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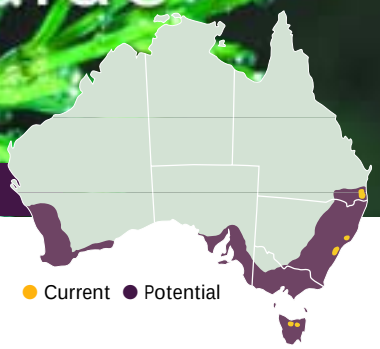
Weed Management Guide

Horsetails – *Equisetum* species



Horsetails (*Equisetum* species)

The problem

Horsetails (*Equisetum* spp.) are on the *Alert List for Environmental Weeds*, a list of 28 non-native plants that threaten biodiversity and cause other environmental damage. Although only in the early stages of establishment, these weeds have the potential to seriously degrade Australia's ecosystems.

The popularity of interesting foliage plants for landscaping in Australian gardens is contributing to a local increase in horsetails, which are among the world's worst weeds. Several species are being sold for use in Australian gardens. Horsetails are also promoted for medicinal purposes.

As well as being highly invasive, horsetails are toxic to livestock and can even kill animals that eat contaminated hay. Horses, cattle and sheep are particularly susceptible and can die within a few hours of eating large amounts of the plants. In high densities, horsetails reduce crop yields by producing inhibitory substances that depress the growth of neighbouring plants.

Horsetails produce inhibitory substances that can depress the growth of neighbouring plants at high densities. *E. arvense* is pictured here.
Photo: Charles Webber, California Academy of Sciences, USDA-NRCS Plants

The weed

Horsetails are primitive, non-woody, non-flowering, perennial plants that grow to heights in the range 50–1200 mm, depending on the species. The plant produces two different kinds of shoots: sterile, green, branched, hollow shoots and fertile, pale-brown, unbranched shoots that bear fruiting cones and die back to the ground each year. Both types of shoots break easily at the joints when pulled and feel hard and rough due to the silica in their tissues. The shoots grow from long, underground stems, called rhizomes, which extend to great depths.

Inconspicuous leaves on the main shoots grow in rings of 6 to 18, joined at their edges to form a black-tipped sheath of sharp teeth around the stem. The fruiting cones, 10–40 mm long, are found at the ends of the stems and contain masses of pale-greenish to yellow spores.

Twelve of the 30 horsetail species are considered weeds. Common horsetail, *Equisetum arvense*, and scouringrush horsetail, *E. hyemale*, are of most concern in Australia.

Key points

- Prevention and early intervention are the most cost-effective forms of weed control. Horsetails are so invasive and difficult to control that it is very important to prevent them becoming established.
- Horsetails can be spread over long distances by movement of soil containing rhizomes.
- If not controlled, horsetails could become persistent weeds of cultivated land, pastures and roadsides in temperate regions, especially on damp ground.
- If you see a plant that may be a horsetail species, contact your local council or state or territory weed management agency. Do not attempt control on your own.

Natural Heritage Trust
Helping Communities Helping Australia
An Australian Government Initiative

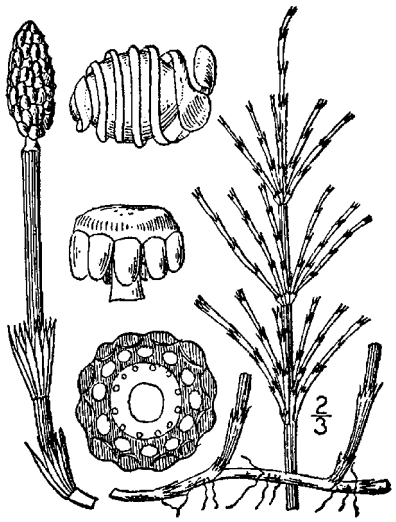
Growth calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tubular growth	■	■	■	■					■	■	■	■
Fruiting stem									■	■		
Spores released	■	■										■
Germination	■	■										■

