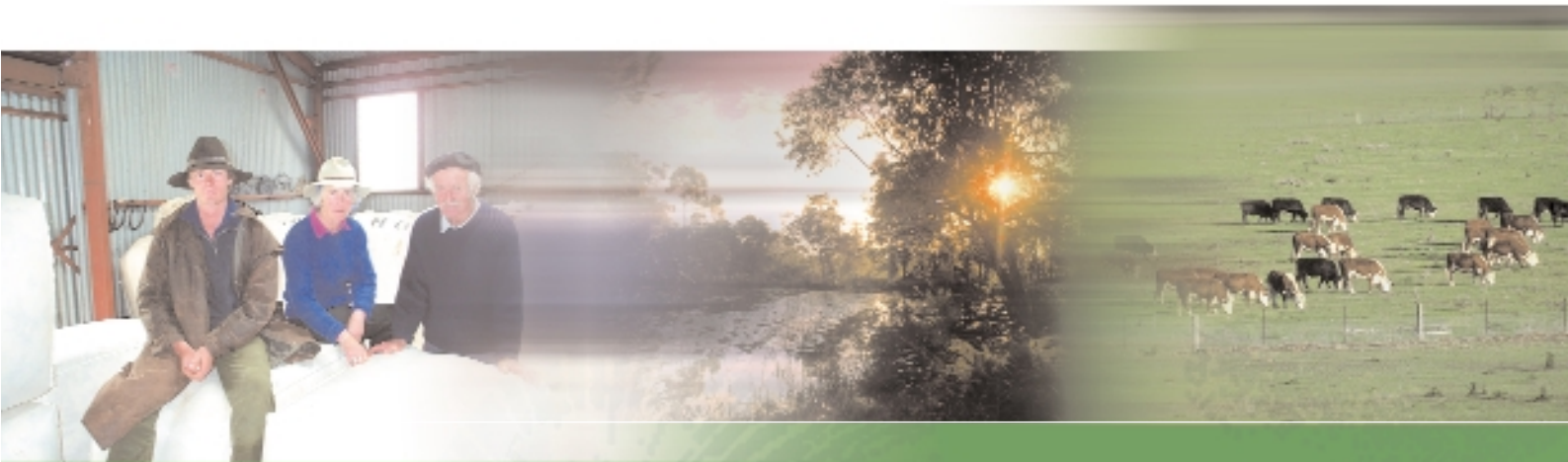


## **Sustaining The Land:**

CASE STUDIES OF FARMERS WORKING FOR OUR FUTURE



## INTRODUCTION



Belinda McNeill  
Conservation Project Manager

**SUSTAINING THE LAND: CASE STUDIES OF FARMERS WORKING FOR OUR FUTURE** has been developed by NSW Farmers' Association as part of an environmental education project to 'Deliver Nature Conservation and Resource Management Options to Farmers in New South Wales' and to promote the positive on-ground natural resource management activities of landholders. This case study booklet is supported by 'Guide to Farm Conservation in NSW' resource toolkit available on the NSW Farmers' Association website ([www.nswfarmers.org.au/nht](http://www.nswfarmers.org.au/nht)) and linked to the 'Farmers Assessing their Resource Management' (F.A.R.M) self assessment workbook.

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Soil



Water



Vegetation

# FOREWORD



Mal Peters, President

*As President of the NSW Farmers' Association, it is my pleasure to introduce this publication to you.*

Natural resource management has become an important part of everyday life on properties across New South Wales. Farmers are acknowledging the links between environmental degradation and loss of agricultural productivity. They are developing practical techniques and best management practice strategies to overcome regional conservation challenges including salinity, environmental weeds, soil erosion and feral animals. Farmers are also enhancing the environment through revegetation, improving water and air quality and, increasing biodiversity.

**'SUSTAINING THE LAND: CASE STUDIES OF FARMERS WORKING FOR OUR FUTURE'** provides an opportunity to read about the hard work being undertaken by farmers in New South Wales to protect, improve and manage their natural resources.

The NSW Farmers' Association commends these inspirational activities and as the leading state based lobbying organisation representing the voice of farmers in NSW, encourages Governments to provide adequate support and incentive frameworks and suitable legislation to foster further on ground conservation activities within the State.

**'SUSTAINING THE LAND'** reflects the commitment of farmers and provides a snapshot of the time, resources and monetary investments made by these individuals who are striving to make their properties more productive and profitable whilst maintaining environmental sustainability. We should all take the time to acknowledge these voluntary activities of farmers who are working for our future.

Sincerely

A handwritten signature in black ink, appearing to read 'Mal Peters'.

Mal Peters  
President  
NSW Farmers' Association



Air



Fauna



Rural Land  
Management

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## Managing manure in an egg production operation

Chicken manure is a nutrient rich by-product of egg production operations. A laying hen produces about 90 grams of manure a day, depending on its diet. NSW Agriculture estimates that 500 000 cubic metres of chicken manure are produced annually in New South Wales. The manure has about 85% moisture content and is high in nitrogen and phosphorous. It has higher nutrient levels than most other livestock manures and is a valuable fertiliser. Egg producers in New South Wales are implementing more efficient systems to minimise the potential of environmental pollution from off-site loss of manure.

### The old method

David and Marie Langfield and their sons Simon, Brett and Justin run an egg production operation on 'Kingsland' near Bendick Murrell. They produce about 500 000 eggs a week that are sold to several companies and distributed throughout New South Wales. The Langfields also operate feed mill and transport enterprises as part of the Langfield Pastoral Company and have an off-site hen-rearing complex. The Langfields have been producing eggs since 1980, utilising A frame cages with natural ventilation. The cages have mesh floors that allow litter including faecal excretions, feathers, dander and moisture from excretions and drinking systems to fall through into piles below. The manure is periodically removed using a tractor, bobcat and truck.

