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The Taarblin experience: a planned approach to soil conservation

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THE

TAARBLIN
EXPERIENCE

A planned approach to soil conservation

By
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Cover photo
An aerial view of the centre section of Taarblin showing contour banks, contour laneway, dam with roaded catchment and areas of fenced, uncleared bush.
Many farms in Western Australia were cleared and developed before there was a full and clear understanding of the effects of bush clearing - that is salinization of soil and water supplies, wind and water erosion, waterlogging and soil structure decline. The productive capacity and inherent problems of the different soil types was also largely unknown.

Modern-day Conservation Farm Planning aims to provide a blue-print for the redevelopment of properties to ensure long term soil fertility, to prevent soil erosion and degradation by waterlogging and salinity. It also provides for a spread of reliable stock watering points and more efficient management by convenient working patterns and access for stock and vehicle movement.

To a very large extent the farmer himself is involved in preparing the Conservation Farm Plan but he can obtain advice on the technical aspects of conservation land management from Advisers and Technical Officers at his local office of the Western Australian Department of Agriculture; thus preparation of a Conservation Farm Plan is a joint effort between the farmer and a Soil Conservation Officer.
THE TAARBLIN EXPERIENCE

A planned approach to soil conservation

This case study, of a typical Western Australian wheatbelt farm, describes the main land-use and soil degradation problems experienced since clearing and development began in the early 1900s. The 2,200 hectare property, Taarblin, which is the subject of the case study, is 40 kilometres east of Narrogin in the Upper Great Southern.

The owners of Taarblin, Greg and Heidi Astbury, have implemented a soil conservation farm plan initiated by Greg’s father in 1968. The plan was drawn up with the help of soil conservation advisers and technicians from the Narrogin office of the Western Australian Department of Agriculture.

The soil conservation farm plan has been implemented at a steady pace since 1968. Renewal and re-alignment of fences, and the installation of soil and water conservation works, proceeded as the financial situation allowed.

The final result is a highly satisfactory level of soil conservation and land management without large investments of capital over a short period of time. Thus the financial impact of replanning the property has been minimal, despite some years of well below average rainfall and poor wheat prices while it was being implemented.

farm planning on all properties in river catchment areas would help to overcome district problems of soil erosion, flooding and waterlogging, salinity and damage to public utilities.

HISTORY OF THE PROPERTY

Taarblin was taken up by the Kelliher brothers, who started clearing the land in 1905. They sold it to Mr Thomas Hardie, whose manager, Mr Aubrey Bickford, ran the property until the Great Depression of the 1930s when the farm became the property of the Union Bank (now the Australia and New Zealand Banking Group Ltd).

Mr Dave Astbury, Greg’s father, began leasing the property from the Union Bank in 1944 and purchased it in 1946. Greg Astbury became involved in managing the land in the early 1970s.

Additional land to the south-west, adjacent to the home farm, was purchased from B.M. and B.J. Orchard in 1979. It was replanned in such a way that the total farm area may be considered a single unit although the area is still referred to as Orchard’s farm.

DISTRICT APPLICATION

This whole farm approach to soil and water conservation, involving the prediction of problems before they arise and taking steps to avoid them, has proved to be most effective in most farming districts. Many properties are already implementing soil conservation farm plans, most of which have been prepared since 1955. The concept could be extended to many more farms with substantial benefits to both the individual landowners and the community. The adoption of soil conservation

LOCATION

Taarblin is 40 kilometres due east of Narrogin in the 400 millimetre rainfall zone (Figure 1). The farm lies just south of Taarblin Lake and the Northern Arthur River lake chain passes through the north-west corner of the property.
The western end of the property consists mainly of a wide flat which originally carried a tall woodland of salmon gum (Eucalyptus salmonophloia), York gum (E. loxophleba) and wandoow (E. wandoow).

The central and eastern parts are more hilly with a major waterway running south-east to north-west through the middle of the property.

To the south of this creek the slope of the land increases and there are several large granite outcrops on the hill tops.

Figures 2 and 3 show the distribution of the different vegetation and soil types on Taarblin.

