Surface water key to success

Case study: Esperance Downs Research Station (EDRS)
Location: 28 km north of Esperance, Western Australia
Property size: 957 ha including 227 ha of remnant vegetation
Mean annual rainfall: 500 mm about 70% from May to October
Soils: Sand, gravelly sand and sand over clay
Enterprises: Research projects Angus cattle, Merino wethers, cropping

If anyone has good records in managing salinity, a government-funded property must be a likely candidate. Esperance Downs Research Station, established in 1949 to provide a model for sandplain development of the eastern South Coast of Western Australia provides such an example.

In the early 1950s, new land development was extensive and politically attractive in WA – "clearing a million acres a year" – and the standard conditional purchase arrangements demanded removal of the bush. EDRS was typical, and by 1954 supported little natural vegetation except in swampy depressions.

Records show that by 1956, less than seven years after it was carved from the sandplain, 53 hectares had become salt-affected, expanding to 67 ha by 1967. Within 35 years 39 per cent of the cleared land was affected to some degree.

Clearly this didn't look good for a property designed to show the way for the farming community (and now committed to an environmental management system). Rehabilitation began in 1990 to "restore productivity and demonstrate profitable farm scale systems to slow, halt or reverse degradation". A three-year project was funded to initiate the rehabilitation and any changes were then incorporated into normal farm planning.

Photos: G Wilson

Aberdeen Angus cattle graze on balansa clover pasture that was 20% salt scalds and dominated by barley grass before the surface drains were installed

Key points

- Salinity and waterlogging were stifling productivity less than 35 years after clearing
- Surface-water control and changing management practices to match land capability have been the most effective treatments
- Surface drains can be very effective, but careful siting and construction are critical to success

Extensive electromagnetic surveys were used to describe the extent and severity of salinity and showed that highly saline groundwater was rising in some places by about 10 cm per year. All the weapons to hand in the arsenal were then used in the most suitable areas – surface drainage, tree planting, high intensity cropping, perennial pastures and saltbush. A farm plan was also developed with rotations to suit land management units and involved re-fencing to suit capability rather than just dividing land off into neat squares.

Looking back after 15 years, current farm manager Colin Norwood says surface water management has proved the biggest winner, although other treatments also played their part in creating the current showpiece of well-drained and productive farmland – if rather smaller than the present district average.

While surface drains had been constructed earlier, and in the right places, high and low points were causing ponding, and some sections were too shallow or too narrow to cope with water flows. Tube drains, 1.5 metres below ground, had also been tried, but these were no more effective than trees, and were more expensive.

EDRS has a localised groundwater flow system and is largely self-contained in terms of water balance. Success or failure of any management treatments is therefore reflected within its boundaries. Previously,

water would just sit around in the flat terrain leading to bare patches, erosion, then holes and more ponding. Now it flows away so that damage is minimal.

On the South Coast rainfall declines rapidly to the north, falling by more than 300 millmetres per year over 100 km. When EDRS has a good season the hinterland can be marginal, but when inland areas have a good year, EDRS and its neighbours closer to the coast face serious waterlogging.

Construction, reconstruction and realignment of surface drains occurred from 1991 to 1993, followed by planting of trees, perennials and new fencing. Using a scraper, the main 'U' drain was realigned and deepened along with additional feeder 'W' drains so that water would flow safely and evenly along flat-bottomed channels without ponding. These were considered "overkill" by some observers when first installed, but have more than justified the effort.

Some maintenance is now required, but Colin believes they are still working pretty effectively after more than 12 years.

Following the rehabilitation work, district economist Harvey Jones edited a comprehensive report on the salinity management work and this is available on the Department's website.

Expenditure on drainage totalled $27,181 out of a total cost of $170,699. While EDRS could not be compared with a commercial farm, he calculates that it has generated sufficient profits to more than cover the cost of the rehabilitation.

Some low-lying areas are still affected by waterlogging and salinity, but the proportion is steadily falling whereas it is estimated that it would have risen to more than 400 ha by 2010 if left untreated.

Photo: G Wilson

EDRS manager Colin Norwood checks a grassed waterway that takes excess surface water out of grazing land and into nearby remnant bush

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The science behind the story

By John Simons, Department of Agriculture, Esperance

Esperance Downs Research Station (EDRS) is situated in the upper reaches of the Dalyup River catchment which flows into Lake Gore, a Ramsar-listed wetland of international significance. The landscape is characterised by a level to gently undulating sandplain incised by a poorly developed drainage system, which consists of salt lake chains and broad, flat, primary saline channels that flow intermittently during winter and spring. The area is prone to salinity, waterlogging, inundation and occasional flooding and these hazards occur because of poor surface, subsoil and groundwater drainage.

In the 1970s, two processes were identified as being largely responsible for secondary salinity developing on EDRS. First, shallow undulating bedrock was impeding groundwater flow causing discharge behind areas where the bedrock neared the surface. Second, groundwater mounds were detected beneath areas where seasonal perched groundwater and surface water inundation occurred.

The waterlogging and inundation in the shallow duplex soils and low-lying areas also inhibited plant growth leaving the soil bare and prone to wind erosion. The subsequent wind erosion deflated the soil surface bringing it closer to the shallow (<2 m) water table and exacerbated the development of secondary salinity.

The farm plan developed in the 1990s considered these processes and endeavoured to manage them through a combination of surface water drainage, increasing the area of perennial vegetation and changing management practices to suit the land capability.

The surface water management system reduced inundation and flooding which enabled other components of the farm plan to be implemented successfully. The increase in biomass in turn reduced recharge and also reduced the incidence of wind erosion through improved ground cover management.

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