of plant and animal life that provided an important source of food, medicine, stems for spears, fibres and leaves for weaving, and a variety of other uses. The native wetland plants provided habitat for large numbers of waterfowl, particularly magpie geese, which frequented this area during the wet season. Additionally, wetland plants such as the blue water lily and the Queensland lace plant were recorded as an important part of the diet of the Aboriginals of the region (Thozet 1868).

Wetland plants associated with the Townsville–Burdekin flood plain are strongly seasonal and linked to moisture availability, and contribute

significantly to the overall function and critical processes of wetlands. Wetland plants form a major component of freshwater wetland communities, including biomass, ecosystem function and species richness (Hutchinson 1975), where changes in their diversity can influence associated biota, including wetland plant species (Heino and Toivonen 2008). Native aquatic plants provide a number of values, including:

- maintenance of water quality
- bank stabilisation
- wildlife habitat (leaf litter, shade, food)
- grazing
- aesthetics.

Submerged and emergent vegetation is particularly important to wetland birds and fish for nesting and feeding (WetlandCare Australia 2008). Wetland plants also have an important role in maintaining water quality by:

- stabilising loose sediment and preventing erosion
- removing sediment, nutrients and toxins from the water.

This is essential for protecting wetland biodiversity and downstream receiving environments, including the Bowling Green Bay Ramsar wetland and Great Barrier Reef. Hence, wetland plants are keystone elements in freshwater systems (Tew *et al.* 2004).

Wetland plants are useful indicators of wetland health. The type and condition of wetland plants present in a wetland provides evidence of excess nutrient levels, salinity levels, degradation and grazing impacts. Land managers familiar with wetland plants can tell a lot about a wetland from the plants that are present, such as its depth, whether the water is permanent or seasonal, fresh, brackish or saline, clean or polluted, and if the site has had a history of disturbance.



Roles and uses for wetland plants

Many of our local native water plants occur naturally in other parts of Australia and the world, and it is interesting to see the values of these plants in other counties and cultures. Plants that many North Queenslanders dismiss as useless 'water weeds' are held in high esteem by other cultures, both for their spiritual connection, and for their daily use in local cuisine and traditional medicine. Recent interest in many of these plants has uncovered a broad range of useful pharmaceutical chemicals, ranging from sedatives, anti-bacterials and anti-tumour to anti-viral products, some of which are being investigated for a potential role in the fight against diabetes, tumours and human immunodeficiency virus (HIV) (Cribb & Cribb 1981b, Neeraja & Elizabeth 2011, Sun *et al.* 2013).



Revegetation and constructed wetlands

The individual roles of wetland plants in natural wetlands is now being commercially exploited for use in constructed wetlands – wetland systems carefully designed and planted to mimic the functions of natural wetlands

in improving water quality. The *Wetland management handbook*, available on www.wetlandinfo.ehp.qld.gov.au/wetlands/ has a dedicated section on constructed (treatment) wetlands in agricultural areas.

Restoration of degraded wetlands is becoming a high priority, not only for those interested in conservation, but also for those whose livelihood depends on good water quality, including farmers, graziers, fishermen, and, ultimately, each of us. Understanding the various roles of water plants in natural ecosystems is critical in correctly diagnosing problems, and therefore devising solutions.

There is also considerable increasing interest in 'water sensitive urban design', and aquatic plants are just as important in these systems as their engineering and hydraulic components. Constructed wetlands are beginning to appear throughout the district, including 'bioretention basins' for capturing and treating suburban wastewater, larger constructed wetlands for managing stormwater or treating polluted wastewater, and phytoremediation projects to assist in restoring contaminated sites.

Although constructed wetlands have been in use overseas for many years, this approach to dealing with wastewater is still very much in its infancy in North Queensland, and there are numerous opportunities for future research and application.

To ensure these wetland restoration and constructed wetland projects are successful, there has been an increasing move to cultivate and grow native aquatic plants. So far, more than 150 wetland plants have been identified as being useful in constructed wetlands (Greenway 2003). Unfortunately, our local native aquatic

plants have been frequently overlooked in favour of subtropical species, due to a lack of suitable identification guides, research or local knowledge of the potential value of our local plants. Non-local sub-tropical species are less likely to succeed in revegetation projects within the Townsville–Burdekin region, as they are typically less tolerant of the climatic and environmental conditions of tropical North Queensland. On the other hand, there are also concerns that in some instances, non-local species may proliferate and out-compete local wetland species, adding to the ever-growing number of invasive weeds within the region.

Many of the species in this book have not been used, or have been too infrequently used, in Australia for us to be able to confidently say much about their role in revegetation or constructed wetlands. Although many species listed here are used widely overseas for such purposes, we are significantly hampered by our lack of knowledge of how these plants will behave under particular conditions, and by a lack of practical experience.

We hope this book will stimulate an interest in carrying out the necessary experimentation and demonstration of their use. Recommendations for the use of particular plants in constructed wetlands should not be regarded as being too prescriptive, but rather serve as a guide. And of course, many of our local wetland plants are not simply functional – many of them are breathtakingly beautiful, so it comes as no surprise that many people grow our native aquatic plants as ornamentals, both in large outdoor ponds and dams, and in smaller indoor aquariums. Again, the use of our local native plants has been overlooked for far too long, and their use should always be encouraged over that of introduced species.



Wetland weeds

Although native wetland plants are critical for wetland processes, the introduction of invasive, exotic aquatic plant species (e.g. cabomba, hymenachne, and salvinia) has had a catastrophic impact. Other factors which have compounded the impact on wetland processes within the Townsville–Burdekin flood plain and its associated values include modifications to the water regime disturbance of riverside (riparian) vegetation and increased nutrient levels (Inglis and Howell 2009). The construction of bund walls in the coastal areas has also contributed to the expansion of weed infestations by preventing tidal influence, which naturally suppresses weed growth. Significant aquatic weeds within the region include para grass (*Urochloa mutica*) and olive hymenachne (*Hymenachne amplexicaulis*), which have been used extensively as ponded pasture species for grazing purposes.

Invasive and exotic aquatic plants have resulted in a number of adverse effects on wetlands, such as:

- altering hydrological regimes
- displacing native plants and animals (blocking fish passage, removing breeding and foraging habitat)
- degrading water quality
- altering soil properties
- changing fire regimes
- degrading fishing grounds.

In addition to the adverse effects on wetlands and their values, invasive weeds also have important impacts on grazing and farming practices within the region. These important negative impacts include:

- out-competing productive native grasses
- limiting access to water by stock
- reduction in water quality, and impacts on irrigation networks and flows (blocking distribution channels and pump stations).

Their introduction into coastal wetlands presents a huge challenge to managers of these areas, who often must continue grazing to manage their growth or otherwise risk these aggressive weeds entirely smothering the wetland (for further information on managing grazing in coastal wetlands, refer to Grazing for Healthy Coastal Wetlands on WetlandInfo: www.wetlandinfo.ehp.qld.gov.au/wetlands/).

The aquarium and nursery trade is a major source of introduced aquatic plants, as these invasive species are sold for ornamental ponds and aquariums, and also inevitably find their way into local waterways and wetlands. Of particular concern is the potential and ease with which new exotic species flourish in our waterways and have negative effects. Serious waterweeds such as salvinia (*Salvinia molesta*), cabomba (*Cabomba caroliniana*), water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) are still commonly grown in aquariums and outdoor ponds, despite being declared weeds under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld). These weeds are wide spread within the Burdekin–Townsville wetlands and are continuing to cause long-lasting environmental and economic impacts. The recent introduction of delta arrowhead (*Sagittaria platyphylla*) in Ross River highlights the ongoing problems caused by ornamental water plants. The native cumbungi







(*Typha domingensis* and *Typha orientalis*) can also form dense impenetrable stands in response to changes in environmental conditions.



How to use this book

Wetland plants vary in their structure and form, depending on the wetland zone they inhabit. Although zones vary between wetland types, they usually fall into the categories riparian/fringing, emergent and aquatic (WetlandCare Australia 2008). This book focuses on plants in wetlands that are considered fringing, emergent and aquatic (submerged, floating), and are permanent or seasonally flooded with freshwater.

Wetland plants (macrophytes) considered in the context of this book are those that occur within the aquatic environment for a period of their lifecycle, but excluding perennial woody plants. These wetland plants are further segregated in the book according to their form and growth habit:

-  **submerged** – plants with leaves fully submerged
-  **floating attached** – plants with leaves emergent but attached to the substrate
-  **free floating** – plants that are free floating and not attached to the substrate
-  **herbs and shrubs** – broad-leaved plants that generally grow on the margins of wetlands
-  **grasses and sedges** – for grasses and grass like plants
-  **weeds** – plants that occur outside of its natural distribution and have an adverse effect on the environment.

Wetland plants of the Townsville–Burdekin Flood Plain is an important resource for land managers, farmers, community groups and local councils, as it provides information (descriptions, habitat, impacts and uses) on 58 aquatic native and introduced water plants commonly found within the region. Identification tips are provided for an additional 65 water plants, supplying a valuable identification tool for professional and novice alike. In this book, we have also tried to encompass the many ways people view and interact with aquatic plants, or ‘macrophytes’ as they are often described. These uses range from food and medicine to their importance to both Australian Aboriginal and other Indigenous cultures throughout the natural range of many of these plants.

This book is intended to complement the following field guides:

- Greg Calvert (2011) *The Burdekin Delta Tree Guide*. Lower Burdekin Landcare Association, Ayr
- Louise Johns (2006) *Field Guide to Common Saltmarsh Plants of Queensland*. Department of Primary Industries and Fisheries, Brisbane.

The guide is also intended to complement the publication *Wetland rehabilitation guidelines for the Great Barrier Reef catchment* (WetlandCare Australia 2008: www.wetlandinfo.ehp.qld.gov.au/wetlands/) which gives practical guidance on wetland rehabilitation. More information, guidelines, maps and tools to help landholders, managers and the community manage wetlands in Queensland can be found on WetlandInfo: www.wetlandinfo.ehp.qld.gov.au/wetlands/.

We trust this guide will raise the profile of these important but little-known plants, improve the success of the local wetland revegetation projects, allow land managers to use wetland plants as an indicator of wetland health and degradation, and identify introduced and invasive species to allow for their strategic control and eradication.



Natural coastal wetland with a high diversity of native wetland plants



The same wetland following invasion by the introduced weeds olive hymenachne and salvinia

Distribution of wetlands on the Townsville-Burdekin flood plain

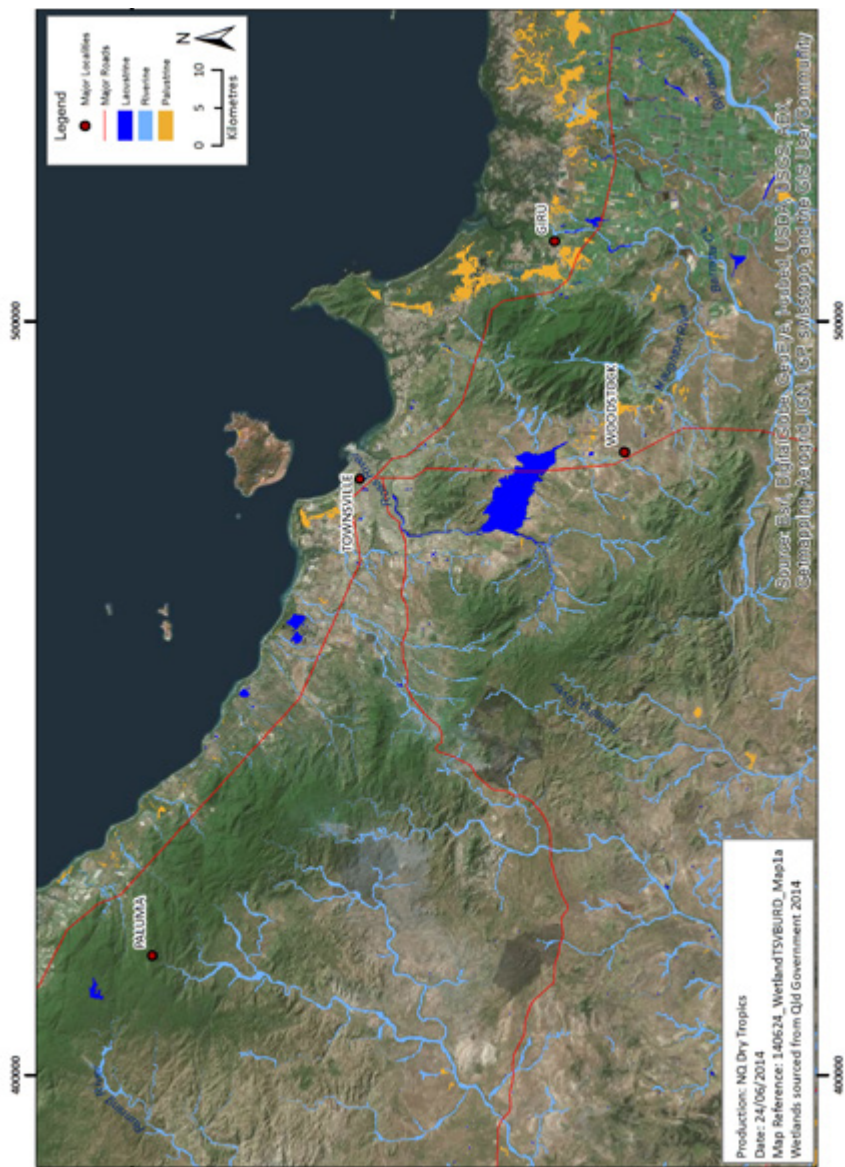
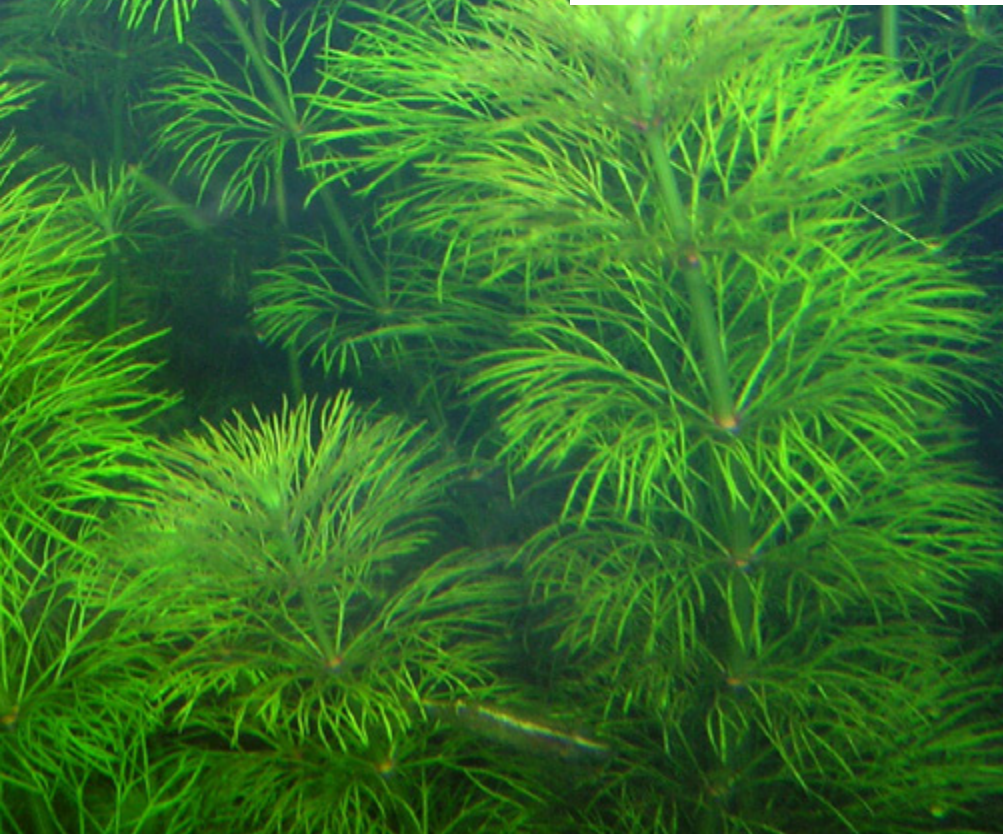


Figure 1: Lacustrine (lakes), riverine (rivers) and palustrine (vegetated swamp) wetlands in the Townsville region

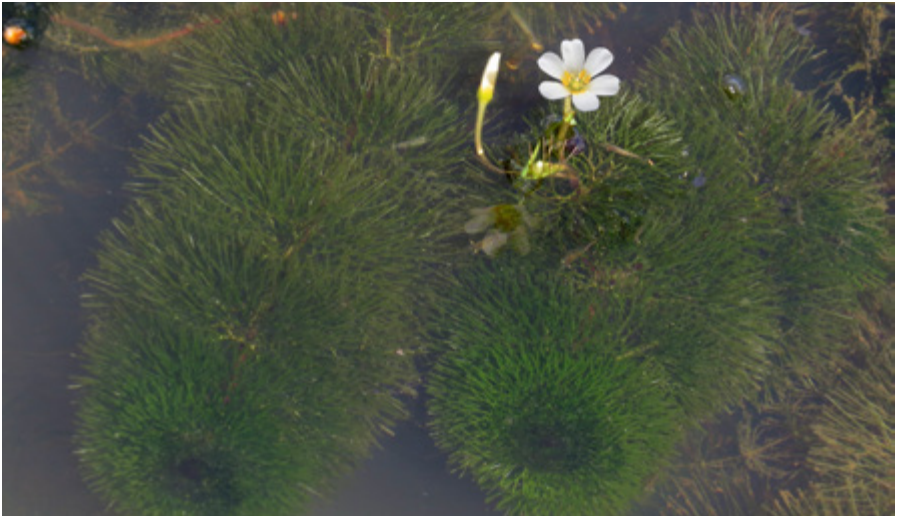


SUBMERGED PLANTS





Opposite fan-shaped leaves on end of a distinct stalk (petiole)



White six-petalled flowers held above water line

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	Not recorded fruiting in Queensland											



Declaration status: Declared Class 2 under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld), and declared a Weed of National Significance

Other common names: green cabomba, carolina fanwort

Description: Submerged perennial plant 1.5 m long, leaves are oppositely arranged, 6–11 mm long, round in outline, deeply dissected and divided into five sections. Flowers are white, symmetrical, 8–11 mm long, with six 'petals', three inner petals yellow at base with short claws, outer petals green at base. Flowers solitary, held several centimetres above water. Fruit dark, oval 3 mm long and 1 mm wide, but plants in Queensland are not known to produce viable seed.

Distinctive features: Opposite leaves are finely-divided and fan-shaped on end of long stalks (petioles). *Myriophyllum* and *Certophyllum demersum* do not have stalks attached to their leaves and *C. demersum* leaves are whorled.

Habitat: Sensitive to drying out so requires permanent water. Generally prefers shallow water with a silt bed but can grow in water 3–10 m deep, and will continue to grow when free-floating. Plants grow best (up to 50 mm/day) with high nutrient levels, high light availability, high temperatures, low salinity, low pH and low calcium levels. First recorded in 1967, it is now a widespread problem in freshwater lakes, dams and rivers in the Townsville–Burdekin region.

Impacts on wetland: Native to America, this noxious weed:

- obstructs water flow, blocking creeks, drains and irrigation infrastructure
- displaces native water plants, fish and other animals
- taints water supplies and significantly increases water treatment costs
- reduces the storage capacity of dams
- severely restricts recreational activities such as swimming, fishing and boating
- creates suitable habitats for mosquitoes to breed.

Weed facts:

- although it is still used in the aquarium trade, it is illegal to grow or sell a declared weed in Queensland.

Spread and control: Humans are the main dispersers. Plants mostly spread vegetatively from broken fragments. Seed production in Queensland is unknown but possible and requires more research. Drying out may eradicate populations. Prevention of spread by quarantine and wash-down of boats and vehicles is the highest priority in susceptible areas. Contact your local council Lands Protection Officer for advice on controlling infestations. For further information on control, refer to Department of Agriculture, Fisheries and Forestry—Cabomba: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/cabomba.



Whorls of finely divided leaves with marginal teeth



Leafy stems often form dense submerged mats

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Hornwort

Ceratophyllum demersum – Family Ceratophyllaceae

Other common names: coontail, common hornwort. Previous scientific name *Ceratophyllum muricatum*

Description: Submerged perennial plant, floating or weakly attached to substrate, to 60 cm long. Roots are absent. Leaves whorled, 15–35 mm long, branching 1–4 times, each of the fine thread-like ‘leaves’ has teeth along its length. Flowers are inconspicuous, male and female separate, petals absent. Fruit is dark brown 3–4 mm long with 1–3 spines up to 3 mm long.

Distinctive features: Whorled, finely-divided leaves with small marginal teeth arising directly from the stem. Leaves of *Cabomba caroliniana* are borne on the end of stalks and are oppositely arranged. *Myriophyllum spp.* do not have marginal teeth on leaves.

Habitat: Occurs in still and slow-moving freshwater, including coastal rivers and creeks (especially those with weirs and dams), bunded wetlands, oxbow lakes, flood plains or permanently wet drainage channels. Occurs in water up to 5 m deep, and generally only where salinity is relatively low.

Value in wetland:

- provides important aquatic habitat in permanent water bodies
- effective in absorbing nutrients
- can become prolific with high nutrients, and has become a weed in countries outside its native range, forms dense underwater mats, creating hazard for swimmers and entanglement has resulted in drowning. It is sometimes managed by mechanical harvesting.

Plant uses:

- used in traditional medicine for ulcers, diarrhoea, scorpion stings and to improve healing of wounds
- it rapidly absorbs nutrients and apparently limits algal blooms making it a useful plant in managing wastewater
- effective in removing heavy metals such as lead, zinc, and copper from solution
- in some countries it is used in animal feed and for mulching
- a popular aquarium plant.

Propagation: Propagation is normally from tip cuttings; however, seeds can be germinated in submerged pots. It is propagated from seeds which are heavier than water and sink to the bottom.





Short leaves usually in whorls of five, with minute serrations on the margins, growing as a low mat or with long stems



Submerged mass of Hydrilla stems

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting							●	●	●	●		

Water thyme

Hydrilla verticillata – Family Hydrocharitaceae



Other common names: hydrilla. Previous scientific name: *Serpicula verticillata*

Description: Submerged perennial plant, attached to substrate, stems up to 2 m long. Produces tubers under the ground. Leaves in whorls of 3–8 (usually 5), 2–20 mm long, 1–5 mm wide. Leaf margins finely toothed with pointed tip. Male and female flowers separate but rarely seen. Female flowers white and transparent, 2–3 mm long, solitary, borne on long stalks. Male flowers are round and released to float to the surface, where they burst and release their pollen. Fruit rarely seen, to 7 mm long.

Distinctive features: Broad, whorled leaf with serrated margin. *Najas tenuifolia* has narrower leaves, leaf stalk sheathing at base and leaves usually sub-opposite. Aquarium keepers can mistake it for *Elodea canadensis* which has leaves in whorls of three and no teeth or serrations of the leaf margin.

