Aquatic weeds in Victoria: Where and why are they a problem, and how are they being controlled?

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Introduction

Aquatic plants are integral components of freshwater ecosystems and provide a number of ecosystem services by providing habitat for fish and aquatic invertebrates, facilitating nutrient cycling and maintaining water quality, and erosion control. However, when in excess, aquatic plants can harm a system by degrading water quality, slowing water velocity, exacerbating siltation or flooding, and reducing species diversity (Madsen 2005). In addition, invasive aquatic weed species which form dense infestations can reduce the diversity of aquatic flora, which can have secondary impacts on aquatic invertebrates and fauna, and fish (van Oosterhout 2009). Such impacts pose a serious threat to the long-term function of freshwater aquatic ecosystems and, if left unchecked, may result in significant habitat alteration (Barnett and Veitch 2007, Yarrow *et al*. 2009).

In recreational situations, dense infestations of submerged aquatic plants restrict human activities such as swimming, fishing and boat navigation (Madsen 2005). Large-scale senescence of a dense population of an aquatic plant can also produce unpleasant odours, affecting those living near the water body. Some invasive species (e.g. cabomba (*Cabomba caroliniana* A.Gray)) are also known to discolour and taint potable water (van Oosterhout 2009).

In earthen irrigation channels, aquatic plants hinder water flow and thus reduce delivery to users (usually farmers), and in some situations excessive growth can lead to channel overflow. Submerged aquatic weeds also interfere with hydroelectric generation by restricting water flow through intakes, blocking or restricting water flow in drains, and blocking pump inlets. It is in these situations that the greatest challenges for controlling aquatic weeds arise (Bill 1969).

Although there is published information available on aspects of aquatic weed management affecting Victoria, and Australia more widely (particularly that of Bowmer and co-workers in the 1980s and 1990s), the problems presented by aquatic weeds in Victoria have not been summarised since Bill in 1969. We document the current problem of submerged aquatic weeds in natural and constructed water bodies, and irrigation channels and drains in Victoria; the techniques used to control them; and what new herbicides might be useful in aiding control. As the aim of this project was to gather information to allow the Department of Environment and Primary Industries (DEPI) to identify aquatic weed management capability gaps in Victoria, we excluded the internal aquatic weed management activities carried out by DEPI, which are the extensive activities undertaken to manage three state prohibited aquatic weeds (alligator weed (*Alternanthera philoxeroides* (Mart.) Griseb.), salvinia (*Salvinia molesta* D.S.Mitch.) and water hyacinth (*Eichhornia crassipes* (Mart.) Solms)).

The extent of the aquatic weed problem in Victoria

To determine the extent of the problem that abundant submerged aquatic plants present for Victorian agencies and communities, a telephone survey of natural resource and waterway managers was conducted in 2010, listed in Table 1. The survey was supplemented with internet searches for information on aquatic weed control in Victoria in general and also with outcomes of meetings with Goulburn-Murray Water (G-MW) Aquatic Plant Services staff and the authors' knowledge of issues relating to aquatic weeds within Melbourne Water and Goulburn-Broken Catchment Management Authority (CMA) through ongoing research collaborations.

This survey found that overall, both direct and indirect involvement with the control of submerged aquatic weeds by management agencies is limited. Some authorities are aware of the presence of submerged aquatic plants in a limited number of water bodies, but the plants either do not create any problems so no action is taken, or the perceived environmental threat posed by such species is not a priority (although there are exceptions). Active control is carried out in two main situations - in artificial standing water bodies and in irrigation channels. In addition, some CMAs engage in the control of marginal emergent species such as parrot's feather (*Myriophyllum aquaticum* (Vell.) Verdc.), cumbungi (*Typha* spp.) or canegrass (*Phragmites australis* (Cav.) Trin. ex Steud.). These emergent species are highly visible and the latter two taxa are native.