**Salmon gum clay flats**
The topsoil is clay-loam overlying heavy clay at 5 to 30 centimetres. Gradients vary from 1 in 750 to 1 in 1,000.
The flats are waterlogged in most winters and flooded after exceptional rainfall events. Soil structure deterioration and salinity are also problems.

**Morrel loams**
These deep red loams occur on well drained, gently undulating land close to the south-east bank of Taarblin Lake. Morrel soils are naturally fertile and can produce excellent crops in seasons with average or above average rainfall and a good 'finish'. Wind erosion is a hazard if morrel soils are fallowed or over grazed. The original vegetation was red morrel (Eucalyptus longicornis).

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**Figure 2. Vegetation types**

- Salmon gum - Eucalyptus salmonophloia
- White gum/wandoow - E. wandoow
- York gum - E. loxophleba
- Morrel - E. longicornis
- Sheoak - Casuarina huegeliana
- Jam - Acacia acuminata
- Sampire - Halosarcia spp.

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**Figure 3. Land surfaces and soil types**

- Gravelly sandy-loam over clay and rock
- Sandy-loam over clay and rock
- Duplex sandy-loam over clay
- Granite
- Loamy-sand over clay
- 'Fluffy' loam
- Deep sand
- Heavy clay
- Woody saline
- Gravelly loamy-sand
- Sandy-loam over clay and rock
- Granite
- Gravelly sandy-loam
Brown sandy loams with granite outcrops
These generally fertile soils have 30 to 60 centimetres of sandy-loam over a clay subsoil and decomposing rock. In high rainfall winters they are prone to waterlogging and surface seepages which are often the focal points for rill and gully erosion. York gum and jam (Acacia acuminata) are typical tree species on this soil type.

Duplex loamy-sands over clay
Duplex soils are the predominant soil type on the lower slopes. Fertility is high under appropriate phosphate fertilizer and subterranean clover pasture programmes. The duplex soils are subject to waterlogging in average rainfall years, when winter rainfall 'perches' on the clay subsoil at 30 to 50 centimetres. This soil type is more prone to water erosion than wind erosion. The original vegetation was wandoo, jam and sheoak (Casuarina huegeliana).

Gravels and sandplain
There are also areas of gravel and sandplain soils typical of the Western Australian wheatbelt. These soils are naturally low in fertility and require large inputs of phosphate and the trace elements, copper and zinc. They are well drained and regularly produce even yielding crops. The water erosion hazard is low except during either high intensity thunderstorms in mid-summer, when the soil is dry, or where sheet laterite outcrops or underlies the topsoil at shallow depth. Wind erosion is a far greater hazard following poor crop and pasture years, when the vegetation cover in summer and autumn is sparse.

LAND CAPABILITY CLASSES

In 1968, when the soil conservation farm plan was prepared, no formal land classification system was in use by the Western Australian Department of Agriculture. Recently a five class system has been introduced, similar to that used in most of the other Australian States. The land capability classification map for Taarblin separates units of land with differing degradation hazards and recommends precautions necessary to ensure long term, stable production (Figure 4). Such maps can be used to plan the intensity of crop rotations, stocking rates and the need for conservation earthworks.

Class I
- Nil to minor degradation hazards.
- Generally suitable for cultivation.
- May require minor conservation measures.

Class II
- Moderate degradation hazard.
- Generally suitable for cultivation, but some conservation management is needed.

Class III
- High degradation hazard.
- Generally suitable for cultivation provided intensive conservation management is applied.

Class IV
- Very high degradation hazard.
- Generally unsuited to cultivation. May be used for grazing which often must be carefully controlled.

Class V
- Extreme degradation hazard or other physical limitation that makes land unsuitable for agricultural and pastoral use.

Sub classes
Subscripts identify the most significant hazards or limitations to agricultural or pastoral use.

e susceptible to water erosion.
w susceptible to wind erosion.
s susceptible to salinization.
c severe soil hindrance to cultivation (gilgais, surface rocks, thixotropic, etc.)
i seasonally waterlogged/impeded drainage (associated with water table rise, poor profile or surface drainage local seeps).
f floodplain (subject to overland flood flows).
r rock outcrop.
t landform feature (lake, frontal dune, river, swamp, etc)
The main land-use and soil conservation problems on Taarblin are:

- water erosion;
- soil salinity;
- waterlogging; and
- wind erosion.

