Esperance Downs Research Station: rehabilitation report

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3. FARM PLANNING
Harvey Jones¹, Stephen Gee² and Martyn Keen³

During the 1970s and 1980s on several occasions changes were made to the farm layout. However, these modifications were only to re-fence around the existing extent of salinity with no underlying changes to management practices or increased water use through deep-rooted perennial vegetation.

3.1 Formulating the farm plan

Figure 1 shows the layout of the station in 1990 before commencement of the rehabilitation program. Figure 2 is a drawing of an interim proposed farm plan including paddock layout, vegetation and drainage originally devised to address the rehabilitation objectives. This plan reflects consideration of electromagnetic conductivity mapping, subsoil water flow, contour relief and soil type as shown in Figures 3, 4, 5 and 6. Figure 7 indicates the actual paddock arrangement and drainage system by 1996 with Figure 8 showing the extent of tree planting.

Figure 7 reflects the final implementation plan incorporating revisions to the original plan based on physical practicalities and more suitable management options. By 1996 the eastern side of the station was split into areas of similar land use capabilities so that the station had a vastly different configuration in 1996 compared to 1990.

The plan (Fox et al. 1990) incorporating the rehabilitation was developed by a team from the Esperance area and included Ted Fox, Manager EDRS; Martyn Keen, Land Conservation Officer; Jeremy Lemon, Adviser and David Bicknell, Revegetation Development Officer. This plan to address land degradation on EDRS used as a starting point the report Salinity and Waterlogging on the Esperance Downs Research Station (McFarlane and Ryder, 1990). It was necessary to also take into account the physical features of the property. Therefore, in addition to mapping of salinity and waterlogging an accurate survey of the station was done with Sokkisha and Wild Total Station gear to plot the position of all existing features.

A draft plan was discussed at a workshop in 1990 attended by local farmers, agronomists, production advisers, hydrologists, soil scientists, agricultural economists and local farmers. Subsequently the aforementioned team made adaptations in keeping with the design of the drainage system and property landscape. The station was surveyed to obtain accurate positioning of proposed fence lines and drainage works. The plan included reference to soil types, drainage, salinity (as measured by electromagnetic survey), groundwater levels and existing vegetation.

The Land Management Plan positioning fencing, revegetation and land use was thus determined by considering a combination of factors with the following order of priority:

1. Necessity to alleviate land degradation.
2. Positioning of existing physical features, drainage lines and remnant vegetation on the station.
3. LMU based on soil type and degree of secondary salinity.
4. Revegetation of perennials as made possible by improved drainage and disposal of run off water.

Generally 75 per cent of the station was to be used for demonstration purposes with the remainder for research. There was no intention for the rehabilitation project to be just a

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research activity. Its primary objective was for the demonstration of an operational system. Thus, no control sections were left to make experimental comparisons with rehabilitated areas. In any case the lack of feasible compartmentalisation for replication would have made for very restricted scientific testing.

### 3.2 Land use planning

Rehabilitation commenced firstly on the eastern side of the station, east of the Esperance-Coolgardie Highway. The western side of the property was subsequently incorporated into the farm plan to account for the fall of land from east to west. In particular it was necessary to address the rising watertable under remnant vegetation on the eastern side resulting from drainage of surface water from the western side of the highway.

As a starting point, 25 per cent of the station area was targeted for planting to high water using perennials. This was deemed as a minimum to forestall the rising watertable being caused by recharge in excess of discharge and water use by annual crops and pastures. A range of land uses aimed at higher water use within the farming system were targeted, with paddocks subdivided and realigned. These included the following:

- Perennial grass pastures on shallow, waterlogging - prone country.
- Block tree planting on high salt storage areas.
- Revegetation of swamp and sump areas.
- Continuous lupin-cereal cropping on deeper well-drained sand.
- Lucerne based pasture on deep sand.
- Salt tolerant forage species on salt affected land.
- Wide spaced trees in alleys on areas with a high watertable where salinity was spreading rapidly; and
- Sub. clover based pasture with a cereal rotation on sloping shallow country.

All these land uses are supported by modifications of the landscape including:

- shelterbelts of trees to reduce wind speed and potential erosion;
- surface drains to remove ponding from low-lying areas;
- fencing consistent with land management units; and
- grade banks and waterways on an area of steeper sloping country.

### 3.3 Land use

The entire station’s LMU are described below in terms of degree of salinity and broad soil characteristics along with the associated land uses. This description is reflected schematically in Figure 7 being the actual farm layout at the completion of implementing the rehabilitation strategy.

