Using trees to reclaim land lost to saline seeps

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Using trees to reclaim land lost to sandplain seeps

By Arthur Wright*

The National Soil Conservation Program (NSCP) has tapped the vigorous community support for landcare initiatives through its demonstration sites for reclaiming sandplain seeps in the Western Australian wheatbelt.

The demonstrations, which use tree plantations to reclaim seeps, began in 1989. The sites are being keenly monitored by participating farmers and members of land conservation districts (LCDs).

Setting up the sites

Farmers and members of LCDs set up tree plantations in 20 conservation districts in the eastern and north-eastern wheatbelt. Two seeps in each of these districts are being rehabilitated using NSCP funds to buy tree seedlings and fencing materials.

Tree seedlings were planted upslope from the seep in similar proportions to those shown in Table 1. Where possible, the chosen sites were close to roadways or easily accessible for field days. Each of the demonstration sites has at least one observation bore downslope from the lowest line of trees so that the water level can be monitored at least twice a year. Water levels should start to fall after two or three years.

Farmers who participated in the 1989 plantings said that fencing and tree planting in June and July did not interfere with their normal farm schedule.

All farmers used tree planting machines, either their own or one borrowed from their land conservation district. Good organization was required if the district’s tree planter was used because these machines were usually in high demand.

One farmer, as well as planting the seedlings supplied, used a direct seeding attachment on his tree planting machine to direct seed golden wattle (Acacia saligna) to provide an understorey. These wattles are growing vigorously.

All of the farmers are keenly interested in the plantations. They returned to the sites later in the year to plant replacement trees by hand. They also planted additional species, ranging from saltbush to tamarisk planted directly onto badly salt-affected ground.

Some problems

Most farmers reported problems with sheep breaching the fences and grazing the planted area. Sheep did not kill many trees, but they set back their growth considerably. Strong fences are needed to exclude sheep from newly planted areas for at least the first three years.

Rabbits were not reported to be a problem. However, if they are present nearby, the Department of Agriculture recommends eradicating rabbits within a minimum 500 m radius of the planting site.

Why do sandplain seeps develop

Sandplain seeps are caused by a shallow, perched aquifer which develops in deep sands. These seeps can cause groundwater recharge to the deep regional aquifer. In some situations, the sandplain and deep aquifer systems combine, resulting in severe waterlogging and salinisation of the valley downstream.

*Arthur Wright, of Inglewood, is a freelance writer. All photos by him.
The 1980 tree plantings on the Broadhurst’s property, ‘Broadview’. After four years the seep had dried up and the area has been cropped since.

Seepage on ‘Rocky View’

The primary cause of sandplain salinity is the clearing of the perennial native mallee or wodjil vegetation, which used more water than annual agricultural plants.

The trouble with seeps

If the water is suitable and seeps are drained they can be extremely useful for stock water supplies. However, if the water is brackish (more than 360 milliSiemens/metre), it can pose a problem if the continual evaporation concentrates salt in the dam. If the salinity is not tackled, problems can worsen. As the seep expands, large areas of land can become unproductive and salinity may worsen lower in the catchment.

Even non-saline sandplain seeps may be unproductive if they have been badly eroded. The lack of vegetation on the affected land makes it susceptible to wind and water erosion.

The solution

Research trials and farmers’ experiences have shown that seeps can be reclaimed and the land returned to productivity by planting trees. They realised that a seep was developing on their ‘Broadview’ property at Kirwan in the Burakin-Bunketch Land Conservation District, when they bogged their harvester during an extremely dry year.

They also noticed that the five hectares affected by the seep yielded only 0.4 to 0.6 t of wheat per hectare, compared with 1.2 t/ha in the rest of the paddock.

At that time no work had been done on reclaiming sandplain seeps, so the Broadhursfs developed their own techniques.