Figure 4 shows areas where these problems occur on Taarblin. Other management problems considered in the soil conservation farm plan were:

- unreliable filling of some dams;
- lack of stock shelter in some paddocks;
- the need for an efficient sheep and vehicle movement system; and
- the need to improve cultivation convenience for big machines.

**The Soil Conservation Farm Plan**

After identification of the main land conservation problems, the Astburys in conjunction with the Department of Agriculture, devised practical solutions which could be implemented over a number of years.

**Water Erosion**

Water erosion has been reduced to acceptable levels, as was proven in the winter of 1983, when the problem was widespread throughout the Upper Great Southern. On Taarblin, slight rill erosion did occur, but at a minor level compared with ‘unplanned’ properties in the district.

The water erosion control programme included filling erosion gullies and the use of a control of water erosion included the filling of erosion gullies and installation of grade banks. The area behind Greg Astbury was once an active erosion gully. It has been filled, topsoiled and grassed.
roadgrader to install grade banks (Figure 5). The land has then been worked on the contour, usually with minimum tillage techniques. This simple formula, minimum tillage on the contour between well built and maintained grade banks, has proved most effective in minimizing water erosion.

Salinity

Sixty hectares or 2.7 per cent of the property is salt-affected. The worst area is in the northeast close to the Northern Arthur River lake chain; some of this area was probably naturally saline before clearing. Because of this, the Astburys have been extremely careful with any further clearing programmes on the flat land and a 225 hectare block of salmon gum has been left uncleared in the area considered at risk. The gradual death of trees along the creek in the south-west corner of the flats suggests the possibility of further salt encroachment.

Saltland is fenced to control stock grazing, thereby encouraging natural regeneration of salt-tolerant plants like samphire (Halosarcia spp.) and bluebush (Maireana brevifolia). These areas of valuable grazing are used mainly in late autumn and early winter but care is taken to avoid overgrazing and baring of the soil surface. Future plans include the planting of trees and saltbush (Atriplex spp.) to help lower watertables on mild saltland.

Waterlogging

Waterlogging is mainly a problem on the salmon gum clay flats, which have about 1 in 1,000 gradient towards the lake chain. Shallow depressions on the flats hold rainfall in pools. In addition the three main creeks running through the flats overflow during abnormal rainfall events.

The Astburys have not spent large sums of money on surface drains to solve this problem. Their main policy is to separate the flat land from better drained sloping land by fencing. The two classes of land are then farmed on different rotations with less frequent cropping on the flats.

Some earthworks have been completed on the creek that runs from south-east to northwest through the middle of the farm. Where the creek becomes ill-defined and has low capacity, a bulldozer has been used to construct a wide channel across the flats and into the bush near the salt lakes.

Some waterlogging occurs on lower slopes in wet winters. To overcome this and reduce crop yield losses some of the existing grade banks could be modified into reverse bank seepage interceptor drains.

The Astburys have restricted clearing on the flat land because of their concern that saline areas could increase. The 557 hectare block of salmon gums has been left uncleared to inhibit the spread of salt.

The salt affected land provides valuable grazing of samphire during summer and autumn.
Wind erosion

Wind erosion is not an acute problem on Taarblin because of the reasonably heavy texture of the topsoils. However, after low rainfall winters when pasture growth is light, paddocks become bare early in the summer unless careful grazing control is maintained.

In poor feed years, it has been difficult to adjust stock numbers rapidly because of the high proportion of mated ewes in the flock. To achieve greater flexibility Greg Astbury intends to run at least one or two mobs of 500 wethers that can be easily and profitably disposed of as the seasonal conditions dictate. This would require a reduction of about 400 ewes for each mob of wethers.

The lighter sandplain and gravel soils at the east end of Taarblin and the area of morrel ‘fluffy’ loam near Taarblin Lake, have a moderate risk of wind erosion damage.

Practices such as fallowing, clover seed harvesting, and early stubble burning, which leave the soil exposed to strong summer winds, are not part of the Astburys’ farming system.

