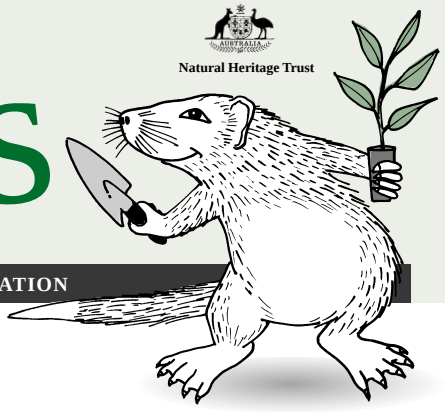
Water and Rivers Commission | **WN31 January 2003**

Natural Heritage Trust

Water notes

Water notes for rivers management

ADVISORY NOTES FOR LAND MANAGERS ON RIVER AND WETLAND RESTORATION



Revegetating with native grasses in the Avon catchment

Native grasses are an integral part of natural waterway ecosystems within the Avon catchment. There are species to fit almost every niche found within the catchment, including the banks of fast flowing streams, waterlogged sites, floodplains and the edge of saline scalds. This Water Note outlines the benefits of using native grasses in revegetation. It provides advice on species selection and site preparation as well as obtaining, planting and maintaining native grasses. While this Water Note specifically covers revegetating with native grasses in the Avon catchment, many of the techniques and species are applicable to other regions within the south-west.

The Avon catchment

The Avon, Lockhart and Yilgarn sub catchments, situated directly east of Perth, comprise an area of approximately 120,000 square kilometres (Figure 1). For simplicity in the context of this Water Note, these catchments will be collectively referred to as the Avon catchment.