In 1980, doing things as cheaply as possible, they borrowed a drilling rig and put in about 20 shallow holes to determine where the clay was closest to the surface, so that they could plant trees upslope of the seep. They salvaged old wire and sleepers from the farm tip and fenced off less than one hectare. In July and August of that year they planted 100 trees by hand. The

<p>| Table 1. Tree species used in the National Soil Conservation Program demonstrations |</p>
<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. camaldulensis</em></td>
<td>River red gum</td>
<td>40%</td>
</tr>
<tr>
<td><em>E. globulus</em></td>
<td>Tasmanian blue gum</td>
<td>15%</td>
</tr>
<tr>
<td><em>E. cladocalyx var. nana</em></td>
<td>Dwarf sugar gum</td>
<td>10%</td>
</tr>
<tr>
<td><em>E. platypus var. heterophylla</em></td>
<td>Coastal moort</td>
<td>10%</td>
</tr>
<tr>
<td><em>E. sideroxylon</em></td>
<td>Red ironbark</td>
<td>10%</td>
</tr>
<tr>
<td><em>E. eudesmoides</em></td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td><em>E. botryoides</em></td>
<td>Southern mahogany</td>
<td>5%</td>
</tr>
<tr>
<td><em>E. maculata</em></td>
<td>Spotted gum</td>
<td>5%</td>
</tr>
</tbody>
</table>

Long-term successes on the farm

In 1979, Jim Broadhurst and his sons, Brian and Garry, were among the pioneers in reclaiming seeps by planting trees. They realised that a seep was developing on their ‘Broadview’ property at Kirwan in the Burakin-Bunketch Land Conservation District, when they bogged their harvester during an extremely dry year.

In 1980, doing things as cheaply as possible, they borrowed a drilling rig and put in about 20 shallow holes to determine where the clay was closest to the surface, so that they could plant trees upslope of the seep. They salvaged old wire and sleepers from the farm tip and fenced off less than one hectare. In July and August of that year they planted 100 trees by hand. The
Table 2. Some other recommended trees for planting to reclaim sandplain seeps

<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Common name</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. cladocalyx</td>
<td>Sugar gum</td>
</tr>
<tr>
<td>E. loxophleba</td>
<td>York gum</td>
</tr>
<tr>
<td>E. microcarpa</td>
<td>Grey box</td>
</tr>
<tr>
<td>E. occidentalis</td>
<td>Flat topped yate</td>
</tr>
<tr>
<td>Acacia saligna</td>
<td>Golden wattle</td>
</tr>
</tbody>
</table>

For other species, consult Farmnote 116/88 'Reclaiming sandplain seeps with small blocks of trees'.

Trees included river red gum (*Eucalyptus camaldulensis*), Tasmanian bluegum (*E. globulus*), and salt river gum (*E. sargentii*).

Four years later the seep had dried up. In 1984, they planted lupins, which use more soil moisture than wheat, upslope of the seep, and wheat downslope. In 1985, they grew wheat upslope and downslope of the seep. The following year the area was grazed by sheep. In 1987, they planted triticale upslope and wheat downslope. In that year, the wheat crop yielded up to 0.8 t/ha, on the 'old seep' and surrounding land, while the triticale produced about 1.0 t/ha. The year 1987 was not a favourable one for wheat crops in the area.

About 90 per cent of the trees have survived. Eleven years after planting, the river red gums are about 12 m tall. The salt river gums and the Tasmanian bluegums tend to lose large branches during storms.

When Department of Agriculture research officer, Richard George, inspected the site eight years after the trees were planted in 1987, he concluded that the siting, selection and number of trees planted adequately matched the needs of that particular seep.

**Trials prove successful at East Belka**

The success of the seep reclamation on Jim Broadhurst's Kirwan property was the result of farmers recognising there was a problem and acting quickly to overcome it. The reclamation was helped by careful planning (using drill test results) before tree planting started, fencing off the area to be reclaimed, and planting the most suitable tree species.

In June 1986, the Department of Agriculture, not knowing of the Broadhurst's success, established and is monitoring a sandplain seep reclamation trial (George, 1991) on Allan and Ann Brown's East Belka property in the Bruce Rock Land Conservation District. Some 310 eucalypts were planted immediately upslope of the seep.

This trial, (see 'Reclaiming sandplain seeps by planting trees' in the *Journal of Agriculture* Volume 32, pages 18-23), showed that the planting of trees alone can lower the water-table by between 0.5 and 1 m in just over three years. Land lost to the sandplain seep has been reclaimed.