Water conservation

Reliable water supplies are needed for about 4,000 sheep and also for the house and garden. The aim is to avoid water carting from off-farm sources. Figure 6 shows the water conservation works on Taarblin.

On the flats, dam construction is difficult because of the shallow depth to the underlying saline watertable. Already two dams have become useless. Consequently the northern part of the flats and the saltland management paddocks have water troughs supplied from the Comprehensive Water Scheme.

On the southern section of the flats, there are three good dams but in the long term these may also become salt-affected. Fortunately the Comprehensive Water Scheme pipeline runs along the southern boundary of the property, so that water is available in dry years.

The central and eastern sloping parts of Taarblin are mainly served by dams on, or near, the main creek which is fed by a good natural catchment and the dams fill in most years. Two dams at the top end of the creek lie below gravelly country and each of these has been provided with 0.4 hectare of roadded catchment to improve reliability. Other dams with unreliable natural catchments, because of their small size or porous soil types, have also been provided with roadded catchments.

Several dams have grade banks running into them to increase their catchment area considerably; in this way the soil conservation works are closely integrated with the water conservation works.
Natural vegetation decline

Unlike many other properties in the district, Taarblin was not seriously overcleared during development (Figure 7). However, the remaining natural bush is subject to many pressures causing die-back and poor regeneration.

Insects, diseases, parasites such as mistletoe, rubbing and ring barking by sheep coupled with sheer old age are causing a gradual loss of trees. On the flats, the saline watertable at shallow depth also stresses the wandoo and salmon gums.

Areas not protected from grazing sheep have virtually no natural regeneration of the indigenous tree and shrub species. The Astburys have started fencing to protect bush areas from grazing by sheep. This includes 30 hectares of non-arable land with rocky outcrops on the south side of the property. Another area which is semi-protected is the tree belt in the stock laneway near the house.

Tree planting has also begun in recent years, mainly along contour fence lines.

Although many paddocks have some bush areas for stock shelter, there is still scope for more reseeding or replanting non-arable areas, such as the main creeks and waterways, deep sands or rocky ridges (Figure 7).

Non-arable rocky areas have been fenced to exclude stock and encourage natural regeneration.

Figure 7. Remnant vegetation and potential planting sites on non-arable land.

Remaining natural bush on Taarblin is subject to many pressures and there is a gradual loss of existing vegetation. A tree planting programme was started in recent years to overcome the problem. Here, trees have been planted just below a sharp bend in a contour bank. An area which was once difficult to cultivate is now used as a shelter belt.
Stock and vehicle movement

Movement of sheep from paddocks to the shearing shed and yards is mainly along fenced laneways. The main laneway system consists of the two shire road reserves running north-south through the property and the connecting laneway which runs east-west past the house and sheds. In addition, the shire road running along the southern boundary is useful for vehicle access, but a little 'busy' for sheep movement (Figure 8).

Two additional laneways are planned to connect more paddocks into the system; one running due south from the house and yards and the other due west through the middle of the flats. When this work is completed every paddock will have direct access to a laneway. This will greatly reduce the time taken to move sheep and vehicles and to check crops and stock.

Cultivation convenience

The basis for fence re-alignment on Taarblin has been to follow natural boundaries to cultivation wherever possible. This includes creeks and grassed waterways, the edge of rocky ridges and natural bush, along contour banks and the boundary between arable and non-arable land, such as saltland. This fits well with contour working, and reduces the number of headlands and small pieces of land which are inconvenient to work.

Since 1968, when the soil conservation farm plan was prepared, fences have been progressively relocated to match the final plan. The original paddock layout shown in Figure 9 can be compared with the improved layout shown in Figure 10.

The original layout had 38 kilometres of fencing, excluding boundary fences. The new layout has 56 kilometres including 10 kilometres of internal laneways. The number of paddocks has remained virtually unchanged.

The basic location of most of the fencing is:

- Along timbered creeks and grassed waterways to allow convenient cultivation and to fit in with contour working. This also provides future opportunities for tree planting along these waterways with the expense of only one additional fence.
- Along contour banks, also to allow convenient working of land cultivated on the contour. Trees could be planted here.
- Between major land classes which require different management, for example, saline and non-saline, flat and sloping land, arable and non-arable rocky land.
- Around remaining areas of native vegetation, to protect them from sheep and to ensure natural regeneration in the future.