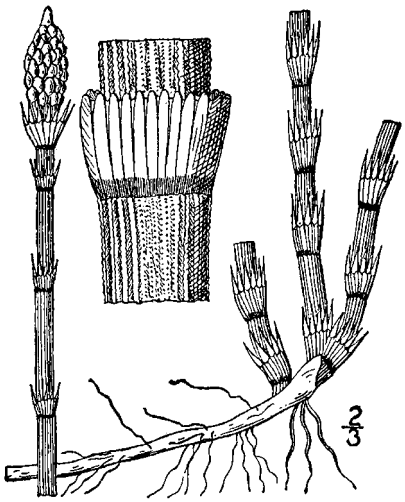
■ General growth pattern in temperate Australia

The persistent, deeply penetrating rhizome system produces new stems by budding from starch filled tubers throughout the growing season, which extends from early spring to autumn. Tubers initiated during late summer grow in size and number until late autumn, providing stored energy to be used in harsh conditions. The stems of common horsetail (*E. arvense*) usually die back to the rhizomes each year, but in other species above-ground growth may survive over winter. Fertile shoots appear early in spring and die after spores have been shed. Sterile shoots appear later and persist until autumn.

In established plants shoot growth begins in early spring and reaches a maximum in mid-summer, with the greatest number of fronds occurring in early autumn. Rhizome growth follows a similar pattern, establishing a layered system extending to 30 m laterally and to a depth of more than 5 m.



The stems of common horsetail (*E. arvense*) usually die back to the rhizomes each year.
Photo: Kentucky Native Plant Society, USDA-NRCS Plants



E. hyemale occurs on moist or springy grasslands, banks and roadsides.
Photo: N.L. Britton and A. Brown, Kentucky Native Plant Society, USDA-NRCS Plants

How it spreads

The spread of horsetails occurs almost entirely by rhizomes. Small pieces of tuber or rhizome broken from the parent plant can grow into new plants. Horsetails also produce millions of tiny, dust-like spores that are carried by wind and water. However, most of these spores die of water stress as they require prolonged moist conditions, such as those found in wetland habitats, to successfully germinate.

Some species of horsetail are sold in nurseries and distributed by herbal or permaculture enthusiasts. They can also be spread accidentally by the dumping of garden rubbish and contaminated soil, or during road making activities.

Where it grows

Horsetails are native to most temperate regions of the Northern Hemisphere, including Europe, North America and Asia. They have spread to New Zealand, Madagascar and parts of South America. They generally require moist conditions to establish but can then persist in a wide range of climates due to a number of adaptations which help to increase water use efficiency: a waterproof outer layer, green stems and special pores in the leaves. In drier areas the plants greatly reduce the size of their leaves to minimise water loss.

Horsetails occur in cold to warm temperate regions with annual average temperatures from <5° to >20°C and annual rainfall between 100 and 2000 mm. Most species inhabit swampy areas such as the edges of lakes, rivers and creeks, and prefer disturbed sites. They grow on many types of soil and can tolerate low nutrient levels.

Common horsetail (*E. arvense*) usually grows in damp, open woodlands, pastures, arable lands, roadsides, streambanks and embankments. It will grow in most wet places below altitudes of 300 m. It is a weed in Australia in areas where the annual rainfall is around 1400 mm.

Equisetum spp. have been found from Tasmania to Brisbane in a variety of naturalised and cultivated settings. For example, they have been identified north of Sydney at Narrabeen Lakes, Belrose, and at Snake Creek, Bayview Heights, infesting hundreds of square metres along creeklines at these sites.

Scouringrush horsetail (*E. hyemale*) similarly occurs on moist or springy grasslands, banks and roadsides, and is naturalised in New South Wales in areas below altitudes of 620 m with annual rainfall of 1100–1500 mm.

Other horsetails, eg branched horsetail (*E. ramosissimum*), have become weeds in New South Wales by outgrowing the garden areas where they were planted.

E. arvense usually grows in damp, open woodlands, pastures, arable lands, roadsides, streambanks and embankments.
Photo: Thomas Barnes, USDA-NRCS Plants

Why we need to be 'alert' to horsetail species

A number of outbreaks in Australia, eg from an Adelaide plant nursery in the 1950s and in the Mt Coot-tha Botanic Gardens in Brisbane, have shown that horsetails could become uncontrollable. Their availability in nurseries, evidence of existing infestations, their ability to survive under a wide range of conditions and their resistance to many herbicides indicate that the threat of invasion in Australia is serious.