Habitat: Occurs in still and slow-moving freshwater bodies such as lakes, dams and slow-moving creeks. High abundance is usually an indicator of high nutrient levels. *Hydrilla* has a high resistance to salinity.

Value in wetland:

- in a natural wetland community *Hydrilla* is not regarded as a weed, and will improve water quality and provide a valuable habitat for juvenile fish
- absorbs nutrients directly from water
- under high nutrient levels, it can grow rapidly and become weedy, displacing other species. It has become a serious weed in the United States and herbicide resistant in some areas.

Plant uses:

- commonly available as a dietary supplement, containing high levels of calcium and vitamin B-12
- claims of medicinal value include properties that are anti-tumour, antibacterial, improve cardiovascular function, improve digestion and circulation, and increase endurance
- used in traditional medicine to treat abscesses and boils and to improve healing of wounds
- ability to absorb nutrients directly from water makes it useful for treating wastewater, though generally requires high dissolved oxygen levels
- a popular aquarium plant for improving oxygen levels and providing food for fish
- of scientific interest for its ability to switch between C3 to C4 photosynthesis pathways, depending on conditions.

Propagation: Seeds are rarely seen.

Propagation chiefly by stem pieces or from vegetative buds that develop in leaf axils. Underground tubers can be divided.



Emergent leaves change shape (feather-like)



Upright emergent stems with flowers and buds



Feather-like emergent leaves become reddish/purple

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●			●	●	●	●	●	●	●	●	●
Fruiting	●			●	●	●	●	●	●	●	●	●

Parrot's feather

Myriophyllum verrucosum – Family Haloragaceae

Other common names: water milfoil, red milfoil. Previous scientific name: *Myriophyllum variifolium* var. *microphyllum*, *Myriophyllum crispatum*

Description: Perennial submerged and emergent herb, attached to substrate, 0.1–1.5 m long. Submerged and emergent leaves are very different. Submerged leaves are whorled, round, 7–18 mm long, deeply divided into 12–20 thread-like 'leaves'. Emergent leaves are whorled, deeply lobed/'feather-like' 2–7 mm long, 2–4 mm wide, often becoming reddish/purple. Male and female flowers separate. Male flowers are yellowish, round to oblong, and 0.6–0.8 mm long. Female flowers are simple, petals absent. Flowers borne at junction of emergent leaves and stem. Fruit is an elongate nut with longitudinal ridges, 1.4–1.5 mm long.

Distinctive features: Whorled, compound, feather-like leaves that are both submerged and emergent. *M. simulans* leaves are longer (more than three times as long as wide). The introduced invasive weed *M. aquaticum* does not occur in this region but is often grown in aquariums.

Habitat: Occurs on the margins or shallow sections of rivers, creeks, oxbow lakes and farm dams in fresh or brackish water generally less than 0.5 m deep. Its different leaf types make it tolerant of cycles of flooding and drying, and it will grow in wet mud. Can become over-abundant when nutrient levels are high.

Value in wetland:

- an attractive plant, providing a valuable aquatic and terrestrial cover on muddy margins of wetlands
- effective for absorbing nutrients
- in high abundance it can block drains and pumps, and taint water.

Plant uses:

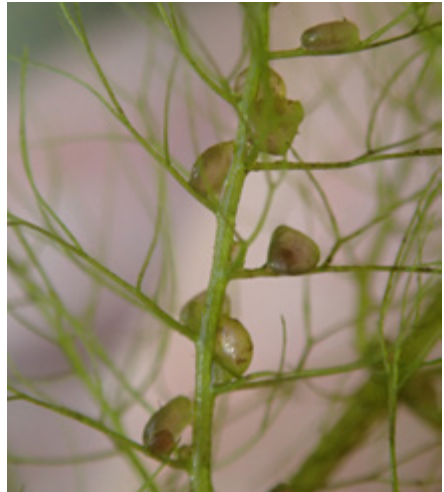
- used medicinally as a cure for diarrhoea and to reduce fever
- used to treat wastewater due to its ability to absorb nutrients but plants may become toxic from high concentrations of hydrogen cyanide
- used in artificial wetlands such as ponds and dams to improve water quality (does not thrive in aquariums)
- used as feed for pigs, ducks, and fish but can be poisonous under some conditions
- used in polishing wood.

Propagation: Seeds are thought to be able to remain dormant in dried mud for years. Usually propagated by stem cuttings. Planted into artificial wetlands at one per square metre.





Yellow flowers with a large upper petal



Stems covered with small bladder traps



The whole plant is submerged, except for the bright yellow flowers
Usually inconspicuous, bladderworts are spectacular when flowering en masse

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Floating bladderwort

Utricularia gibba – Family Lentibulariaceae

Other common names: creeping bladderwort, humped bladderwort.
Previous scientific name: *Utricularia exoleta*

Description: Submerged annual or perennial plant, free-floating or weakly attached to substrate, to 20 cm long. Roots absent but anchors with specialised stems (stolons). Leaves opposite, alternate or whorled towards the tip, 5–15 mm long. Each leaf is deeply divided into 1–2 main segments, then into numerous thread-like leaflets, many bearing small rounded sacs (bladders) 1–2.5 mm long, used as vacuum traps to capture microscopic animals. Flowers bright yellow, with large upper petal and smaller lower petal, often with red nerves, 4–25 mm long, borne several centimetres above water in groups of 1–3 on erect stalks up to 30 mm long. Fruit round, 2–3 mm diameter, winged.

Distinctive features: ‘Leaves’ sparsely branched. Bladder traps are attached to leaves by a short stalk. *U. aurea* and *U. australis* are both aquatic with yellow flowers; however, both have a smaller upper petal than lower petal.

Habitat: A common plant of still or slow-flowing wetlands, including river margins, lakes, swamps and drainage channels. Prefers full sun and shallow water. Although it can grow as a free-floating plant, it does best when loosely attached to the substrate and where levels of nutrients such as phosphorus and nitrogen are low.

Value in wetland:

- an attractive flowering plant in the shallow margins of wetlands, providing fish habitat and improving oxygen levels.

Plant uses:

- a popular novelty aquatic carnivorous plant for outdoor ponds and small dams, but generally not popular in aquariums due to its untidy growth habit
- sometimes planted for mosquito control; however, its usefulness is dubious
- this plant is famous among geneticists due to its very small genome.

Propagation: Regarded as very easy to propagate and grow. Can be grown from seeds but normally grown from divided sections wedged into a submerged pot of sand and peat. Best not to fertilise but grow in pond water to provide the necessary zooplankton such as rotifers and copepods.





Thin strap-like leaves and coiled flowering stems



Female flowers enclosed in a sheath



Long strap-like leaves and coiling flower stems are distinctive

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering			•	●	●	●	●	•	•	•	•	•
Fruiting			•	•	•	●	●	●	●	•	•	•

Ribbonweed

Vallisneria nana – Family Hydrocharitaceae



Other common names: eel grass, freshwater eelgrass, narrow leaf eelgrass, jungle val.
Previous scientific name: *Vallisneria spiralis*

Description: Perennial herb, with submerged or floating thin leaves and slender above-ground stems (stolons) about 50 mm long. Leaves are long and strap-like, 700 mm–2+ m long, 6–15 mm wide, with 3–5 obvious longitudinal veins and minute teeth along the leaf margins. Male and female occur on separate plants. Female flowers green with inconspicuous petals, enclosed in a sheath (spathe) 9–18 mm long and borne on the ends of long spiralling stems (peduncles) to 700 mm long. Male flowers are minute (0.5 mm) and produced in leaf sheaths at the base of the plant. The male flowers break off and rise to the surface where they pollinate the floating female flowers. Pollinated flowers are pulled underwater and produce a cylindrical greenish yellow fruit, about 10–90 mm long, 2.3–3.3 mm wide, with numerous small seeds 1.3–1.6 mm long, covered in dense, short hairs.

Distinctive features: *V. nana* is perennial with blunt (acute to obtuse) leaf tips, *V. annua* is an annual with tapering (attenuate) leaf tips. Other introduced *Vallisnerias* often grown in aquariums (Java moss).

Habitat: Grows submerged in still or, preferably, gently flowing permanent water in creeks, rivers, billabongs, flood plain channels, and irrigation drains in water 0–1.3 m deep. Can grow vigorously under high light levels. Prefers low salinity and a mud or sandy substrate.

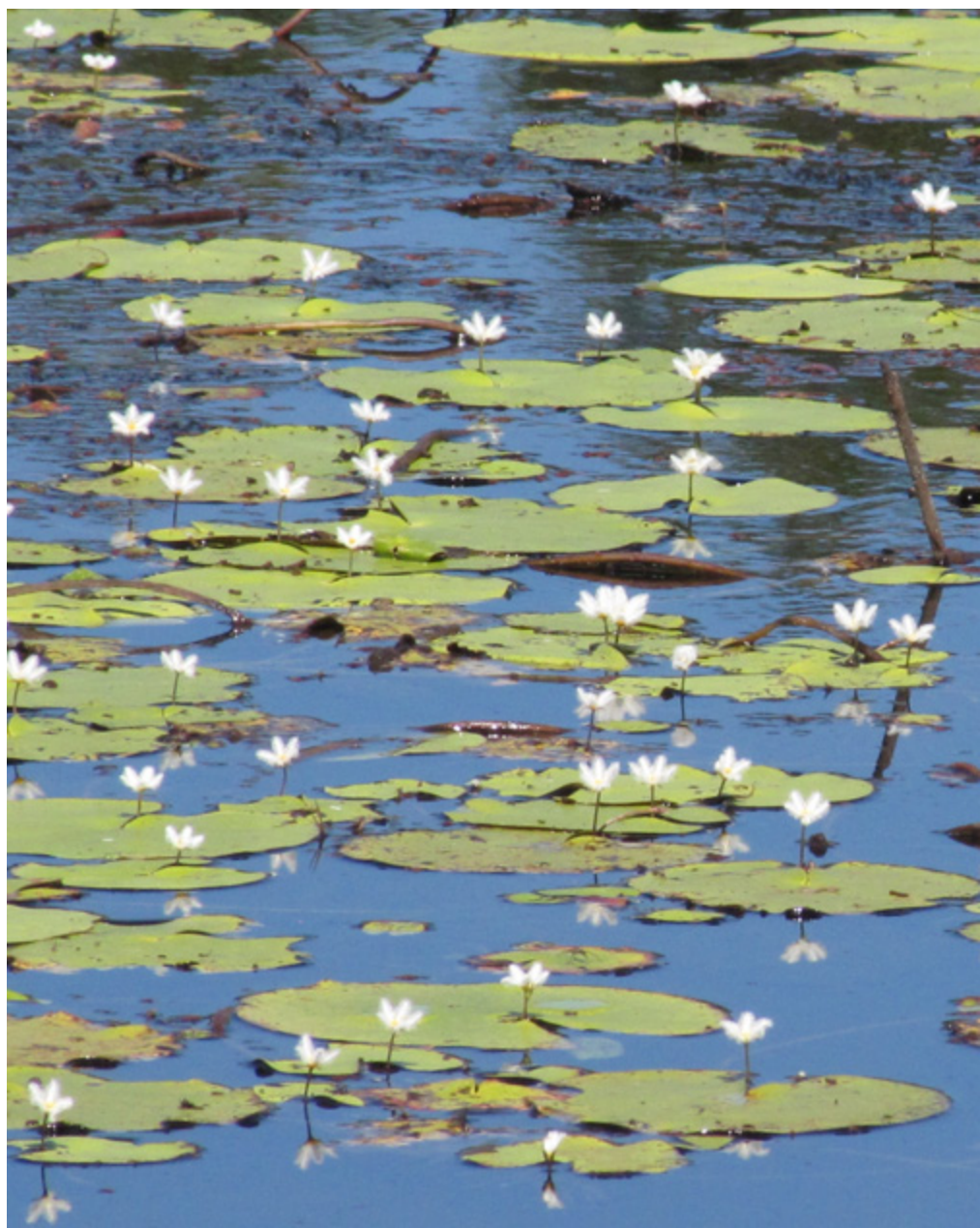
Value in wetland:

- considered a keystone (very important) submerged plant species, providing valuable in-stream habitat and food for fish, macroinvertebrates and freshwater turtles
- although this species can become over-abundant in waterboard channels, it has generally declined significantly in natural habitats in the Townsville–Burdekin region and other parts of its range in northern Australia due to changes in flow rates and turbidity
- it is a useful indicator species for a range of ecosystem health issues, including nutrient levels, competition from weeds and turbidity.

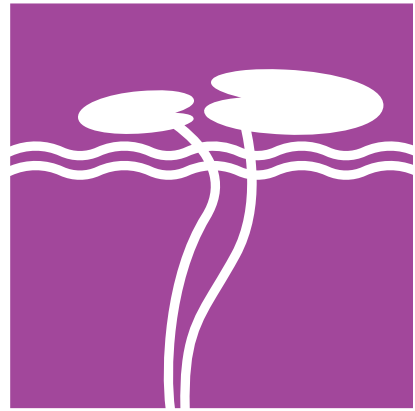
Plant uses:

- a useful submerged aquatic species suitable for use in constructed wetlands. Has been promoted for use in stormwater projects in Townsville
- very popular aquarium plant, apparently good for providing oxygen, and several cultivated varieties are known. Often grown in pots to limit spread in the aquarium.

Propagation: Seeds may require acid treatment to germinate, usually propagated by dividing the stolon.



FLOATING ATTACHED PLANTS





Emergent spikes of small, golden yellow flowers



Fruits with a prominent beak



Large population in a shallow seasonally dry (ephemeral) freshwater pool

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●				●	●
Fruiting	●	●	●	●	●	●	●					●

Queensland lace plant

Aponogeton queenslandicus – Family Aponogetonaceae

Other common names: Aboriginal names:

Koomabie, Bangana, recorded by Jimmy Morrill (1863). Previous scientific name: *Aponogeton monostachyos*

Description: Emergent perennial herb, leaves mostly floating and consist of underground tubers (dies back to underground tubers during the dry season). Single leaf at the end of long stem (petiole) up to 700 mm long, leaf elliptic to lance shape 28–140 mm long, 6–43 mm wide. Flower cluster (inflorescence) usually emergent, single, 15 mm long, yellow. Flowers closely packed into a cylinder. Fruits 2.5–4.5 mm long, 2.3–3 mm wide; with prominent beak, often curved.

Distinctive features: Almost all leaves floating on water surface, heart-shaped (cordate) at base, borne on long stalks (petioles). Species of *Potamogeton* can appear similar but have multiple leaves arising from a single stem (*Aponogeton* only has single leaf on the end of each stem). *Ottelia ovalifolia* has larger leaves and a large white flower. Floating leaves of *Monochoria vaginalis* are similar, but mature leaves are emergent. Several other Asian and Madagascan *Aponogeton* species are grown in aquariums but no wild populations are known.

Habitat: Restricted to still or slow-flowing shallow seasonally dry (ephemeral) freshwater pools, 30–60 cm deep, with clay or sand substrates; absent from permanent or deeper waters. Usually in full sun and dies back to an underground tuber during the dry season.

Value in wetland:

- an attractive flowering aquatic plant for ephemeral wetlands and shallow-drying margins of dams
- formerly listed as a threatened plant in Queensland due to over-collection for the aquarium trade.

Plant uses:

- underground tubers were baked and eaten by Aboriginals in the Townsville–Burdekin region.

Propagation: Rarely cultivated and information of propagation is limited. It is generally believed that this species requires a drying-out period and is therefore not a good aquarium plant.





Branched clusters of flowers on end of tall stalks with three white petals



Floating leaves may resemble water lilies

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	•	
Fruiting	•	•	•	•	•	•	•	•	•	•	•	

Other common names: Adamasonium.

Previous scientific name: *Alisma oligococcum*

Description: Annual floating plant with flowers on end of tall emergent stalk. Round leaves 60–250 mm long, 180 mm wide, deeply notched leaf base (cordate); with 9–17 prominent parallel veins and prominent cross veins. Flower cluster (inflorescence) pyramid shape 80–300 mm long on the ends of long stems (peduncle) up to 600 mm long. Flowers white, 2.5–6 mm long with three petals and six stamens. Fruit (achenes) kidney shaped, faintly compressed, 1.5–4 mm long, with four prominent ribs and with blunt warts or short spines.

Distinctive features: Broad floating leaves with emergent flowers arising from long branched stalks. *Nymphoides indica* flowers do not rise from long stalks and leaves do not have the prominent nerves and cross veins.

Habitat: Generally grows in shallow freshwater 20–30 cm deep, usually in seasonally dry (ephemeral) depressions, drains and lagoons, or seasonally dry margins of lagoons, billabongs and riverbanks. Plants usually die back to an underground rootstock during the dry season.

Value in wetland:

- an interesting and distinctive component of seasonal (ephemeral) wetlands
- the abundant seeds are an important food resource for water birds.

Plant uses:

- used in traditional medicine—a tea (infusion) of leaves is astringent, increases urination (diuretic), increases perspiration (diaphoretic) and healing of wounds
- popular and easily grown as a bogplant or aquatic plant in shallow dams and ponds.

Propagation: Propagate by planting seeds in a pot standing in water, or by dividing the rootstock.





Robust erect clumps of rounded leaves



Yellow flowers on the end of angular branched stems



Infested rice paddy, Sulawesi, Indonesia

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	●	•
Fruiting	•	•	•	•	•	•	•	•	•	•	•	•



Declaration status: Declared Class 1 (prohibited plant) under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld)

Other common names: bur head, sawah flower rush, sawah lettuce, velvetleaf

Description: Perennial attached herb, 0.2–1.2 m tall. Leaves rounded and succulent 50–300 mm long, 40–250 mm wide, arising from angular stalks, 50–750 mm long. 11–15 parallel veins. Flower heads (inflorescence) borne on angular stalks from the base of the plant, each with 5–15 pale yellow flowers. Flowers have three white or yellow petals, and numerous bright yellow stamens in the centre. Fruit is a globular capsule which splits into 10–20 floating segments, each crescent containing about 1000 shaped dark brown seeds, 10–15 mm long.

Distinctive features: Succulent angled stems and triangular leaf stalks are distinctive. Distinguished from *Eichornia* (water hyacinth*) by being anchored, having taller triangular leaf stalks, broader leaves with more prominent veins and pale yellow flowers.

Habitat: Prefers shallow muddy areas with good nutrient levels in freshwater pools, swamps, irrigation ditches and margins of slow-flowing streams. Grows as a significant weed of rice paddies in South East Asia. Since 2001, this plant has been subjected to an eradication campaign in Queensland, and in 2014 there are no known populations in the Townsville–Burdekin region.

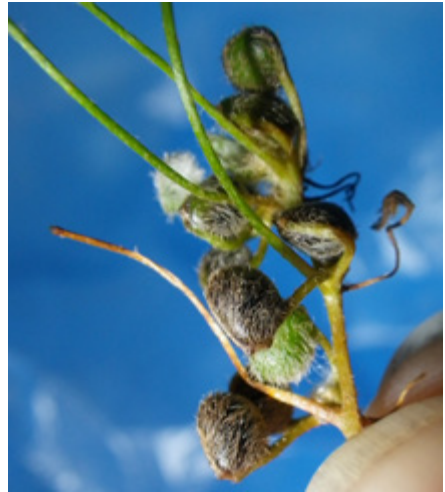
Impacts on wetland: Originally from Central and South America, this weed:

- forms dense infestations that displace native plants and animals
- chokes waterways and irrigation channels
- provides mosquito-breeding habitats and traps silt
- has a significant impact on agriculture, especially rice.

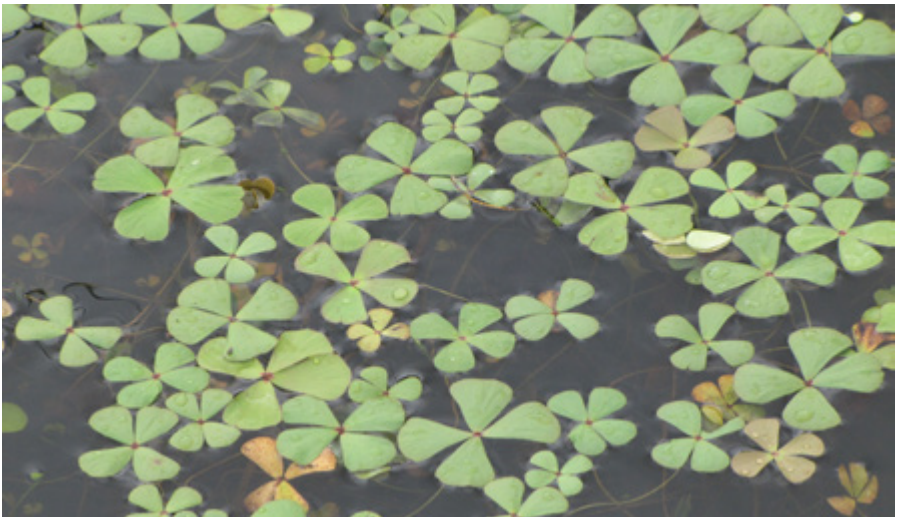
Weed facts:

- previously used as an ornamental pond plant; however, it is illegal to grow or sell a declared weed in Queensland. This is a Class 1 weed, thus, importation into Australia is prohibited. Any sightings should be immediately reported to Biosecurity Queensland.

Spread and control: Produces abundant seeds, which are dispersed by running water, water birds and animals, and by mud attached to vehicles, boats, machinery and footwear. Therefore, good hygiene practices, such as washing down vehicles and equipment, are critical in preventing spread. Seeds may remain dormant for several years. Also reproduces vegetatively from cuttings, detached leaves and stems. For information on control, refer to the Department of Agriculture, Fisheries and Forestry—Limnocharis: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/limnocharis.



Hairy spore capsules (sporocarps) produced in clusters beneath the ground



Masses of floating leaves with four wedge-shaped leaflets

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	Not applicable											
Fruiting	Not applicable											



Other common names: smooth nardoo, water clover, four-leaved clover, false pepperwort. Previous scientific name: *Marsilea elata* var. *crenata*

Description: Perennial floating or creeping herb with underground stems (rhizomes). Stems (stipes) about 25–300 mm long, hairless (glabrous). Leaflets wedge shaped in clusters of four, sometimes yellowish at base, 5–27 mm long, 4–28 mm wide. Broad ends of leaves may have a wavy (crenate) margin. No flowers are produced. Spore capsules (sporocarps) in clusters beneath the ground, 4.5–6 mm long, densely hairy.

Distinctive features: *Marsilea mutica* has coloured bands towards the base of some leaflets, and stalks are longer than the size of the spore capsules (sporocarps), compared to *M. crenata*, whose stalks are a similar length to the size of the sporocarps. *M. hirsuta* spore capsules are more than 4 mm long (< 3 mm in *M. crenata*).

Habitat: Grows in mud in shallow water up to 20 cm deep, and the wet, damp or drying margins of still and slow-flowing fresh water bodies. In water, the leaves float on the surface of the water but on mud banks can form a 'carpet' amongst grasses and sedges.

Value in wetland:

- sporocarps eaten by water birds which often pass through undamaged
- protects and stabilises mud banks, preventing erosion
- it provides a moist microclimate during dry periods, providing valuable habitat for frogs and invertebrates.