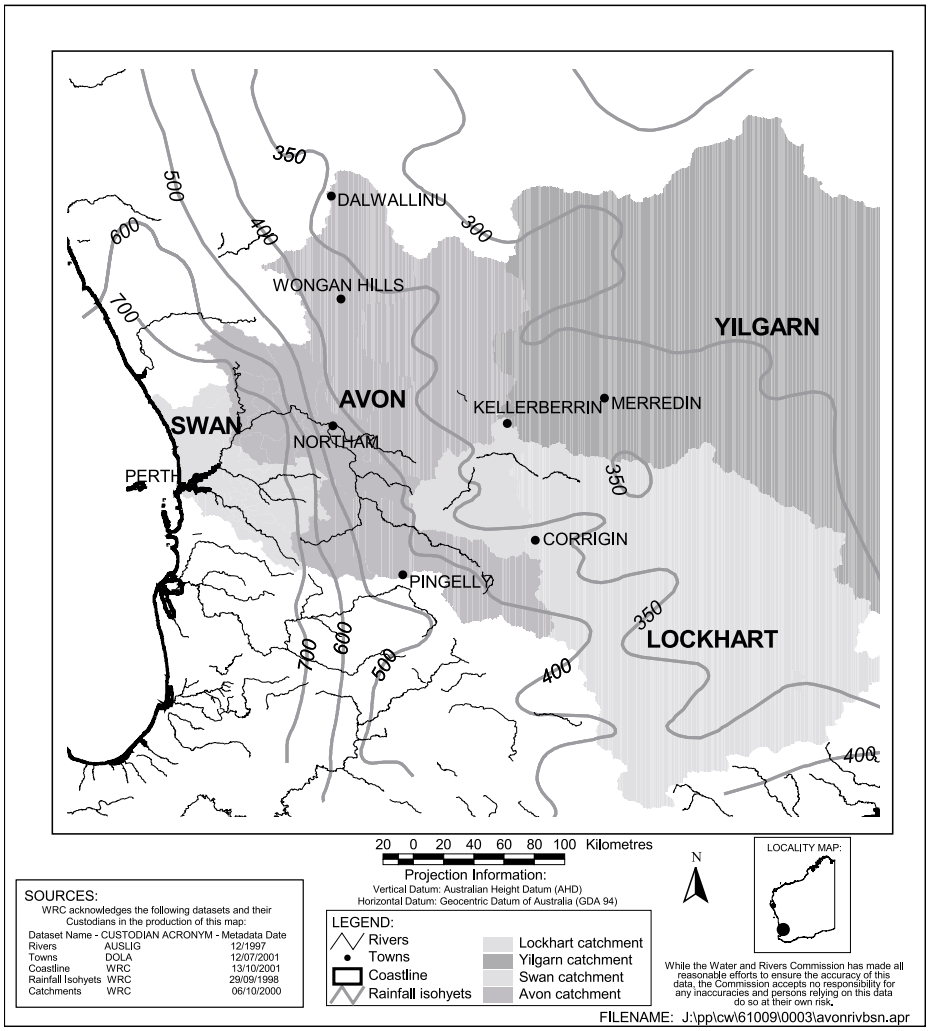


Figure 1. The Avon, Lockhart and Yilgarn sub catchments, showing the rainfall isohyets of the region.

The majority of the Avon catchment falls within the Transitional Rainfall Zone (800-300 mm), and is subject to a broad range of climatic influences. Coupled with this is a patchwork of varying soil types and changing topography, which has resulted in the evolution of a rich and diverse flora. The overriding trend of decreasing rainfall in an easterly direction across the catchment is reflected in the vegetation changes. For example, the riparian vegetation becomes more salt and drought tolerant towards the eastern parts of the catchment.

A unique characteristic of Avon catchment riparian zones is their braided nature (Figure 2). This refers to a watercourse having more than one channel. These watercourses are also generally broad and shallow and some of the channels only flow following high rainfall. More information on the nature and characteristics of braided streams can be found in RR17, *Recognising channel and floodplain forms* (Water and Rivers Commission 2002).

It is important to understand the approximate locations of the different areas within the riparian zone, such as the floodway or the flood fringe, as these influence the type of species that can be successfully grown (see Table 1). The Glossary at the end of this Water Note provides definitions of the features of the riparian zone. Water Note 11 also provides more information on identifying areas within the riparian zone.