Standing water bodies

Benalla City Council and Goulburn Broken (GB) CMA control cabomba in Lake Benalla for environmental and anthropogenic reasons. Cabomba was identified as a significant threat to the fish communities of the Upper Broken Creek and Lower Broken River in an Ecological Risk Assessment of the water bodies (Newall *et al*. 2008), and its potential dispersal downstream to wetlands in Barmah Forest is of particular concern to GBCMA. It also causes significant impacts on recreational uses of the lake (primarily aesthetic and being a potential drowning hazard). Because of these issues, Lake Benalla has been subject to five drawdowns since 1999 to control cabomba (Hunt *et al*. 2012, Dugdale *et al*. 2013: drawdown refers to the removal of water from a water body for several weeks to desiccate the aquatic plants). In addition, there is a large infestation of cabomba in Lake Nagambie/Goulburn Weir that is recognised as being problematic by Goulburn-Murray Water and the local community. However, no control is carried out there because, until 2012, there was no herbicide registered for cabomba control and the control efficacy, and the social and environmental impacts of a water level drawdown in this system are unknown (Table 2).

Mexican water lily (*Nymphaea mexicana* Zucc.) in Lake Nagambie/Goulburn Weir (and Gunbower Creek) is another example of an aquatic weed that is controlled for environmental gain. It forms dense stands in shallow backwaters where its canopy prevents gas exchange between the water and atmosphere and its high biomass produces a high biological oxygen

Table 1. Agencies interviewed in relation to aquatic weed issues as part of this project.

Agency
Corangamite Catchment Management Authority (CMA)
East Gippsland CMA
Glenelg-Hopkins CMA
North Central CMA
North East CMA
West Gippsland CMA
Grampians Wimmera Mallee Water
Lower Murray Water
Goulburn-Murray Water
Southern Rural Water
Parks Victoria

Table 2. Impoundments with aquatic weed problems in Victoria.

Water body	Weed	Impact	Hydrology	Control under-taken	Current herbicide options
Lake Mulwala	Egeria	Clogging of intake of hydroelectric power station and fish ladder. Impedes boating (water skiing, fishing and sailing clubs form the basis of a large tourism industry). Impedes swimming. Aesthetic – the townships of Yarrawonga and Mulwala front the lake. Accumulation of rotting vegetation on shore.	Weir pool created by a weir across the Murray River. Lake is maintained at very stable levels (+/- 0.5 m).	Multiple drawdowns	Diquat registered and efficacious against egeria but not used because the lake is an irrigation and town water supply.
Lake Benalla	Cabomba	Threat to native fish community. Impedes swimming (caused cancellation of annual triathlon). Aesthetic – the lake forms the centre piece of municipal parkland. Accumulation of rotting vegetation on shore.	Artificial lake created by weir across the Broken River. Lake is maintained at very stable levels (+/- 0.5 m).	Multiple drawdowns. Benthic barriers in select areas.	Carfentrazone was registered in 2012 but is not yet used because of a general reluctance to use herbicides in lakes combined with its long withholding period for irrigation water. Dichlobenil may be useful but it has toxicity issues and can not be used in water intended for irrigation, stock watering or human consumption.
Lake Nagambie/ Goulburn Weir	Cabomba	Rowing – the lake hosts the Nagambie Lakes regatta centre. Aesthetic – a township and many houses front the lake. Accumulation of rotting vegetation on shore.	Weir pool created by weir across the Goulburn River. Lake is maintained at very stable levels (+/- 0.5 m).	None. Drawdown difficult.	Carfentrazone was registered in 2012 but is not yet used because of a general reluctance to use herbicides in lakes combined with its long withholding period for irrigation water. Dichlobenil may be useful but it has toxicity issues and can not be used in water intended for irrigation, stock watering or human consumption.
Lake Nagambie/ Goulburn Weir	Mexican water lily	Depressed dissolved oxygen. Restricted boat access. Aesthetic.	Weir pool created by weir across the Goulburn River. Lake is maintained at very stable levels (+/- 0.5 m).	Foliar herbicide	Annual glyphosate applications are carried out.
Albert Park Lake	*Potamogeton* spp., ribbon weed	Aesthetic – the lake forms the centre piece of municipal parkland. Accumulation of rotting vegetation on shore. Impedes sailing.	Permanent lake fed by urban stormwater. Small water level fluctuations.	Harvesting	Diquat registered but with variable efficacy against *Potamogeton* spp. it is used, probably because harvesting provides adequate control.
Lake Wendouree	Native milfoil species	Aesthetic – the lake forms the centre piece of municipal parkland. Accumulation of rotting vegetation on shore. Impedes boating and other recreational activities.	Semi-permanent lake that occasionally dries completely, although changes to water supply sources now maintain water volume.	Harvesting	No efficacious chemical registered against milfoil. Dichlobenil may be useful but it has toxicity issues. Lake Wendouree has been used as a source of water for fish aquaculture, a situation that precludes using dichlobenil. Also, harvesting provides adequate control.