The risk of horsetails establishing is considered to be greatest in temperate regions with annual rainfall above 500 mm. They have the potential to become persistent weeds of wetlands and other low-lying areas. Large areas of natural vegetation are potentially under threat.

The weedy behaviour of several horsetail species overseas provides a warning to be alert to the threats posed by them.

What to do about it

Prevention is better than the cure

As with all weed management, prevention is better and more cost-effective than control. The annual cost of weeds to agriculture in Australia, in terms of decreased productivity and management costs, is conservatively estimated at $4 billion. Environmental impacts are also significant and lead to a loss of biodiversity. To limit escalation of these impacts, it is vital to prevent further introduction of new weed species, such as horsetails, into uninfested natural ecosystems.

Horsetails are occasionally being illegally sold as garden ornamentals in some nurseries and markets around Australia, particularly on the east coast. These plants could spread from gardens or be inappropriately dumped into bushland. Notify the vendor or state or territory weed control contacts if you find

The Alert List for Environmental Weeds

The Federal Government's *Alert List for Environmental Weeds* was declared in 2001. It consists of 28 weed species that currently have limited distributions but potentially could cause significant damage. The following weed species are therefore targeted for eradication:

Scientific name	Common name	Scientific name	Common name
Acacia catechu var. *sundra*	cutch tree	*Koelreuteria elegans* ssp. *formosana*	Chinese rain tree
Acacia karroo	Karroo thorn	*Lachenalia reflexa*	yellow soldier
Asystasia gangetica ssp. *micrantha*	Chinese violet	*Lagarosiphon major*	lagarosiphon
Barleria prionitis	barleria	*Nassella charruana*	lobed needle grass
Bassia scoparia	kochia	*Nassella hyalina*	cane needle grass
Calluna vulgaris	heather	*Pelargonium alchemilloides*	garden geranium
Chromolaena odorata	Siam weed	*Pereskia aculeata*	leaf cactus
Cynoglossum creticum	blue hound's tongue	*Piptochaetium montevidense*	Uruguayan rice grass
Cyperus teneristolon	cyperus	*Praxelis clematidea*	praxelis
Cytisus multiflorus	white Spanish broom	*Retama raetam*	white weeping broom
Dittrichia viscosa	false yellowhead	*Senecio glastifolius*	holly leaved senecio
Equisetum spp.	horsetail species	*Thunbergia laurifolia*	laurel clock vine
Gymnocoronis spilanthoides	Senegal tea plant	*Tipuana tipu*	rosewood
Hieracium aurantiacum	orange hawkweed	*Trianoptiles solitaria*	subterranean Cape sedge

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Environment ACT	(02) 6207 9777	EnvironmentACT@act.gov.au	www.environment.act.gov.au
NSW	NSW Agriculture	1800 680 244	weeds@agric.nsw.gov.au	www.agric.nsw.gov.au
NT	Dept of Natural Resources, Environment and the Arts	(08) 8999 4567	weedinfo.nreta@nt.gov.au	www.nt.gov.au
Qld	Dept of Natural Resources and Mines	(07) 3896 3111	enquiries@nrm.qld.gov.au	www.nrm.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9500	apc@saugov.sa.gov.au	www.dwlbc.sa.gov.au
Tas	Dept of Primary Industries, Water and Environment	1300 368 550	Weeds.Enquiries@dpiwe.tas.gov.au	www.dpiwe.tas.gov.au
Vic	Dept of Primary Industries/Dept of Sustainability and Environment	136 186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au

The above contacts can offer advice on weed control in your state or territory. If using herbicides always read the label and follow instructions carefully. Particular care should be taken when using herbicides near waterways because rainfall running off the land into waterways can carry herbicides with it. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

horsetail species for sale, and plant more suitable local native species instead.