Three species of eucalypts were planted: *E. globulus*, *E. cladocalyx var. nana* and three 'types' of *E. camaldulensis*, including the salt-tolerant clone 'saltdown'. The trees were planted in five rows of about 62 trees per row upslope of the seep. About 20 ha of saline and waterlogged land had been unproductive since the late 1960s, when the seep developed.

In 1989 the previously waterlogged and salt-affected area yielded 1.2 t/ha of wheat, the paddock average. The 1990 and 1991 barley and wheat crops on the same area also yielded well.

**Some useful advice**

Farmers considering the reclamation of sandplain seeps should consider the following points.

**Background reading**

**Recommended tree species**

The recommended species of trees (Table 2) should be ordered well in advance. If needed, the land conservation district's tree planting machine should be booked.

**Time of planting tree seedlings**

Tree seedlings should be planted as early as possible after the start of the winter rains, preferably between May and July. Seedlings left to sit in their pots for long periods may develop diseases. Weed control in the first year will give the seedlings a better start before their first summer.

**Number of trees**

The number of trees to be planted at any particular seep can be estimated from Table 3. It is better to over-estimate than under-estimate the number of trees needed because they are an inexpensive cost of the whole project.

**Fence the treed block**

The block of trees should be securely fenced to keep out livestock for three to five years. Stock can then have limited access.

**Planting on the contour**

Trees should be planted on the contour immediately upslope of the seep, beginning no further than 10 to 20 m upslope of the saline area. Salt-tolerant species can be planted close to the affected area. Trees should not be planted in waterlogged ground unless they are planted on a mound.

**Dimensions of the block of trees**

The dimensions of the treed block are important. The block should be wide enough to cover the full width of the seep, so that trees intercept all the water flow entering from upslope. The treed block should also be at least five to ten rows broad, to intercept the movement of water from upslope, and to provide enough mass to enable the trees to withstand wind damage and losses after establishment.

**Extending the block of trees around the contour**

The block of trees can be easily extended around the contour to the nearest natural or artificial boundary (creek or fence). Fewer (about four) rows of trees, or a belt of direct-seeded or transplanted local trees that use less water, can be established further from the seep where there is little or no groundwater. The belt of trees must be effective as a windbreak, as well as being able to lower the water-table.

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**Table 3. Estimates of the minimum number of trees needed to reclaim a sandplain seep**

<table>
<thead>
<tr>
<th>Size of seep (ha)</th>
<th>Width of seep on upslope edge (m)</th>
<th>Volume of inflow (kL/year)</th>
<th>Number of trees needed if average tree groundwater use is 10 L/day/tree</th>
<th>Number of trees needed if average tree groundwater use is 30 L/day/tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>1,000</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>2,000</td>
<td>600</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>300</td>
<td>3,000</td>
<td>900</td>
<td>300</td>
</tr>
<tr>
<td>7</td>
<td>400</td>
<td>4,000</td>
<td>1,200</td>
<td>400</td>
</tr>
<tr>
<td>9</td>
<td>500</td>
<td>5,000</td>
<td>1,500</td>
<td>500</td>
</tr>
</tbody>
</table>

* The inflow volume is included as a guide. The age and width of the seep, the number of rows of trees, their density, water-use rates and groundwater quality are also important.

**Widening the block of trees**

The block of trees upslope of the seep can be made wider than five rows at relatively little cost because the major cost of fencing is enclosing the width of the seep. A small increase in the width of the treed block will allow more trees to be planted.

**Is the seep stable or still growing?**

If the seep is not getting bigger then there is less need for exploratory bores upslope. If the seep is continuing to expand on the uphill side, drilling bores is important to determine the changes in the depth to groundwater. Reclamations may fail if a still-growing seep can spread uphill through the planted trees more quickly than the reclamation rate of the trees. In some very large seeps, two blocks, 50 to 100 m apart, may be needed.

**Good planning**

Recharge control is also important. Lupin-wheat rotations will lessen recharge from upslope of the seep. Try not to have pasture on the reclaimed area in the first five years, unless it is salt-tolerant.

Prompt diagnosis of the problem, good planning and prompt action will ensure best results. If you are not sure about how to treat your sandplain seep, contact your local Department of Agriculture district office or your land conservation district.

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**Further reading**


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**References**