Table 2. Continued.

Water body	Weed	Impact	Hydrology	Control under-taken	Current herbicide options
Lake Lilydale	Egeria	Aesthetic – the lake forms the centre piece of municipal parkland (~1 000 000 visitors annually). Accumulation of rotting vegetation on shore. Impedes swimming, fishing and sailing.	Permanent lake fed by urban stormwater. Constructed behind an earthen dam across Olinda Creek as a flood retarding basin. Small water level fluctuations.	Multiple drawdowns	Diquat registered and efficacious against egeria but not used. Current turbidity in the lake likely to be too high for diquat to work.
Melbourne Water constructed wetlands	Egeria, elodea	Displaces native flora Impedes flow.	Mostly permanent constructed wetland basins fed by urban stormwater. Small water level fluctuations.	None	Diquat registered and efficacious against egeria but not used as egeria does not impede function of the wetlands. Turbidity in wetlands often too high for diquat to work.

demand. These factors combine to create low dissolved oxygen in the water, which has been suspected as the cause of a fish kill (Hofstra *et al. in press*). It has been controlled for several years with annual foliar herbicide applications (Table 2).

Goulburn-Murray Water and Murray-Darling Basin Authority have subjected Lake Mulwala to at least four drawdowns to control submerged aquatic weeds, including three since 2008. The reasons for control are because of the impact on boating, weir function, hydroelectric generation and the aesthetics of large, surface-reaching weed beds in the lake. Initially drawdowns were used to control the native floating pondweed (originally named as *Potamogeton tricarinatus* F. Muell & A. Benn. but now thought to be a different species) but they are now aimed at controlling the exotic species, egeria (*Egeria densa* Planch.), which became much more abundant than *P. tricarinatus* sometime before 2008 (Dugdale *et al.* 2012a).

Many stormwater retarding basins and constructed wetlands managed by Melbourne Water are infested with egeria and to a lesser extent elodea (*Elodea canadensis* Michx.). These species displace native flora and retard water flow, but from a management point of view, the problems created do not usually warrant specific control work because they do not interfere with the function of the wetlands. The exception to this is egeria infestations in Lake Lilydale, which has been subject to at least three drawdowns (~1998, 2000 and 2012): these have successfully controlled the weed. Lake Lilydale is a high profile public asset that hosts a sailing club and is a popular recreational fishery (Table 2).

Ballarat City Council and Parks Victoria have both had harvesting programs in place to remove submerged aquatic weeds that interfere with boating and recreation. In Ballarat, native milfoil species (*Myriophyllum* spp.) form surface reaching beds in Lake Wendouree, while in Melbourne the native pondweed species (*Potamogeton* spp.) and ribbonweed (*Vallisneria australis* S.W.L.Jacobs & Les) do the same in Albert Park Lake. We are also aware of at least two housing estates where the native submerged species ribbonweed and seatassel (*Ruppia megacarpa* R.Mason) are problematic in constructed lakes. These weeds are subject to regular harvesting, multiple times per year, with specialised weed harvesters. It is notable that Albert Park Lake (with elodea and *Potamogeton ochreatus* Raoul) and Lake Wendouree (with milfoil species, ribbon weed and *Potamogeton* spp.) also had problematic submerged weed growths in the 1950s and 1960s (the latter being particularly important as it was the site of the rowing events for the 1956 Olympics). At this time, they were successfully controlled with acrolein in Albert Park Lake, but a range of herbicides were tried without reliable success in Lake Wendouree, so weed cutting boats were employed (Bill 1969).