Plant uses:

- an important traditional staple plant food—Aboriginals pulverised and ground the sporocarps between two stones to obtain a yellow starchy power that could be mixed with water, kneaded into dough and baked in ashes to make a damper. However, special preparation is necessary, as the plant contains toxic levels of thiaminase, an enzyme that destroys thiamine (vitamin B1)
- some nardoo species are known to be toxic to livestock (especially sheep) when there is lush new growth
- leaves are a popular ingredient of cuisine in East Java and Thailand, but alone are not tasty
- used for treating household greywater
- a valuable plant for stabilising mud banks and banks of wetlands
- commonly grown in aquaria and outdoor ponds.

Propagation: Propagation is usually by planting sporocarps or by separating the underground stems (rhizomes). Plant on boggy margins, not actually into water. Spores are drought-resistant and can remain dormant for many decades.



Large spectacular flowers and erect round leaves



Leaves, flowers and fruit borne on the end of robust stems

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering			•	•	•	•	•	•	•	•	•	
Fruiting	•	•	•	•	•	•	•	•	•	•	•	•

Pink lotus lily

Nelumbo nucifera – Family Nelumbonaceae

Other common names: sacred lotus, pink water lily. Previous scientific name: *Nelumbo speciosa*, *Nelumbium leichhardtii*

Description: Perennial robust herb, with underground stems (rhizomes) containing large hollow chambers up to 10 mm wide. Leaves initially floating, becoming mostly erect on spiny stems (petiole) to 1.5 m long. Leaves rounded, 200–700 mm wide, waterproof, with prominent veins radiating from the centre. Flowers pink or reddish pink, rarely white, 150–250 mm diameter, with bright yellow receptacle in the centre, developing into the fruit. Fruit are a flat-topped conical structure containing multiple solitary seeds. Fruit are erect at first, then tipping towards the water upon maturity. Seeds 14–16 mm long, initially green but hardening and turning dark grey to black upon maturity.

Distinctive features: The only water lily with robust emergent leaves and large pink flowers.

Habitat: Occurs primarily in still or slow-flowing rivers, dams, billabongs, oxbow lakes, permanent or seasonally inundated swamps in water up to 2 m deep. Tolerant of a broad range of pH, but generally prefers lower salinity levels.

Value in wetland:

- generates extensive thickets along the deep margins of wetlands, creating an excellent habitat for a range of water birds, including white-browed crakes, swamp hens and bitterns
- flowers attract numerous insects, which in turn attract insectivorous birds. The pink lotus is able to generate heat in the flowers to maintain a warm temperature, possibly a mechanism to attract pollinating insects.

Plant uses:

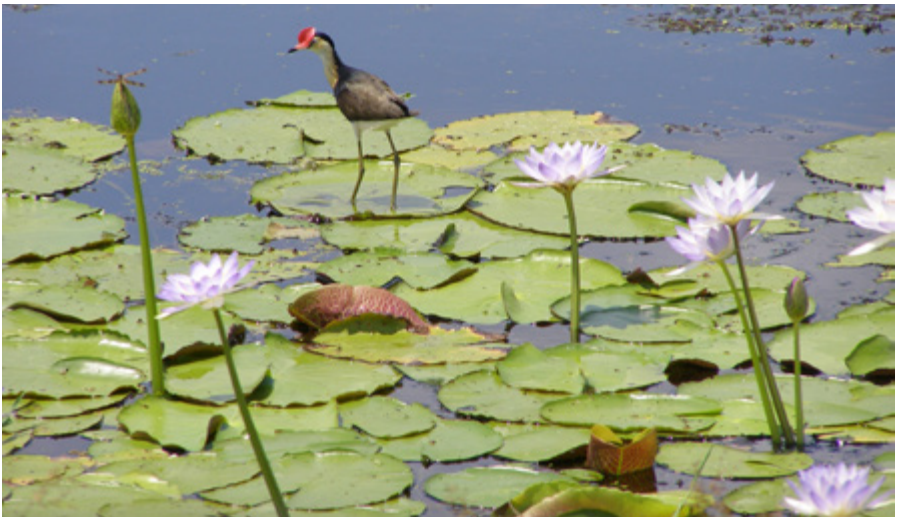
- Aboriginals ate the immature peanut-sized seeds raw, roasted or boiled, or ground into flour for bread. The explorer Ludwig Leichhardt roasted and pounded the seeds as 'a most excellent substitute for coffee'. Flower petals are used in soups or as a garnish
- edible rhizomes raw or cooked. In Asia, they are boiled and dried, or tinned and used as a vegetable, or candied as a sweet. Aboriginals ate the lower part of leaf stalks after stripping off the tough outer skin
- extensively used in Chinese medicine—seeds are used as a tonic tea to stop vomiting, soothe stomach upsets, and cure insomnia, fever, restlessness and hypertension. The leaves and juice from leaf stalks used to cure diarrhoea, fever, haemorrhoids and leprosy (untried by authors). Rhizomes used to cure diarrhoea. General cure for mushroom or alcoholic poisoning
- the distinctive conical woody seed pods are used in dried floral arrangements
- huge mature leaves used as hats or to wrap food for steaming
- cultivated as an ornamental in lakes and ponds. Several cultivated varieties are known
- of great significance to Buddhists, who regard the flower as a symbol of purity and tranquillity.

Propagation: Seeds are hard and require careful cutting or sanding (scarification) before planting into submerged pots, otherwise they may remain dormant. Seeds found during archaeological excavations in China have been known to germinate after 1350 years. Commercially, the pink lotus lily is propagated by division of the rhizome to reduce genetic variation. In small ponds, they are often grown in tubs to prevent from spreading. Has been mistaken for an introduced plant.





Toothed leaves with large blue or white flowers that fade with age



In deep permanent wetlands, blue water lily provides valuable in-stream habitat for a range of water birds and aquatic macroinvertebrates.

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●							

Blue water lily

Nymphaea gigantea – Family Nymphaeaceae



Other common names: giant water lily.

Aboriginal names, Kaourou/Kaouru, recorded by Jimmy Morrill (1863). Previous scientific name: *Nymphaea georginae*

Description: Perennial robust herb, with globular underground stems (rhizomes). Floating leaves are produced on the ends of long stem (petioles) 150 cm long. Leaves round, 200–800 mm diameter (apparently increases with water depth), green above, purplish underneath, and notched deeply at the base to the centre of the leaf. The margin of the leaf has prominent teeth 4–5 mm long. Flowers up to 300 mm wide, borne on the ends of long stems (peduncles) up to 500 mm above the water. Flowers open during the day and close at night; with up to 32 petals, usually blue but can be white or, rarely, pink, fading with age. Centre of flower is a dense mass of around 400 yellow stamens. Fruit are round and spongy, around 50 mm diameter, sinking beneath the water after the flower has finished. Fruit contain numerous oval-shaped seeds to 2.5 mm, each with rows of short hairs.

Distinctive features: Often misidentified. *N. gigantea* has regularly spaced teeth to 5 mm long, unlike *N. nouchali* and *N. violacea*, with smooth leaf margins. *N. pubescens* has a toothed leaf, but is finely hairy under the leaf. *N. immutabilis* also has a toothed leaf but petals do not fade with age. The introduced *N. caerulea* has blue tips on the anthers and does not occur in this region.

Habitat: Occurs primarily in still or slow-flowing fresh water up to 3 m deep, in swales, swamps, billabongs, oxbow lakes, and on the edges of lakes and slow-flowing rivers. Prefers relatively clear water and may eventually die in turbid water.

Value in wetland:

- provides valuable in-stream habitat for a range of water birds and aquatic macroinvertebrates
- due to its sensitivity to poor water quality and invasion by water hyacinth, it is a useful biological indicator of wetland health. It forms a key threatened aquatic plant community in the Burdekin area.

Plant uses:

- most parts are edible. Australian Aboriginals roasted and ate the thick rhizomes, which are high in calories and carbohydrates compared to potatoes
- fruits were collected before they split, then roasted for easier extraction of the seeds. Seeds are high in potassium and were pounded with rocks to make flour
- young flower stalks were stripped of fibres and eaten
- Aboriginals in Western Australia rubbed the leaves over their bodies to prevent bites from aquatic leeches
- many cultivated varieties are grown in artificial pools for their colourful fragrant flowers.

Propagation: Can be propagated by seeds or by dividing the rhizome. Seeds need to be moist prior to sowing. The seed with the surrounding pulp needs to be covered by approximately 25 mm of water, with a temperature of 23–27°C. Once the first floating leaves appear, the water level needs to be increased as they grow. For propagation using the rhizome, a portion of the rhizome with a sprouting eye should be removed and potted in a small pot immersed in water.



Yellow flowers with a delicate fringed margin, round leaves with a wavy (crenate) margin



A colourful component of swamps, billabongs and dams

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	●	●	●	●	•	•	•	•	•	
Fruiting		•	●	●	●	●	●	•				

Yellow fringe lily

Nymphoides crenata – Family Menyanthaceae



Other common names: wavy marshwort, yellow villarsia. Aboriginal names: Kournabal, recorded by Jimmy Morrill (1863). Previous scientific name: *Villarsia crenatum*

Description: Perennial or annual herb with floating leaves and floating reddish above-ground stems (stolons). Leaves are green, round to oval shaped, 20–110 mm long, 15–100 mm wide, with a wavy (crenate) margin and notched from the base to the centre of the leaf. Leaves are borne on the end of long stems (petioles) up to 3 m long. Yellow flowers are borne erect above the water surface on stems (pedicels) 30–140 mm long. Flowers 20–50 mm diameter, yellow but drying to pale yellow or white, with 5–6 petals, each with a delicate fringed margin. Fringed petals increase surface tension and help prevent dunking. Fruit is an elliptic capsule containing more than 100 thin brown seeds 0.7–1 mm long.

Distinctive features: *Nymphoides aurantiaca*, *N. exiliflora* and *N. geminata* all have yellow flowers but have smooth, entire leaf margins. *N. aurantiaca* flower petals have a translucent membrane rather than a fringed margin.

Habitat: Occurs primarily in swamps, billabongs and dams, in water 0.4–1.5 m deep, but including wetlands subject to seasonal drying. Generally requires a muddy substrate.

Value in wetland:

- provides valuable in-stream habitat for a range of fish and aquatic macroinvertebrates
- flowers reflect UV to attract numerous insects, which in turn attracts insectivorous birds
- adds colour and beauty to wetlands (aesthetic values).

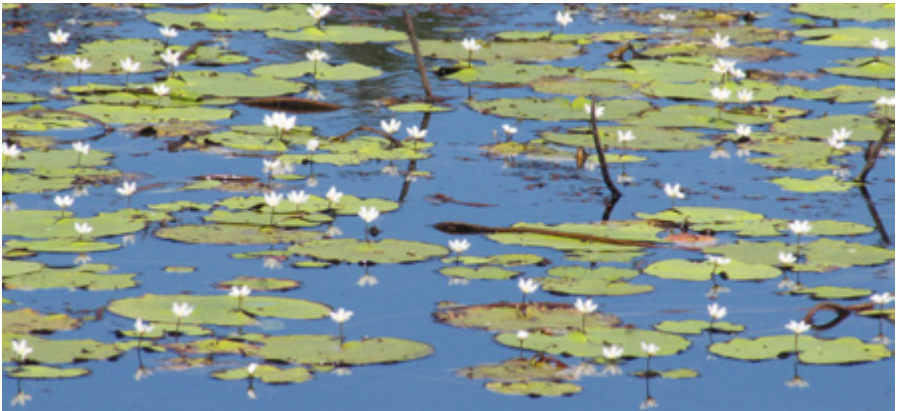
Plant uses:

- Australian Aboriginals roasted the small round tubers on coals before eating
- flower stalks are an edible green
- captures nutrients from the water so may be useful for treating storm or wastewater
- has been established easily and quickly in local constructed wetlands projects
- increasingly popular as an ornamental aquatic plant for dams up to 1 m deep and aquariums
- A number of selected forms and cultivars are available for aquatic gardeners.

Propagation: Can be propagated by dividing the root ball or from herbaceous stem cuttings. The seed is long lived and will retain its viability if stored at domestic room temperature.



White flowers with a delicate fringed margin



An abundant plant of most permanent freshwater wetlands

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting			●	●	●	●	●	●	●	●	●	

Water snowflake

Nymphoides indica – Family Menyanthaceae



Other common names: snowflake marshwort. Previous scientific name: *Menyanthes indica*

Description: Perennial or annual herb, with floating leaves and floating above-ground stems (stolons) up to 2 m long that sometimes send out roots at the nodes. Leaves are produced on the ends of long stem (petioles) 2 m long. Leaves are roughly circular in shape, 20–270 mm long, 20–250 mm wide, broadly notched at base to the centre of the leaf (cordate). Margins of the leaf are smooth or, rarely, slightly wavy. Clusters of 4–7 white flowers borne erect above the water surface on stems (pedicels) 10–80 mm long. White flowers with five (rarely, four or seven) delicately fringed petals, yellow at the base. Fringed petals increase surface tension helps prevent dunking. Fruit is a globular capsule, containing between 1–50 round seeds, 1–2 mm diameter.

Distinctive features: *Nymphoides parvifolia* and *N. quadriloba* have white flowers but much smaller floating leaves, and are annuals, not perennials. *N. quadriloba* has a horseshoe-shaped leaf and usually only four petals.

Habitat: Occurs in a broad range of freshwater wetland types, including lakes, lagoons, billabongs, swamps and margins of slow-flowing creeks and rivers. Prefers permanent water on either a clay or sandy substrate. Often naturally colonises artificial wetlands.

Value in wetland:

- provides valuable in-stream habitat for a range of fish and aquatic macroinvertebrates
- generates excellent habitat for a range of water birds, including comb-crested jacanas and white-browed crakes
- flowers reflect UV to attract numerous insects, which in turn attract insectivorous birds
- captures nutrients from the water
- adds colour and beauty to wetlands (aesthetic values).

Plant uses:

- young leaves, stems, flower buds and fruits can be boiled and eaten in curries
- used medicinally in Vietnam to treat fever and flatulence, and prevent scurvy (antiscorbutic)
- has been established easily and quickly in local constructed wetlands projects
- used in constructed wetlands to strip nutrients from wastewater
- water snowflake is a highly ornamental species popular in dams and aquariums, often as a substitute for the introduced *Nymphoides aquatica**.

Propagation: Easily propagated, as each leaf produces a plantlet. If not dislodged from the parent plant, then plants can be divided by cutting the stolons and removing the plantlets. Propagation can also be undertaken by leaf and herbaceous stem cuttings. Can be grown from seed, although division has been shown to be the simplest method.



Large white flowers with three broad white petals, maroon/magenta at base



Broad floating leaves and flowers held erect on angular stems

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●			●	●	●	●	●	●

Swamp lily

Ottelia ovalifolia – Family Hydrocharitaceae

Other common names: water poppy.
Previous scientific name: *Damasonium ovalifolium*

Description: Perennial or annual herb. Young leaves are submerged and strap-like, maturing to floating leaves borne on stems (petioles) 1.2 m long. Mature leaves are oval shaped, 160 mm long, 30–70 mm wide, and tapering to a blunt point. Leaves are reddish underneath and usually have seven prominent veins. Flowers 60 mm diameter, borne on angular stems (peduncle) with three broad white petals, maroon/magenta at base, lasting one day. A second type of flower is produced underwater, never opens and is self-pollinated (cleistogamous). Fruit is a submerged bladder-like sac (utricle) containing numerous seeds embedded in a gluey substance.

Distinctive features: Floating leaves similar to *Aponogeton*, which does not have numerous distinct veins. *O. alismoides* has completely submerged leaves and the centre of the flowers are yellow, without any magenta colouring.

Habitat: Occurs primarily in still or slow-flowing freshwater creeks, dams, lagoons, billabongs or swamps, to 1 m deep, with muddy substrates. High growth rates are often indicative of high nutrient levels.

Value in wetland:

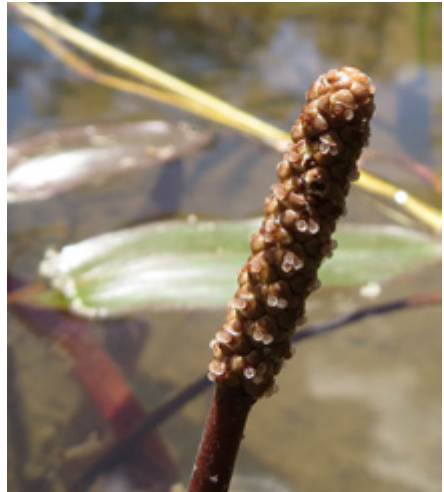
- provides valuable in-stream habitat for a range of fish and aquatic macroinvertebrates
- important dry season source of food for fish and water birds
- captures nitrogen and phosphorus nutrients from the water
- adds colour and beauty to wetlands (aesthetic values).

Plant uses:

- leaves, flowers, fruit and stems cooked as a vegetable in South-East Asia
- Australian Aboriginals ate the tubers and roots but method of preparation is unknown
- in the Philippines, leaves are used as a poultice (compress) to treat fevers and haemorrhoids
- used in constructed wetlands for removal of nitrogen and phosphorus
- often grown in outdoor ponds and dams for attractive flowers and leaves. Reported to be difficult to grow, but can also be over-abundant when there are excess nutrients
- provides drought feed for stock.

Propagation: Can be propagated from fresh seed, which germinates readily in mud and in warm, shallow water to produce narrow, entirely submerged ribbon-like leaves.





Leaves with parallel veins and short erect flower spikes



Multiple leaves arranged alternately along floating stems

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	•	•
Fruiting				•	•	•	•	•	•	•	•	•

Floating pondweed

Potamogeton tricarinatus – Family Potamogetonaceae

Other common names: furrowed pondweed.
Previous scientific name: *Potamogeton natans*

Description: Annual or weakly perennial herb, with submerged and floating leaves, and underground stems (rhizomes). Submerged leaves, lance-shaped 80–110 mm long, 15–25 mm wide. Floating leaves borne alternately along stems up to 3 m long, connected via a leaf stalk (petiole) 25–11 mm long. Leaves broad to oval shaped, 20–70 mm long, 7–30 mm wide, with 11–15 veins, reddish underneath. Flower head (inflorescence) is a dense spike 30 mm long, held erect above water level. Individual flowers 3–4 mm wide, followed by small fruit 3–3.5 mm long with a short beak.

Distinctive features: *Aponogeton* has only a single leaf on the end of each stalk and no obvious parallel veins. *Potamogeton crispus* has long, thin submerged leaves with a distinctly wavy margin. *Potamogeton octandrus* has long, thin submerged leaves.

Habitat: Grows in either permanent or seasonally dry (ephemeral) water bodies, either shallow or up to 3 m depth, including dams, billabongs, channels, rivers and gilgai depressions. Prefers a muddy substrate but has been recorded on rocky substrates.

Value in wetland:

- provides valuable in-stream habitat for a range of fish and aquatic macroinvertebrates
- captures nitrogen and phosphorus nutrients from the water
- can become seasonally over-abundant in dams and irrigation channels, blocking pump intakes.

Plant uses:

- used in constructed wetlands for removal of nitrogen and phosphorus from storm and wastewater. Tolerant of broad range of water quality and light levels
- grown as an ornamental in outdoor ponds and dams, but not often used in aquariums despite being able to be pruned to maintain the submerged leaves.

Propagation: Can be propagated from seeds or, more simply, vegetatively from rhizomes and stem fragments.





FREE FLOATING PLANTS





Scale-like leaves harbour blue-green algae. Plants turn red in bright sunlight.



Floating plants are triangular with small scale-like leaves

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	Not applicable											
Fruiting	Not applicable											

Water fern

Azolla pinnata – Family Azollaceae



Other common names: ferny azolla

Description: Free-floating perennial fern to 30 mm long, generally triangular-shaped with feathery roots. Fronds with scaly lobes 1 mm long in alternating rows; initially green but changes colour to reddish when exposed to direct sunlight. Upper rows of leaves contain photosynthetic blue-green algae (*Anabaena azollae*). Reproduces either vegetatively from broken fragments or by two types of spores. Microspores or produced in conical structures under the plant surface, while megaspores are produced in the lower lobe of the leaves.

Distinctive features: *A. pinnata* has fine rootlets that are absent from *A. filiculoides*. *A. filiculoides* is irregularly shaped, not triangular like *A. pinnata*.

Habitat: Occurs primarily in still or slow-flowing rivers, creeks, channels, ponds, swamps and dams. Often occurs as scattered plants caught up in vegetation along the sides of creeks but, in the presence of high nutrient levels, especially phosphorous, it can double every seven days and eventually completely cover water bodies.

Value in wetland:

- through its association with blue-green algae, *Azolla* fixes atmospheric nitrogen and rapidly takes up nutrients in the water, thereby limiting the growth of introduced weeds such as salvinia* and water hyacinth* and, by reducing light penetration, reduces blooms of blue-green algae
- provides a high protein food source and habitat for water birds, fish, insects, snails and crustaceans
- high nutrient loads may cause *Azolla*

to become over-abundant, potentially blocking pumps and water inlets, and reducing stock access to water; however, spraying herbicide on *Azolla* will cause de-oxygenation of the water, potentially causing fish-kills. If *Azolla* is removed from high nutrient wetlands, toxic algal blooms may result.

Plant uses:

- valuable as a biological indicator of nutrient levels in wetlands
- valuable in constructed wetlands for reducing nutrient loads and limiting algal growth
- mats of *Azolla* can be used as a form of biological mosquito control by preventing mosquito larvae surfacing for air (sometimes called 'Mosquito fern')
- excess *Azolla* can be harvested, and has been used for compost or as a chicken feed supplement
- grown as companion plant in rice paddies, as it fixes nitrogen and suppresses weeds
- attractive plant easily grown in dams, garden ponds and aquaria
- of botanical interest as a living fossil—*Azolla* fossils extend back at least 80 million years.

Propagation: *Azolla* is propagated vegetatively and from fragments. Under ideal conditions, it can double every seven days.



Floating plant with round glossy leaves and clusters of large pink/purple flowers



One of the world's most invasive water weeds, it can completely cover water bodies

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●			●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●



Declaration status: Declared Class 2 under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld) and declared a Weed of National Significance

Other common names: Previous scientific name: *Pontederia crassipes*, *Eichhornia speciosa*

Description: Perennial floating herb to about 1 m tall, with dense masses of fibrous purple or black roots, and connected via spongy above-ground stems (stolons). Leaves glossy green, almost circular in shape, 30–250 mm diameter, held erect on stems (petioles) 30–750 mm long, 30 mm wide, swollen and spongy towards the base. Flower head (inflorescence) is a vertical spike to 200 mm long, with 4–20 flowers. Flowers 60–100 mm wide, with six petals, pink or purple. Upper petal with a blue circle surrounding a yellow blotch. Fruits are a capsule 15 mm long, submergent, containing multiple seeds.

Distinctive features: Clusters of large pink or purple flowers, floating habit, bulbous stems are rounded, leaves are highly distinctive. *Limncharis flava** is superficially similar but has yellow flowers.