### Reducing the risks

In 2000 the Langfields started construction of a new complex consisting of six egg production sheds that house 35 280 laying hens. The new production sheds allow environmental control over air, light and feed conditions.

They also minimise hen and egg contact with manure thus reducing the potential of bird illness and food contamination. Chicken manure is collected on a conveyor belt below each deck of cages. Air is then blown over the manure drying it to about 60% moisture content. This process lowers ammonia levels and reduces odour.

The Langfields currently remove 75 cubic metres of dry manure from the complex a week. The manure is stockpiled away from waterways and in gravel lined pits to prevent any potential leaching of nutrients into the soil or water. It is stored for up to 12 months to allow composting before use as a fertiliser. The manure is then spread on Langfield Pastoral Company land with a spreader or sold as a fertiliser for between \$5 and \$10 per cubic metre. The manure is usually purchased by broadacre farmers and vineyards, and transported using Langfield Pastoral Company transport trucks.

The Langfield family's egg production operation involves consideration of the environment in all aspects of manure production, drying, storage, transport and application.



## Blade ploughing to control woody weeds

The encroachment of woody weeds is a major conservation issue being faced by landholders in the western division of New South Wales. Woody weeds are unpalatable native plants that inhibit the growth of other plants such as grasses. They reduce the carrying capacity of the land and cause conservation problems such as erosion and habitat loss. Woody weed control on Western Land Leases is listed as an exemption under the *Native Vegetation Conservation Act (1997)*. This allows for a range of different control options to be explored in country with different soil and vegetation types, such as blade ploughing in red soil and sand hill areas.

### Invasion of woody weeds

Bill and Lisa Ridge have a 16,195 hectare sheep and cattle property 'Tuon' north of Bourke. Like most properties in the region, Tuon has been invaded by woody weeds including turpentine (*Eremophila sturtii*) and hop bush (*Dodonaea sp.*). Almost three years ago, the Ridge family invested in a D8 tractor and blade plough and started work on woody weed control on their property. Blade ploughing is a slow process, as the large ploughing tractor must avoid fodder trees. For effective control, the blade plough must travel at least 30 centimetres under the soil to cut the roots of the woody weeds. Only about 3 acres per hour can be cleared, at a cost of more than \$35 per acre.



Photo: Dense area of woody weeds in western division of New South Wales

### An effective solution

The Ridges use a blade plough fitted with a seeder that distributes seed as the area is ploughed. The Ridges usually seed with buffel grass (a vigorous perennial) at one kilogram per acre. Some of the seed is harvested on the property and the remainder purchased. It is treated with a fungicide before sowing and germinates after rain. Once an area on Tuon has been blade ploughed, it is left for at least 12 months for the grasses to establish before stock is re-introduced.

In the past three years the Ridges have blade ploughed about 485 hectares of woody weeds on their own property and have had a high level of success. Only a small amount of regrowth has occurred which is controlled by spot spraying. Ownership of the blade ploughing equipment has allowed Bill to do contract work for woody weed control on other properties.

Bill and Lisa Ridge's property north of Bourke had a serious woody weed problem that is being managed through blade ploughing and reseeding.



### **Financial support**

The Ridges gained some financial support through the WEST 2000 woody weed control program. This program (now finished) provided landholders in the western division with up to \$10, 000 for woody weed control, which was matched dollar for dollar (or equivalent) by the landholder. The Ridges obtained two rounds of funding through this program and provided labour, fuel and use of the blade ploughing equipment to meet their required levels of input. They also received an interest subsidy incentive from WEST 2000 for the purchase of the blade plough.

### **Continuing combat**

Blade ploughing is one of the most effective management options currently available to control woody weeds. Despite the high level of success of woody weed control through blade ploughing, experienced by the Ridge family, the problem is still extensive and the control needs to be continuous. However, blade ploughing is becoming increasingly expensive with high machinery and fuel prices. Bill and Lisa are hoping to be eligible to apply for funding under the WEST 2000 Plus program so they can continue to combat the onslaught of woody weeds on their property.



Photo: The Ridge's blade plough with seeder at Tuon



## Revegetation on a Hunter Valley vineyard

Vineyards were first planted in the Hunter Valley during the 1830s. The region now boasts more than 70 wineries operating as vineyard and tourism ventures. Vineyard establishment has been somewhat ad hoc leading to the fragmentation of native vegetation and the isolation of remnant vegetation. Landholders are increasingly seeing the benefits of native vegetation in controlling soil erosion, preventing rising watertables and providing habitat for insects and birds that are often useful natural predators. Native vegetation is being preserved and reintroduced to vineyards throughout the Hunter Valley for environmental and productivity values.

### Establishing the club

Helen Palmer and Kees Van de Scheur manage Van de Scheur Wines, a viticulture and wine making enterprise near Cessnock in the Lower Hunter Valley. The 4 hectare vineyard is located on the 13 hectare property 'Ingleside'. Helen and Kees bought the property in 1994, restored the original 1870s homestead, planted the vineyard with several grape varieties including Semillon, Chardonnay, Shiraz and Cabernet Sauvignon, and opened Van de Scheur Wines in 1995. The winery is operated using a 'club style', where the 350 club members are given the opportunity to be involved in all aspects of grape production and wine making. Helen and Kees also grow olives and manage a small olive tree nursery.

### Creating corridors

In 2000, Helen and Kees were involved in a revegetation project on Ingleside with Cessnock City Council. Cessnock City Council has been running two revegetation projects to increase biodiversity by creating wildlife corridors between areas of remnant vegetation in the Cessnock region. 'Lower Hunter Corridors Project' and 'Vineyards Corridor Project' (partly funded through the Commonwealth's Natural Heritage Trust) have involved an impressive 14,500 tubestock being planted in the past two years. The projects are due to finish during 2002 and have provided information, advice, local tree and shrub tubestock and tree guards for revegetation projects.