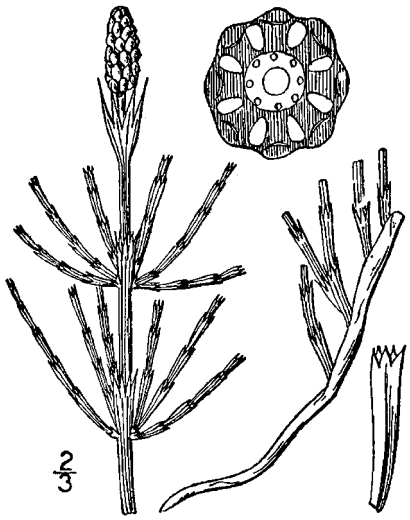
Early detection and eradication are also important to prevent infestations of horsetail species. Small infestations can be easily eradicated if they are detected early but an ongoing commitment is needed to ensure new infestations do not establish.

Quarantine to prevent further introductions

The importation of three horsetail species (*E. arvense*, *E. palustre* and *E. ramosissimum*) is not permitted into Australia because of the risk of further spread, and the potential introduction of new genetic diversity that could make future control more difficult.

Importation of other *Equisetum* species is not encouraged due to their potential to become serious environmental weeds.

Do not buy seeds via the internet or from mail order catalogues unless you check with quarantine first and can be sure that they are free of weeds like horsetails. Call 1800 803 006 or see the Australian Quarantine and Inspection Service (AQIS) import conditions database <www.aqis.gov.au/icon>. Also, take care when travelling overseas that you do not choose souvenirs made from or containing seeds or spores, or bring back seeds or spores attached to hiking or camping equipment. Report any breaches of quarantine you see to AQIS.



The importation of *E. palustre* (shown above), *E. arvense* and *E. hyemale* into Australia is not permitted.
Photo: Kentucky Native Plant Society, USDA-NRCS, Plants

As well as being highly invasive, horsetails are toxic to livestock and can kill some animals (horses, cattle and sheep) within hours of eating contaminated hay.
Photo: John Virtue

Raising community awareness

Some 65% of weeds, including horsetails, which have recently established in Australia have escaped from plantings in gardens and parks. The detrimental impacts of these weeds far outweigh any potential horticultural benefits. The public should be made more aware of these impacts, and other issues such as how to identify horsetails and what to do if they find them.

Horsetails are non-flowering perennial plants with erect, segmented stems, or shoots. Two types of shoots are produced: green, branched, hollow shoots and pale-brown, unbranched shoots that bear fruiting cones. The inconspicuous leaves encircle the stem as a sheath of short, teeth-like structures at the joints between the stems.

...case study

Common horsetail in Sydney, New South Wales

The largest infestation of horsetail in New South Wales is an outbreak of common horsetail (*E. arvense*) in the northern suburbs of Sydney. When it was discovered in the late 1980s, there were no known control measures. The property owners had been spraying the infestation with a non-specific herbicide. However, although this caused superficial burning to shoots, it was obviously not translocating to the roots as the regrowth was vigorous and quick.

The NSW Department of Agriculture experimented to discover which herbicides were most effective in controlling horsetail species. One herbicide was found to be particularly effective and did not cause off-target damage to desirable garden plants such as camellias. This herbicide is now registered by the Australian Pesticides and Veterinary Medicines Authority for 'off-label' minor use in New South Wales until 2008.

Although this herbicide treatment was killing root systems, the infestation was vast and extended into stony creek beds, ie sites that were not suitable for herbicide application. Continual follow-up work is necessary to keep the weed under control.

Infestations of scouringrush horsetail (*E. hyemale*) and branched horsetail (*E. ramosissimum*) in New South Wales were also extensive, but have been brought under control by excavation and follow-up chemical control with herbicide. Note that only persons trained or experienced in the use and handling of agricultural chemicals, and who are employees of certain companies listed on the 'off-label' permit, are allowed to use the herbicide to control horsetail species. Check with your local council or state or territory weed management agency for relevant control advice in your area.

New infestations of horsetail species

Because there are relatively few horsetail infestations, and they can potentially be eradicated before they become established, any new outbreaks should be reported immediately to your state or territory weed management agency or local council. Do not try to control horsetails without their expert assistance. Control effort that is poorly performed or not followed up can actually help spread the weed and worsen the problem.