Habitat: Occurs primarily in still or slow-flowing freshwater wetlands, including rivers, creeks, swamps, billabongs and dams. Under high nutrient loads it is capable of doubling every two weeks, eventually covering entire water bodies. Has a relatively low salt tolerance so has benefited from bunding of salt-marsh areas that are supplemented with irrigation runoff. Floating rafts often get flushed into brackish and saline areas, where they eventually die.

Impacts on wetland: Native to South America, this noxious weed is widely considered to be the world's worst water

weed, due to the following impacts:

- rapidly covers the surface of water, blocking light, reducing oxygen, killing aquatic plants, and reducing fish and water bird diversity
- blocks water flow in creeks and irrigation channels, blocks access to water by stock and wildlife, limits boat and recreational access, ruins fishing grounds, clogs hydro-electricity turbines and increases flood damage
- infestations may benefit mosquitoes
- high rates of evapotranspiration causes water loss from dams far in excess of normal evaporation
- floating mats allow other weeds to establish
- decaying hyacinth increases nutrient levels, causing algal blooms and loss of oxygen.

Weed facts:

- young leaves edible after boiling
- stems are used as a source of fibres for making cord, or pulp for making paper
- originally used in the aquarium trade since the 1890s; however, it is illegal to grow or sell as it is a declared weed in Queensland
- its high uptake of heavy metals makes it generally unsuitable for use as stock fodder.

Spread and control: Seeds may germinate in a few days or remain dormant for up to 15 years; however, most spread is vegetative by growth of new plants from stolons. A biological control agent *Neochetina bruchi* leaves distinctive scars on the leaves. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. For further information on control, refer to Department of Agriculture, Fisheries and Forestry—Water Hyacinth: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds/a-z-listing-of-weeds/photo-guide-to-weeds/water-hyacinth.



Floating plant with an oval-shaped leaf and a single root, divides to form daughter plants



Plants may form dense colonies when nutrient levels are high

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	•	•
Fruiting	•	•	•	•	•	•	•	•	•	•	•	•

Lesser duckweed

Lemna aequinoctialis – Family Araceae



Other common names: common duckweed, tropical duckweed, three-nerved duckweed. Previous scientific name: *Lemna perpusilla*

Description: Free-floating annual or perennial herb 1–6 mm long, consisting of a green, oval, lance-shaped to round leaf, flat with three indistinct veins, and a single root to 30 mm long, with a sheath at the base. Flowers are produced on separate leaves, inconspicuous, minute, developing into small fruit 0.5–0.8 mm long.

Distinctive features: Many other duckweed species look superficially similar. Roots in *Wolffia angusta* are absent and often absent in *L. trisulca*. *L. trisulca* often grows as branched chains. *Spirodela oligorrhiza* and *S. polyrrhiza* have more than one root per plant.

Habitat: Occurs as a floating plant in still freshwater ponds and lagoons, and among streambank vegetation in lakes and slow-flowing waterways, often where medium-high nutrient levels are present.

Value in wetland:

- important native floating plant, providing structural diversity in wetlands
- important protein-rich food for waterfowl such as ducks
- valuable indicator of nutrient levels, improves water quality by removal of excess nutrients
- used for toxicity bioassays to test for water quality parameters and levels of toxins.

Plant uses:

- can be cooked as a vegetable
- used medicinally in South-East Asia to treat hypothermia, flatulence and acute kidney infections
- this and other duckweed species are widely used in constructed wetlands throughout the world to improve water quality. They are highly effective in removing suspended solids, faecal coliforms and nutrients, especially nitrates
- duckweed can be grown and harvested for stock feed, generating 10–30 tons of dried feed per hectare per year
- harvested *Lemna* has been successfully converted to produce gasoline, diesel and kerosene
- often grown in dams as a food source for ducks, pygmy geese and other water birds. Freshwater fish enthusiasts often grow duckweed as live food for goldfish and native freshwater fish
- of interest to botanists as these are among the smallest flowering plants in the world.

Propagation: Plants rarely flower and set seed. Reproduction is usually vegetative, by ‘budding’ new plants at either side of the floating leaf, leading to small irregular clusters of cloned plants developing. Plant numbers may double every couple of days under optimal conditions.



Lettuce-like rosette of leaves



New plants are produced on the end of floating stolons



Water lettuce can completely cover the surface of water bodies, effectively blocking light

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●			●			●			●
Fruiting	Not applicable											



Declaration status: Declared Class 2 under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld)

Other common names: water cabbage, Nile cabbage, water bonnet, tropical duckweed

Description: Perennial floating herb 17 cm diameter (rarely, up to 30 cm), with a lettuce-like arrangement of leaves, long feathery roots and often connected via above-ground stems (stolons). Leaves are pale green, oval to spatula-shaped (spatulate), with distinct longitudinal nerves. Leaf length varies from 20–115 mm long, 15–85 mm wide, with smaller leaves towards centre of rosette. Flower head (inflorescence) 8–12 mm long, with separate male and female flowers, but this plant is not known to produce viable seed in Australia. Reproduction is vegetative.

Distinctive features: Lettuce-like rosette of leaves make it unlikely to be confused with other water plants.

Habitat: Occurs as a floating plant in still or slow-moving freshwater wetlands, such as slow-flowing streams, dams and lagoons, especially where nutrient levels are high. Has a relatively low salt tolerance so has benefited from bunding of salt-marsh areas that are supplemented with irrigation runoff. Floating rafts often get flushed into brackish and saline areas, where they eventually die.

Impacts on wetland: Probably native to South America, and possibly parts of Asia, Africa and the Northern Territory, this noxious weed can rapidly spread to completely cover the surface of water bodies with the following impacts:

- blocks light penetration, killing aquatic plants
- reduces oxygen levels

- reduces fish and water bird diversity
- blocks water flow in creeks and irrigation channels
- limits boat and recreational access
- ruins fishing grounds
- clogs hydro-electricity turbines
- increases flood damage
- provides habitat for mosquitoes
- floating mats allows other weeds such as para grass* to establish and bind the raft
- is generally not as problematic as water hyacinth in the Townsville–Burdekin region, possibly due to biological control, or competition from other floating weeds.

Weed facts:

- It contains calcium oxalate crystals and other toxins that cause intense burning of the mouth, tongue and throat, resulting in swelling and choking. Causes nausea, vomiting and diarrhoea
- leaves have been used medicinally to treat stomach problems, painful urination (dysuria), gonorrhoea, boils, syphilis and haemorrhoids. Roots have been pounded and used to treat burns
- harvested material is good for composting
- although it is still used in the aquarium trade, it is illegal to grow or sell as it is a declared weed in Queensland.

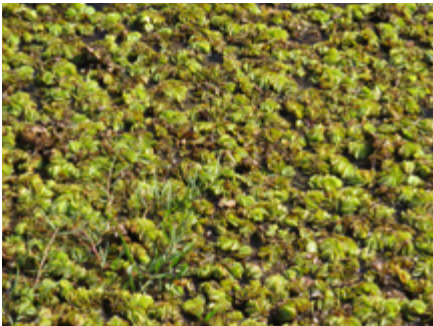
Spread and control: In Australia, plants only reproduce vegetatively by producing new plantlets on the end of stolons. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. For further information on control, refer to Department of Agriculture, Fisheries and Forestry—Weeds: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds.



Leaves covered in stiff white 'egg-beater' hairs



Leaves fold along the midrib when compressed



Dense smothering infestations can generate up to 400 tonnes of wet weight per hectare



	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	Not applicable											
Fruiting	Not applicable											



Declaration status: Declared Class 2 under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld)

Other common names: giant salvinia, kariba weed, water moss

Description: Perennial floating fern with green floating fronds and brown submerged fronds that are branched and hairy to 300 mm long, resembling roots. Floating fronds are oval shaped or circular, 8–35 mm long, 5–35 mm wide, with a distinct folding midrib. Leaf surface is covered in stiff four-sided ‘egg-beater’ shaped hairs that repel water and assist flotation. When plants become crowded, the leaves fold along the mid-rib, allowing them to pack together tightly. Although salvinia has spore-producing structures (sporocarps), they are not known to produce spores in Australia. All salvinia in Australia are sterile clones, reproducing vegetatively.

Distinctive features: *Salvinia molesta** is the only salvinia in Australia and is distinguished by its ‘egg-beater’ shaped hairs on the upper surface. All other 11 species are totally prohibited.

Habitat: Usually grows on still or slow-flowing water such as lakes and dams, especially where nutrient levels are very high (eutrophic).

Impacts on wetland: Native to Central and South America, this noxious weed:

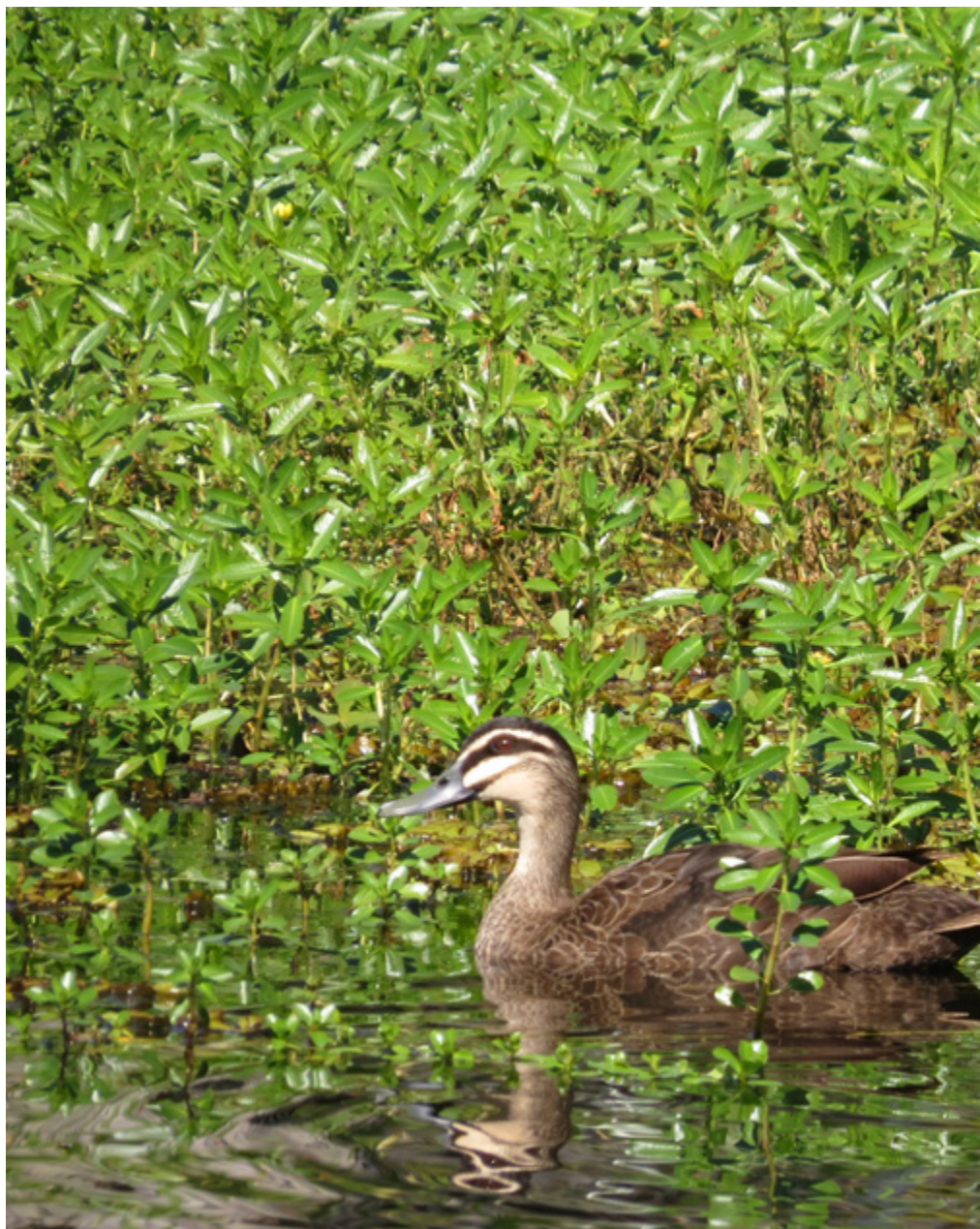
- can rapidly spread to completely cover the surface of water bodies, generating up to 400 t of wet weight per hectare, effectively blocking light, and killing aquatic plants and fish

- significantly reduces the use of wetlands by water birds, wildlife and recreational users
- reduces water quality by tainting and discolouring water supplies
- may provide habitat for disease-carrying mosquitoes to breed
- can reduce oxygen levels in the water, creating barriers to fish passage and leading to fish kills
- allows other weeds such as para grass to establish and bind the infestation.

Weed facts:

- originally introduced in 1953 for the aquarium trade; however, it is illegal to grow or sell as it is a declared weed in Queensland.

Spread and control: Plants are sterile, and any spores are usually deformed. Spread is vegetative by dividing into daughter plants, doubling in as little as 3–4 days. The size of infestations in the Townsville–Burdekin region has been substantially reduced since introduction of the salvinia weevil (*Cyrtobagous salviniae*) in the 1980s. Other controls include mechanical (aquatic mechanical harvesters) or chemical. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. Note that large quantities of decomposing salvinia can cause nutrient blooms and a loss of oxygen levels. For further information on control, refer to the Department of Agriculture, Fisheries and Forestry—Weeds: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds.



HERBS AND SHRUBS





Yellow pea flowers with a red splotch, compound leaves and an elongated pod



Forms low, dense thickets on wet mud along wetland edges or shallow depressions

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●			●	●
Fruiting	●	●	●	●	●	●	●	●			●	●

Declaration status: Not declared

Other common names: Indian jointvetch,
Previous scientific name: *Aeschynomene*
pumila

Description: Annual scraggly shrub 0.5–2 m tall, with long, tapering compound leaves. Compound leaves are alternately arranged on stems 50–145 mm long, consisting of 30–60 oblong leaflets, 2–10 mm long, alternately arranged and becoming smaller towards the tip of the compound leaf. Leaves are green but become distinctly silver during the cool, dry season. Stipule (leaf-like structure at base of leaf) 7–10 mm long, roughly triangular, falling with maturity. Flower head (inflorescence) is borne on the end of a stem (peduncle) 15–60 mm long, bearing 1–4 pea flowers. Petals are pale yellow, though enlarged top petal (standard) has a red splotch and red-streaked veins. Fruit is a elongate pod 10–45 mm long, 3.5–5 mm wide, green, and dotted with distinct glandular hairs when young, maturing to brown with distinct segments, containing up to nine dark seeds 4 mm long, 3 mm wide.

Distinctive features: *Aeschynomene americana** has pink flowers with a yellow centre, and seed pods with obvious constrictions between segments.

Habitat: Grows singly or in small dense thickets on clay soils in or along the margins of creeks, billabongs flood plains, melon holes or seasonally flooded depressions in woodland or grassland habitats. Often indicates the presence of shallow water, or poorly drained pockets of wet or drying mud in grasslands.

Impacts on wetland: The origin of this weed is obscure but possibly from the Americas.

This plant:

- grows in dense thickets on muddy ground, outcompeting smaller bog plants such as bog hyacinth
- is a serious weed of rice paddies and drains
- is toxic to stock but of low palatability, so tends to increase in abundance under grazing
- reduces aesthetic appeal of wetlands after plants have died off.

Weed facts:

- considered an excellent herbal medicine in India for treating kidney stones and leprosy. Lesser known uses include treating snake bite. Research shows it has strong antimicrobial and antifungal activity, and has potential as a drug for enhancing sperm count
- wood is burnt to provide charcoal for gun powder
- light wood is used as floats for fishing lines and nets
- although introduced for stock fodder, it has relatively low palatability, and is suspected being mildly toxic. Stock deaths are reported from overseas. Seeds are known to be toxic to pigs.

Spread: Flowering takes place in summer and autumn, where seed sets and germinates in spring and summer. Has a prolific seed production, with seeds dispersing within 4 weeks of flowering. Seeds have a hard seed coat that allow them to remain dormant in the soil. Burning may be necessary to remove a dormant seed bank.





Opposite leaves with a broad base and clusters of round red fruit at leaf bases



Annual herb on drying margins of seasonal wetlands, turning red in full sun

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	●	●	●	●	•						
Fruiting	•	●	●	●	●	•						

Jerry-jerry

Ammannia multiflora – Family Lythraceae

Other common names: : red ammannia.

Previous scientific name: *Ammannia australasica*

Description: Annual herb to 60 cm tall. Leaves are simple, arranged opposite along the stem without any attaching stalk (sessile), leaves relatively long and narrow, 18–44 mm long, 1.5–9 mm wide, often with a distinctly broad leaf base. Leaves are usually green but may turn red in full sun. Flower parts are fused to form a cup-like structure (hypanthium) about 1 mm long, with minute purple petals 0.5–1 mm long. Fruit is a roughly globular capsule 1.5–2.5 mm in diameter; often red in colour.

Distinctive features: *Oldenlandia* spp. (Rubiaceae) have a distinct scar on the stem between pairs of leaves. *Ammannia baccifera* does not have a broad leaf base.

Habitat: Usually seen on the high water mark of drying, receding wetlands, including swamps, dams, billabongs, and seasonal (ephemeral) creeks and gullies. Always seen above the water level, in sun or partial shade, often in moist, boggy ground in association with various sedges. Favours the bare ground generated by receding water levels.

Value in wetland:

- acts as a pioneer species providing valuable cover for frogs, reptiles and invertebrates along the otherwise bare margins or receding water bodies. Does not appear to be eaten by stock.

Plant uses:

- has been recommended as an experimental plant for landscaping around artificial ponds
- Australian Aboriginals ground the seed to make flour
- leaves used medicinally in India as a blistering agent (vesicant), possibly to remove warts
- leaves used medicinally in Tanzania to treat eye problems caused by parasitic filaria worms
- tests have found several useful compounds, including an anti-tuberculosis chemical and anti-hyperglycemic chemicals potentially useful for treating diabetes.

Propagation: This plant is rarely cultivated and seed treatment is unknown. Other *Ammannia* species are easily propagated by pushing cuttings into the muddy substrate.





Broad sterile fronds (left) and slender fertile fronds (right)



Small plantlets developing in the junctions (axils) on fertile fronds

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	Not applicable											
Fruiting	Not applicable											

Water fern

Ceratopteris thalictroides – Family Parkeriaceae

Other common names: water sprite.

Previous scientific name: *Acrostichum thalictroides*

Description: Aquatic perennial fern to 1 m tall, either submerged, emergent or free-floating. Fronds occur in two distinct types, and are clustered and fragile. Stems (stipe) are fleshy and contain numerous long air canals. Sterile fronds 40–600 mm long, erect or spreading, with broad dissected and irregularly shaped paper-thin green leaves (lobes). Fertile fronds are longer and more erect than sterile fronds, initially green, becoming brown after maturity, with long, narrow and recurved lobes. Small plantlets may form in the junctions (axils) on fertile fronds. Spore capsules (sporangia) are solitary and are scattered along the veins, containing 16–32 spores.

Distinctive features: *C. thalictroides* is the only aquatic erect freshwater fern, apart from *Pityrogramma calomelanos**, which is silver on the underside of the leaves. *Acrostichum speciosum* (mangrove fern) is a much taller robust species and prefers estuarine areas.

Habitat: A strictly aquatic plant, usually growing in still or slow-flowing freshwater wetlands such as swamps, billabongs and bunded watercourses, or in the quiet backwaters of faster flowing creeks. Sometimes occurs in saline areas such as saltwater couch grassland. At various stages of its life cycle it can be either attached or free-floating. Tends to die off as water levels recede. The plant is fragile and often grows in partly shaded areas tangled with or partly protected by other plants. Easily overwhelmed by many introduced water weeds.

Value in wetland:

- provides habitat for small fish and fry, food source for herbivorous fish, snails and waterfowl
- assists stripping nutrients from the water, thereby reducing algal growth.

Plant uses:

- has been used in constructed wetlands receiving high nutrient levels
- one of the most popular and commonly used tropical aquarium plants, but requires high light
- leaves are considered a delicacy in many countries, either raw or cooked as a green vegetable, or used in salads. Can be used as a substitute for spinach or watercress
- commonly used in Chinese medicine as a tonic, to stop bleeding (styptic) and heal skin complaints, including treatment of severe abscesses and boils
- contains anti-viral properties, due to the presence of the anti-HIV protein CVN (cyanovirin-N)
- used as a teaching aid for botanists examining the genetics, biochemistry, and cell biology of ferns.

Propagation: Propagation can occur from plantlets, developing from the asexual buds and breaking away to form separate plants. Spores can also be used for propagation, by burying or placing the spores on wet mud.





Inflorescence is a clustered mass of small white flowers surrounded by thin white petals (ray florets).



Often grows as a sprawling woody herb along the wet margins of creeks and swamps

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

White eclipta

Eclipta prostrata – Family Asteraceae

Other common names: false daisy, swamp daisy. Previous scientific name: *Eclipta erecta*, *Eclipta alba*

Description: Annual woody herb, low growing or erect to 30 cm tall. Leaves are opposite, with a very small or absent leaf stem (petiole), narrow and tapering to a point 25–90 mm long, 5–30 mm wide. Young leaves may be densely hairy, becoming sparsely hairy with age and rough to the touch. Leaf margins are irregular or sparsely toothed. Flower heads (inflorescence) appear at first glance like single flowers but are actually a clustered mass of small white flowers (capitula) surrounded by a circle of thin white petals (ray florets). Fruit are masses of small dry brown seeds (achenes) 1.5–3 mm long, with a small ring or hairs (pappus) about 0.5 mm long.

Distinctive features: *Eclipta* are the only semi-aquatic daisies with opposite leaves. *Eclipta platyglossa* has yellow flowers.

Habitat: Usually found on moist soils, and low banks on seasonally flooded rivers, lagoons and billabongs, particularly on clay soils with recent disturbance. Often colonises bare wet soil.

Value in wetland:

- Provides habitat complexity along the moist margins of wetlands, probably suitable for bank stabilisation in a range of environments as it can form dense stands.

Plant uses:

- can be a minor nuisance weed in some crops
- young leaves and shoots are apparently edible after cooking
- roots and leaves are used medicinally throughout Asia for various problems, including toothache, coughs, asthma, obesity, anorexia, anaemia, spleen and liver complaints, tuberculosis, skin diseases, athlete's foot, bacterial infections, snakebite and headaches
- in Malaysia, tea from roots and leaves is taken for dizziness or as a tonic following childbirth
- chemical extracts are being commercially trialled to stimulate hair growth and have been investigated as a treatment for HIV
- boiled leaves are used as an ingredient in shampoos, hair dye and tattooing
- leaves have been found to contain small amounts of nicotine.

Propagation: Propagation is by seed barely covered in a moist seed tray, preferably planted in spring, as germination is influenced by light and temperature. Seeds have no dormancy. Plants may also spread vegetatively from stems that produce roots at nodes.