Helen Palmer and Kees Van de Scheur are working with Cessnock City Council and other landholders in the Hunter Valley to protect native vegetation and establish wildlife corridors.





Revegetation on Ingleside took place along Marrowbone Creek where 300 metres of riparian vegetation were diversified with a range of local trees and shrubs. The riparian area was covered in a monoculture of swamp oaks (*Casuarina glauca*) and plants for revegetation were selected to introduce structural and species diversity. The 100 metre wide site was prepared by slashing and spraying excess grass to reduce competition for moisture and soil nutrients. Members of Van de Scheur Wines helped Helen and Kees plant 950 tubestock in a scattered pattern. Tree species included Sydney green wattle (*Acacia decurrens*), Sydney golden wattle (*Acacia longifolia*), grey gum (*Eucalyptus punctata*), cabbage gum (*Eucalyptus ampifolia*), forest red gum (*Eucalyptus tereticornis*), and Slatey gum (*Eucalyptus dawsonii*); and shrub species included: hop bush (*Dodonaea triquetra*), *Leucadenderon petersoni*, violet bottlebrush (*Callistemon violeous*) and green bottlebrush (*Callistemon pinifolius*). Tree guards were put around the plants to help retain moisture and to protect the trees from rabbits. Once established, the trees and shrubs should assist in improving water quality in the Marrowbone Creek by capturing excess sediment and nutrients during times of high water flow.

### **Spreading the word**

Helen mentioned the planting project on Ingleside to her neighbour who also decided to become involved in the Cessnock City Council revegetation project. They planted 350 trees and shrubs along their section of Marrowbone Creek. This has created a 1.5 kilometre wildlife corridor over the two properties, where Helen and Kees have observed a variety of small and medium birds nesting and feeding.

The trees and shrubs on Ingleside are thriving in the moist alluvial soil. Some of the fast growing species such as wattles (*Acacia spp.*) are now several metres tall. Helen and Kees would like to continue to enhance the biodiversity on Ingleside by further revegetation with trees and shrubs to increase the width of their wildlife corridor.



Photo: Helen and Kees on Ingleside in the Lower Hunter Valley



# Enhancing native grassland in a snow gum remnant

The Southern Tablelands of New South Wales is mostly grazing country covered in pasture including native grasses. It is scattered with paddock trees that have been retained to provide shade and shelter for stock. Native grasses are an important part of this landscape as they are often perennial, drought resistant and assist in stabilising the soil.

## Saving the remnants

Max and Joan Limon's property 'Sunnybrook' is located on the eastern side of Lake George, near Tarago and has been in the Limon family since 1948. The 650 hectare sheep and cattle grazing property has several large patches of native grasses. Native grass species that survive in the acidic soils found in the region include: kangaroo grass (*Themeda australis*), wire grass (*Arstida sp.*), wallaby grass (*Austrodanthonia sp.*) and spear grass (*Austrostipa sp.*). The Limons have developed a farm plan which has been used to plan conservation projects on their property, including preservation of a remnant area of snow gum.

Revegetation on Sunnybrook began in the 1950s with small tree lots being planted by Max's father. In 1995 Max and Joan began to create windbreaks and wildlife corridors along their fence lines. Linear strips were ripped, fenced, sprayed and revegetated with a mix of native and exotic plant species. While tubestock have grown well, direct seeding has produced a disappointingly low survival rate.

## Fencing funds

In May 1999 Max and Joan fenced off a two hectare remnant of snow gum (*Eucalyptus pauciflora*) woodland in a 120 hectare paddock. The Limons could see the significance of the area and the value of its preservation, although it provided the only shade in the paddock and was previously a stock camp. A stock-proof fence was constructed around the area, with barbwire on top and a single electric wire on the outside, costing about \$2,700 per km including labour. The Limons received \$1,200 per km towards construction of the fence through Greening Australia's Native Vegetation Fencing Incentive Scheme. They also entered into a ten year management agreement for the area with the NSW Department of Land and Water Conservation through the Native Vegetation Incentive Fund, which provided funding for the additional fencing costs and for weed control.

Max and Joan Limon's property in the Southern Tablelands has important native grassland and snow gum remnants that they are working to protect.



The NSW National Parks and Wildlife Service and the NSW Grasslands Society surveyed the snow gum remnant seven months after stock had been excluded. An amazing diversity of plants were found with 75 native herbaceous grass and forb species and six native tree and shrub species being identified. This included several regionally significant plants such as the Australian anchor plant (*Discaria pubescens*) which is considered a rare species in the area. The Limons are considering planting tubestock to introduce a shrub layer into the remnant as most of the natural plant regeneration has been in the groundcover layer.

### **Unexpected outcomes**

Fencing the remnant has given rise to a serious management issue – weeds have emerged in patches where they were previously kept eaten down by stock. A survey in December 1999 identified 25 exotic weed species of forbs, grasses and shrubs in the remnant. Max and Joan have spot sprayed some of these weeds. They are currently exploring the option of burning the area to destroy the mass of weeds and provide an opportunity for natural regeneration of native plants.



Photo: Max and Joan Limon in their fenced snow gum remnant on Sunnybrook

Adjoining the protected snow gum remnant on Sunnybrook and fringing Taylors Creek is another native grassland area. It is only rarely used by stock and has had about 80 species of native grasses and forbs identified in it.

The Limons plan to fence off the area in the future to allow further natural regeneration to occur. They are also involved in a gully erosion control project that involves fencing to exclude stock and revegetating with native species.