Irrigation channels

Water supply authorities who administer and supply irrigation water vary in how they respond to the presence of weeds in supply channels and drains. Southern Rural Water, who manage ~1 200 km of irrigation channels, usually leave supply channels empty during the off-season and control vegetation growing in that time using standard terrestrial herbicides, where required. However, in the past they have relied heavily on treatment of the channels with acrolein while they were carrying water. In December 2009, Southern Rural Water returned to using acrolein in some channels and drains as excessive vegetation severely restricted water delivery during the irrigation season and other control techniques were inadequate.

In contrast, Goulburn Murray Water, because of a policy of maintaining channels full throughout the irrigation off-season to save water, still require aquatic herbicides (notably acrolein) to keep channels and drains clear of submerged vegetation. The most acute problem caused by the vegetation in Goulburn-Murray Water irrigation channels is their interference with the operation of automated water supply gates, causing them to lose synchronicity. The vegetation in the channel slows water flow through the channel, which delays the delivery of water to the downstream gate. This delay sends a signal, through an automation system, to the upstream gate requesting more water. The upstream gate opens wider sending more water downstream, by which time the original water has reached the downstream gate. Once out of synchrony, efficient delivery of water in not possible.

The biggest threat to Goulburn-Murray Water and Southern Rural Water maintaining clear irrigation supply channels is the mooted withdrawal of acrolein from the Australian market; no other herbicides currently available are as effective or suitable for their needs.

The presence of any vegetation in irrigation channels is a problem, regardless of whether or not it is native. Most problems for Goulburn-Murray Water and Southern Rural Water caused by submerged vegetation are caused by members of the native *Potamogeton* and *Vallisneria* genera and the exotic species, elodea. It is notable that the same species were reported to cause the most problems

in irrigation channels in the 1960s, although a much wider range of herbicides were used to control them (Bill 1969).

Two emergent species (parrot's feather and sagittaria (*Sagittaria platyphylla* (Engelm.) J.G.Smith)), cause blockages of Goulburn-Murray Water's irrigation channels and drains. Sagittaria has a large impact on Goulburn-Murray Water's operation (along with those managed by the New South Wales authorities Murray Irrigation, Murrumbidgee Irrigation and Coleambally Irrigation). This species has become well established north of the Great Divide in Victoria, with rapid expansion since the 1970s (Adair *et al.* 2012). It thrives in irrigation channels, drains and natural creeks and wetlands <1 m deep and tolerates periods of drying. It is usually controlled with foliar herbicides (glyphosate and 2,4-D at high rates, amitrole and imazapyr – all under Australian Pesticides and Veterinary Medicines Authority (APVMA) permits), but herbicide effectiveness is short lived and multiple application per year are often required (Adair *et al.* 2012).

Summary

All the aquatic weed issues described above occur in irrigation channels or standing water bodies with artificially stable water levels, such as weir pools (Lakes Mulwala, Nagambie and Benalla), artificial lakes (Lake Lilydale and Albert Park Lake) and stormwater retarding basins (to a lesser degree). The characteristics of the impoundments are summarised in Table 2. Even within irrigation channels, problematic growths are restricted to the larger distribution channels that remain full with water at a constant level (not necessarily flowing) throughout the irrigation season and are usually not dry at any time (Bowmer *et al.* 1979). In contrast, most natural waterbodies in Australia are ephemeral (Boulton and Brock 1999), and the aquatic vegetation in these systems is adapted to tolerate such conditions. A key response in the submerged vegetation flora of Australia is that native species all rely on sexual reproduction to survive the dry periods. During wet periods they may also reproduce by clonal stem fragmentation (Brock 1991). This is in contrast to the exotic submerged species, such as egeria, elodea and cabomba. These species all rely on simple stem fragmentation to reproduce in their invasive ranges and produce dense multi-branched canopies that represent a considerable reproductive effort. This means that these species have a competitive advantage over native species in systems where water levels are stable.