**COSTS**

The main cost has been the relocation of fences. Since 1968, $1,500 per year has been budgeted, so the financial impact has been slight. Practically all the fences were relocated when the old fences were past repair and had to be rebuilt.

Contour banks were constructed using disc ploughs or road graders. The total length of 20 kilometres cost about $800.

Some gully filling was necessary on the farm purchased from the Orchards; the cost for bulldozer and grader hire was about $500.

Earthworks on the clay flats have been restricted to the three kilometre long single levee bank costing $3,000.

Improvements to three dams included the construction of 1.2 hectares of roaded catchment on each at a total cost of $600.

In recent years about $600 has been spent on trees.

**Figure 9.**
Original farm layout (1962)

**Figure 10.**
New farm layout (1986)

**BENEFITS**

The direct costs of implementing the Taarblin farm plan have totalled about $32,000 or $1,800 per year. Most other soil conserving practices such as direct drilling of crops have not involved greater expenditure than conventional cropping methods.

The soil conservation farm plan on Taarblin has produced the following benefits.

**Good soil conservation**

Since 1968, severe water erosion occurred during the winters of 1974 and 1983. Whereas neighbouring farms suffered serious rill and gully erosion, there was almost no erosion on Taarblin. It is difficult to quantify the effect of the soil loss on neighbouring farms but often the rills were ten centimetres deep and evenly spaced over whole slopes. A loss of eight millimetres of soil can cause reductions in crop yield the following year of up to 25 per cent and some effects can continue for many years where erosion is severe.
The problem of wind erosion control is not yet fully solved, though farm practices such as minimum tillage, pasture establishment and avoidance of stubble burning and clover seed harvesting are all beneficial. Careful attention to achieving a safe stocking rate in relation to seasonal conditions is the most important approach to this problem.

**Saltland management**
The soil conservation farm plan has meant that salt-affected land can be managed separately and at low-cost by fencing to control stock and to allow natural colonisation by salt-tolerant plants. This has slowed the rate of spread of the salt and produced useful late autumn/early winter sheep feed.
The retention of native trees on land likely to go salty has also helped restrict the area of saltland, thus maintaining the capital value of the property.

**Waterlogging**
By separating flat waterlogged land from well drained land the soil conservation farm plan allows Greg Astbury to avoid cropping land with a high risk of failure. This helps maintain high average crop yields from the property.
Construction of reverse bank seepage interceptor drains on waterlogged parts of the sloping land could result in further yield increases - perhaps by as much as one tonne of wheat per hectare.

**Water conservation**
Integrating the contour bank systems with the dam sites has improved the dams' chances of filling. This is also true of the three dams with rooded catchments. These works implemented under the plan have reduced the reliance on the Comprehensive Water Scheme, high water bills and the need for expensive reticulation equipment.

**Stock shelter**
Steps taken to protect non-arable areas from sheep grazing, and a tree planting programme, have reversed the trend of tree decline so common on properties in the district.

**Stock and vehicle movement**
The laneway system in the farm plan has resulted in considerable time saving when moving sheep or moving vehicles at seeding and harvest.

**Cultivation convenience**
The planned layout has resulted in many fences following natural boundaries to cultivation. This creates 'natural paddocks' and improves cultivation convenience, saving valuable time.
Time saved at seeding, by means of good access for machines and convenient cultivation, results in early seeding, which is a major factor in high crop yields.

**Separation of land classes**
The new paddock layout has in many cases separated classes of land with different production potential and management requirements. This results in more efficient use of expensive inputs such as fertilizers and herbicides and also reduces land degradation.

**Job satisfaction**
The redevelopment of Taarblin according to the soil conservation farm plan has given Greg and Heidi Astbury a great deal of satisfaction in a job well done. It also has important long term implications for the capital value of the property and the productivity of the land for future managers of this property.
The level of protection of the land resource that has been achieved on Taarblin through the steady, systematic implementation of a soil conservation farm plan is needed on every farm in Western Australia. A conservation programme can be followed over a period of years with relatively small annual investments tailored to the financial situation in each farming year.