Methods to control horsetails

Control of horsetails has been a challenge, both in Australia and overseas. They contain large amounts of silica, making it almost impossible for herbicides to penetrate the plants.

Ploughing and hand removal are ineffective as the plant can regrow from very small pieces of rhizome or tuber remaining in the soil. Fire, mowing and slashing are similarly ineffective as new stems grow quickly from the rhizomes. Mulching with a leaf compost or black plastic may give some benefit but is expensive.

Small areas can be removed by digging out all plant material, including the rhizomes.

In Tasmania infestations of scouringrush horsetail (*E. hyemale*) have been eradicated by excavation followed by deep burial of the material onsite.

Legislation

Legislation declaring the weed status of horsetails exists in all states and territories except the Northern Territory. All horsetail species are prohibited from sale in Queensland, and Victoria has recently listed them as 'state prohibited weeds', which means that the state government is required to eradicate existing infestations. In New South Wales, Western Australia and Tasmania all species of *Equisetum* are declared as weeds, which may mean that landholders are required to eradicate them.

Infestations of *E. hyemale* in NSW have been brought under control by excavation and follow-up chemical control with herbicide. Photo: Larry Allain, USDA-NRCS Plants

Acknowledgments

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Maps: Base data used in the compilation of actual and potential distribution maps provided by Australian herbaria via Australia's Virtual Herbarium and Queensland DNRM, respectively.

If you find a plant that may be horsetails

Quick reference guide

Identification

You will first need to confirm its identity. Contact your state or territory weed management agency for help in identifying the plant. You will need to take note of the characteristics of the plant in order to accurately describe it. Some important features of horsetails are:

- segmented, green vegetative stems that are conspicuous throughout summer after the pale-brown cone-bearing stems have withered
- leaves on main stems in rings of 6 to 18, often dark-brown on lower stems, with 2–3 mm long 'teeth'
- pale-green cones, 10–40 mm long, on the end of fruiting stems.

Reporting occurrences

Once identified, new occurrences of horsetails should be reported to the relevant state or territory weed management agency or local council, who will offer advice and assistance on their control. Because horsetail species spread so easily and pose such a serious threat, their control should be undertaken with the appropriate expertise and adequate resources.

Follow-up work will be required

Once the initial infestation is controlled, follow-up monitoring and control will be required to ensure that reinfestation from rhizomes does not occur.

Collecting specimens

State or territory herbaria can also identify plants from good specimens. These organisations can provide advice on how to collect and preserve specimens.

State/Territory	Postal Address	Phone	Web
Australian National Herbarium	GPO Box 1600 Canberra, ACT, 2601	(02) 6246 5108	www.anbg.gov.au/cpbr/herbarium/index.html
National Herbarium of New South Wales	Mrs Macquaries Rd Sydney, NSW, 2000	(02) 9231 8111	www.rbgsyd.nsw.gov.au
National Herbarium of Victoria	Private Bag 2000 Birdwood Avenue South Yarra, Vic, 3141	(03) 9252 2300	www.rbg.vic.gov.au/biodiversity/herbarium.html
Northern Territory Herbarium	PO Box 496 Palmerston, NT, 0831	(08) 8999 4516	http://www.nt.gov.au/ipe/pwcnt/
Queensland Herbarium	c/- Brisbane Botanic Gardens Mt Coot-tha Rd Toowong, Qld, 4066	(07) 3896 9326	www.env.qld.gov.au/environment/science/herbarium
South Australian Plant Biodiversity Centre	PO Box 2732 Kent Town, SA, 5071	(08) 8222 9311	www.flora.sa.gov.au/index.html
Tasmanian Herbarium	Private Bag 4 Hobart, Tas, 7000	(03) 6226 2635	www.tmag.tas.gov.au/Herbarium/Herbarium2.htm
Western Australian Herbarium	Locked Bag 104 Bentley DC, WA, 6983	(08) 9334 0500	http://science.calm.wa.gov.au/herbarium/

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CRC Weed management

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