Control options

A variety of techniques are available to reduce dense aquatic weed populations, of which the most common are herbicide applications, drawdown and harvesting. Feedback from the survey participants indicated that they felt that the current asset-based approach to managing submerged aquatic weeds in non-irrigation water bodies is hampered because control techniques suitable for Victorian conditions are underdeveloped, particularly regarding the availability of herbicides and knowledge about their use. Further, the vast network of open irrigation channels and drains (in excess of 9 800 km in the Goulburn-Murray Water districts with ~1 200 km in the Southern Rural Water districts) in use today need to be maintained and finding a replacement chemical for acrolein is a primary objective for irrigation companies.

Aside from harvesting, the only tool regularly used for the control of aquatic weeds in impoundments is drawdown. This is the removal of all or most of the water from a water body that has a target aquatic weed present. The water body then needs to remain empty for a period, usually several weeks, sufficient to allow the aquatic weed to desiccate and die. Obviously, this is a very blunt instrument and has significant impacts on flora, fauna, water quality and water supply. These broad scale impacts need to be kept in mind and weighed against the potential toxicity of relevant herbicides in making decisions about submerged aquatic weed control. Drawdown provides no capacity to strategically treat restricted areas. For example, a useful strategy is to treat localised areas of weed around high use areas of a lake such as boat ramps and jetties. This serves two purposes: 1) it reduces the impact of the weed on recreation; and 2) it lessens the risk of the weed entangling equipment (such as boat trailers) and then being dispersed to other uninfested locations. Herbicides potentially provide options for doing this but drawdowns do not.

Aquatic herbicides

Given the above information, there are two key areas where the current control options are hampered in Victoria. One is in standing water bodies, where control of submerged species requires whole lake drawdown or repetitive harvesting programs. The other is weeds of irrigation channels, where herbicides are the most cost effective option, but one of the currently used herbicide may not be available in Australia for much longer (it is also very toxic and dangerous). Both of these situations could be improved by the use of additional herbicides, or improved use of the current ones.

There are restrictions where herbicides can be used in riparian and aquatic ecosystems, due primarily to potential off-target effects of the herbicide in the aquatic environment. These restrictions are constrained further when dealing with submerged aquatic plants, particularly when they are present in natural waterways or where the water is used for human or stock consumption, or irrigation. Despite these issues, herbicides are widely used to control aquatic weeds, particularly in United States of America (Getsinger *et al.* 2008).

Diquat and dichlobenil are the only products registered for control of aquatic weeds in standing water in Victoria. However, there is no evidence that either chemical has been used extensively for such control. We have no way of knowing if private landholders use herbicides to control submerged aquatic weeds. Despite being very effective against both elodea and egeria, diquat is not currently used in irrigation situations (where the former is a key problem), or in standing waters (where the latter is problematic). The inactivation of diquat in turbid water means it is not a suitable tool for Victoria's turbid irrigation channels (as demonstrated by Bowmer 1982a, b and Clements *et al.* 2013) and recent testing has shown it to be ineffective on cabomba (Hunt *et al. in press*). The influence of a gelling agent, which is now available, may improve its efficacy in turbid water. Its long withholding period and the requirement for static water during application are key problems for irrigation companies. The same arguments are true for dichlobenil, although dichlobenil is not affected by turbidity.

Acrolein is registered (and used widely) for the control of submerged and emergent species in irrigation channels and drains only. All other herbicides registered for use in aquatic situations in Victoria are for the control of emergent species or plants growing on the banks or margins of channels, drains or natural water bodies. A brief summary of possible herbicides for aquatic weed control is provided in Table 3 (not all of which are registered in Australia). Of the chemicals listed in Table 3, only acrolein is used regularly and only in irrigation channels where it is a vital tool in the delivery of irrigation water.