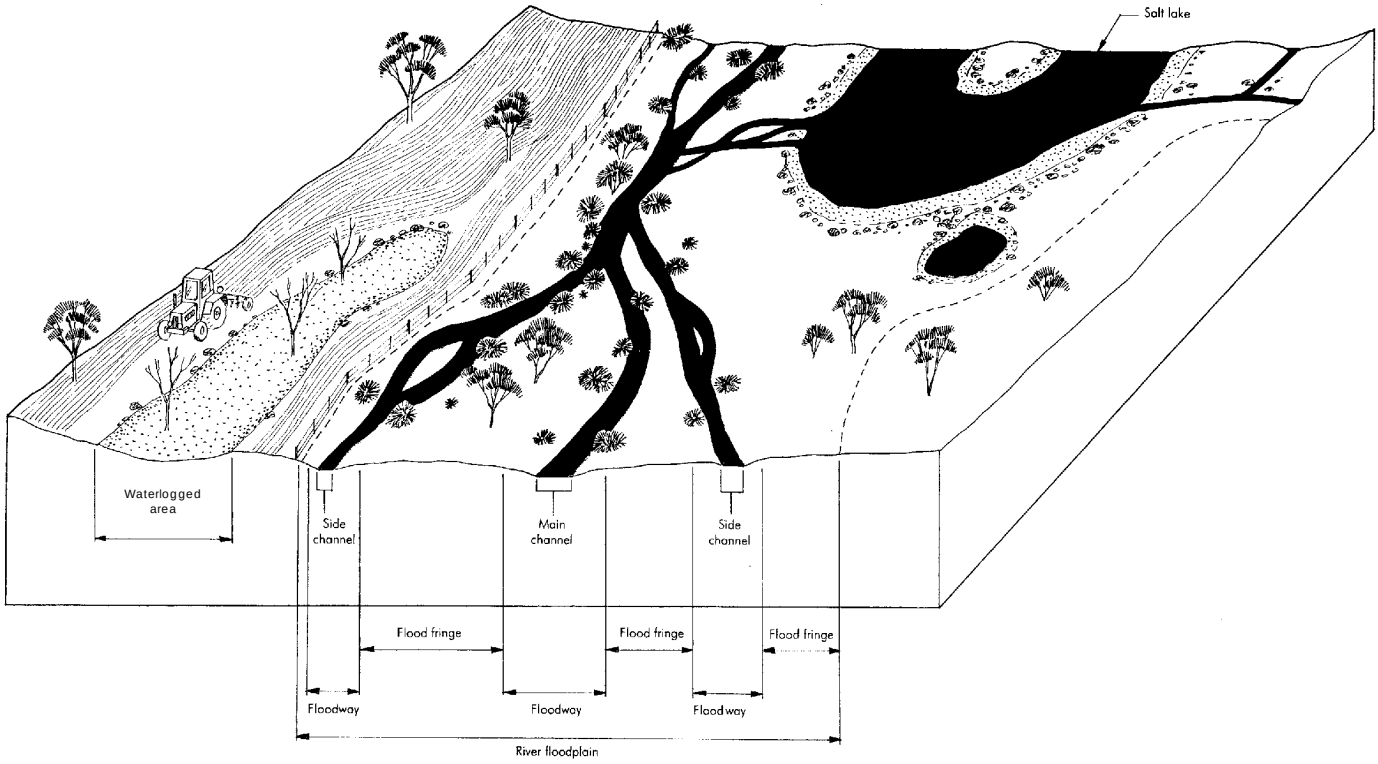


Figure 2. Cross sectional representation of a typical watercourse in the Avon catchment.

What are native grasses?

Native grasses belong to the Poaceae family and can be either annuals or perennials. They are also classed as being either C3 or C4 plants which gives an indication of their growth types. In general, C3 grasses grow during the cooler months while C4 grasses grow when the weather is warm. This is due to the two types of grasses having different methods for converting sunlight into energy within the plant. From a revegetation point of view, it means that the seeds germinate at different times and will need to be sown according to their preferred season. Information on the best sowing time for each species can be found in Table 1. Incorporating both types of plants into a revegetation site gives maximum diversity and stability to the area.

Native grasses can often be difficult to identify due to the lack of immediately obvious distinguishing characteristics.

*Figure 3. Native marine couch (*Sporobolus virginicus*): A salt tolerant grass that prefers wet areas. Its extensive network of roots and dense foliage forms a protective cover along the banks of waterways.*

There are also a large array of introduced or weed grasses within the Avon catchment which, superficially, look similar to many native species. This is especially relevant in riparian areas where the presence of higher nutrient and moisture levels means dense stands of introduced grass species are often present. For this reason identification of the grasses at a particular site may require expert assistance. This may be available through a regional herbarium program or professionals within the natural resource management field. There are also a number of identification tools and keys mentioned in the References and Further Reading section.

Figures 3 and 4 illustrate two common native grasses found in the Avon catchment, although each live in different parts of the landscape. Their different growing requirements need to be considered when selecting species for revegetation (see also Table 1).

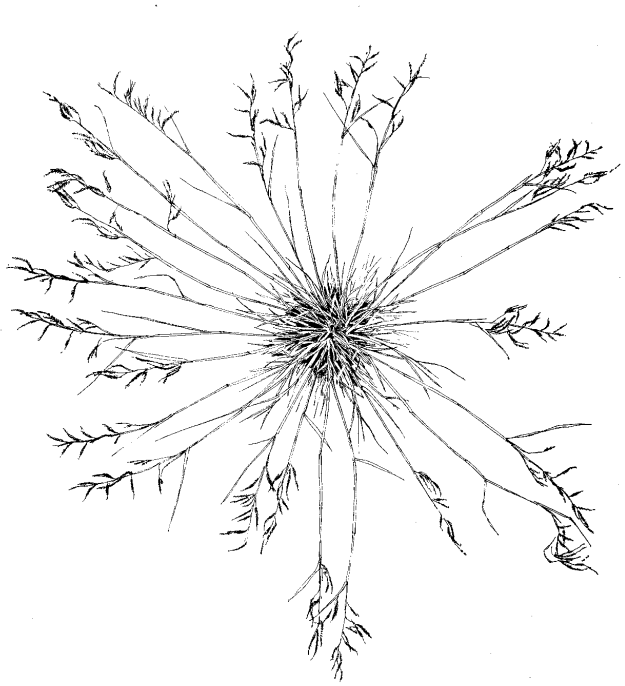


*Figure 4. Mallee lovegrass (*Eragrostis dielsii*): A common grass found throughout floodplains of brackish to mildly saline waterways. The prostrate stems provide protection of the soil from rain and moving water during flood events.*