### **Active participants**

Max and Joan are active members of Taylors Creek Landcare Group. In 2000 the group successfully received a grant through the Commonwealth's Natural Heritage Trust to protect and enhance native vegetation. The funding was used to fence, direct seed and plant native species over ten properties, and included fencing a small snow gum remnant on Sunnybrook. Taylors Creek Landcare Group has also been involved in a biological control trial for scotch thistle with CSIRO and has recently put in another grant application for funding to plant tree corridors and join native tree remnants to Taylors Creek.

### **Looking to the future**

The diversity of native grassland species found in areas of Sunnybrook is very high. Most of these species have persisted after years of grazing, indicating use of successful land management practices by the Limons. Max and Joan hope to continue enhancement of the native grassland areas on their property in the future.



## Rehabilitating acid scalds in Tuckean Swamp

Acid scalds are areas of land where acid sulfate soils are at the ground surface. These soils are constantly oxidising, producing a range of acid products such as mineral salts and sulfuric acid. Plant growth is reduced to very few acid tolerant plants or no vegetation at all. This is due to high levels of acidity reducing nutrient availability. Aluminium toxicity and high levels of mineral salts also inhibit plant growth. Acid runoff from the scalds can enter nearby waterbodies and affect water quality causing fish disease from the aluminium.

### Legacy of the past

Arthur and Ruth Weis are second-generation Jersey dairy farmers in the Tuckean Swamp. They have 90 milkers and run a few steers over two properties, 'Tuckean' is an 113 hectare property used for dry cattle. It has two acid scalds about one acre (0.4 hectare) each that are denude of vegetation and have a soil pH of about 3.8 (pH is a unit for measuring acidity or alkalinity of soil and water where seven is neutral, lower numbers are more acidic and higher numbers are more alkaline). The acid scald on Tuckean was probably exposed through burning of the peat topsoil layer in the past. Arthur recalls the areas always being bare with a crusty surface. This area has not posed problems for productivity as the farm is on a floodplain, and usually has plenty of pasture available for grazing. Over time, Arthur and Ruth have realised the problems associated with acid scalds and decided to try and improve the quality of the acidic water running off their property.

Arthur and Ruth Weis have a dairy in the Tuckean Swamp. They are rehabilitating an acid sulfate soil scald through mulching, mounding and allowing natural regeneration.



Photo: Tuckean Landcare Group acid sulfate scald rehabilitation project sign



### **Hatching a plan**

In 1997, the Tuckean Swamp Land and Water Management Plan was released and the Weises were involved in forming the Landcare group, Tuckean Landcare. The group successfully applied for funding through the Commonwealth's Natural Heritage Trust to implement some of the findings of the plan. This included funding for trials to combat acid sulfate soils in the Tuckean Swamp and required 50% capital input by landholders.

In 1998, Arthur and Ruth started a trial to treat one of the acid scalds on Tuckean in conjunction with Tuckean Landcare, Richmond River County Council, the Department of Land and Water Conservation and NSW Agriculture.

The trial involved fencing off the scald with a two-barbwire fence, furrow and ridging the soil and dividing it into four separate plots which were then exposed to different treatments. The first plot was a control plot, which was left without treatment; the second plot was surface limed with 5 tonnes of lime per hectare; the third plot was mulched with four inches of straw mulch on top of the scald; and the fourth plot was limed and mulched using the treatments from plots two and three.

### **Help from the experts**

Tuckean Landcare Group, NSW Agriculture, and Southern Cross University periodically monitored the site, conducting tests to measure the changing acidity of the soil. The trial found that:

- breaking up the scald crust and using ridges promoted the leaching of mineral salts and acid down into the soil allowing vegetation to grow;
- liming lifted the soil pH to 5.5, however this only lasted for about five months before falling to the acidic pre-trial level;
- mulching helped with the retention of soil moisture and appears to have reduced salts encrusting the soil surface, and
- stock management/exclusion from these areas also appears to have reduced pressure on plant establishment.

The acid scald is now covered in acid tolerant plants, including broad leaf melaleuca (*Melaleuca quinquinervia*); swamp oak (*Casurina glauca*); water couch (*Paspalum distichum*); and red weed (*Polygonum strigosum*) which have regenerated naturally and will hopefully help to stabilise the scald and reduce production of acid.

### **Ongoing efforts**

Tuckean has been used for various field days to share the results of the trial with other landholders in the region. Arthur and Ruth plan to continue their own trial of methods to rehabilitate acid scalds by testing the soil pH and monitoring the impact of stock. The Weises are also continuing to work with the Landcare Group on other projects to address acid sulfate soils in the Tuckean Swamp, including stock management to reduce grazing pressure, floodgate trials and drain reshaping to reduce runoff.



# Protecting the Plains-wanderer in the Riverina

Threatened species can include animals or plants, ecological communities, or critical habitats that are declining in numbers and considered at risk of facing possible extinction. Species may become threatened through modification of natural systems such as urban and agricultural development and competition from feral animals. Landholders in New South Wales with identified threatened species and habitat for threatened species on their properties are including activities to assist with recovery of species as part of their day-to-day farm management.

## Home to a threatened species

Richard and Elaine Walker manage a 11,975 hectare property, 'Euroka' at Conargo, where they run 5,000 merinos and a small herd of beef cattle. The property is covered in patches of sparse lowland native grasslands. This vegetation is typical in the southwestern Riverina region and is known habitat of the Plains-wanderer. The Plains-wanderer (*Pedionomus torquatus*) is a small ground-dwelling bird that is classified as vulnerable in the threatened species listing under the *Environmental Protection and Biodiversity Conservation Act (1999)*. Landscape modifications that are threatening the Plains-wanderer include cultivation, overgrazing and excessive application of pesticides. The number of Plains-wanderers is unknown. Population estimates by Environment Australia are being based on identified areas of potential habitat in a two million hectare strip across southwestern NSW, northwestern Victoria and southeastern South Australia. Aerial photos of habitat and a general rule that nine hectares could support a breeding pair of Plains-wanderers has been used to estimate that the population may be fewer than 10,000. The population changes seasonally depending on climate and available food sources.