Large, funnel-shaped flowers, white with or without a pink centre and a star shape radiating from the centre



Floating stems allow tangled thickets to develop out from the water's edge

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering			●	●	●	●	●	●	●			
Fruiting			●	●	●	●	●	●	●			

Kang kong

Ipomoea aquatica – Family Convolvulaceae



Other common names: swamp morning-glory, swamp convolvulus, water spinach. Aboriginal names: Wangoora, recorded by Jimmy Morrill (1863). Previous scientific name: *Ipomoea reptans*

Description: Low trailing or weakly climbing perennial, or annual vine or herb, with trailing or floating hollow green or reddish stems that often develop roots at the nodes. Glossy, smooth leaves are borne alternately along the stem, roughly triangular in shape with a deeply lobed base (cordate), 60–105 mm long, 30–70 mm wide, on a stem (petiole) 20–100 mm long. Leaves have a prominent mid-rib and numerous raised veins. Flowers in groups of 1–4, but usually solitary, funnel-shaped, 40–50 mm long, white, with or without a pink centre and a star shape radiating from the centre. Entirely white flowered forms may be an introduced Asian variety. Fruit is a smooth woody, spherical capsule 10–13 mm long, containing 1–4 reddish-brown three-cornered seeds.

Distinctive features: Twenty-one other *Ipomoea* species occur in this area, but nearly all are vigorous climbers, and no other species has a tendency to grow prostrate in fresh water.

Habitat: Occurs on the margins of fresh and brackish creeks, dams, bunded depressions, swamps, lagoons and billabongs, in gullies and irrigation channels, or as a component of wet grasslands and sedge-lands. It usually germinates on the muddy bank and grows out over deeper water, with floating hollow stems. It may take advantage of other floating vegetation to form large floating mats. It rarely climbs but may scramble over low features.

Value in wetland:

- a valuable plant for stabilising creek banks and dam walls, providing good aquatic habitat for fish
- significantly reduces suspended solids and nutrients.

Plant uses:

- has been successfully used in constructed wetlands in Africa, significantly reducing suspended solids and ammonia from waste water
- useful in wetland revegetation or cultivation in damp boggy areas, or around the margins of wetlands where the plant can grow out into the water to develop a floating fringe
- stem cuttings will grow in a vase of water as an indoor plant
- in the Townsville–Burdekin region, the roots were traditionally soaked, baked and washed before eating
- young shoots and leaves are a mild-flavoured but popular ingredient in Melanesian and South-East Asian cooking, containing many vitamins and minerals
- young shoots can be eaten raw or in salads but care should be taken if plants were growing in contaminated areas
- studies have revealed hypoglycaemic compounds useful for treating diabetes.

Propagation: Is easily propagated by cuttings. Stem cuttings can be rooted in water or moist sand and transplanted into pots of fertile potting soil mixture. Seeds should be lightly cut (scarified) and soaked in water for 1–3 weeks before planting. White flowering forms should be regarded as introduced and not used in revegetation projects.



Flowers are yellow with four spatula-shaped petals underlain by four large green leafy sepals



Usually grows as a dense woody shrub on permanently or seasonally wet margins of wetlands

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Willow primrose

Ludwigia octovalvis – Family Onagraceae

Other common names: shrubby water primrose, raven primrose willow. Previous scientific name: *Jussiaea suffruticosa*

Description: Annual or weakly perennial, woody shrub, 0.4–2 m tall. Leaves are arranged alternately on the stem, hairy, elongate to lance-shaped, 60–165 mm long, 2–35 mm wide on leaf stalks (petioles) 2–8 mm long. Flowers are yellow with four spatula-shaped petals underlain by four large green leafy sepals. Fruit is brown, roughly cylindrical, 20–55 mm long, 3–6 mm wide, with the four leafy sepals persisting on the end. Fruits split longitudinally to release hundreds of small globular seeds.

Distinctive features: *Ludwigia adscendens* and *L. peploides* are prostrate plants with five petals. *Ludwigia hyssopifolia** have smaller flowers (< 10 mm wide) and shorter leaves (10–90 mm long). *L. perennis* is a smaller plant (up to 1 m) and has a shorter fruit (< 10 mm). *L. longifolia** has comparably much longer (to 350 mm long), thinner and hairless leaves.

Habitat: Usually occurs in permanently or seasonally wet margins of wetlands, including rivers, billabongs, flood plains, depressions in open woodland, shallow swamps, gullies and drains. Plants may be sparsely spread or may form narrow thickets.

Value in wetland:

- provides habitat complexity along the moist margins of wetlands, probably suitable for bank stabilisation in a range of environments, as it can form dense stands
- provides habitat for a range of species, including frogs and small birds such as cisticolas and grassbirds.

Plant uses:

- used as an early pioneer species in wetland revegetation sites
- plant can become a weed in irrigated crops
- may cause gastroenteritis in sheep and cattle
- used in herbal medicines to treat diarrhoea, dysentery and parasitic worms and as a laxative
- has been used to promote vomiting (purgative) and to relieve headache, chest pain and rheumatoid pain.

Propagation: Propagated easily by seed, which germinates immediately in wet or flooded soils, without the need for any special treatments.





Glossy alternate leaves and yellow flowers with five petals



Low-growing perennial herb, either trailing across water or forming low tangles at water's edge

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Water primrose

Ludwigia peploides – Family Onagraceae

Other common names: water buttercup.
Previous scientific name: *Jussiaea peploides*

Description: Low-growing perennial herb, either trailing across water with floating stems that develop roots at the nodes, or forming low tangles at water edge. Leaves are arranged alternately on the hairy stems, broadly elongated to lance-shaped, 10–100 mm long, 4–30 mm wide on leaf stalks (petioles) 2–30 mm long. Leaves are glossy green with a distinctly pale midrib, coarsely hairy on the underside. Stems rise vertically when flowering. Flowers are yellow, 20–30 mm diameter, with five petals underlain by five tapering green sepals. Fruit is an elongated, recurved capsule, 10–40 mm long with five angles. Fruit split irregularly to release numerous small seeds.

Distinctive features: *Ludwigia hyssopifolia**, *L. longifolia** and *L. octovalvis* are erect woody plants with four petals. *L. longifolia** has comparably much longer (to 350 mm long), thinner and hairless leaves. *L. adscendens* has white flowers with a yellow centre.

Habitat: Usually occurs on the moist and muddy margins of still or slow-moving creeks, swamps, dams, lagoons and other water impoundments. Young plants establish in this wet zone before growing outwards over the water on floating stems, eventually developing partially floating thickets along wetland margins. Generally not seen in areas subject to regular floods, as fast-flowing water will damage their stems.

Value in wetland:

- provides habitat for fish and aquatic macroinvertebrates
- seeds are a food source for ducks and other water birds
- removes phosphorus and other nutrients from the water column
- colourful plant, adding aesthetic values and structural complexity to wetland margins.

Plant uses:

- has been successfully used in constructed wetlands for improving water quality, particularly when planted along the sunny margins of wetlands
- an excellent species for wetland revegetation, or as an ornamental in dams and artificial ponds, providing a lot of colour if the site is not too shaded
- can become over-abundant under high nutrient loads, potentially obstructing water flow in extreme cases.

Propagation: Can be propagated by seeds or fragmentation, where rooting occurs at the nodes.





Flowers are blue/purple with six pollen-bearing stamens; one is blue-tipped and much larger than the others



Semi-aquatic herb, rooted in mud with glossy, elongate heart-shaped leaves on fleshy stems

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•					
Fruiting	•	•	•	•	•	•	•	•	•			

Bog hyacinth

Monochoria vaginalis – Family Pontederiaceae



Other common names: pickerelweed, heartleaf false pickerelweed, oval-leafed pondweed. Previous scientific name:

Pontederia vaginalis

Description: Annual or perennial semi-aquatic herb, rooted in mud in or adjacent to shallow water, leaves floating or forming clusters of leafy stems up to 45 cm high, though usually around 20 cm. Glossy green leaves are broad at the base, tapering to a fine point, resembling an elongate heart-shape, 25–120 mm long, 5–80 mm wide, borne on the ends of fleshy, hollow stems (petioles) 40–700 mm long. Specialised leaves sheath around the flowering stem. The flower heads (inflorescence) consist of a dense spike containing 1–20 flowers. Flowers are blue or purple, 9–18 mm long, with six pollen-bearing stamens. One stamen is blue-tipped and much larger than the others. Fruit is a capsule broadly oval in shape, 8–10 mm long, 3–4 mm wide. Seeds light brown, 1–1.2 mm long, with longitudinal ridges.

Distinctive features: *Eichhornia crassipes** (water hyacinth) is a floating plant with larger, paler flowers and bulbous stems. *Monochoria cyanea* has yellow male parts (anthers).

Habitat: Usually occurs in soft mud on the edges of still or slow-moving swamps, lagoons, billabongs and flood plains, including depressions, gullies and roadside drains. Perennial if constantly wet. In seasonal (ephemeral) wetlands, plants die when they dry out with receding water levels, but regenerate the next season from the seed bank.

Value in wetland:

- can occur as a dominant herb in shallow marshes and swamps (significant weed of rice paddies in South-East Asia) but often outcompeted by introduced grasses (e.g. para grass*)
- seeds are eaten by a range of water birds, including magpie geese and broilgas
- moderate capacity for uptake of nutrients such as phosphorus
- adds colour and beauty to shallow wetlands (aesthetic values).

Plant uses:

- used as an ornamental plant in aquariums and outdoor ponds
- studies have shown it to accumulate arsenic in roots, therefore it has been recommended for phytoremediation and would be suitable in the saturated zone of bioretention basins
- most parts apparently edible raw or cooked, including leaves, stalks and tubers
- used to treat burns, asthma, nausea, fever, haemorrhage, scurvy and snakebite
- leaves mixed with ginger and honey to treat coughs and colds
- studies have shown that the roots contain pain-killing (analgesic) compounds and have been used to treat toothache.

Propagation: Propagation is by seeds planted below the water level. Seed germinates reliably, though sporadically in water temperatures above 28°C. Patterns of seed germination vary greatly according to moisture levels, with optimal germination occurring in submerged conditions, with a germination peak of 15–25 days. Plants can also be propagated from root stock.



Branches with spikes of white/greenish white flowers



Ochrea with a collared sheath



Thick, dense pure stands on the banks and edges of wetlands provides good wildlife habitat

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	•	•
Fruiting		•	•	•	•	•	•	•	•	•	•	•

Water pepper

Persicaria attenuata – Family Polygonoaceae



Other common names: smartweed, velvet knotweed. Previous scientific name: *Polygonum attenuatum*

Description: Perennial erect herb, growing to 1 m tall on wetland margins or sprawling and floating in water with stems to 3 m long. The leaves are arranged alternately on the stem, broadly elongate and tapering, 50–250 mm long, 15–45 mm wide, densely covered in short white hairs especially on veins and leaf margins. Leaf stem (petiole) may be absent or up to 30 mm long. A basal leaf membrane (ochrea) is generally hairless, striated and may or may not be ringed with small stiff hairs (cilia). Flower heads (inflorescence) consists of 2–4 spikes 30–130 mm long, densely covered in white/greenish white flowers 3–5 mm long with 5 petals. Fruit is a shiny lens-shaped nut 2.5–3 mm long.

Distinctive features: *Persicaria decipiens*, *P. orientalis* and *P. subsessilis* may have pink flowers. *P. orientalis* has a basal leaf membrane (ochrea) with a collared sheath. *P. decipiens* is a smaller plant (up to 30 cm) and a narrower leaf (5–13 mm wide). *P. barbata* and *P. subsessilis* has ochrea with cilia more than 3 mm long. *P. lapathifolia* has no cilia. *P. strigosa* has a shorter spike (up to 1 cm).

Habitat: Usually occurs along the margins of flood plains, swamps, lagoons, billabongs, dams and rivers, in both seasonal (ephemeral) and permanent freshwater. Often forms thick dominant stands, spreading out over the water, developing partially floating thickets along wetland margins.

Value in wetland:

- thick, dense pure stands provide valuable food source and habitat for birds, frogs and other wildlife
- one of the best native plants for withstanding wetland degradation and weed invasion. Can be used to replace and displace para grass* but has not been investigated for allelopathic chemicals
- an over-abundance as dense floating mats can lead to reduced diversity of aquatic macroinvertebrates.

Plant uses:

- has been used in wastewater treatment, as it grows well under high nutrient loads and is known for removal of arsenic from contaminated water
- useful as a companion plant for stabilising the margins of wetlands
- leaves may cause irritation in sensitive people
- leaves may be used as a salad plant or as a cooked vegetable
- various parts used to treat syphilis, rheumatism, haemorrhoids, diarrhoea, fever, itching, stomach aches, or used to clean and purify the blood.

Propagation: Seed germination best using the 'bog method'—fresh seed sown shallow in a water-logged pot in bright light. Seeds can be hand-broadcast onto a bare muddy bank. May also be propagated from stem cuttings.



Separate male and female flowers



Clusters of erect elongated leaves



Grows either submerged or in a dense, spreading infestation on wet, muddy banks

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●			●	●	●	●	●
Fruiting	●	●	●	●	●				●	●	●	●



Declaration status: Weed of National Significance

Other common names: sagittaria, broad-leaf arrowhead. Previous scientific name: *Sagittaria graminea*

Description: Perennial submerged or emergent aquatic herb up to 1.5 m tall, developing spreading clusters of erect leaves via underground stems (rhizomes), commonly developing underground tubers 40 mm long and 15 mm wide. Submerged leaves are thin and strap-like, 500 mm long, 20 mm wide. Emergent adult leaves are borne on erect stalks (petioles) to 800 mm long, triangular in cross-section. Leaves are glossy green, broadly elongated, to 280 mm long and 100 mm wide, with prominent parallel veins and sometimes elongated lobes at the leaf base. Flower heads (inflorescence) borne on a leafless erect stem from the base of the plant, and consist of clusters of separate male and female flowers. Female flowers lower in the inflorescence, petals absent and resemble lobed green berries on short stalks. Male flowers 30 mm diameter have three rounded white petals with yellow centre. Fruit is a 5–10 mm wide cluster of small one-seeded segments 1.5–3 mm long. A single plant can produce up to 20 000 seeds.

Distinctive features: *Monochoria vaginalis* has blue flowers and shorter, less erect leaves. Other species of *Sagittaria*, *Echinodorus* and *Alisma* do not have stems that are triangular in cross-section and have not been recorded from this region.

Habitat: Usually growing in still or slow-flowing permanent freshwater, such as lagoons, dams, bunded watercourses,

irrigation channels, drains and rivers. Usually occurs in shallow water, where it can grow up to the water surface, but is also known to break free as part of large floating mats. Although first introduced to Queensland in 1959, it was first recorded in the Townsville region in 2013.

Impacts on wetland: Native to North and Central America, this noxious weed:

- blocks creeks and irrigation channels, reducing water supply to crops and causing siltation
- alters flow regimes of waterways, affecting stream health
- infestations exclude native plants and animals, lowering biodiversity
- reduces use of water bodies for swimming, fishing and boats
- can also be a weed in crops.

Weed facts:

- although it is still used in the aquarium trade, it is regarded as a serious environmental weed in Queensland and should not be cultivated or sold.

Spread and control: Can reproduce by seeds, vegetatively by stem or root fragments, or underground rhizomes and corms. Each plant has the ability to produce thousands of seeds that can either germinate or remain dormant in the soil. Seeds can float up to three weeks prior to settling, which aids in their dispersal. Adopting good hygiene practices, such as washing down vehicles, boats and equipment is critical in preventing spread. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. Mechanical clearing is not recommended as it can break up the rhizome and facilitate spreading.



Clusters of 1–8 hanging yellow pea flowers



Tall annual woody shrub with compound leaves and narrow, hanging pods

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Sesbania pea

Sesbania cannabina – Family Fabaceae

Other common names: yellow pea bush.

Previous scientific name: *Aeschynomene cannabina*

Description: Annual woody shrub to 3.5 m tall, developing a woody trunk up to 100 mm diameter. Long compound leaves are alternately arranged on stems, 50–250 mm long, consisting of 16–70 oblong leaflets 6–22 mm long, 2 mm wide, often with a small spine on the tip, opposite or alternately arranged on the compound leaf. Flower head (inflorescence) consists of 1–8 yellow pea flowers 10–16 mm wide hanging on a stem 20–60 mm long. Fruit is a brown pod 120–200 mm long, 2.5–3 mm wide containing around 25–35 hard seeds 3–4 mm long.

Distinctive features: *Leucaena leucacephala** is larger perennial shrub or tree with dense white pom-pom flowers and broad pods. Budda pea (*Aeschynomene indica**) is a much smaller plant, with smaller leaves, shorter flat pods and a red splotch on the yellow flowers.

Habitat: Usually grows along the margins of swamps and watercourses, or in seasonally waterlogged areas of grassland and open woodland, particularly low, wet depressions. Tolerates a broad range of soil types, including relatively saline soils, but prefers heavy, cracking clays.

Value in wetland:

- rapidly growing pioneer of disturbed sites (3.5 m tall in 6 months), with a seed bank that can remain dormant for years under swards of introduced grasses. Seed germination is stimulated by fire or direct sun after weed removal
- grows in infertile soils and can fix nitrogen—useful for soil improvement and

bank stabilisation

- provides roosting habitat for many small bird species, attracts many insects, including bees.

Plant uses:

- used in revegetation sites as a windbreak, erosion control and habitat for birds
- tolerant of heavy metal toxicity, and has potential for use in phytoremediation of mercury contaminated soil
- flowers are edible and are used as a vegetable in India
- various plant parts are used medicinally to treat dysentery, fevers, headaches, small pox, sores, sore throat, and inflammation or infection of the mouth and lips. Eating leaves as a vegetable is reported to improve eyesight
- straight stems used by Aboriginals to make light spear shafts for hunting fish and small animals
- seeds contain a water-soluble gum with broad applications as a food additive, textiles, paper products and various industrial uses
- stems contains fibre similar in quality to jute
- fast-growing habit provides reliable fuel wood in developing countries, used as pulpwood
- widely used in Asia as green manure crop to increase yields of rice, wheat and maize
- young plants are grazed by stock and have high protein but generally unpalatable
- may be a weed of cotton, and other irrigated crops on heavy soils.

Propagation: A single plant can produce over 1200 seed pods, and seeds can remain dormant for long periods. Dormancy can be broken by dunking seeds in boiling water, then planting.





GRASSES AND SEDGES





Inflorescence comprising 3–6 spikes arranged like fingers on a hand (digitate)



Perennial, sprawling low-growing grass, often forming a 'lawn' to the water's edge

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Declaration Status: Not declared

Other common names: green couch, Bermuda grass, swamp couch. Previous scientific name: *Panicum dactylon*

Description: Perennial, sprawling low-growing grass to 0.3 m, spreading by above-ground stems (stolons) and underground stems (rhizomes) to form dense mats. Leaves arranged alternately along stem, thin, broadest at the base, 15–90 mm long, 1–2 mm wide, hairy at the junction with the stem. Flower head (inflorescence) is borne on a stem (culm) 150–200 mm tall, comprising 3–6 spikes arranged like fingers on a hand (digitate). Spikes 25–60 mm long, each with two rows of flowers (spikelets). Fruit is a brown grain, 1.3 mm long.

Distinctive features: *Sporobolus virginicus* has narrower and more stiff and erect leaf blades. *Paspalum distichum* (water couch) has a flower head (inflorescence) consisting of only two arms. *Cynodon dactylon** has both above-ground stems (stolons) and below-ground stems (rhizomes). *Cynodon aethiopicus** and *Cynodon nlemfuensis** both have stolons but no rhizomes.

Habitat: Usually grows on sandy to clay soils along watercourses and on flood plain margins, especially in disturbed areas. Forms a 'lawn' to the water's edge and is tolerant of short-term seasonal inundation. In areas with more frequent tidal influences it is replaced by saltwater couch (*Sporobolus virginicus*).

Value in wetland:

- a valuable soil binder in sandy soils associated with wetland buffers and river banks. This species also has a good tolerance to saline soils
- as this species is considered very competitive, it presents a threat to irrigated crops and is considered a weed in 80 countries.

Plant uses:

- although introduced, it is widely used in rehabilitation as it is considered a hardy pioneer plant with strong root development, which improves soil structure and recycles nutrients
- used as a lawn and turf due to its outstanding spreading ability, where stolons are able to grow more than 7.5 cm per day
- is one of the most grazing-resistant grasses and can withstand heavy grazing once established. Tolerates frequent mowing
- makes good quality hay and haylage, can be baled and maintains good nutritive value during storage
- may cause contact dermatitis in sensitive people and, with its high production of pollen, can be a common cause of hayfever
- regarded as a serious weed of agriculture throughout the world.

Propagation: This grass is widely grown by seed, spread by hand or in a hydromulch. While debate continues regarding its country of origin, most commercially available seed is from overseas provenance. The grass is easily propagated by division of the rhizomes and stolons.





Tall perennial sedge to 1.5 m



Robust, cylindrical masses of yellow-brown



Effectively stabilises muddy edges of perennial freshwater channels and lakes

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	
Fruiting	●	●	●	●	●	●	●	●	●			

Foxtail flat sedge

Cyperus alopecuroides – Family Cyperaceae



Other common names: foxtail sedge, mat sedge. Previous scientific name: *Juncellus alopecuroides*

Description: Perennial, loosely clumping sedge, 1 m tall. Leaves mostly arising from base of plant, variable in length but more than half the height of the flowering stem. Leaves are finely toothed on margins and somewhat sharp. Flowers are borne on the ends of tall robust stems, triangular in cross-section, to 2 m long. Flower head (inflorescence) is borne above 5–8 green leafy bracts 10–15 mm wide. Inflorescence has 6–8 unequal sprays originating from the same point (umbel), with dense, cylindrical masses of up to 70 flowers (spikelets) 10–30 mm long, 4–22 mm wide. Spikelets 5–10 mm long, brown to reddish-brown. Fruit is a smooth nut, 0.8–0.9 mm long.

Distinctive features: A very tall sedge (1–2 m tall), with robust, cylindrical masses of yellow-brown spikelets.

Habitat: Usually growing in coastal swales, along the margins of seasonal (ephemeral) or permanent freshwater swamps, lagoons, creek banks and bunded wetlands. Forms a component of dense sedgeland or may be a dominant species. Often occurs as an early pioneer of disturbed permanent wetlands, with a similar role as bulrush (*Typha*). Has probably declined in this region from invasive introduced grasses.

Value in wetland:

- fast-growing pioneer for colonising new or disturbed wetland margins
- known food plant of the endangered yellow chat, and habitat for a range of water birds, including the endangered painted snipe
- can form extensive stands in shallow water and floating mats, providing habitat complexity and competitively reducing colonisation by weeds and bulrushes.

Plant uses:

- used in riparian revegetation and constructed wetlands for bank stabilisation and wildlife habitat
- not edible. Chemical extracts are antibacterial, cytotoxic and moderately oestrogenic (similar to that of oestrogen), and may be potentially toxic to humans
- leaves used for weaving mats.