Benefits of using native grasses in revegetation

- *Bind the soil*. Native grasses often have a fibrous root system, just under the soil surface. This root system helps bind the soil and protect it from the erosive forces of wind and water. The multitude of stems at the soil surface also assists with slowing surface water and catching mobile debris during high flow events and flooding.
- *Reduce fire risk*. Many native grasses tend to retain less dry leaf matter than the introduced annual grass weeds commonly found around riparian areas, especially during the hot summer months. The thick annual grass weed thatch is highly combustible and represents a significant fire threat. Replacing annual grass weeds with native perennial grasses and other native perennial vegetation at revegetation sites can lower the level of dry leaf matter and reduce the fire risk.
- *Provide habitat and food*. Native grasses also provide necessary habitat and a food source for an array of fauna species that like to live close to the ground. These include lizards, ground dwelling and seed eating birds and some frog species.
- *Consume water*. As perennial species, native grasses assist in consuming excess water that finds its way to the riparian zone. As a rule a foreshore with trees and understorey can consume an extra 30% of the available soil moisture than just trees. This can further reduce the water table level.
- *Self propagate*. Many of these species will self propagate, making them a very efficient option for riparian revegetation. This means that only small areas need to be sown. Over time, given favourable conditions and no grazing by stock, the runners will spread or seeds will disperse and grow across the areas suitable for the species.
- *Can be direct seeded*. Native grasses can also be direct seeded in weed free soils. Direct seeding is most favourable in lighter soils. It is a good option for sandy floodplain areas, but not in wetter areas that receive regular flows that have high weed burdens. Achieving adequate weed control in wetter areas is difficult. In these areas, native rhizome grasses can be propagated using runners or stolons[1] instead.

All of these reasons make native grasses a valuable group of plants to include in revegetation programs for riparian areas.

How should I select a site?

When choosing a revegetation site for planting native grasses, or any other species for that matter, it is necessary to know the desired end result for the area. The site can then be examined and analysed in relation to this goal. The following points are universal to all riparian revegetation works. Aspects to consider include:

1. The characteristics of the site (e.g. are there any native grasses or other vegetation present? what is the soil salinity level and soil type?).
2. The effect that the surrounding landscape and landuse will have on the project (e.g. will weeds spread into the area from surrounding farms?).
3. Understanding the waterway's hydrology and water quality throughout the seasons (e.g. will the grasses need to be salt tolerant or able to withstand strong water flows?).
4. The likely long term environmental changes to the area (e.g. is the area likely to become more saline?).

The chance of succeeding with establishing native grasses is greatly increased when the above issues are addressed before any on-ground work begins. This information is needed to assist with species selection and where grasses should be planted in relation to the riparian landscape.

Figure 2 will assist in locating the various zones around a waterway, such as the floodway, floodplain and flood fringe. Definitions of these terms and others are provided in the Glossary at the end of this Water Note.

As a general rule, it is most economical and productive to protect and increase the size of areas that already exhibit good environmental characteristics, such as a healthy stand of natural vegetation, rather than exerting efforts and funds into areas after they have become degraded. Grasses can be incorporated into a revegetation program at any stage, so old revegetation sites can be revisited to have grasses under-sown. Other options include scattering seed along a rip line when trees and shrubs are being planted or sowing between mature, uncleared vegetation in areas where the local native grasses have disappeared.

[1] A stolon is the creeping stem of a plant, either above or below ground, that can give rise to another plant from its tip.

What species are best for my area?

Once the information above has been gathered, a species list can be drawn up to match the individual characteristics of the site. The following factors should be considered in the selection of species:

1. Does it naturally occur in the area?
2. Is it suitable for current conditions? (e.g. which riparian zone, soil type, water tolerance, rainfall zone and salt tolerance does it suit?)
3. Is it suitable for future conditions such as increasing salinity, nutrient loads and increased water levels?

