Information in this leaflet will help landholders select the right plant species to use in river bank (or riparian) restoration in the Hunter River estuary – the part of the river influenced by the tides.

WHY RESTORE RIVER BANKS IN THE ESTUARY?

Native vegetation plays a vital role in river bank stabilisation. The estuary’s river banks are impacted by tides, floods, wind, waves, as well as human and animal activities. In their current state, river banks need active assistance and management to maintain and improve their stability and resistance to erosion. Local native trees, shrubs and groundcovers are best suited to protect and restore river banks:

- tree roots help river banks resist erosion by holding soil in place
- over-hanging foliage regulates water temperature and provides shade for fish
- fallen trees provide additional river bank protection and native fish habitat.

Erosion and deposition of sediment are natural river processes. However, rates of erosion in the Hunter estuary have been accelerated with the removal of native vegetation, over-grazing and other pressures of development, leading to:

- loss of productive land
- loss of habitat
- reduced water quality
- degraded aquatic habitat for fish.

Disturbance or destruction of river bank native vegetation and invasion of weeds have severely limited the ability of river banks to repair themselves through natural regeneration of vegetation between flood events.

HOW TO RESTORE RIVER BANKS IN THE ESTUARY?

A healthy river and estuary relies on good riparian land management throughout the river valley or catchment.

Recommended management practices include:

- removing stock access to waterways
- providing off-stream water and shade for stock
- restoring riverbanks with native vegetation.

This leaflet provides a landholders a guide for putting the right plant in the right place to restore healthy riparian vegetation which will protect and enhance our estuarine waterways.

Steps to successful planting

Step 1
Find out in which zone your rehabilitation site is located using the map on the back cover.

Step 2
Use the plant species and bank location table on page 2 for your zone to determine the right species for your project and where to plant them on the river bank.

Step 3
Use information on page 3 to help plan and carry out your project.

For further information and advice on river bank restoration contact Hunter Local Land Services.
Ph: (02) 4930 1030
Email: admin.hunter@lls.nsw.gov.au

ACKNOWLEDGEMENTS

Concept for this fact sheet was based on the Bellinger River Estuary Revegetation Guide initiated by Bellinger Landcare Inc. Local botanical expert advice was provided by Noel Jupp and Dr Stephen Bell.
HOW TO PLANT YOUR SITE

1. Use your chosen species from the table on page 2, including a mixture of ground covers, shrub and tree canopy species.
2. Design the site and work out plant numbers and spacing as outlined below.
3. Place your order with local nurseries in spring/summer for autumn and winter planting.

4. Arrange to collect or have plants delivered as close as possible to your planting day(s). Store nursery plants in a protected area and water twice daily.
5. Remove livestock from planting site and fence if required, allowing access for maintenance.
6. Prepare the site by slashing, weeding, applying herbicide (contact LLS staff for advice – allow two weeks after herbicide treatment before planting) and/or mulching.
7. Plant, water in and protect from herbivores, wind, and extreme elements using tree guards and stakes. See planting methods below.
8. Maintain planting: water weekly for the first month then as needed, depending on weather; reduce competition by regular weeding and/or mulching, checking every month.
9. Retrieve all plastic tree guards when plants are waist high.

PLANTING SPACING AND DESIGN

Mangroves & saltmarsh:
Exclude livestock and other damaging influences from river bank and allow inter-tidal vegetation to naturally establish in suitable areas within brackish areas of the lower estuary.

Rushes & sedges:
*Lomandra, Juncus, Schoenoplectus, Eleocharis and Crinum species* form clumps and their matted roots and stems help anchor soils on the ‘toe’ or river edge. Plant densely among tree seedlings at 0.5-1m centres.

Trees:
Dense plantings provide greater protection from sun, wind and cold, help shade out weeds and rapidly reinforce river bank soils. On middle and upper bank plant trees 1-2m apart in a random zig-zag pattern. Distribute fast growing species throughout the planting, including Eucalypts, Wattles and Casuarinas. Plant trees and shrubs alternately to achieve a mix of species.

PLANTING METHODS

Most native tree seedlings are sold in trays of 40 tubes or hikos. These small pots are designed to be an optimal size for field planting considering weight, price, speed of plant growth and development of roots. Using a mattock, spade or auger, dig a hole just big enough to comfortably fit the root ball of the plant. Gently remove the plant from the plastic tube and place the plant in the hole. Make sure that all of the roots are beneath the surface of the ground. Back fill the hole with topsoil and press down firmly around the plant. Build a water basin around the outside of the planted tree, especially if planting on a slope or in fast draining soils. Give the tree plenty of water.

Tree guards used on the upper river bank protect from wind, sun, frost, and browsing herbivores (hares, wallabies, kangaroos), and can be biodegradable cardboard (better near creeks and rivers) or reusable plastic ‘sleeves’. All guards must be staked straight and tight to prevent them from collapsing, leaning on tree seedlings or blowing away. *Mulch* from an approved supplier may be applied (across whole site or in rings around plants) to reduce grass growth and preserve soil moisture but must not be heaped against the stem of the seedling as this can rot the bark. Retrieve plastic guards when plant is about waist high.