It is thought that more birds are found in areas that have had fewer disturbances.

## Protecting habitat

Euroka has small patches of potential habitat for the Plains-wanderer and Richard and Elaine first sighted the bird on their property about 10 years ago however it may have been present in the region for a lot longer. The grassland habitat is usually found on the red duplex soil with about 50% bare ground and grasses such as corkscrew grass (*Stipa setacea*) and yellow buttons (*Chrysocophalum sp.*). The patches of lowland native grasslands on Euroka are located in larger paddocks with various vegetation types depending on the soil and include plants species such as lignum (*Muehlenbeckia florulenta*), bluebush (*Chenopodium sp.*), cottonbush (*Maireana aphylla*) and rye grass (*Lolium spp.*).

On the Riverina property managed by Richard and Elaine Walker, a special resident, the vulnerable Plains-wanderer is being protected through active management of native grasslands and feral animals.



Photo: Richard Walker in typical Plains-wanderer habitat

The Conargo region has a marginal climate with low rainfall that usually occurs in winter. The Walkers manage Euroka as a sensitive environment by stocking conservatively, annually selling off surplus stock and agisting out animals during droughts and times when there are low feed levels on ground. In 1987, a severe bushfire wiped out all vegetation on Euroka leaving a totally denuded landscape. The Walkers set up exclusion zones in natural depressions as management tools to encourage the landscape to regenerate. These exclusion zones were fenced off to reduce pressure from stock and fully regenerated in two seasons following the fire.

### **Keeping ferals at bay**

Foxes are another major threat to the Plains-wanderer and to stock in the region. The Walkers are members of the North Conargo Land Management Group that is involved in a biennial fox control program with the local Rural Lands Protection Board. The Rural Lands Protection Board assists landholders in the group with preparation of baits that are laid at strategic times to make the greatest impact on the fox populations.

The North Conargo Land Management Group has about 25 landholder members and is involved in activities that demonstrate responsible land management in the region.

### **Buffer zones for the Plains-wanderer**

The Euroka partnership has recently gained a licence to develop a semi-artesian irrigation operation on about 3% of Euroka, where the Walkers plan to cultivate various irrigated crops in a rotational system. The licence application and development approval involved lengthy negotiations with the Department of Land and Water Conservation to incorporate protection of the Plains-wanderer and its habitat. Certain areas of the property have been identified for the irrigation development and others as Plains-wanderer habitat that will be protected by buffer zones.

### **Managing for wildlife**

The irrigation development on Euroka fits into the property's broader management plan. The impact of stock on the environment is being managed by the reduction of paddock sizes to allow for rotational grazing systems and positioning watering troughs away from fences and paddock corners to reduce soil compaction and potential erosion problems. Richard and Elaine are taking steps to manage the Plains-wanderer and its habitat as part of their overall farm management.



# Managing regrowth through farm forestry

Many rural properties in northern New South Wales have areas of dense regrowth forest, which have re-established after past logging and clearing. These areas usually have little agricultural value, low biodiversity and are prone to erosion. Management of native forest regrowth may include sustainable forestry.

## Sustainable forestry

Brian and Cynthia Tomalin have a 518 hectare grazing property 'Chittick' near Nundle and run about 100 breeding cows. Chittick has about 55% woody vegetation cover mostly made up of regrowth scrub including silvertop stringybark (*Eucalyptus laevopineae*), messmate (*Eucalyptus obliqua*), mountain gum (*Eucalyptus dalrympleana*) and manna gum (*Eucalyptus viminalis*). The Tomalins manage much of the regrowth on their property for timber production. High grade timber is used for the construction timber market while low grade and salvage timber is used for the wooden pallet market.

Most of the timber regrowth country on Chittick is on a greater than 18 degree slope and is classified as State protected land - requiring consent from the Department of Land and Water Conservation for timber management. The Tomalins obtained consent for five years in 1999, after going through a native vegetation and whole farm planning process for Chittick. Maps and plans were established and different management prescriptions agreed on for the various vegetation and land types. The plans involve Brian and Cynthia preserving some areas of native grass, establishing improved pasture and selectively removing regrowth to promote uneven aged stands of trees.

By managing the regrowth on their grazing property near Nundle, Brian and Cynthia Tomalin are improving timber production and grazing potential while increasing biodiversity.

## Encouraging native grasses

Chittick has large areas of native grasses and improved pasture. The native species include poa tussock (*Poa sieberiana* and *Poa labillardieri*), weeping grass (*Microlaena stipoides*) and kangaroo grass (*Themeda australis*). The improved pastures are a shotgun mixture of phalaris, cocksfoot, fescue, rye and clover. Brian and Cynthia rotationally graze cattle utilising the various grasses for fodder. Poa tussock can become the dominant pasture species without regular management. Periodic grazing of the native pasture grasses generally encourages new palatable growth and inhibits the poa tussock smothering more palatable species.

## Regrowth management trial

The Tomalins are also involved in a native regrowth management trial with Greening Australia for better biodiversity and timber outcomes. Regrowth forests are often very dense with unproductive pasture growth and lack a diverse range of flora and fauna.



Young saplings also compete with each other for space, light, water and nutrients and inhibit successful growth of timber. Eucalyptus spp. are crown sensitive, so when the crowns of adjoining trees touch the growing tips are rubbed off. This can result in stand lockup where growth stagnates until a gap in the canopy provides space for new growth. The trial aims to promote sustainable thinning and silviculture management to improve timber production and nature conservation. It is funded through the Commonwealth's Natural Heritage Trust. Early indications from the trial show that regular thinning can be beneficial in native regrowth areas.