Propagation: Plants can be propagated vegetatively from division of the clump, possibly from stem cuttings or from seed. Plants often produce many empty seeds, and viable seeds may be dormant. Seed germination best using the 'bog method'—sown shallow in a waterlogged pot in bright light. Natural dispersal may include growth from vegetative fragments in floating rafts.



Large spreading bracts around flower clusters gives it an umbrella-like appearance



Forms dense impenetrable tangles, especially along seasonally dry creeks

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●		●	●	●	●	●	●	●	●	●	●
Fruiting				●	●	●	●	●	●	●		

Declaration Status: Not declared

Other common names: umbrella plant, African sedge. Previous scientific name: *Cyperus flabelliformis*

Description: Perennial, tall clumping sedge, up to 1.5 m tall, with large spreading bracts giving it an umbrella-like appearance. Leaves are inconspicuous, reduced to sheaths wrapped around the stems. Stems are rigid and erect, 3–5 mm wide, smooth and hairless, with longitudinal ridges. Flower head (inflorescence) consists of numerous unequal length stalks 50–100 mm long, branching into secondary stalks 10–20 mm long. Flowers (spikelets) are arranged into dense clusters 20 mm wide, reddish-brown at maturity. The inflorescence is surrounded by a spiralling ring of 12–22 leafy bracts (involucral bracts) 100–300 mm long, 10–15 mm wide. Fruit is a yellowish-brown nut, 0.6 mm long.

Distinctive features: At 1.2–1.5 m tall and forming large clumps, this is a much larger species than most other sedges. The numerous green leafy bracts under the flower heads give the plant an unmistakable umbrella-like appearance.

Habitat: Generally occurs in seasonal (ephemeral) swamps and seasonally dry creek beds, particularly those with sandy creek beds. Often grows as a weed in irrigation and drainage channels, in water up to 0.4 m deep.

Impacts on wetland: Native to Madagascar and Africa, this is an invasive weed and can grow vigorously forming dense colonies which can:

- impact on water quality
- outcompete other semi-aquatic plants
- interfere with movement of fish and wildlife
- be toxic to stock and may cause skin irritations in sensitive persons
- becomes a nuisance weed in irrigation channels and drains, and within natural wetlands.

Weed facts:

- stems woven into mats
- widely used as an ornamental plant for landscaping, water gardens and flower arrangements but should not be grown near drains where seeds can wash into natural waterways.

Spread and control: This species can reproduce by seed and stem segments (i.e. pieces of rhizome) that are commonly dispersed by water and dumped garden waste. Develops a dormant seed bank. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label.





Distinctive rusty brown flower heads (inflorescence) consists of 3-8 stalks



Loosely clumping sedge often forms dense stands along water's edge

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●			
Fruiting	●	●	●	●	●	●	●	●	●			

Bunchy sedge

Cyperus polystachyos – Family Cyperaceae



Other common names: giant sedge, flat sedge, many-spiked sedge. Previous scientific name: *Cyperus venustus*

Description: Perennial (sometimes annual), loosely clumping sedge, 0.6 m tall with underground stems (rhizomes). Leaves mostly arising from base of plant, rough to the touch, 200 mm long, 2–5 mm wide. Flower head (inflorescence) is borne on stems (culms) 100–600 mm long, with 3–6 leafy bracts (involucral bracts) 20–100 mm long. Inflorescence consists of 3–8 stalks, 30 mm long, bearing clusters of 2–15 yellowish or reddish-brown flowers (spikelets). Fruit a reddish-brown to black nut 1–1.2 mm long.

Distinctive features: Usually in dense stands, with distinctive rusty brown flower heads (inflorescence). The female flower parts (styles) are divided in two, unlike most other sedges, which are divided into three.

Habitat: Usually occurs on moist margins of wetlands such as swamps, lagoons and creek banks, usually freshwater but sometimes in more saline areas such as saltwater couch grassland. Often grows in distinctively thick swards, particularly in previously disturbed areas. Often occurs along moist road-side ditches after grading and slashing. May grow under tree canopies in riparian areas.

Value in wetland:

- a valuable fast-growing pioneer species for bare, disturbed sand, loam or clay wetland margins, including areas subject to occasional tidal influence
- dense cover provides good habitat for frogs and invertebrates
- dense colonisation of disturbed areas reduces rate of weed invasion by competitive exclusion.

Plant uses:

- used as a filtering plant in constructed wetlands including swales, buffer strips and batters, creating better fauna habitat than turf species
- recommend for investigation as a direct seeding dense cover for bare wetland margins
- leaves used for weaving mats and baskets
- indicator of disturbance;

Propagation: Plants can be propagated vegetatively from pieces of rhizome or from seed. Plants often produce many empty seeds. Viable seeds are often dormant. Seed germination best using the 'bog method' – sown shallow in a waterlogged pot in bright light.

Other sedges



Cyperus conicus (Cone flat sedge)—perennial solitary sedge to 1 m high, water's edge to ephemeral wetlands



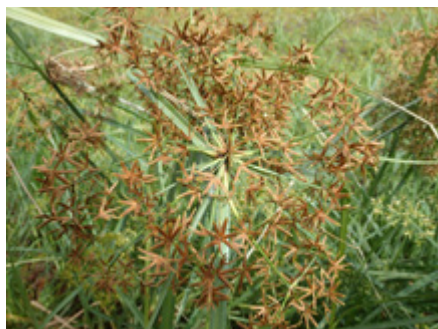
Cyperus difformis (Dirty Dora)—annual to 0.5 m, grows in masses in permanently wet open areas



Cyperus javanicus (Javanese flat sedge)—perennial native sedge, 1.2 m tall, swamps, riparian forest, woodland



Cyperus platystylis (Bunchy sedge)—perennial native sedge, to 0.8 m, often as a dense floating mat in freshwater



Eleocharis minuta (Variable Spike-rush*)—perennial introduced sedge, tussock, in rocky creeks and springs



Eleocharis philippinensis (Five-cornered spike-rush)—perennial sedge to 0.5 m with 4–5 angled stems



Other sedges



Fimbristylis bisumbellata (Fringe sedge)—annual sedge to 0.4 m on edge of fresh and brackish wetlands



Fimbristylis dichotoma (Common fringe sedge)—perennial sedge 0.1–.75 m on wetland margins and moist areas or depressions in woodland



Fuirena ciliaris (Eyelash sedge)—native annual sedge to 0.4 m, swamp margins and moist woodland areas





Flower head (inflorescence) has 10-30 side branches arising from a central stalk, each with multiple clusters of 4-10 spikelets.



Pale flower heads (inflorescence) are very distinctive, even from a distance.

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	●	●	●	●	●	●	●	●	●	●
Fruiting		•	●	●	●	●	●	●	●	●	●	●

Brown beetle grass

Diplachne fusca var. fusca – Family Poaceae

Other common names: brown-flowered swamp grass. Previous scientific name: *Leptochloa fusca*, *L. fusca subsp. muelleri*, *Diplachne parviflora*

Description: Erect, slender perennial grass to 1.5 m tall. Leaves mostly arising from base of plant, 250–550 mm long, 1.5–8 mm wide, erect, slightly rough (scabrous). Ligule at junction of leaf base is a hairless, pointed membrane. Flower head (inflorescence) is a panicle 20–40 cm long, with 10–30 side branches arising from a central stalk, each with multiple clusters of 4–10 flowers (spikelets). Spikelets are dark green initially, fading to light brown or white on maturity. Fruit is a grain 1.6–1.8 mm long.

Distinctive features: Flowerhead (inflorescence) is very pale and distinctive from a distance. Some *Eragrostis* may look similar but lack the secondary branches of *Diplachne*. *Dinebra neesii* (commonly used in wetland plantings) has only 1–2 flowers per spike (*D. fusca* has 4 to 10). Two varieties occur (*var. iniveria** inflorescence dark green or lead coloured and *var. fusca* inflorescence is generally dark green or lead coloured).

Habitat: Found in drier parts of flood plains and swamps and usually in semi-saline clay soils, where it sometimes occurs in fairly saline areas such as saltwater couch grassland.

Value in wetland:

- important pioneer of saline, sodic or alkaline soils, where it can enhance hydraulic conductivity, microbial activity, organic matter and ultimately leaching of salts through the penetration of its roots.

Plant uses:

- can act as a primary coloniser for remediating salt-affected and sodic soils but is a poor competitor on better quality soils
- productive and highly palatable to sheep, goats, buffaloes and cattle.

Propagation: Can be easily propagated and established through seed, stem cutting, root stumps or rhizomes.





Side branches arising from a central stalk with overlapping flowers (spikelets), each with a stiff bristle (awn)



Forms dense infestations in water that can be more than 2 m deep during the wet season

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	Not applicable											



Declaration status: Not declared

Other common names: creeping rivergrass.

Previous scientific name: *Echinochloa spectabilis*, *Oplismenus polystachyus*

Description: Robust, erect perennial grass 1–3 m tall with underground stems (rhizomes). Leaves borne along the stem, 200–400 mm long, 10–22 mm wide, hairless, slightly rough (scabrous). Ligule at junction of leaf base is a fringe of stiff hairs 2–5 mm long. Flower head (inflorescence) is a panicle 14–35 cm long, hairy, with side branches 2–10.5 cm long arising from a central stalk, flowers (spikelets) overlapping, dense, in pairs or clusters 3.5–5 mm long, each with a stiff bristle (awn) 2.5–8 mm long. Fruit is a grain, oblong, 2–2.5 mm long; however, aleman grass is not thought to set viable seed in Australia.

Distinctive features: Tall, robust aquatic grass, mostly hairless, dense seed head and flowers (spikelets) with long awns. Para grass (*Urochloa mutica**) has densely hairy stems.

Habitat: Grows on the margins of billabongs, in swamps and constructed wetlands, where it can grow in water that is seasonally more than 2 m deep.

Impacts on wetland: Native to South America, this weed was introduced for ponded pasture systems. Impacts include:

- forms monocultures that can smother native plant species, reducing biodiversity and impacting on fisheries and water bird habitats
- can grow in water up to 2 m deep for short periods but prefers water to 1 m
- aleman grass is capable of invading crops such as sugar cane and rice
- due to the large amounts of nitrogen it accumulates, it may cause nitrate or nitrite poisoning in grazing cattle following drought.

Weed facts:

- used in ponded pasture systems; however, negative impacts on wetlands significantly outweigh its value as a cattle fodder and its use is not recommended
- invades crops, including sugar cane and rice.

Spread and control: Aleman grass spreads easily vegetatively when broken stems, runners and roots are moved in water, where they can move considerable distances. Therefore, good hygiene practices, such as washing down vehicles, boats and equipment is critical in preventing spread. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. For further information on control, refer to the Department of Agriculture, Fisheries and Forestry—Weeds: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds.



Flower head (inflorescence) is cylindrical and borne on the tip of the stem



Often dominates on seasonally dry wetlands with occasional tidal influence

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering			•	•	•	•	•	•	•			
Fruiting				•	•	•	•	•	•			

Bulkuru sedge

Eleocharis dulcis – Family Cyperaceae



Other common names: water chestnut.
Previous scientific name: *Eleocharis tuberosa*

Description: Perennials or annual sedge with erect cylindrical stems to 1 m tall. Thin underground stems (rhizomes) produce numerous rounded tubers 5–11 mm wide. Leaves absent. The thin-walled hollow stems (culms) are separated into sections by transverse partitions (septa). Flower head (inflorescence) is cylindrical and borne on the tip of the stem, 20–70 mm long, 3–5 mm wide, sometimes wider than the stem, bearing 3–7 rows of flowers. Fruit is a pale brown, glossy nut 1.3–1.5 mm long.

Distinctive features: Stems (culms) divided by septa and the flower spike (inflorescence) gradually tapers to a blunt end. *E. equisetina* inflorescence is very sharply pointed. Stems (culms) are not divided by septa in *E. spiralis*, *E. setifolia* and *E. plana*.

Habitat: Often forms large swards in shallow lagoons and swamps, especially those under some tidal influence but generally experiencing seasonal drying. Prefers wetlands that are acidic and low in nutrients. It is used to define a particular Regional Ecosystem (RE 7.3.1: 'Eleocharis dulcis (bulkuru) closed sedgeland').

Value in wetland:

- important food and habitat for magpie geese and brolgas, which dig up the tubers. Magpie geese squash the stems flat for nesting. Feral pigs also dig up the tubers, causing significant damage
- important plant for stabilising the bank and bed of wetlands
- valuable for removing nutrients and heavy metals, improving water and soil quality
- an increasingly rare community due to changes in hydrology, weeds and feral animals.

Plant uses:

- used in constructed wetlands and phytoremediation ponds to remove nutrients (especially nitrogen) and heavy metals, including uranium. Has been used successfully in the Townsville–Burdekin region but expected damage from wildlife has restricted its use
- tubers were eaten by Aboriginals as a staple food. Widely eaten in Asia (Chinese water chestnuts). May be eaten raw, but the skin may transmit parasitic flukes. Tubers are usually cooked by being boiled, grilled or added to stir-fries. Has higher protein and carbohydrates than potatoes. Also a good source of dietary fibre, riboflavin, vitamin B6, potassium, copper, and manganese
- tubers are dried and ground into flour to thicken sauces or made into batter for deep-fried food
- the juice extracted from tubers contains puchiin, a strong antibiotic
- green stems are woven into mats, bags and 'grass' skirts
- eaten by cattle and resilient to light grazing.

Propagation: Plants can be propagated by seed or vegetatively from the tubers or culms. Seed should not be dry-stored as this significantly reduces seed viability. Seed should be planted into moist pots. Germination is sporadic but best in high light and high oxygen conditions. Usually propagated vegetatively from tubers, which are harvested in June–July, and then planted in the late dry season.



Flower head (inflorescence) is a dense and cylindrical, leaves are broad at base and clasp the stem



Dense infestations exclude all other native wetland plants and removes wildlife habitat

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering				●	●	●	●	●	●	●		
Fruiting				●	●	●	●	●	●	●		



Declaration status: Declared Class 2 under the *Land Protection (Pest and Stock Route Management) Act 2002* (Qld), and declared a Weed of National Significance

Other common names: hymenachne, West Indian marsh grass. Previous scientific name: *Panicum amplexicaule*

Description: Robust perennial grass to 2 m tall, spreading by above-ground stems (stolons) to form dense mats. The smooth, hairless stems develop new roots at the nodes. Leaves borne along the stem, broad and triangular, 50–400 mm long, 8–60 mm wide, distinctly lobed at the base and clasping the stem. Ligule at junction of leaf base is absent or 1 mm long. Flower head (inflorescence) is a dense, cylindrical panicle 10–38 cm long, 1–1.5 cm wide, with flowers (spikelets) 4–6 mm long. Seeds are thin, elongated, 3–4 mm long (each flowering head can produce 4000 seeds).

Distinctive features: Readily distinguished by the stem-clasping bases of the blade of the leaf, which is absent in the less-robust native species *Hymenachne acutigluma*.

Habitat: Low-lying freshwater wetlands and flood plains, which are inundated during the wet season followed by a drying-out period. Factors limiting its growth include an extended drying period and higher conductivity (saline) waters. Similar to water hyacinth, floating rafts will wash into brackish areas after floods but generally do not persist.

Impacts on wetland: Native to South America, this noxious weed was introduced in 1988 for grazing ponded pasture systems.

Impacts to wetlands include:

- forms thick monocultures which exclude other native plants and palatable forage grasses, suppresses tree recruitment, removes water bird breeding and foraging habitat, blocks fish passage, changes soil properties, smothers and generates organic loading of wetlands that reduces dissolved oxygen levels and water quality, potentially leading to fish kills
- poses a significant threat to biodiversity of Townsville–Burdekin coastal wetlands
- generates massive fuel loads that produce very hot wildfires, damaging ecosystems such as riparian forests.

Weed facts:

- although imported for ponded pasture-grazing systems too deep for para grass*, its significant negative impacts on wetlands led to it being declared a noxious weed and Weed of National Significance. It is illegal to sell or deliberately cultivate a declared weed.

Spread and control: Reproduces from seed and broken stem fragments. There are only a few herbicides registered for use of weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. For further information on control, refer to the Department of Agriculture, Fisheries and Forestry—Weeds: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds.



Inflorescence has 1–5 branches, each with 3–10 flowers (spikelets), each with a distinct row of curved teeth



Forms dense stands that excludes weeds and stabilises edges of waterways

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	●	●	●	●	●	•	•	•	•	•
Fruiting	•	•	●	●	●	●	●	●	•	•	•	•

Swamp rice grass

Leersia hexandra – Family Poaceae



Other common names: native rice grass, cutgrass. Previous scientific name: *Leersia australis*

Description: Erect perennial grass 1–2 m tall. Nodes covered with downward-facing hairs. Leaves arranged alternately along the stem, 40–200 mm long and about 3–10 mm wide, erect, blue-green in colour, with rough or sharp margins and lower mid-rib. Ligule at junction of leaf base is a membrane 3 mm long. Flower head (inflorescence) is a loose panicle 50–120 mm long, with 1–5 side branches, each with 3–10 flowers (spikelets) 3.5–5 mm long. Each spikelet with a distinct row of curved teeth. Fruit is a grain, rarely developed and remaining enclosed within the floret.

Distinctive features: Thin erect leaves, sharp along the margins and mid-ribs beneath, spikelets with distinct spines.

Habitat: Associated with margins of marshes, streams, lakes, canals, backwater swamps and billabongs, and sometimes forms floating mats that can grow in water to a depth of 1.8 m. Common in the zone between brackish and freshwater systems.

Value in wetland:

- forms thick swards, stabilising banks of waterways and wetlands, tolerating periods of flooding, drying, fire and grazing
- provides important foraging habitat for water birds, and seeds are eaten by a range of waterfowl
- food plant for grass-dart butterflies

Plant uses:

- useful in constructed wetlands, where it has been successfully used by Greening Australia. Can be used for revegetation, where it is suitable for bank stabilisation and erosion control, as stems grown in deep water reduce flood flow and thus reduce erosion
- is a hyper-accumulator of heavy metals for use in phytoremediation ponds, able to remove copper, nickel and, especially, chromium
- palatable to cattle, either grown as a pasture grass in wet areas or cut for hay.

Propagation: Can be propagated by seed and the division of rhizomes. It is produced for revegetation sites by the division of stock plants. Plants in 140 mm pots that are planted 1 m apart on the edge of the wetland have been observed to form a dense sward within one year.



Inflorescence with two branches per node



Leaf tips on *L. longifolia* and *L. hystrix*



Clumping tussock grass-like plants are popular for streambank stabilisation

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering			•	•	•	•	•	•	•	•	•	•
Fruiting	•	•	•	•	•	•	•	•	•	•	•	•

Spiny-headed mat-rush

Lomandra longifolia – Family Laxmanniaceae (formerly Xanthorrhoeaceae)

Other common names: longleaf mat rush, honey reed, basket grass (numerous named varieties include Tanika, Nyalla)

Description: Perennial, clumping tussock grass-like plant to 1 m tall. Leaves are long, flat and strap-like, 500–1000 mm long, 4–8 mm wide. Erect at base then becoming arching, leaf tips often with three or more large prominent lobes or teeth. Flower heads (inflorescence) of male and female are separate but similar, consisting of an erect simple or branched spike 80–150 mm long, with whorls or clusters of whitish flowers at nodes along the spike. Flower clusters are protected by a whorl of sharp bracts. Male flowers 3–3.5 mm long, female flowers 4.5 mm long. Fruit is a capsule, 5 mm long.

Distinctive features: Leaf tips of *Lomandra filiformis*, *L. laxa* and *L. multiflora* not distinctly toothed and *L. confertifolia* leaves are narrower (0.5–2.5 mm). *Lomandra* taxonomy is still unclear, *L. hystrix* have four branches at each node, compared to two branches in *L. longifolia*. Leaf tip of *L. hystrix* has one tooth much longer than others, *L. longifolia* has 2–3 prominent teeth.

Habitat: Typically located on stream edges, often in rocky or sandy substrates where it can form large and dense communities, and where moisture is constant. Considered to be highly drought-tolerant but also able to tolerate occasional flooding.

Value in wetland:

- provides excellent stream bank stabilisation
- provides important habitat for ground-dwelling wildlife, birds and butterflies. A food plant for several species of Skipper butterfly.

Plant uses:

- widely used for bank stabilisation in revegetation and road construction projects, and widely used in constructed wetlands, especially bioretention basins
- Aboriginals ground the seed into flour for making damper, and chewed the base of leaves to reduce dehydration
- long flat leaves woven into nets and baskets
- unless closely spaced on slopes, should be planted in association with a running grass otherwise rill erosion may develop between tussocks
- very popular in cultivation as a low-maintenance ornamental plant. Many different cultivars are now widely available in the nursery trade, including ‘Tanika’, ‘Nyalla’, and ‘Lush green’ selected for differences in height and colour.

Propagation: Propagates by seed or clump division. When the fruits are matured and turn brown, sow the seed in moist soil for six weeks in the greenhouse or outdoors. Seeds are slow to germinate and have not been used successfully in direct seeding. Can be propagated by dividing the plant in half and planting in moist soil.





Pale flower head (inflorescence) with long stiff hairs (awns) is very distinctive from a distance



Large stands of native rice are a valuable resource for many waterbirds

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering		●	●	●	●	●	●					
Fruiting		●	●	●	●	●	●	●				

Native rice

Oryza australiensis – Family Poaceae

Other common names: Australian wild rice

Description: Perennial tufted grass, erect to semi-erect, 0.8–3 m tall, with above-ground stems (stolons). Multiple stems branching from the base, smooth and hairless but distinctly ribbed at base. Nodes are hairless. Leaves are borne along the stem, 210–450 mm long, 6–12 mm wide, both surfaces smooth to slightly rough (scabrous). Ligule at junction of leaf base is a hairless membrane 3–7 mm long. Flower head (inflorescence) is a panicle 18–50 cm long, supported by a ribbed stem (peduncle). Flowers (spikelets) are thin to oblong, 6–7.5 mm long, 2.4–3.5 mm wide. Fertile florets with a stiff bristle (awn) 3–43 mm long. Fruit is an oblong grain, 5–5.5 mm long, brown or reddish-brown.

Distinctive features: Pale flower head (inflorescence) with long wispy hairs (awns) and very distinctive from a distance. *Oryza rufipogon* has a joint at the base of the lemma. *O. sativa* (commercial rice) usually has a white or greenish seed, while native *Oryza* have reddish-brown seeds.

Habitat: Occurs on seasonal (ephemeral) swamps and flood plains, usually on heavy clay or black soils. Unsustainable grazing practices and the invasion of introduced grasses in wetland areas has led to a significant decline.

Value in wetland:

- provides important habitat for native birds, including as a preferred food and nesting site for magpie geese
- in the wet season, these plants may grow to 1 m or 2 m in height, either as isolated tussocks or in dense patches or swards, but they bend under the weight of mature stalks and seeds, and eventually collapse and dry out. The plant is an important food source and provides an important habitat.

Plant uses:

- successfully used on banks of constructed wetlands in Townsville
- seeds were an important staple in North Queensland, with a high protein content, reportedly sometimes stored for up to four years
- has been used to create hybrids with commercial rice that have increased resistance to drought, salinity and pests.