The herbicide 2,4-D has limited potential for controlling submerged aquatic weeds because it controls dicot species only, of which there are few submerged aquatic weeds. The ester formulation appears to be more effective than the amine formulations, particularly on cabomba, but the use of this high volatile class of herbicide has been suspended by APVMA, e.g. Estercide 800 and Agricrop Rubber Vine Spray. There are now lower volatility 2,4-D esters available but we do not know how effective they will be on aquatic weeds.

Observations from New South Wales (A. Petroeschevsky personal communication) and our own testing (Hunt *et al. in press*) suggest that the newly registered

Table 3. Herbicides with potential for use on aquatic weeds.

Herbicide	Diquat	Acrolein	Endothal DPS	Endothal MAS	Carfentrazone	Dichlobenil	2,4-D ester
Submerged weeds effectively controlled	Egeria, elodea, some *Potamogeton* spp.	Most	Dipotassium salt formulation: Hydrilla, hornwort, lagarosiphon, milfoil and *Potamogeton* spp. including floating pondweed and ribbon weed.	Amine formulation: cabomba, ribbon weed and sagittaria.	Cabomba (based on unpublished New South Wales trials) and variable milfoil.	Ribbon weed, milfoils, *Potamogeton* spp., hydrilla and lagarosiphon,	Cabomba
Submerged weeds <u>not</u> effectively controlled	Chara, some *Potamogeton* spp., hydrilla, variable to poor against lagarosiphon and cabomba.	Poor control of floating pondweed.	Egeria, elodea and cabomba.		Poor for most submerged species.	egeria Little information available.	Not usually used for submerged species control.
Emergent species controlled	*Typha* spp., waterlilies, water hyacinth and salvinia.	None	Parrot's feather	Hygrophila	Water lettuce; suppression of alligator weed (on-label).	Unknown but non-selective in terrestrial situations.	Sagittaria
Typical degradation time in water (Netherland 2009)	0.5 to 7 days. Inactivated very rapidly in natural water.	4 hour half-life in irrigation channels (Bowmer *et al*. 1979).	2 to 14+ days	Not reported	Hours to 1+ day	Not reported	Not reported
Aquatic use on label	Yes	Yes for irrigation channels only.	No, but off-label permit for G-MW current (PER9835).	No but off-label permit for G-MW current (PER9835).	No	Yes	No
Effect of turbid water	Ineffective in turbid water.	Effective in turbid water.	Effective in turbid water.	Effective in turbid water.	Unknown	Unaffected	Unknown
Required contact time (Netherland 2009)	Hours to days. Contact herbicide.	Short – hours. Contact herbicide.	Hours to days. Contact herbicide.	Not reported	Hours to 1 day. Contact herbicide.	Not reported	Not reported
Other comments	A gelling agent has recently been registered for use with diquat. This may improve efficacy in turbid water.	Very toxic to fauna and dangerous to handle. Likely to be become unavailable commercially.	Minor use permit for Irrigation Australia. Also has a test kit available to allow rapid determination of residuals in the treated water and so determine when it is safe to use water.	Minor use permit for irrigation in Australia. Also has a test kit available to allow rapid determination of residuals in the treated water and so determine when it is safe to use water.	Registered for use in Australia in 2012.	High environmental toxicity, particularly for fish and aquatic insects.	Formerly used for cabomba control is Australia but registration of ester formulations have been suspended by APVMA.

carfentrazone can be useful for the control of cabomba, but it is unlikely to be effective on other submerged species (Table 3).

Although unregistered, endothal has great potential for use in Victoria. This is because: 1) it is effective in turbid water; 2) it is effective against *Potamogeton* spp. (including floating pondweed), cabomba, ribbon weed and sagittaria (Dugdale *et al*. 2012b); 3) the contact time required is short; 4) it is used effectively in flowing irrigation channels in USA (Sisneros *et al*. 1998), where it is used without a withholding period being applied to treated water, meaning that the water can be used to irrigate crops immediately after treatment; 5) there is a commercially available test for rapidly determining its concentration in the treated water; 6) there is an APVMA permit (PER9835) that allows it to be used in irrigation systems; 7) one of its formulations (dipotassium salt) has relatively low environmental toxicity. An additional advantage of endothal is that it is very effective against lagarosiphon (*Lagarosiphon major* (Ridley) Moss) (Wells and Champion 2010). Lagarosiphon is a state prohibited submerged weed that is not known to be present in Australia but there are no control options effective against it if it does arrive.