### **Feral peril**

Ben Hall's Gap National Park adjoins the Tomalins property and although largely undisturbed has similar tree cover to Chittick. The area has been used as habitat by wild dogs since the region was first settled in the 1840s. Wild dogs are a mixture of dingoes, dingo - feral crosses and escaped domestic dogs that attack and stress stock. Reactive wild dog control includes trapping, ground and aerial baiting.

Populations of wild dogs reached plague levels in the Nundle region during 1950s and 1960s, leading to the start of aerial baiting in the region in 1965. Aerial baiting involves using a helicopter to strategically drop baited meat into wild dog habitat and along routes that wild dogs are known to travel. The Tomalins are involved in an annual aerial baiting project through their local Wild Dog Control Association.

The baiting program involves landholders providing meat and time to prepare the meat, navigators, bait droppers and labour to load the helicopter. The Rural Lands Protection Board and NSW Agriculture coordinate the program, inject the meat with 1080 poison and spread it aerially. Until recently, the program was successfully

controlling wild dogs in the Nundle region and had led to an increase in local populations of several endangered native fauna. During the past couple of years, changes to Government agency policy on the control of wild dogs has resulted in aerial baiting being excluded from many State Forests and National Parks. This has led to a reduction in effectiveness of strategic control programs and increased wild dog attacks on domestic stock in the Nundle region.

The valley where Chittick is located also has a population of feral goats that free-range between properties. Feral goats usually originate from large mobs of domestic goats that escaped from a failed goat breeding enterprise and are gradually reducing in number. Worms, foxes, wild dogs, feral pigs and wedge tailed eagles put considerable pressure on feral goat populations in the Nundle region. Large feral goat populations can compete with stock for food and water. The Tomalins maintain and manage about 100 feral goats for controlling weeds such as blackberry. The population is monitored and controlled when necessary. Feral animal control is an on-going part of management on Chittick.



Photo: Brian Tomalin on his property Chittick, near Nundle



## Improving water quality at a dairy

Dairy effluent contains high levels of nutrients and organic matter. If it is released into the environment it can pollute waterways and contribute to increased algal growth. This has been recognised by many dairy farmers in New South Wales who have adopted effluent recycling systems as part of their whole farm management.

### Encouraging recycling

Valtin Campbell has a 68 hectare property, 'Bickley Vale' near Camden, where he operates a dairy with 130 milkers. It is a dryland grazing farm and the cattle are supplementary fed with brewer's yeast and cottonseed. In 1995, Valtin was one of four dairy farmers in the Camden region to be involved in a NSW Agriculture project to encourage use of dairy effluent recycling systems on farms. The project included 'whole farm' planning workshops that utilised aerial photographs, and site visits.

### Installing the system

In late 1995, Valtin constructed a two-pond dairy effluent system designed by NSW Agriculture. The system stores wastewater during extended wet weather periods and avoids any overflow or runoff into the environment.

It comprises:

- a solids trap;
- a 0.5 megalitre anaerobic first pond that holds the effluent for 40 to 60 days while a biological de-sludging process occurs to decompose the organic matter; and
- a 0.6 megalitre aerobic second pond that holds the effluent for up to 100 days providing a higher level of treatment.

The system was designed to exclude storm water by providing a diversion and the ponds were fenced off to protect wandering stock and children.

Valtin Campbell runs 130 milkers at his Camden dairy. A two pond dairy effluent recycling system saves water usage in dairy operations, provides fertiliser and importantly protects the environment from potential nutrient pollution.

### Financing the project

The cost of establishing a dairy effluent recycling system varies depending on the type of system (single or double pond), size of the dairy (amount of effluent produced) and the location of the ponds in relation to the dairy. It usually costs about \$4,000 to construct a solids trap, \$6,000 to construct two ponds, \$2,000 for pipes and up to \$5,000 for a pump (the size of which depends on the end use). The dairy effluent recycling system on Bickley Vale was established as a demonstration site and was partially funded by a Hawkesbury Nepean Catchment Management Trust grant. Half the cost of the system was covered and Valtin contributed the rest. Bickley Vale has been used for several field days and events.



### **Water reuse**

All of the recycled effluent from the second pond at Bickley Vale is used to wash down the yard and is approved by the NSW Dairy Corporation. A typical dairy uses 50 litres of water per cow each day to wash down the yards to remove manure and urine after milking. Consequently, Valtin's effluent recycling system has led to a significant saving in water used in the daily operation of the dairy.

### **Maintaining the system**

As the system on Bickley Vale has been established for more than five years, Valtin has developed a regular maintenance regime as part of the whole farm management. The solids trap is cleaned out using a bobcat every seven to ten days and the solids are spread over the paddocks as a fertiliser. Grass and weeds have to be periodically controlled in the pond area by slashing, scraping of pond walls and spraying. It is expected that accumulated sediments will have to be cleaned out of the anaerobic first pond every ten years.

### **Looking good**

Valtin has planted screening trees around the perimeter of the effluent recycling ponds. He is experimenting with local and exotic tree species to determine which species are most suited for revegetating other areas of the property. The dairy at Bickley Vale is currently being expanded with the installation of a new 1110 litre milk vat and a covered feedlot. The existing effluent recycling system is equipped to cope with the expansion.



Photo: Valtin Campbell with the solids trap — part of the dairy effluent recycling system on Bickley Vale



## Assistance to protect a wildlife refuge

During a rainy week in October, six international volunteers from the Australian Trust for Conservation Volunteers (now Conservation Volunteers Australia) were involved in a fencing project to assist in the management of a wildlife refuge on 'Ellington' at Mullion Creek, north of Orange. Ellington is a 200 hectare sheep property which is one of two properties in the area owned and operated by Garry and Robyn Ostini. During the late 1950s, 80 hectares of Ellington was proclaimed as a wildlife refuge through Gordon Ostini (Garry's father) entering into an agreement with the National Parks and Wildlife Service. The agreement is voluntary and non-binding but allows for formal recognition of the conservation value of the wildlife habitat in the area. The wildlife refuge on Ellington is a mixed forest (yellow box and stringybark), providing habitat to a variety of wildlife including kangaroos, birds and gliders.