Propagation: Can be propagated by seed or by dividing clumps. Seeds may require dry storage for a couple of months to break dormancy mechanisms, and normally germinate in 30–60 days after sowing. They are planted as tubestock 1 m apart on edge of wetland, where they can form dense swards within 1 year.





Hollow, spongy, air-filled stems



Inflorescence with overlapping rows of spikelets



Dense, spreading mats may develop in seasonally dry flood plains and swamps

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	●	●	●	●	●	•			•		
Fruiting		●	●	●	●	●	●	●	●	•		

Spongy swamp grass

Paspalidium udum – Family Poaceae

Other common names: Previous scientific name: *Setaria uda*

Description: Perennial semi-aquatic or aquatic grass to 1.5 m tall, with fibrous roots and creeping above-ground stems (stolons). Smooth stems (culms) are filled with air chambers, giving them a spongy feel. Leaves are arranged alternately along the stem, 150–300 mm long by 5–10 mm wide, usually erect at a 45-degree angle to the stem. Leaves are smooth but leaf sheaths are rough to the touch when rubbed downwards. Flower head (inflorescence) is 200–300 mm long, borne vertically on the ends of culms, consisting of several smaller branches 10–30 mm long, closely pressed together, and numerous flowers (spikelets) 2.7–3 mm long, borne neatly in two alternate and overlapping rows along branches.

Distinctive features: Growth habit is superficially similar to *Urochloa mutica* (para grass*). Para grass has very hairy stems, a different arrangement of flowers and lacks the air-filled chambers in the stem.

Habitat: The only known occurrence in Queensland is the Townsville Town Common where it was discovered growing in January 2005; however, it is possible that this plant has been overlooked in other wetlands in the region. Its known habitat is in seasonal (ephemeral) freshwater wetlands on heavy clay soils, either on the margins or on slightly raised 'islands' within the wetlands. During the wet season, it briefly occupies wetlands up to 1 m deep and tolerates being almost entirely submerged. Tolerant of fire but suitable habitat is rare due to para grass* invasion.

Value in wetland:

- it is possible that this species was more widespread before the introduction of para grass* and may have dominated vegetated swamps slightly deeper than that now dominated by para grass*
- provides valuable food and habitat for water birds
- likely to absorb significant amount of nutrients
- now listed in Queensland as a threatened species 'vulnerable' to extinction
- known to be sensitive to heavy grazing and para grass* invasion.

Plant uses:

- suitable for wetland revegetation along the edge of seasonal (ephemeral) vegetated swamps
- unsuccessfully trialled in riparian revegetation in Townsville
- suitable for use in constructed wetlands, especially bioretention basins prone to cycles of flooding and drying.

Propagation: Propagate from fresh seed spread over a potting mix of equal sand and a small particle potting soil, though germination is often sporadic. Seed germination is enhanced by smoke treatment. Can also be propagated vegetatively from cuttings of the stolons or by dividing mature clumps.





Phragmites australis: flowers with silky hairs



Phragmites karka: more pendulous flowering



Phragmites australis: Long ligule hairs



Phragmites karka: Shorter ligule

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●	●	●	●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Common reed

Phragmites australis – Family Poaceae



Other common names: bamboo grass, canegrass, swamp sedge, giant reed. Previous scientific name: *Arundo australis*

Description: Robust perennial grass with stout upright stems (culms) 1.5–3 m tall, with sturdy, creeping above-ground stems (stolons) and underground stems (rhizomes). Large smooth leaves, tapering to a fine point, arranged alternately along the stem, 100–600 mm long, 5–35 mm wide. Ligule at junction of leaf base is a rim of long hairs, with a hairy tuft on the opposite side of the culm. Flower head (inflorescence) 150–400 mm long with multiple branches (panicle), slightly nodding. Small stems that bear flowers (rachillas) have distinctive long silky hairs 12 mm long. Flowers (florets) in groups of 2–6; the lowest are male and others are bisexual. Produces prolific thin brown seeds with an attached bristle.

Distinctive features: *Arundo donax** looks superficially similar but has very hairy flowers (florets) compared to *Phragmites*. *Phragmites karka* (sometimes mistaken for *P. vallatoria*) has leaves noticeably rough to touch (scaberulous) and, in this region, shorter ligule hairs and a more pendulous flowering head (inflorescence).

Habitat: Has a low tolerance to rapidly moving water, found in permanently wet areas in wetlands, riverine, flood plain and estuarine areas, where it grows in water 0–1.5 m deep. This species can survive in poorly aerated sediments associated with stagnant water. Can occur in fresh, brackish and also highly acidic wetlands. Has been observed to grow in highly saline water.

Value in wetland:

- colonising pioneer plant, forms thickets that protect stream banks and edges of wetlands from erosion
- removes nutrients such as nitrogen and phosphorus, and filters sediment from the water
- produces an abundance of organic matter and oxygenates wetlands
- provides food and habitat for birds and other native fauna
- sometimes poses management issues in water supply channels by impeding water flow.

Plant uses:

- used in constructed wetlands to uptake or remove nutrients, filter sediment, and stabilise banks, especially for binding and immobilising sediments at inlet zone
- leaves and shoots were eaten by North Queensland Aboriginals
- long leaves may be woven into baskets, the tall stems used as light spears and the stem segments worn as ornaments
- can indicate areas affected by acid sulphate soils, and may be suitable for restoring those areas. The organic matter that accumulates around the base of *Phragmites* clumps increases the rate of sulfate reduction, effectively reducing acidification.

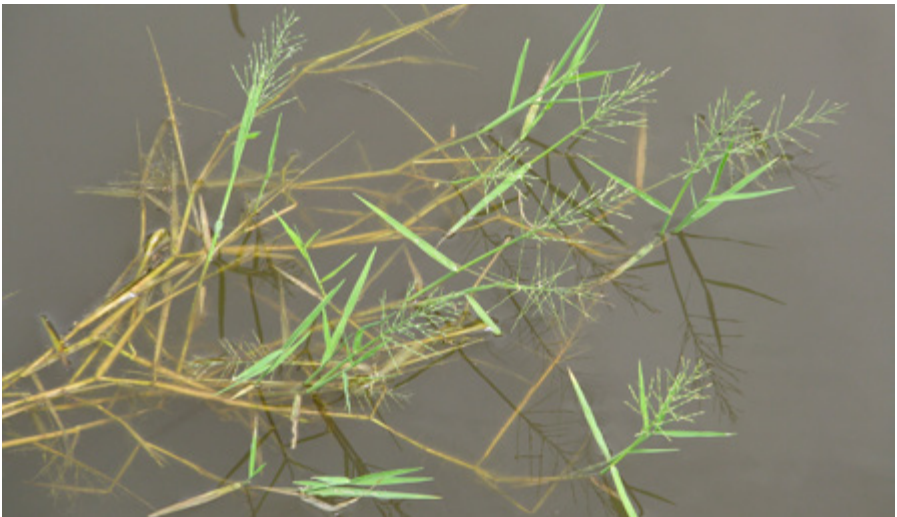
Propagation: Spread is mainly through vegetative means via rhizome and stolon fragments, where dispersal to new sites is typically by seed. Seed germination is higher on moist soil than on saturated soil, where no seeds germinate under water. Seeds are apparently of low viability and considered variable. Seed viability has been shown to drop significantly if dry-stored.



Alternately spaced flowers (spikelets)



Smooth stems and leaves with minute ligule



Floating stems grow out across the water surface

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	●	●	●	●	●	•				
Fruiting		•	●	●	●	●	•	•				

Spiny mud grass

Pseudoraphis spinescens – Family Poaceae



Other common names: floating couch grass, mud grass, moira grass. Previous scientific name: *Panicum spinescens*

Description: Sprawling perennial grass to 0.5 m tall, with creeping above-ground stems (stolons) forming dense mats. Nodes on stem are variable, either smooth or covered in thick silky hairs, and producing roots. Smooth leaves arranged alternately along the stem, thin and tapering, 30–120 mm long, 10–40 mm wide, often held at right angles to the stem. Ligule at junction of leaf base is a membrane collar 1 mm long. Flower head is (inflorescence) 40–70 mm long, with 8–20 branches (panicle), each with alternately spaced flowers (spikelets). Fruit is a pale rounded seed 1.3 mm long.

Distinctive features: *Panicum paludosum* can have a similar growth habit but the flower head (inflorescence) has secondary branches. *Paspalum distichum* (water couch) has a flower head consisting of only two arms. *Pseudoraphis paradoxa* looks similar but the flower head has much smaller branches, with only 1–2 flowers (spikelets) per branch.

Habitat: Common component of grass-sedge wetlands and is found in a diverse range of habitats, including shallow zones of ephemeral or permanent pools, watercourses and flood plains associated with mud, heavy clays or dark cracking clay soils. Considered to be moderately salt tolerant.

Value in wetland:

- useful role in bank stabilisation and erosion control
- contributes to the ecological function of wetlands by providing food and habitat for waterfowl and other aquatic organisms, and nutrient cycling
- considered a useful indicator of the condition and integrity of aquatic ecosystems
- can sometimes become a nuisance in water channels by reducing water flow.

Plant uses:

- successfully used in constructed wetlands in Townsville. Particularly useful on wetland verges, where it produces a close turf on drying mud and forms dense floating mats in adjacent inundated areas
- suitable for bank stabilisation and erosion control, and has been trialled in bioretention ponds
- new shoots are considered palatable and grazed by stock and kangaroos.

Propagation: In natural conditions seeds are dispersed by water and germinate on saturated soils where water depth is about 2 cm. Germination can occur over prolonged periods, up to 40 weeks. Can also establish vegetatively or by fragmentation. Should not be allowed to dry out during establishment phase.



Flowers in clusters on branched stems are followed by brown to black nuts



Forms dense swards where wetlands have occasional tidal influence

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	•	•	•	•	•	•	•	•	•	•	•	•
Fruiting			•	•	•	•	•	•	•	•	•	•



Other common names: mangrove club rush.
Previous scientific name: *Schoenoplectus litoralis*, *Scirpus litoralis*

Description: Erect perennial sedge forming tussocks to 2 m tall, with rigid striated stems to 10 mm wide and underground stems (rhizomes). Leaves are often reduced to sheaths wrapped around the stem, though narrow leaves to 200 mm may sometimes be present. Flower head (inflorescence) occurs as a cluster of three or more drooping cigar-shaped flowers (spikelets), 6–25 mm long, on branched stems to 45 mm long. Above the inflorescence is a single stiffly erect bract (involucral bract) to 95 mm long, appearing superficially as part of the stem. Fruit is a brown to black nut 1.8–2.3 mm long, 1.3–1.6 mm wide.

Distinctive features: Of the seven *Schoenoplectus* species in the region, only *S. subulatus* and *S. mucronatus* grow to more than 0.5 m height. *S. subulatus* stems are round in cross-section, while *S. mucronatus* has three distinct corners.

Habitat: Usually grows in slow-moving brackish or saline water along the edges of tidally influenced rivers, creeks, channels and swamps, where it can form very large pure stands. It may be found in areas with a higher salinity than seawater. Broad tolerance to pH and shade. In freshwater with very low electrical conductivity (EC), it tends to be replaced by *S. mucronatus*.

Value in wetland:

- important food and wildlife habitat for water birds including the endangered painted snipe, moorhens, swampheens, and magpie geese, which crush down the stems to build nests
- provides a substratum for algal epiphytes and biofilms to enhance soluble pollutant uptake
- valuable for stabilising erosion-prone banks.

Plant uses:

- useful for restoring erosion-prone and disturbed areas, and as an ornamental in ponds or dams
- has been established easily and quickly in local constructed wetland projects
- underground rhizomes are apparently edible after roasting and hammering to remove the starch
- used in traditional medicine to reduce fever, increases urination (diuretic) and anti-parasitic (anthelmintic)
- leaves used to weave baskets and mats
- young submerged plants grown as an ornamental in aquariums
- used overseas to remove nutrients and pathogens from wastewater, it has the ability to remove heavy metals from phytoremediation ponds, including nickel, manganese, copper, zinc and lead.

Propagation: Seeds may be dormant. Dormancy can apparently be broken by exposure to ethylene or by chilling at 2°C for 30 days and then propagated uncovered in well-lit trays of wet soil. Usually propagated by division of a clump.



Female flowers form a dense brown rod that splits to release masses of dry fluffy seeds



Cumbungi forms dense swards where wetlands receive freshwater with high nutrients

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering	●	●	●	●	●	●			●	●	●	●
Fruiting	●	●	●	●	●	●	●	●	●	●	●	●

Cumbungi

Typha domingensis – Family Typhaceae



Other common names: bulrush, narrow-leaf cumbungi, cats tail. Previous scientific name: *Typha brownii*, *Typha angustifolia*

Description: Perennial erect herb to 2–3 m tall, with stiff and rigid stems and underground stems (rhizomes). Leaves are long and erect, sheathed at the base of the stem, 2 m long, 5–15 mm wide. Flower head (inflorescence) occurs as a spike on the tip of the stem. Male and female flowers are separate; short-lived male flowers are on top but soon disintegrate after pollen is shed. Female flowers form a dense brown rod 85–260 mm long, persisting for a long time. Fruit is a dry, single seed with a whorl of long silky hairs.

Distinctive features: *Typha orientalis* is very similar, sometimes with a slightly broader leaf but with a distinct collar where the leaf sheath separates from the main stem.

Habitat: Usually grows in still or slow-moving water up to 2 m deep in freshwater swamps and streams, extending into seasonally brackish bulkuru swamps. Often dominates as dense colonies where saline areas are bunded and receive freshwater with high nutrients, and where water-logged areas are heavily disturbed. Prefers permanent and relatively stable water levels, tending to die off where wetlands are subject to seasonal drying.

Value in wetland:

- important wildlife habitat for water birds, frogs, tadpoles and fish fingerlings. An overabundance can lead to reduced diversity of bird habitat and biodiversity by reducing open water and mud banks
- valuable for removing suspended solids and nutrients, particularly nitrogen and phosphorus

- reduces evaporation, stabilises banks, reduces flood energy, reducing erosion
- often considered a weed in irrigation channels and drains, altering hydrology, creating anoxic conditions and blocking fish passage
- considered an indicator of disturbance, excess nutrients and changed hydrology, particularly where tidal areas have been bunded and/or supplemented with irrigation or stormwater runoff.

Plant uses:

- Australian Aboriginals ate the rhizome after peeling, separating starch from the fibres, roasting, baking and pounding, where they either chewed it or made it into bread. New shoots were eaten raw like asparagus
- pollen is edible either steamed or used as flour, and has a very high calorie and carbohydrate content
- starch from rhizomes is used for dysentery and gonorrhoea, the pollen to dry wounds. Masses of fluff from seeds may be used for bandaging wounds, and the sap used to protect from leech bites
- fluff from seeds used to start fires or stuff pillows
- long straight stems used as light spears
- fibre from rhizomes used to make twine, and leaves to weave baskets and mats
- *Typha* colonisation can be prevented by densely revegetating bare banks to prevent seedlings establishing
- control at the end of the dry season by slashing 150 mm below water level or drying and burning, then allowing water levels to drown the regrowth. Herbicide is known to be effective.

Propagation: Is propagated from seed and requires high light conditions. Plants produce up to 222,000 seeds per spike.



Long hairy stems up to 5 m long



Inflorescence is roughly pyramid shaped with alternate arms



Forms dense swards in water up to 1.5 m deep, excluding other native wetland plants

	J	F	M	A	M	J	J	A	S	O	N	D
Flowering		•	•	●	●	●	●	•	•			
Fruiting				●	●	●	●	•				



Declaration status: Not declared

Other common names: Mauritius signal grass. Previous scientific name: *Brachiaria mutica*, *Panicum muticum*

Description: Perennial African grass, 0.6–3 m tall but producing long, hairy above-ground stems (stolons) running up to 5 m long. Leaves are arranged alternately along stem, 60–300 mm long, 5–20 mm wide, often hairy. Flower head (inflorescence) is roughly pyramid shaped and consists of several alternate arms, each with numerous spikelets, 3–3.5 mm long.

Distinctive features: The long, running hairy stems (stolons) are distinctive of this grass.

Habitat: Occurs in permanent or ephemeral rivers and wetlands, anchored in water up to 1.5 m deep, but may trail long distances over the top of floating weeds to form a solid dense mat. It may also occur on floating rafts.

Impacts on wetland: Native to Africa, this noxious weed:

- forms monocultures, excluding other native plants and suppressing their seed germination
- causes a reduction in diversity of plants, birds (especially brolgas and magpie geese) and fish species
- modifies its environment through dense shading, generating high fuel loads and hot fires, and may impact water quality, especially dissolved oxygen.

Weed facts:

- formerly introduced for use in 'ponded pastures' for cattle grazing, but the benefits are outweighed by negative impacts on biodiversity, agriculture (by choking irrigation drains) and fishing
- still widely used for grazing—maintaining appropriate grazing pressure is often necessary to prevent para grass dominating the wetland.

Spread and control: Seeds have a low viability, and para grass is mostly spread vegetatively. Slashing, grazing and/or hot fires can be used in conjunction with herbicides to manage infestations. It is highly tolerant to fire and can generate high fuel loads, leading to destructive fires, but hot late-season fires can kill para grass, allowing other grasses to recolonise. It is highly palatable to cattle, and excluding cattle may cause para grass to expand, but grazing is not a permanent solution. It has a low tolerance to salinity, and restoring tidal influence has been effective in eradicating infestations in the lower Burdekin. There are only a few herbicides registered for use on weeds in waterways. It is a legal requirement that all herbicides be applied in strict accordance with the directions on the label. For further information on control, refer to the Department of Agriculture, Fisheries and Forestry—Weeds: www.daff.qld.gov.au/plants/weeds-pest-animals-ants/weeds.

Glossary

Achenes	small one-seeded, indehiscent fruit
Acute	sharply pointed
Allelopathic	where one plant suppresses the growth of another, often by the release of a toxin
Annual	a plant that lives for one year or less (c.f. perennial)
Anther	the terminal part of a stamen which forms pollen
Asexual	reproduction not involving the fusion of male pollen with the female ovule but may involve budding, fission or spore formation
Attenuated	tapered
Awn	hair or bristle-like structure
Axil	the upper angle between the stem and a leaf, branch or petiole
Bioretention basin	vegetated basins used to slow and treat on-site stormwater runoff
Bracts	modified leaf underneath (subtending) a flower cluster (inflorescence)
Capitula	dense cluster of flowers or foliage
Compound leaf	a leaf divided into multiple smaller leaflets
Cordate	heart-shaped
Cilia	stiff hairs
Cleistogamous	plants with non-opening, self-pollinating flowers
Corms	an underground plant stem that can act as a vegetative reproductive structure
Crenate	where the margin of the leaf is scalloped or has rounded teeth
Culm	stem of a grass
Digitate	branching from the same point-like fingers
Ephemeral	wetlands that do not have surface water for the entire year
Eutrophic	a process where a water body receives excess nutrients
Evapotranspiration	loss of water from plants including both evaporation and active transpiration through the leaf surface
Florets	a small or reduced flower
Glabrous	without hairs
Hydromulch	application of mulch in wet slurry
Hypanthium	a cup-shaped structure formed by fusion of several flower parts
Inflorescence	group or cluster of flowers
Involucral bract	modified leaves or bracts located below a flower or inflorescence
Lacustrine	large, open, water-dominated systems (for example, lakes) larger than 8 hectares. This definition also applies to modified systems (for example, dams), which are similar to lacustrine systems (for example, deep, standing or slow-moving waters)
Ligule	a small appendage at the base of a grass leaf, made of hairs and/or a membrane
Lobes	a blunt segment or division that is not entirely separate from each other
Macrophytes	water plants that grows in or near water, including plants that are submerged, emergent or floating
Megaspores	larger of two kinds of spores

Microspores	smaller of two kinds of spores
Obtuse	blunt or rounded
Ochrea	basal leaf sheath
Palustrine	primarily vegetated non-channel environments of less than 8 hectares. They include billabongs, swamps, bogs, springs, soaks etc, and have more than 30% emergent vegetation
Panicle	an inflorescence with multiple branches each bearing multiple flowers, and each with their own individual stalk (pedicel)
Pappus	tuft of hairs or bristles on the seeds of daisies
Pedicels	the stalk of an individual flower
Peduncles	the stalk of an inflorescence
Perennial	plant that lives for more than one year (c.f. annual)
Petiole	stalk of a leaf
Phytoremediation	use of plants to reduce the concentrations of contaminants in the environment
Rachilla	the central stem (axis) of a spikelet
Receptacle	the expanded base of a flower where some or all of the flower parts are attached
Rhizomes	underground stem that often sends out roots and shoots from its nodes
Riparian	occurring on the bank of a watercourse
Riverine	all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water
Scabrous	rough to touch (often caused by stiff hairs)
Scarification	the cutting or abrasion of the seed coat to promote germination
Septa	a dividing wall membrane
Serrated	toothed
Sessile	lacking a stalk, joining directly onto the stem
Spathe	sheath
Spathulate	spatula-shaped
Spikelet	a flower of a grass or sedge
Sporangia	structure producing and containing spores
Spores	asexual reproductive body that gives rise to a new individual
Sporocarps	spore capsules
Stamens	male reproductive part of a flower, consisting of a filament and anther
Stipe	stem of a fern
Stipule	leaf like structure found at the base of a leaf stalk (petiole)
Stolon	a stem growing above ground which forms roots at the nodes
Style	slender column joining the ovary to the stigma (female flower parts)
Umbel	an inflorescence in which the rays all arise from a common point
Utricle	bladder-like one-seeded fruit
Whorls	an arrangement of three or more leaves or other plant parts at a single point

Recommendations for revegetated



Note:

These recommendations are based on best information available and there are no guarantees that these plants are either the best species available or best-suited to the purposes recommended.