Using all of the above criteria, a selection of grasses that best match your site can be chosen from those listed in Table 1. For other species to complement the grasses, see Water Notes WN20, WN24 and WN32 as well as River Restoration Manual chapters RR4 and RR8.

Illustrations or images of the various native grass species in Table 1 can be found in Sharp and Simon (2002) and on *Florabase*, a Department of Conservation and Land Management web site: <www.calm.wa.gov.au/science/florabase.html>

How can I prepare my site?

The site will need to be prepared to give the new grasses the best possible chance of survival while causing the least amount of damage to the selected area and its surrounds. Depending on the characteristics of your site, preparation could include the following:

- *Total stock exclusion*. This is necessary for grass establishment as they are readily grazed, so fencing may need to be constructed. Rabbit control is also vital through baiting or physical eradication.
- *Weed control*. Control of annual grass and broadleaf weeds is essential and can be achieved by a range of physical means including ripping and mounding, or by scalping. However, this is not advisable in areas where strong water flows are expected, such as creeks, riverbanks and channels, as it may increase the chance of erosion. In these cases, or if planting throughout existing vegetation, herbicide spraying or covering the ground with a form of organic matting is advised. Spraying with herbicide will provide the most benefit if started in the growth season prior to planting (before seed set), to reduce the number of weed seeds present. A second spray is recommended after the germination of new weeds once the winter season has started. Good weed control before planting is vital as it is very difficult to control weed species using herbicides after planting, especially in a revegetation program that involves a mixture of trees, shrubs, sedges and native grasses. This range of growth types makes it hard to use a selective herbicide that doesn't affect at least one native species. The recommended herbicides for use around waterways can be found in Water Note 22, the most commonly used type being the frog friendly glyphosphates, which act as a general knockdown. Extreme care should be used to minimise the negative effects of herbicide spraying.
- *Smoke treatment*. In areas that still contain bush, the application of smoke and associated smoke products may assist natural regeneration of some grass species. Many of the plants in the Avon catchment have smoke responsive seeds so this technique can result in the germination of a range of species found naturally in the revegetation site. The most effective way to apply the smoke is to set up smoking tents over the patch of ground to be revegetated. Smoke is pumped from a controlled oven to the tent where it settles over the ground. This is not always practical over large areas. In this case there are a number of products that contain the seed activating smoke chemicals such as 'smoke water' and 'smoke granules'. These can easily be broadcast over large areas. These products are available commercially but can also be made at low cost by those undertaking revegetation work.
- *Protection from strong water flows*. In areas where plants are likely to experience high waterflows, various forms of protection can be erected. These can be objects that slow or deflect the flow away from the new plants such as matting, logs strapped together and rocks. (See River Restoration Manual Section RR10 and Water Notes 13 and 21).
- *Mounding waterlogged sites*. In some areas, especially waterlogged saline sites, mounding the soil may allow native grasses to establish naturally, as this provides a slightly less waterlogged and saline environment for establishment.
- *Choosing appropriate planting method*. Most native grasses are currently planted using direct seeding. This form of planting needs excellent weed control and so may not always be suitable in areas that experience high water flows (see Weed control – above). For these areas, grasses that can be grown by rhizome, such as Native Marine Couch (*Sporobolus virginicus*) or Weeping Rice Grass (*Microlaena stipoides*) may the best option (see Table 1).