**A. Areas of high salt (EM 38, 250 mS/m - 800 mS/m)**

1. **Very shallow sand (< 15 cm)**
   - N15 acacias
   - N16 puccinellia, tall wheat grass, saltbush
   - N6 saltbush demonstration site

2. **Shallow sand (15-25 cm)**
   - E6 trees, acacias
   - E7 puccinellia, tall wheat grass, saltbush
   - N9 trees
(3) Sump areas with little sand
   N17  trees
   N20  trees
   N3   trees

(4) Variable salt seep area - drainage
   N8   tall wheat grass, perennial ryegrass/balansa

B. Areas of moderate salt (EM 38, 50 mS/m - 250 mS/m)
   Area subject to water logging, not suitable for cropping.
   Shallow sand and/or gravel over clay.
   N11  phalaris, tall wheat grass, perennial ryegrass, sub. clover
   N13/14 phalaris, tall wheat grass, perennial ryegrass, sub. clover
   N5   tall wheat grass, perennial ryegrass, sub. clover
   E2   tall wheat grass, phalaris, fescue, balansa, sub. clover
   E9   tall wheat grass, phalaris, fescue, balansa, sub. clover
   E12  tall wheat grass, phalaris, fescue, veldt grass

C. Areas of low salt (EM 38, less than 50 mS/m)
   (1) Very shallow sand (< 15 cm)
       N7   annual pasture
       N19  phalaris

   (2) Shallow sand (15-25 cm)
       N15  annual pasture
       N18  tall wheat grass, phalaris
       E10  annual pasture/crop rotation
       E3   annual pasture/crop rotation
       E4   annual pasture/crop rotation

   (3) Moderate sand (30 cm)
       N1/N2 feedlot, annual pasture
       E1   lucerne
       E5   tall wheat grass, phalaris, fescue, balansa, sub. clover
       N10/N12 annual pasture

Perennial species and their distribution were selected according to the following criteria:
   • Salt tolerance
   • Insect susceptibility
   • Soil type suitability
   • Tolerance to post-emergence herbicides
   • Water use; and
   • Commercial potential

In particular, windbreaks were planned keeping in mind structural suitability using different species to achieve both height/density requirements and avoidance of wind turbulence. The farm layout was also a consideration with rows adjoining laneways where appropriate according to the prevailing wind direction. Grazing areas have shorter trees in the row adjacent to the paddock to give stock shelter. Spacing of windbreaks took account of the balance between land occupied by trees and available agricultural area so that the maximum distance between tree belts is 400 m.
Shelter groves for livestock were placed to provide lambing havens and off-shears shelter. Fodder shrubs were incorporated into these shelter areas and species chosen with known cutting management requirements. Trees were mostly sown as seedlings. This was due to easier establishment in the face of considerable problems with non-wetting soils on the station.

3.4 Farm management practices
To fully implement the farm plan several management changes were adopted, which influenced aspects of farm practice, thereby enabling a more sustainable and flexible operation.

The management changes from prior to rehabilitation included the following:

- Grazing pressure was reduced to allow for extensive establishment of perennial pastures as paddocks were prepared and sown over several years.
- The sheep flock was changed from a ewe dominant breeding flock to one carrying some wethers to allow flexibility for feedlotting and sale in poorer seasons.
- Cattle numbers were maintained to graze newly established perennial pastures.
- A feedlot area was fenced and watered which allowed paddock destocking in seasons with late breaks.
- Temporary electric fencing is used to protect wide spaced trees and help ensure even grazing of paddocks.
- Perennial pasture paddocks are rotationally grazed with spring deferment.
- Selected annual paddocks are grazed to target Feed on Offer (FOO) levels to maintain pasture composition and prepare paddocks for cropping.
- Red legged earth mite (RLEM) control is practised to improve and maintain high legume content in both annual and perennial pastures.
- Paddock records are maintained on a computer based recording system (Paddock Action Manager) for ease of retrieval, paddock comparisons and reporting.
Figure 1. Aerial photo of Esperance Downs Research Station in 1990.
Figure 2.  Interim farm plan of Esperance Downs Research Station.
Figure 3. Electromagnetic conductivity analysis 1990, EM 38 vertical with 20 mS/m intervals.
Figure 4. Subsoil water flows (McFarlane and Ryder, 1990).
Figure 5. Land form contours on 1999 farm layout.
Figure 6. Soil type distribution on 1999 farm plan.
Figure 7. Esperance Downs Research Station farm photo and layout, 1996.

Figure 8. Distribution of tree planting (in grey colour) on 1996 farm plan.