



NSW DEPARTMENT OF  
PRIMARY INDUSTRIES

## **Salvinia control manual - Readers' Note**

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This document is part of a larger publication. The remaining parts and full version of the publication can be found at:

<http://www.dpi.nsw.gov.au/aboutus/resources/majorpubs/guides/salvinia-control-manual>

Updated versions of this document can also be found at the above web address.

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*Salvinia washed onto a floodplain in the Northern Territory.*

Anne Ferguson

## Part 2: Managing salvinia

Salvinia management requires site-specific consideration. Priorities depend on the climate; the nature and use of the water body; the extent of the infestation; and the availability of resources. Control methods for salvinia include a biological control agent, a number of registered herbicides, and mechanical and manual removal methods. Management strategies should consider the use of these control methods according to the site-specific variables.

### Climate

The distribution of salvinia across tropical, subtropical and temperate climates in Australia has implications for biological control. Management considerations for biological control in different climates are summarised in the Biocontrol Management Table (see *Biological control* in Part 3).

Seasonal growth rates associated with different climates also affect other control methods. Under ideal conditions salvinia growth can exceed the capabilities of mechanical removal or herbicide application (see *Herbicides* and *Mechanical removal* in Part 3).

#### Tropical climates

Tropical climates provide ideal conditions for salvinia growth. During the dry season, permanent water bodies, billabongs and waterholes provide perfect conditions for salvinia growth, as temperatures remain ideal. Flushing associated with the wet season usually moves infestations downstream to estuarine waters where the plant does not survive; however, salvinia

can be washed out onto floodplains where fresh water can sit for months, allowing large infestations to build up. These usually dry out and die off when the water recedes, but some salvinia is likely to remain in these systems.

Problems arise when one or more poor wet seasons are experienced and flushing does not occur to the usual extent allowing salvinia levels to build up.

#### Subtropical climates

Subtropical climates provide ideal conditions for salvinia for most of the year. Growth will slow in the cooler months. Subtropical areas can be subject to prolific salvinia infestations, often without the benefit of a cyclical wet season to flush fresh water systems out.

#### Temperate climates

In temperate climates growth is more seasonal, with a definite slowing over winter. There is still enough time over the year when temperatures are high enough to allow prolific growth to occur.

### Nature and use of the water body

The nature and use of a water body will often determine which control methods are appropriate. Infestations can occur in any still bodies of fresh water (such as dams, lakes and wetlands), as well as in rivers, creeks, drains, and channels when flows are slow or still. Water bodies have a range of uses and values, such as conservation, primary production, recreation and consumption.

#### Manipulating water levels

In some situations it may be possible to drain a small enclosed body of water, stranding an infestation and



Salvinia on a farm dam.



Use of waterways may need to be restricted for salvinia control.

causing it to dry out and die. This requires follow-up treatment of any remaining sections where regrowth occurs (a multilayered mat stranded on mud can contain viable buds for up to 12 months).

### Conservation areas

In conservation areas it is usually critical to keep salvinia at low levels to prevent impacts on other aquatic wildlife. Minimal use of herbicides, manual removal and biocontrol are relied on in areas of high conservation value. Some of the best examples of ongoing salvinia management occur in conservation areas, as the importance of follow-up is recognised (see *Myall Lakes National Park case study*).

### Fish stocks

Some control methods can affect fish stocks by lowering the levels of dissolved oxygen that fish and other aquatic organisms use to survive. Decreases in dissolved oxygen (deoxygenation) occur when decomposing organic matter and bacterial activity consume oxygen. The reduction in available dissolved oxygen in the water causes fish to die.

Massive deoxygenation can occur if large amounts of salvinia die and sink at once, such as after broadscale treatment with herbicides (see *Herbicides* section). Deoxygenation can also occur as a result of successful biocontrol, but the effects are lessened as the process occurs over a longer period of time.

### Stock watering, domestic use and potable water

If herbicides are to be used, check the product label for stock withholding or potable water withholding periods (see *Herbicides* in Part 3). Booms can be used to keep potable water offtake areas free of salvinia.

### Irrigation

Salvinia can clog pump intakes and cause water losses from storage areas by increasing levels of evapotranspiration. Booms or meshed containment fences can be used to keep intake areas free of salvinia. If herbicides are used, check the product label for irrigation water withholding periods.

### Recreation

Groups and individuals who use recreation areas where salvinia is present should be aware of salvinia and able to identify it. Aquatic weed hygiene practices should be observed (see *Aquatic weed hygiene* under *Planning a management strategy* below) so as not to spread salvinia to other areas on boats, trailers or watercraft. Recreational use of a water body should be restricted while salvinia control is being carried out. Signage and public awareness campaigns may be required, particularly when herbicides are used.

### Extent of the infestation and availability of resources

The extent of an infestation depends on the length of time salvinia has been present in a system, the conditions (e.g. temperatures, nutrients) over that time, and other external factors such as the degree of flushing a system has been subject to. Primary salvinia growth will occur for as long as it takes for plants to become crowded on the water surface. The rate of growth will depend on the seasonal climatic conditions and the availability of nutrients. For example, salvinia may be introduced to a system at the end of autumn and remain scattered in primary form over the cooler months, only starting to build up into the secondary and tertiary forms the following spring and summer. Alternatively, salvinia may be introduced to a system in late spring and then rapidly build up to form an extensive infestation in a matter of weeks.

## Early detection

If detected early, salvinia can be kept at low levels while plants are scattered and in the primary stage of growth. Containment, herbicide application and small-scale mechanical or manual removal will be required regularly (possibly weekly) over the warmer months to prevent the infestation progressing, and then each year thereafter (before and during each growth season). In some cases, small new infestations may be eradicated (see *Eradication* below).