Table 1. Native grasses of the Avon catchment – list of species and their site specific requirements (see Glossary for explanation)*

				Riparian zone					Soil type	
Native Grass species	**C3 or C4**	**Annual**	**Perennial**	**Floodway***	**River bank***	**Swamp land***	**Lake edge***	**Flood fringe***	**Sand**	**Loam**
Agrostis avenacea (Blown grass)	C3	✓			✓	✓	✓		✓	✓
Amphibromus nervosus (Swamp Wallaby Grass)	C3		✓	✓	✓	✓	✓			✓
Amphipogon turbinatus	C3		✓	✓			✓	✓	✓	✓
Aristida contorta (Bunched Kerosene Grass)	C4	✓	✓				✓	✓	✓	✓
Aristida holathera (Great Kerosene Grass)	C4	✓	✓					✓	✓	✓
Austrodanthonia setacea (Smallflower Wallaby Grass)	C3		✓				✓	✓	✓	✓
Austrodanthonia caespitosa (Wallaby Grass)	C3		✓	✓	✓		✓	✓	✓	✓
Austrostipa elegantissima (Featherspear Grass)	C3		✓				✓	✓	✓	✓
Austrostipa macalpinei (Golden Speargrass)	C3	✓					✓	✓	✓	✓
Austrostipa pycnostachya (Salt Speargrass)	C3		✓	✓		✓	✓		✓	✓
Austrostipa tenuifolia	C3		✓					✓	✓	✓
Austrostipa trichophylla	C3		✓			✓	✓	✓	✓	✓
Chloris truncata (Windmill Grass)	C4		✓	✓	✓	✓		✓		✓
Cymbopogon ambiguus (Scentgrass)	C4		✓		✓			✓	✓	✓
Enteropogon acicularis (Curly Windmill Grass)	C4		✓	✓	✓			✓	✓	✓
Eragrostis australasica (Canegrass)	C4		✓	✓	✓	✓	✓	✓		
Eragrostis dielsii (Mallee Lovegrass)	C4	✓	✓	✓	✓		✓	✓	✓	✓
Eragrostis elongata (Clustered Lovegrass)	C4		✓	✓	✓	✓	✓		✓	✓
Leptochloa fusca (Brown Beetle Grass)	C4		✓	✓	✓	✓	✓		✓	✓
Microlaena stipoides (Weeping Grass)	C3		✓	✓	✓	✓	✓			✓
Neurachne alopecuroidea (Foxtail Mulga Grass)	C3		✓	✓				✓	✓	✓
Polypogon tenellus	C3	✓		✓	✓	✓	✓		✓	✓
Puccinellia stricta (Marsh Grass)	C3		✓	✓	✓	✓	✓		✓	✓
Sporobolus viriginicus (Native Marine Couch)	C4		✓	✓	✓	✓	✓		✓	✓
Themeda triandra (Kangaroo Grass)	C4		✓	✓				✓	✓	✓
Triraphis mollis (Needle Grass)	C4		✓	✓				✓	✓	✓

	Water tolerance			Rainfall zone			Salt tolerance				Propagation and sowing		
Clay	**Perm wet**	**Seas Wet**	**Drought Tolerant**	**350mm-400mm**	**300mm-350mm**	**<300mm**	**Fresh**	**Brackish**	**Saline**	**Seed**	**Seed collecting time**	**Sowing time**	**Vegetative propagation**
		✓		✓	✓	✓		✓	✓	✓	Jan	Autumn	
✓	✓	✓		✓	✓	✓	✓			✓	Nov/Dec	Autumn	
		✓	✓	✓	✓		✓			✓	Dec/Jan	Autumn	
✓			✓	✓	✓	✓	✓	✓		✓	Nov/Jan	Spring	
			✓	✓	✓	✓	✓	✓		✓	Dec/Jan	Spring	
✓			✓	✓	✓	✓	✓	✓		✓	Dec/Jan	Autumn	
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			✓	✓	✓		✓			✓	Nov/Dec	Autumn	
✓		✓		✓	✓		✓	✓	✓	✓	Dec/Jan	Autumn	rhizomes
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✓		✓		✓			✓			✓	Jan/Feb	Spring	rhizomes
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✓	✓	✓		✓	✓			✓	✓	✓	Dec/Jan	Autumn	
✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	Jan/Feb	Spring	rhizomes
			✓	✓			✓			✓	Dec/Jan	Spring	
✓			✓	✓	✓	✓	✓		✓	✓	Oct/Dec	Autumn	

Where can I obtain native grasses and how much do they cost?

You can collect your own seed or purchase it from seed collecting contractors. Prices will vary depending on the species but can range between $20 and $2000 per kilogram. You can also purchase and/or grow your own tube stock, but this is expensive for large areas. Purchasing seed for direct seeding is the most cost-effective approach.