Form a water basin around plants to catch and retain water.
**ESUARY**

<table>
<thead>
<tr>
<th>TOE</th>
<th>MIDDLE</th>
<th>UPPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swamp rush</td>
<td><em>Spiny-headed mat rush</em></td>
<td>Sydney golden wattle</td>
</tr>
<tr>
<td><em>Juncus kraussii</em></td>
<td><em>Lomandra longifolia</em></td>
<td>Acacia longifolia</td>
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<tr>
<td>Spiny-headed mat rush</td>
<td><em>River lily</em></td>
<td>Bleeding heart</td>
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<tr>
<td><em>Lomandra longifolia</em></td>
<td><em>Crinum pedunculatum</em></td>
<td>Omalanthus nutans</td>
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<tr>
<td>River lily</td>
<td>Swamp oak</td>
<td>Whalebone tree</td>
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<tr>
<td><em>Crinum pedunculatum</em></td>
<td>Casuarina glauca</td>
<td>Streblus brunonianus</td>
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<tr>
<td>Tall spike rush</td>
<td>Broad-leaved paperbark</td>
<td>Tuckeroo</td>
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<tr>
<td><em>Eleocharis sphacelata</em></td>
<td>Melaleuca quinquenervia</td>
<td>Cupaniopsis anarcoides</td>
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<tr>
<td>Club rush</td>
<td><em>Prickly-leaved paperbark</em></td>
<td>Coffee bush</td>
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<tr>
<td><em>Schoenopectclus subulatus</em></td>
<td><em>Melaleuca styphelioides</em></td>
<td>Breynia oblongifolia</td>
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<tr>
<td><strong>ZONE A</strong></td>
<td><em>Narrow-leaved paperbark</em></td>
<td>Forest red gum</td>
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<tr>
<td>Grey mangrove</td>
<td><em>Melaleuca ericifolia</em></td>
<td>Eucalyptus tereticornis</td>
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<tr>
<td><em>Avicennia marina</em></td>
<td><em>Pink tip bottlebrush</em></td>
<td>Wild quince</td>
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<tr>
<td>River mangrove</td>
<td><em>Callistemon salignus</em></td>
<td>Alectryon subcinereus</td>
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<tr>
<td><em>Aegiceras corniculatum</em></td>
<td>Swamp mahogany</td>
<td>Rosewood</td>
</tr>
<tr>
<td>Streaked arrow grass</td>
<td><em>Eucalyptus robusta</em></td>
<td>Dysoxylum fraserianum</td>
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<tr>
<td><em>Triglochin striatum</em></td>
<td>Swamp oak</td>
<td>Hard guandong</td>
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<tr>
<td>Glasswort</td>
<td><em>Casuarina cunninghamii</em></td>
<td>Elaeocarpus obovatus</td>
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<tr>
<td><em>Sarcocornia quinqueflora</em></td>
<td><em>River oak</em></td>
<td>Muttonwood</td>
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<tr>
<td>Seablite</td>
<td><em>Casuarina cunninghamii</em></td>
<td>Myrsine variabilis</td>
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<tr>
<td><em>Suaeda australis</em></td>
<td><em>Cabbage gum</em></td>
<td>Rusty-leaved fig</td>
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<tr>
<td>Sea rush</td>
<td><em>Eucalyptus amplifolia</em></td>
<td>Ficus rubignosa</td>
</tr>
<tr>
<td><em>Juncus kraussii</em></td>
<td><em>River red gum</em></td>
<td>Yellow pittosporum</td>
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<tr>
<td><strong>ZONE B</strong></td>
<td><em>Flooded gum</em></td>
<td>Pittosporum revolutum</td>
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<tr>
<td>Fresh reaches: Williams River, Paterson River and Hunter River upstream from Raymond Terrace</td>
<td><em>Cheese tree</em></td>
<td>Lilly pilly</td>
</tr>
<tr>
<td><strong>ALL SPECIES ABOVE PLUS:</strong></td>
<td><em>Glochidion ferdinandii</em></td>
<td>Syzygium smithii</td>
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<tr>
<td>Common reed</td>
<td><em>Black wattle</em></td>
<td></td>
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<tr>
<td>Phragmites australis</td>
<td><em>Acacia melanoxylon</em></td>
<td></td>
</tr>
<tr>
<td>Common rush</td>
<td><em>Creek sandpaper fig</em></td>
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<tr>
<td><em>Juncus usitatus</em></td>
<td><em>Ficus coronata</em></td>
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<tr>
<td>Tall sedge</td>
<td><em>Native peach</em></td>
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<tr>
<td>Carex appressa</td>
<td><em>Trema tomentosa</em></td>
<td></td>
</tr>
<tr>
<td>Tall spike rush</td>
<td><em>Wallaby grass</em></td>
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<tr>
<td><em>Eleocharis sphacelata</em></td>
<td><em>Austrodanthonia fulva</em></td>
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**Species by Location on River Bank**

Select from the short-list of species from the table above:

- Grey mangrove
- *Avicennia marina*
- River mangrove
- *Aegiceras corniculatum*
- Streaked arrow grass
- *Triglochin striatum*
- Glasswort
- *Sarcocornia quinqueflora*
- Seablite
- *Suaeda australis*
- Sea rush
- *Juncus kraussii*

- Swamp rush
- *Juncus kraussii*
- Spiny-headed mat rush
- *Lomandra longifolia*
- River lily
- *Crinum pedunculatum*
- Tall spike rush
- *Eleocharis sphacelata*
- Club rush
- *Schoenopectclus subulatus*
- *Spiny-headed mat rush*  
- *Lomandra longifolia*  
- River lily  
- *Crinum pedunculatum*  
- Swamp oak  
- Casuarina glauca  
- Broad-leaved paperbark  
- *Melaleuca quinquenervia*  
- *Prickly-leaved paperbark*  
- *Melaleuca styphelioides*  
- *Narrow-leaved paperbark*  
- *Melaleuca ericifolia*  
- *Pink tip bottlebrush*  
- *Callistemon salignus*  
- Swamp mahogany  
- *Eucalyptus robusta*  

**Ground cover / grass may not be suitable in dense vegetation, can be added later**

If levee present contact LLS staff for advice on planting proximity.

* Ground cover / grass may not be suitable in dense vegetation, can be added later.
Map of Hunter River Estuary

References for further details
https://kooragangwetlands.com/library/