Photo: Volunteers in wildlife refuge on Ellington

With the help of volunteers, Garry and Robyn Ostini's fencing of a wildlife refuge on their property near Orange has expanded the work carried out by Garry's father in the 1950's and boosted the conservation values of their property.

### Fencing volunteers

The Ostinis applied for assistance through the Australian Trust for Conservation Volunteers (now Conservation Volunteers Australia) to do some fencing in the wildlife refuge. A group of volunteers and a team leader were assigned to the site for a week, where they assisted Garry with fencing three 50 metre wide corridors. As part of the cell grazing system used on Ellington, the fencing plan includes seven corridors to allow for easier grazing management within the remnant. It aims to encourage increased biodiversity and will include areas of total grazing exclusion and areas grazed only in the autumn and winter, allowing vegetation to flower and set seed during spring and summer.



The volunteers are trained in the field and provide labour while the landholder provides the project materials. It normally costs the landholder about \$440 per week for the team (between six and ten volunteers from Conservation Volunteers Australia) to cover the costs of food, transport, organisation and supervision. The Ostinis were eligible for a free team as the work was within a proclaimed wildlife refuge. The free labour is part of a NSW Environmental Trust scheme, funded by the NSW Environment Protection Authority.

### **Fence funding**

The Ostinis received some funding for the fencing materials through Greening Australia's fencing incentive scheme that assists landholders to fence areas of uncleared native bush to encourage natural regeneration on approved sites (not only wildlife refuges). The landholder applies to their local Greening Australia Office and is reimbursed up to \$1,200 per kilometre for fencing materials. The landholder supplies the labour to construct the fence and any additional material costs and enters into a management agreement with Greening Australia.

They stipulate the type of fence to be constructed and give some time goals for construction. In the Ostinis' case, a seven wire fence is to be constructed for 5.5 km and completed within eight months. The management agreement usually states that although the landholder maintains full control of the land, he/she agrees to manage the site for regeneration of the native vegetation, including weed and feral animal control. The agreement allows for some grazing.

### **A positive future**

Garry and Robyn still have some fencing to finish in their wildlife refuge. Once complete, the cell grazing management system on Ellington will encourage regeneration of native trees, shrubs and groundcovers and provide habitat for native animals. The volunteers were enthusiastic and assisted greatly with fencing work in the wildlife refuge.



# Agroforestry ventures in a low rainfall area

Agroforestry combines traditional farming enterprises with commercial timber production. It can provide additional income while allowing farm investment and risk to be spread over several enterprises and over a long period. Selection of suitable agroforestry trees requires consideration of future timber markets as well as rainfall, climate and soil factors. Commercial timber production on farms is a relatively new venture in low rainfall areas of New South Wales. In these areas less advanced genetic selection and variety of species are available than in high rainfall areas.

## Getting started

Noel and Kim Passalacqua have a 655 hectare property 'Jayfields' on the New South Wales southwest slopes near Holbrook. The region receives about 700 mm of rainfall a year and the property has a mixture of shale and granite soils. When the Passalacqua's bought Jayfields in 1983, the pasture was in poor condition and the soil was very acidic (pH 4.1). Noel and Kim decided to change the landscape amenity by improving the soil and venturing into agroforestry.

## Improving the zones

Jayfields was roughly divided into three different management zones: the steep shale ridges, the rolling shale hills and the granite flats. The 280 hectares of shale country includes 160 hectares of native bush along the steep ridges. The remnants contain white box (*Eucalyptus albens*), scribbly gum (*Eucalyptus haemostoma*) and a variety of understorey and groundcover plants. Noel is in the process of fencing these remnants to exclude stock, and they will be managed for conservation. The granite flats are highly productive and used to run merinos, fatten prime lambs and steers, and to grow a few annual fodder crops.

The Passalacqua's started to improve the soil on Jayfields in 1983 with the aim to increase productivity and raise the soil pH to about 5. In 1992 they began an annual fertilising regime using a high phosphorous fertiliser and a progressive liming regime. Within two years all of the grazing country on Jayfields should be included in the liming regime where 2.5 tonnes per hectare of lime is spread every eight years.

## Planting the woodlots

In 1993 Noel and Kim started to plant mixed agroforestry woodlots on the granite flats for aesthetic, agronomic, environmental and timber benefits. Alleys were fenced to exclude stock, rows ripped in a north/south orientation and weeds sprayed with a knock down and residual herbicide before planting.

By improving the soil, establishing agroforestry plantations and protecting native vegetation, Noel and Kim Passalacqua are increasing their farm's economic viability, productivity, biodiversity and aesthetics.



Four thousand five hundred trees were planted from container grown seedlings including Sydney blue gums (*Eucalyptus saligna*) and silky oaks (*Grevillea robusta*). They were fertilised at planting with a high nitrogen and phosphorous fertiliser at 200 grams per tree and selectively thinned at two years.

The shale country on Jayfields is less productive than the granite flats and the cleared rolling hills have been used to establish large agroforestry plantations for commercial timber production and salinity recharge control. After considerable research, Noel and Kim decided to plant radiata pines (*Pinus radiata*) due to the known productivity, management, genetic improvement and markets. In 1995, 6 hectares of pine clone cuttings were planted at 500 trees per hectare. In 1998, 7 hectares of pines were planted and a further 10 hectares in 2000. Site preparation involved controlling rabbits, spraying weeds and ripping the soil. Trees were fertilised at planting, thinned to 220 trees per hectare at four years and lift pruned to 4.2 metres when four to six years old.