Species	Common name
<i>Ammania multiflora</i>	jerry-jerry
<i>Aponogeton queenslandicus</i>	Queensland lace plant
<i>Azolla pinnata</i>	water fern
<i>Caldesia oligococca</i>	caldesia
<i>Ceratophyllum demersum</i>	hornwort
<i>Ceratopteris thalictroides</i>	water fern
<i>Cynodon dactylon</i>	couch grass
<i>Cyperus alopecuroides</i>	foxtail flat sedge
<i>Cyperus conicus</i>	cone flat sedge
<i>Cyperus difformis</i>	dirty Dora
<i>Cyperus javanicus</i>	Javanese flat sedge
<i>Cyperus platystylis</i>	bunchy sedge
<i>Cyperus polystachyos</i>	bunchy sedge
<i>Diplachne fusca (Leptochloa fusca)</i>	swamp grass
<i>Eclipta prostrata</i>	white eclipta
<i>Eleocharis dulcis</i>	bulkuru sedge
<i>Eleocharis philippinensis</i>	five-cornered spike rush
<i>Fimbristylis bisumbellata</i>	fringe sedge
<i>Fuirena ciliaris</i>	eyelash sedge
<i>Hydrilla verticillata</i>	hydrilla
<i>Ipomoea aquatica</i>	swamp morning-glory
<i>Leersia hexandra</i>	swamp rice grass
<i>Lemna aequinoctialis</i>	duckweed
<i>Lomandra longifolia</i>	spiny-headed mat
<i>Ludwigia octovalvis</i>	willow primrose
<i>Ludwigia peploides</i>	water primrose
<i>Marsilea crenata</i>	nardoo
<i>Monochoria vaginalis</i>	bog hyacinth
<i>Myriophyllum verrucosum</i>	parrot's feather
<i>Nelumbo nucifera</i>	pink lotus lily
<i>Nymphaea gigantea</i>	blue water lily
<i>Nymphoides crenata</i>	yellow fringe lily
<i>Nymphoides indica</i>	water snowflake
<i>Oryza australiensis</i>	native rice
<i>Ottelia ovalifolia</i>	swamp lily
<i>Paspalidium udum</i>	spongy swamp grass
<i>Persicaria attenuata</i>	water pepper
<i>Phragmites australis</i>	common reed
<i>Potamogeton tricarlinatus</i>	floating pondweed
<i>Pseudoraphis spinescens</i>	spiny mud grass
<i>Schoenoplectus subulatus</i>	ricefield bulrush
<i>Sesbania cannabina</i>	sesbania pea
<i>Typha domingensis</i>	bulrush
<i>Utricularia gibba</i>	bladderwort
<i>Vallisneria nana</i>	ribbonweed

and constructed wetlands

Wetland Revegetation	Bioretention (Saturated)	Bioretention (Ephemeral)	Stormwater	Wastewater	Phyto- remediation
●					
				●	
				●	●
	●			●	
●		●	●		
●		●			
●	●				
●	●	●			
●		●	●		
●		●			
●		●		●	●
●		●	●		
●		●			
				●	
●				●	
●	●	●	●	●	●
				●	
●		●			
●				●	
●	●			●	
●	●			●	
				●	
●				●	
				●	
●				●	
●				●	
●				●	
●	●	●	●	●	●
●		●		●	
●	●			●	
●			●	●	●
			●	●	●
●				●	
				●	
				●	

References and further reading

- AECOM (2011) *Water sensitive urban design (WSUD) for the Coastal Dry Tropics (Townsville): Technical Design Guidelines for Stormwater management*. Report to Townsville City Council
- Ahmad, F. (2010). *Leptochloa fusca* cultivation for utilization of salt-affected soil and water resources in Cholistan desert. *Revista Sociedade & Natureza*, Vol. 22(1), pp.141-149.
- Anderson E. (1993) *Plants of Central Queensland – their identification and uses*. Department of Primary Industries, Brisbane.
- Armstrong J.E. (2001) Fringe Science: are the corollas of Nymphoides (Menyanthaceae) flowers adapted for surface tension interactions? *American Journal of Botany* 89(2):362-365
- Aruna C., Chaithra D., Alekhya C., Yasodamma N. (2012) Pharmacognostic studies of *Aeschynomene indica* L. *International Journal of Pharmacy and Pharmaceutical Sciences* 4(4):76-77
- Aston, H.I. in George, A.S., (Ed) (1987) Pontederiaceae. *Flora of Australia* 45: 52-53, Australian Biological Resources Study (ABRS)/CSIRO Publishing.
- Bindon P. (1996) *Useful bush plants*. Western Australian Museum, Perth
- Blackman, J.G., Spain, A.V., Whiteley, L.A. (1992) *Provisional Handbook for the Classification and Field Assessment of Queensland Wetlands and Deep Water Habitats*. Queensland Department of Environment and Heritage.
- Bostock, P.D., (1998) Parkeriaceae. *Flora of Australia* 48: 287-288 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Brand J.C., Rae C., McDonnell J., Lee A., Cherikoff V, Truswell A.S. (1983) *The nutritional composition of Australian Aboriginal bushfoods* 1. Food Technology in Australia. 35: 293-298
- Briggs, B.G. in George, A.S., (Ed) (1987) Typhaceae. *Flora of Australia* 45: 9-10 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Brock J. (2001) *Native plants of northern Australia*. Reed New Holland, Sydney
- Burkill, H.M. (1998) *The useful plants of West Tropical Africa*. Vol. 4. Royal Botanic Gardens, Kew, UK.
- Calvert G., Lokkers C., Cumming R. (2005) *Rare and threatened plants of the Townsville – Thuringowa Region*. Coastal Dry Tropics Landcare, Townsville, Qld.
- Chinnock, R.J., (1998) Azollaceae. *Flora of Australia* 48: 176-177 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Connolly N., Kahler C., Mackay S., Fry S., Cameron R. (2012) *Variations in wetland condition across land zones in the Lower Burdekin: Aquatic weed distribution determined by underlying differences in water and salinity regimes*. Report by Wetlands and Healthy Waters, Planning and Assessment, North Region, Queensland Department of Environment and Heritage Protection, Townsville – for the NQ Dry Tropics NRM Pty.Ltd.
- Cook, B. G. ; Pengelly, B. C. ; Brown, S. D. ; Donnelly, J. L. ; Eagles, D. A. ; Franco, M. A. ; Hanson, J. ; Mullen, B. F. ; Partridge, I. J. ; Peters, M. ; Schultze-Kraft, R., (2005) Tropical Forages. CSIRO, DPI&F(Qld), CIAT and ILRI, Brisbane, Australia
- Coops H., van der Velde (1995). Seed dispersal, germination and seedling growth of six helophyte species in relation to water-level zonation. *Freshwater Biology* 34: 13–20.
- Cowie, I.D., (2000) *Flood plain Flora. A flora of the coastal flood plains of the Northern Territory, Australia*. Flora of Australia Supplementary Series Number 10, Australian Biological Resources Study (ABRS).

- CRC Weed Management (2003a) *Weed management guide – Cabomba (Cabomba caroliniana)*. <http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/c-caroliniana.pdf>
- CRC Weed Management (2003b) *Weed management guide – Salvinia (Salvinia molesta)*. <http://www.environment.gov.au/biodiversity/invasive/weeds/publications/guidelines/wons/pubs/s-molesta.pdf> Accessed August 2014.
- Cribb A.B., Cribb J.W. (1981a) *Useful wild plants in Australia*. William Collins Pty Ltd, Sydney.
- Cribb A.B., Cribb J.W. (1981b) *Wild Medicine in Australia*. William Collins Pty Ltd, Sydney.
- Cribb A.B., Cribb J.W. (1987) *Wild Food in Australia* (2nd ed) William Collins Pty Ltd, Sydney.
- Crowder S., Siggers B. (2010) *Grasses of the Northern Territory Savannas: A field guide*. Greening Australia, Darwin.
- Department of Agriculture, Fisheries and Forestry (DAFF) (2013) *Declared plants of Queensland* http://www.daff.qld.gov.au/_data/assets/pdf_file/0019/72253/IPA-Declared-Plants-Qld-PP1.pdf Accessed August 2014.
- Department of Natural Resources, Environment and the Arts (2008) *Northern Territory Cabomba Eradication Program 2005/06*. http://lrm.nt.gov.au/_data/assets/pdf_file/0017/13517/Cabomba_erad_0506.pdf Accessed August 2014.
- Dunlop, C.R., Leach, G.J. & Cowie, I.D., (1995) *Flora of the Darwin Region* Vol.2. Northern Territory Herbarium, Conservation Commission of the Northern Territory.
- Elliot, W.R. & Jones, D.L. (1984). *Encyclopaedia of Australian Plants suitable for Cultivation*. Vol. 3. (Lothian Publications: Melbourne).
- Environment Australia (2001). *A Directory of Important Wetlands in Australia*. Third Edition. Environment Australia, Canberra.
- Faithful J.W. (1996) *The fate of Phosphorus in wetlands: A review*. ACTFR Report No. 96/15 to the Queensland Department of Natural Resources.
- FAO, (2012) *Grassland Index. A searchable catalogue of grass and forage legumes*. FAO, Rome, Italy
- Farooq Ahmad (2013) *Leptochloa fusca* Cultivation for Utilization of Salt-Affected Soil and Water Resources in the Cholistan Desert *Global Journal of Human Social Science Geography, Geo-Sciences, Environmental Disaster Management*. Volume 13 Issue 6 Version 1.0
- Fyson A (2000). Angiosperms in acidic waters at pH 3 and below. *Hydrobiologia* 433:129-135.
- Greenway M., Woolley A. (1999) Constructed wetlands in Queensland: Performance efficiency and nutrient bioaccumulation. *Ecological Engineering* 12 (1-2):39-55
- Greenway, M. (2003) Suitability of macrophytes for nutrient removal from surface flow constructed wetlands receiving secondary treated effluent in Queensland Australia. *Water Sci. Technol.* 48(2): 121-128
- Greenway M. (2005) The role of constructed wetlands in secondary effluent treatment and water reuse in subtropical and arid Australia. *Ecological Engineering* 25:501-509
- Hacker J.B. (1990) *A guide to herbaceous and shrub legumes of Queensland*. University of Queensland Press, St Lucia, Qld.
- Hacker, J. B.; Jank, L., (1998) Breeding tropical and subtropical grasses. In: Cherney, J. H.; Cherney, D. J. R. (Eds.). *Grass for dairy cattle*: 49-71. CABI Publishing, Wallingford, UK

References and further reading

- Hannan-Jones, M., Weber, J. (2008) *Pest Plant Risk Assessment: aleman grass (Echinochloa polystachya)*, Biosecurity Queensland, Department of Primary Industries and Fisheries, Brisbane. https://www.daff.qld.gov.au/_data/assets/pdf_file/0020/52256/IPA-Aleman-Grass-Risk-Assessment.pdf Accessed September 2014.
- Hariyadi, Yanuwadi B., Polii B., Soemarno (2013) Phytoremediation of arsenic from geothermal power plant waste water using *Monochoria vaginalis*, *Salvinia molesta* and *Colocasia esculenta*. *International Journal of Biosciences* 3(6):104-111
- Hay, A., (2011) Araceae. *Flora of Australia* 39: 274 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Heino, J. and H. Toivonen. (2008). Aquatic plant biodiversity at high latitudes: patterns of richness and rarity in Finnish freshwater macrophytes. *Boreal Environment Research. Res.* 13: 1-14.
- Hellquist, C.B. & Jacobs, S.W.L. in Wilson, A.J.G. (Ed) (2011) Aponogetonaceae, *Flora of Australia* 39: 48 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Hewson, H.J. & Beesley, P.L., (1990) Lythraceae. *Flora of Australia* 18: 99 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Hutchinson, G.E. (1975). *A treatise on limnology*, Volume 3. Limnology Botany. Wiley, New York.
- Inglis, S.N. and Howell, S. (2009). *Aquatic Conservation Assessments (ACA), using AquaBAMM, for the non-riverine wetlands of the Great Barrier Reef catchment*. Department of Environment and Resource Management (DERM), Brisbane. http://wetlandinfo.ehp.qld.gov.au/resources/static/pdf/assessment-monitoring/aquabamm/non-riverine-1-2-230310/gbr_aca_nr_all_reports_v1_2_web.pdf Accessed August 2014.
- Jacobs, S.W.L. & McColl, K.A., (2011) Alismataceae. *Flora of Australia* 39: 11-12 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Jacobs, S.W.L. & Porter, C.L. (2007) Nymphaeaceae. *Flora of Australia* 2: 259-275 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Jacobs, S.W.L. & McColl, K.A., (2011) Hydrocharitaceae p.p. *Flora of Australia* 39: 30 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Jaensch R., Joyce K. (2006) *Wetland Management Profile: Coastal Grass-Sedge Wetlands*. Ecosystem Conservation Branch, Department of Environment Protection Agency. <http://wetlandinfo.ehp.qld.gov.au/resources/static/pdf/resources/fact-sheets/profiles/p01781aa.pdf> Accessed August 2014.
- Jessup L.W., Sharpe P.R. (2004). *Cyperaceae in Queensland: Descriptions, Illustrations, Identification, and Information Retrieval*. Version: 5th April 2004.
- Jones, D.L. in McCarthy, P.M. (Ed) (1998), *Flora of Australia* 48: 167-168 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Kumar G., Srivastava N. (2012) Mercury induced genomic disturbance and flowering inhibition in *Sesbania Pea* (*Sesbania cannabina* Poir.) *Rom. J. Biol-Plant Biol.* 57 (1):27-35
- Laiden, I (2008) *Wetland Management Handbook Farm Management Systems (FMS) guidelines for managing wetlands in intensive agriculture*. Queensland Wetlands Program. Department of Employment, Economic Development and Innovation http://wetlandinfo.ehp.qld.gov.au/resources/static/pdf/resources/reports/fms/fms_025_handbook_web.pdf Accessed August 2014.

- Landolt, E., (2011) Lemnaceae. *Flora of Australia* 39: 27 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Linnaeus C. (1735) *Systema naturae per regna tria naturae :secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis* (1st ed.). Stockholm: Laurentius Salvius.
- Linder, H.P., (2005) Trib. Arundineae. *Flora of Australia* 44B: 8 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Liogier, H.A. (1995) *Descriptive flora of Puerto Rico and adjacent islands*. Vol. 4. Editorial de la Universidad de Puerto Rico, San Juan, PR. 617 p.
- Lukacs G.P., Weber E. (1997) *Seed germination requirements of four emergent macrophytes in North Queensland*. Australian Centre for Tropical Freshwater Research (ACTFR) Report 97/21
- McCarthy, P.M., (1998) Salviniaceae. *Flora of Australia* 48: 173 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Miller J.B., James K.W., Maggiore P.M.A. (1993) *Tables of composition of Australian Aboriginal Foods*. Aboriginal Studies Press, Canberra.
- Mkandawire M., Dudel E.G. (2007) Are lemna spp. Effective Phytoremediation agents? *Bioremediation, Biodiversity and Bioavailability* 1 (1):56-71 [http://www.globalsciencebooks.info/JournalsSup/images/0706/BBB_1\(1\)56-71o.pdf](http://www.globalsciencebooks.info/JournalsSup/images/0706/BBB_1(1)56-71o.pdf) Accessed August 2014.
- Morrill J. (1863) *Sketch of a residence among the Aborigines of Northern Queensland for seventeen years*. Courier General Printing Office, George Street, Brisbane.
- Neeraja P.V., Elizabeth M. (2011) *Eclipta alba* (L.) Hassk: A Valuable Medicinal herb. *International Journal of Current Pharmaceutical Review and Research*, 2(4): 188-197
- Nguyen Q.V., Hicks D. (2001) *Exporting lotus to Asia: An agronomic and physiological study*. Rural Industries Research & Development Corporation Publication No. 01/032, Gosford NSW.
- Office of the Gene Technology Regulator (2005) *The biology and ecology of rice* (*Oryza sativa* L.) in Australia. Office of the Gene Technology Regulator, Australian Government Department of Health and Ageing, Canberra
- Osmond R., Petroeschevsky A. (2013) *Water hyacinth control modules: Control options for water hyacinth* (*Eichhornia crassipes*) in Australia. NSW Department of Primary Industries. http://www.weeds.org.au/WoNS/waterhyacinth/docs/Water_hyacinth_control_options_WEB-ACCESSIBLE_VERSION_FINAL_V2.pdf Accessed August 2014.
- Papassotiropoulos, S.E., Jacobs, S.W.L. & Hellquist, C.B. in Wilson, A.J.G. (Ed) (2011), Potamogetonaceae. *Flora of Australia* 39: 92 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Parrotta, J.A. (2001) *Healing plants of Peninsular India*. CABI Publishing, Wallingford, UK and New York. 917 p.
- Perna, C., Tait, J. (2003). Fish Habitat Management Challenges on an Intensively Development Tropical Flood plain: Burdekin River North Queensland *RipRap* 19, 14-21
- Perna, C., O'Connor, R. and Cook, B. (2012) *Hydroecology of the lower Burdekin River alluvial aquifer and associated groundwater dependent ecosystems*. Department of Environment and Resource Management.

References and further reading

- Quattrocchi U. (2012) *CRC World Dictionary of Medicinal and Poisonous Plants: Common names, Scientific Names, Eponyms, Synonyms and Etymology*. CRC Press
- Reid, R.J. and Butcher, C.S. (2011) Positive and negative impacts of plants on acid production in exposed acid sulphate soils. *Plant and Soil*, 349(1-2):183-190
- Romanowski N. (2009) *Planting wetlands and dams: A practical guide to wetland design, construction and propagation*. (2nd Ed.) Landlinks Press, Collingwood, Victoria
- Rowlatt U. (1981) *Water plants of the Townsville Town Common*. James Cook University, Townsville
- Sainty, G.R. and Jacobs, S.W.L. (2003) *Waterplants in Australia*, Sainty and Associates Pty Ltd
- Sayed H.M., Mohamed M.H., Farag S.F., Mohamed G.A., Ebel R., Omobuwajo O.R.M., Proksch P. (2006) Phenolics of *Cyperus alopecuroides* Rottb. Inflorescences and their biological activities. *Bull. Parm. Sci. Assiut University* 29(1):9-32
- Sharpe, P.R. (1986) *Keys to Cyperaceae, Restionaceae and Juncaceae of Queensland*. Queensland Botany Bulletin No. 5.
- Shen-Miller, J.; M.B. Mudgett; J.W. Schopf; S. Clarke and R. Berger, (1995) Exceptional seed longevity and robust growth: Ancient sacred lotus from China. *American Journal of Botany* 82 (11):1367-1380
- Short P.S., Cowie I.D. (Eds) (2011) *Flora of the Darwin Region*. Northern Territory Herbarium, Department of Natural Resources, Environment, the Arts and Sport.
- Smith, N.M. (2011) *Weeds of the Wet/Dry Tropics of Australia – A Field Guide*. Environment Centre NT Inc.
- Srivastava N. (2014) Taxonomic characterisation and economic importance of lesser known Green manure crop *Sesbania cannabina* Poir. *Int. Research J. Biol. Sci.* 3(5):85-88.
- Stanley, T.D. (2007) Nelumbonaceae. *Flora of Australia* 2: 258-259 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Stanley, T.D. (2007) Ceratophyllaceae. *Flora of Australia* 2: 287- 289 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Stephens, K.M. and Dowling, R.M. (2002) *Wetland Plants of Queensland – A field Guide*, CSIRO Publishing.
- Sun J1, Su Y, Wang T. (2013) Expression, Purification and Identification of CtCVNH, a Novel Anti-HIV (Human Immunodeficiency Virus) Protein from *Ceratopteris thalictroides*. *Int J Mol Sci.* 14(4):7506-14
- Sutrisno Sa'ad N., Artanti R., Dewi T. (2011) Phyto-remediation for rehabilitation of agricultural land contaminated by Cadmium and Copper. *Indonesian Journal of Agriculture* 4(1): 17-21
- Swan S. (2006) *A tale of two "common" grasses, one a vulnerable endemic - Paspalidium udum, the other an introduced invasive - Urochloa mutica: implications for conservation and management with an emphasis on germination, performance and physiology*. Hons Thesis, School of Marine and Tropical Biology, James Cook University.
- Sweeney M.E. (2008) *The 101 best aquarium plants*. T.F.H. Publications Inc., Neptune City, N.J., USA
- Tait J. (2013) *Coastal Ecosystem Management – Lower Burdekin flood plain (LBF) Case Study*. Report for GBRMPA.
- Tews, J., U. Brose, V. Grimm, K.Tielborger, M.C. Wichmann, M.Schwager and F. Jeltsch. (2004). Animal species diversity driven by habitat heterogeneity and diversity: the importance of keystone structures. *Journal Biogeography*. 31: 79-92.

- Thompson, J., (1990) Onagraceae. *Flora of Australia* 18: 226-227 Australian Biological Resources Study (ABRS)/CSIRO Publishing
- Thozet A. (1866) *Notes on some of the roots, tubers, bulbs, and fruits, used as vegetable food by the Aborigines of Northern Queensland, Australia*. W.H. Buzacott, "Bulletin" Office, Rockhampton
- Tothill J.C., Hacker J.B. (1996) *The grasses of southern Queensland*. Tropical Grassland Society of Australia Inc., St Lucia, Qld
- Walters P. (1998) *Flora Useful in Environmental Engineering Applications*. Department of Primary Industries and Water (Tasmania).
- WetlandCare Australia (2008) *Wetland Rehabilitation Guidelines for the Great Barrier Reef catchment*. Compiled for Department of the Environment, Water Heritage and the Arts
- WetlandSummary—facts and maps*, WetlandInfo, Department of Environment and Heritage Protection, Queensland. <http://wetlandinfo.ehp.qld.gov.au/wetlands/facts-maps/>
- Wetland values*, WetlandInfo, Department of Environment and Heritage Protection, Queensland, <http://wetlandinfo.ehp.qld.gov.au/wetlands/management/wetland-values/>. Accessed August 2014.
- Williams K. (1979) *Native plant of Queensland* Vol.1. Keith A.W. Williams, Ipswich
- Williams K. (1984) *Native plant of Queensland* Vol.2. Keith A.W. Williams, Ipswich
- Williams K. (1987) *Native plant of Queensland* Vol.3. Keith A.W. Williams, Ipswich
- Williams K. (1999) *Native plant of Queensland* Vol.4. Keith A.W. Williams, Ipswich
- Williams P.R., Collins E.M., Grice A.C. (2005) Cattle grazing for Para Grass management in a mixed species wetland of north-eastern Australia. *Ecological Management & Restoration* 6 (1): 75–76
- Zhang, X. H., Liu J., Huang H.T., Chen J., Zhu Y.N., Wang D.Q. (2007). Chromium accumulation by the hyperaccumulator plant *Leersia hexandra* Swartz. *Chemosphere* 67(6), 1138-43.

Web reference

- AusGrass2 - Grasses of Australia
<http://ausgrass2.myspecies.info/>
- Australian Plant Name Index
<http://www.cpbr.gov.au/apni/index.html>
- Australia's Virtual Herbarium
<http://www.anbg.gov.au/avh>
- Discover Nature (Plants) at James Cook University
http://cms.jcu.edu.au/discovernature/plants_t/index.htm
- Fern K. (2014) The Useful Tropical Plants Database.
<http://tropical.theferns.info/>
- Molonglo Catchment Group (2011) Glove box guide: waterplants of the ACT Region
<http://www.molonglocatchment.com.au/Documents/Waterplants/Glovebox%20guide%20Waterplants%20of%20the%20ACT%20region.pdf>
- Simpson D. (2013) Some Magnetic Island Plants.
<http://www.somemagneticislandplants.com.au/>
- Society for Growing Australian Plants (Townsville Branch)
<http://www.sgaptownsville.org.au/>

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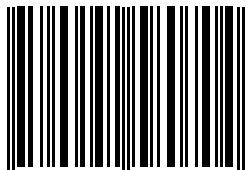
Authors Greg Calvert and Laurence Liessmann in their natural habitat

(Photo: Matthew McIntosh)

This image shows a blank sheet of white paper designed for writing. It features a series of horizontal light blue lines spaced evenly down the page. A single vertical red line runs along the left edge, creating a margin. The word "Notes" is written in a blue, cursive font in the top right corner.

WETLAND PLANTS OF THE TOWNSVILLE – BURDEKIN FLOOD PLAIN

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