Recommendations

There are two active ingredients that we recommend be investigated further, that have the potential to enhance Victoria's aquatic weed control in the key areas of submerged weeds in standing water bodies and irrigation channels. The first is carfentrazone, which has now been registered for use in Australia. This indicates that it is effective but, given that its testing and early use has been undertaken in subtropical environments and as cabomba is a serious problem in both Lakes Benalla and Nagambie, we recommend conducting trials with this herbicide in Victoria. A particular problem with carfentrazone is its long withholding period before treated water can be used for irrigation. If this restriction cannot be surmounted, endothal offers a likely alternative (Hunt *et al. In press*).

Endothal appears to offer a suitable tool for controlling the key aquatic weed issues in Victoria, i.e. 1) use in flowing irrigation channels against ribbon weed and floating pondweed in place of, or in addition to, acrolein, and 2) use in standing water bodies to control cabomba (and lagarosiphon, if it arrives). A similar conclusion was also apparently reached by Bowmer and Smith (1984) who tested it in Australian irrigation channels against elodea. Although they found it to be fairly ineffective on elodea they did not test it against the more common species (ribbon weed and floating pondweed).

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Proposed new invasive species management legislation for Victoria

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The Department of Environment and Primary Industries is developing new Invasive Species Management legislation to replace the noxious weeds and pest animal provisions of the Victoria *Catchment and Land Protection Act 1994* (CaLP Act) and close the gaps in powers to deal with incursions of taxonomic groups currently not, or only partially, covered by Victoria's biosecurity legislation.

The CaLP Act covers many aspects of catchment and water management and is the main legislation providing for the management of noxious weeds and pest animals in Victoria. The Minster for Environment and Climate Change and the Minister for Water formally administer the CaLP Act jointly and severally. The Minister for Agriculture and Food Security, through Biosecurity Victoria, is responsible for biosecurity policy and direction setting and for enforcing the noxious weed and pest animal provisions of the CaLP Act.

Whilst many of Victoria's key strategies and policies relating to invasive species reflect a modern approach to biosecurity, the CaLP Act has not maintained pace with the breadth and nature of change in the biosecurity sphere.

The expansion of overseas trade and travel, changing land use and demography, as well as changing community preferences and expectations, combined with legislative deficiencies of existing legislation have all contributed to a recognition by Victoria's Biosecurity Standing Committee and the Minister for Agriculture and Food Security that legislative reform is needed to provide a contemporary approach to the future management of biosecurity threats posed by invasive species.

The proposed legislation is intended to:

- simplify, standardise and combine invasive species provisions into one comprehensive and enabling piece of legislation;
- enable the management of invasive species across all the stages of invasion and result in greater alignment to national and state biosecurity policy;
- remove the existing vacuum in powers to deal with incursions of a range of invasive species currently not, or only partially, covered by Victoria's biosecurity framework (e.g. certain invasive invertebrate or marine species);
- enable an integrated approach, which is not constrained by tenure, to manage the serious threats posed by invasive species to the environment, social values, human health and economic activity;
- introduce provisions to reduce the risks associated with increased movements and trade; and
- provide a better range of legislative tools to manage the risks posed by invasive species.

The Department of Environment and Primary Industries is developing the proposed legislation through a two-step process. The first step is to develop the primary legislation. Royal assent for the Bill is anticipated within the current term of the Victorian Parliament. To date a conceptual framework for the Bill has been developed and public feedback has been received on the proposal. The second step is to progressively develop, in consultation with stakeholders, relevant subordinate rules and instruments. This step will commence upon receiving Royal Assent for the Bill. Administratively, it is proposed that the Minister responsible for biosecurity policy and direction setting has the administrative responsibility for the proposed legislation.

Further information, including a discussion paper, frequently asked questions and consultation program outcomes, is available at DEPI (2013).

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