## Multilayered mats

Multilayered infestations require thinning to promote new regrowth so that herbicides and biocontrol are effective. Strip treatments with herbicides have been used to break up multilayered mats and promote new regrowth. Alternatively, some degree of mechanical removal will be necessary once a mat has become multilayered.

## Reducing resource inputs over time

Cases have occurred where large stretches of river (up to 80 km) have become covered with multilayered salvinia over a single summer. Such extensive infestations on rivers often require very high levels of resources to bring them to a manageable level.

The initial high costs associated with controlling extensive infestations can be reduced over time with biological control, strategic use of herbicides and ongoing small-scale mechanical removal (see *Hawkesbury River case study* and *Ewen Maddock Dam case study*). Resource allocation should allow for monitoring and follow-up each year on an ongoing basis.

## Eradication

There are very few situations where eradication is possible. These are usually restricted to new infestations (small amounts of salvinia found early) or small infestations on enclosed bodies of water (surface areas up to 1 ha) such as farm dams, where every plant can be treated or removed. Ongoing monitoring and follow-up treatments are required whenever regrowth occurs, until every plant has been removed from the system.

For eradication to be successful the source of the infestation needs to be found and contained, and time and resources need to be compatible with the extent of the infestation. Eradication will not be possible without dedicated follow-up effort and monitoring on an ongoing basis (for numbers of years). Bodies of water with emergent vegetation have less likelihood of eradication, as it is physically more difficult to retrieve or treat salvinia in amongst other vegetation.

Substantial infestations in conservation areas have been eradicated by extensive follow-up programs of manual removal and herbicide application (see *Myall Lakes National Park case study*).

Even if eradication is possible, there will usually be a threat of reinfestation. Most salvinia infestations require ongoing management and monitoring.

## Planning a management strategy

Undertake planning and assessment as early as possible. As well as accommodating the site-specific variables mentioned above, it is important that you consider a number of factors that apply to all salvinia management strategies.

- **Contain the infestation where possible.** Containment is important for new or small infestations, or where an extensive infestation has the ability to invade new areas (see *Booms and containment* in Part 3).
- **Identify the source of the infestation.** Find, contain and manage upstream or off-stream sources. Check nearby garden ponds as these are often the source of an infestation.
- **Consider seasonal implications for the timing of control methods.** All the control methods are affected by either seasonal changes or corresponding salvinia growth rates. Take advantage of slow growth periods over cooler months (particularly after frosts) to carry out physical removal, and plan to carry out herbicide treatments as early as possible in the growth season (usually early spring). Starting herbicide treatments during peak growth periods may have little impact on an infestation. Some herbicides require active growth and some have minimum temperature requirements. Release biocontrol agents as early as possible in the growth season (see Biocontrol Management Table). Carry out monitoring and follow-up as early as possible each growth season (usually early spring).
- **Check for permit requirements.** Permits may be required if control treatments are likely to cause disturbance to an aquatic environment (including stream banks, stream beds, other vegetation, or water quality). Check with local and State government before undertaking any form of control.
- **Map the infestation and record changes.** If maps aren't available, draw a simple outline of the water body on an A4 piece of paper and make 24 copies (one per month for a 2-year period). This allows the areas that correspond to salvinia coverage to be sketched and recorded each month. Keep the series of drawings to show changes over time.

*You've got to try and map it—make some guestimates so that you don't waste money.*

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- **Assess priority and available resources.** Small or new infestations in catchments that are relatively free of salvinia should be given higher priority for a complete eradication effort.
- **Allocate resources for ongoing control and follow-up.** In all cases ongoing control and follow up will be required. Even if the infestation is eradicated there is a chance of reinfestation, and monitoring will be required.

*You'll never get rid of it completely on a river system—maybe on a farm dam where you can get to it all, but not on a river. From the second year onwards you have to keep monitoring weevils, re-releasing if necessary, checking for regrowth, and mopping up the hotspots with herbicide ... and keep doing all that forever.*

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- **Monitor the efficacy of control treatments.** Record where and when control treatments are carried out, and use photo reference points to record progress. Photographs can be taken from the same point of reference each time treatment or monitoring is carried out.
- **Identify and minimise sources of nutrients entering the water body.** Increases in nutrient levels can occur from a number of sources:
  - septic systems and grey water runoff
  - stormwater drains
  - intensive livestock handling or feeding areas
  - garden runoff
  - golf course runoff and leachate
  - cropping and agriculture
  - erosion of cultivated land
  - urban sewage outflows
  - industrial wastewater.
- **Carry out regular early detection surveys.** Identify areas at high risk of infestation by salvinia (or other aquatic weeds), and carry out early detection surveys in spring and summer, and after seasonal rain. Risk of infestation is higher in ponded or slow-moving permanent water bodies. Check areas known to receive artificially high nutrient loads from surrounding land uses (i.e. agriculture, horticulture, industrial land); and areas close to human activities or urban development (e.g. waterways near residential estates; bridge crossings; waterways beside parks; boat ramps).
- **Aquatic weed hygiene.** Ensure that good hygiene practices accompany any control operations to prevent spreading salvinia on boats, machinery and equipment. Boat hulls and propellers, scoops, trailers, harvesters and any other vehicles or equipment should be thoroughly washed down before they leave a control site. Small fragments of plants can reinfest a water body, and any parts of plants that do not dry out completely can remain viable for long periods of time (i.e. while equipment is stored between uses).
- **Act early.** Don't miss opportunities for early releases of biocontrol agents and containment that can occur during the planning stage.