Collecting your own seed can help reduce the monetary cost, especially if there are good stands of native grasses nearby. Professional identification of the grass to be collected, through the local Regional Herbarium program or from a reputable botanist, is highly advisable. This information will be invaluable in determining the species and therefore the best methods for collecting its seed and subsequent use in revegetation.

A seed collecting licence, available from the Department of Conservation and Land Management, is required if collecting seed from non-private land or if selling the seed. It is advisable to collect seed from as many different plants as possible and to collect no more than 20% of the seed found on any one plant. This enables a good genetic mix for the revegetation site while maintaining adequate future seed stocks in the collection area. There has been some development with machinery to harvest native seed but this would only be economical when harvesting large stands.

When and how should I plant?

The time to direct seed or plant tube stock is species dependent and varies from either autumn or spring. Suggested sowing times for different species can be found in Table 1.

The most economical way to sow native grasses is to trickle grass seed into a rip line being used for planting trees and shrubs. This is a good option for floodplain areas. Native grasses can also be planted as tube stock but this is not economical for large areas. Direct seeding is the preferred method, except in areas where adequate weed control is not achievable, and/or where high water flows are experienced. Achieving adequate weed control in wetter areas that receive regular flows is unlikely.

For some species vegetative reproduction is also an option. With these species, the rhizomes of mature plants can be divided into sections. These sections can then be planted into the area to be revegetated or pots for planting later on. This is similar to planting couch runners for a lawn and is suitable for planting native grasses in wetter areas. Table 1 contains a list of species for which this is possible.

What sort of planting density is best?

When direct seeding grasses the amount of seed used will depend on the form of sowing and the species used. In general 3kg/hectare of grass seed is recommended but this is highly variable. It is better to over sow, as this will reduce bare areas that can be invaded by weeds. Grass seed may sometimes not germinate for a few years after sowing, so germination success should be looked at over a number of years.

Often grass seed is incorporated into a mix of understorey species that will include groundcovers, shrubs and herbs. The composition of this mix will determine the amount of grass seed needed. Having a diverse mix of plant species suited to the site allows for a more stable revegetated environment, due to the species complementing each other in their soil and water use.

What should I do after planting?

Once the site has been planted it is vital that there is ongoing maintenance and monitoring to increase the success of the revegetation. The main factors to monitor are destruction by animals and competition by undesirable plants.

Fence repairs to exclude stock and continued rabbit control may be necessary. Insect attack may also be an issue, although there are limited options for control of insects. Insecticides should never be used near waterways.

Weed competition should be low if prior treatment is successful. If there is a problem with weeds, physical removal or herbicide spraying may be needed.

Selective herbicide spraying of weeds presents problems in areas that contain a range of native species. This is because there are likely to be both weed and non-weed species that will be affected by the chosen herbicide. This is especially relevant when native grasses have been planted in riparian areas of the Avon catchment where the common weeds are usually annual grasses.

Selective herbicide spraying near waterways will also present problems to both the new plants and aquatic animals in the area. For these reasons, careful consideration and care is needed before any herbicide spraying is undertaken. More information on this subject can be found in Water Note WN22.

Monitoring your site can also help to assess the success of the grasses over time. The presence of new plants establishing from the parent plant seed is a good indication that the grasses have become well established. This information will be invaluable in the design of future revegetation projects in similar environments throughout the catchment. Further information on monitoring and evaluation can be found in Water Note WN28 and Coote *et al* (2002).

Glossary

Flood fringe	The area of the floodplain outside of the floodway.
Floodplain	Includes all flood prone land out to the area likely to flood once in a hundred years.
Floodway	The main flow path during an average 2-3 year flood.
Lake edge	Area around lakes that may be flooded sporadically, and generally has a higher soil moisture than the surrounding landscape.
River bank	Inclined edge of the main channel in defined creeklines/rivers.
Swampland/ waterlogged areas	Flood prone land that may have surface water only occasionally. The soil moisture is higher than surrounding land.

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Notes

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