Photo: Noel Passalaqua in pine plantation

### **In a couple of decades . . .**

The agroforestry woodlots and plantations on the Passalaqua's property should start to provide returns in 2023, when they will begin to mature for harvest. Noel and Kim have decided to only harvest the saw logs from their pine plantations to sell on the open market, leaving the thinnings on site. Thinnings can be sold for pulpwood, however the Passalaquas calculated that the revenue from thinnings would not cover the additional opportunity costs for the construction and maintenance of a gravel access road during the growth period of the trees.

### **Low rainfall specialists**

Noel and Kim have always had an interest in forestry and in 1987 they started a nursery on their property. Jayfields Nursery grows native container grown seedlings for farm forestry and revegetation, specialising in low rainfall varieties. Over the past five years a 6 hectare seed orchard of cloned and genetically improved trees including spotted gums (*Corymbia maculata*), Sydney blue gums and ironbark (*Eucalyptus sp.*) was planted on Jayfields in conjunction with CSIRO. The Passalaquas also have a contract tree planting service that has planted about 1.4 million trees throughout Victoria and southern New South Wales.

### **A continuing interest**

The Passalaquas have recently planted an additional 20 hectares of pines and plan to plant a further 15 hectares within the next three years. This will be the extent of their agroforestry ventures on Jayfields with 385 hectares for grazing and 270 hectares under vegetation. Noel and Kim plan to continue their interest in agroforestry through their involvement in the Holbrook Trees on Farms Landcare Group and by expanding Jayfields Nursery with further development of genetically improved tree stock.



## Landholders managing public floodgates

Floodgates are physical flood mitigation structures between rivers and drainage systems. They can be of single or multiple designs and are manipulated to hold or release water according to seasonal needs. Introducing fresh water from the main river into drainage systems containing excess backwater from adjoining properties can provide water for irrigation, introduce oxygen that is vital for fish, flush drains improving water quality and help to control weeds.

### Vital irrigation

Geoff and Joy Duckworth are fourth generation farmers on a 120 hectare property near Grafton. The property is located at the headwaters of Swan Creek, a 20 kilometre modified creek-drainage system that is a major sub-catchment of the Clarence River. With their son Joe, Geoff and Joy run 90 dairy milkers, 20 beef cattle and grow lucerne, corn and rye for use on-farm. The stock is watered off-stream using reticulated town water and the crops are irrigated using an overhead system with water pumped from Swan Creek.

### Opening the floodgates

Floodgate structures were built at both ends of the Swan Creek system in 1968. The structures are made up of a concrete pipe and seven penstock gates on a levee bank. Penstock gates are vertical lift barriers that allow water to be retained in the drainage channels behind the gates at varying heights. The floodgates open if there is sufficient pressure to allow drain water to discharge into the river system. These floodgate structures were built by the Department of Water Resources and managed and operated by the Clarence River County Council.

In 1983 the floodgates were modified to include a steel cable, pulley and winch system for easier use.

### A change of management

In 1996 a group of landholders with properties along Swan Creek formed the Swan Creek Flood Mitigation and Water Users Association. Geoff is vice president of the Association, which has 20 members and meets periodically to discuss opening and closing of the floodgates and their impact on irrigation and stock water. These landholders worked with the Clarence River County Council to develop a Floodgate Management Plan for Swan Creek.

Geoff and Joy Duckworth and other landholders irrigating with water from Swan Creek, Grafton, formed an Association that now manages the floodgates on the creek. The Duckworths are also involved in Landcare activities and development of a model riparian management site on their property.

It was signed off in 1998 and the Swan Creek Flood Mitigation and Water Users Association officially took over management of the floodgates, using the management plan as an agreed basis for operation of the floodgates.





The aim of the agreement was to consider rainfall, salinity, tide levels and land use to allow timely release of floodwaters, periods of tidal flushing to improve water quality and maintain certain water levels to meet livestock, irrigation and environmental needs. The Floodgate Management Plan agreement includes the water level being maintained at 0.4 metres during the wet season and 0.65 metres in the dry season. Water entering the drainage system must not exceed a salt concentration of 700 parts per million.

Geoff and five other members of the Swan Creek Flood Mitigation and Water Users Association have been trained to operate the floodgates on Swan Creek. They have been provided with pocket meters for salinity and acidity. This information is used along with measurements made by Council staff and automatic data loggers to determine when operation of the floodgates is required. The floodgates on Swan Creek were opened 27 times during 1999 and 15 times during 2000 by trained landholders using a hydraulic motor on a tractor. It takes about five minutes to open each penstock gate.

### **Fish freeway**

The Swan Creek system contains fish including mullet and Australian bass. Floodgates can be a hazard to fish as they can become trapped in potentially toxic low oxygen or high acid conditions. Fish passage to and from the Swan Creek system is currently only possible when the floodgates are open. The Swan Creek Flood Mitigation and Water Users Association recognises the importance of fish in the system and is investigating modifying the penstock gates to allow fish passage in both directions during high tide.

### **Active participants**

Geoff, Joy and Joe Duckworth are active members of the Swan Creek Landcare Group. In 1999 the group successfully applied for a grant from the Commonwealth's Natural Heritage Trust to look at conservation management options along Swan Creek. The funding was used in 2000 to hire a consultant who prepared an options paper on potential improvements in land and water management of the Swan Creek system. The recommended actions included enhancing the riparian zone by fencing to exclude stock, revegetating, and improving water quality by encouraging dung beetles to control excess animal manure. The Swan Creek Landcare Group plans to apply for further funding to implement some of these recommended options.

### **Model management**

The Duckworths have become involved in a Wetland Care Australia project. They plan to develop a model riparian management site along one kilometre of Swan Creek frontage on their property. The project, which is funded through the NSW Environment Protection Authority's Environment Trust, will involve fencing and revegetating the riparian zone. The site on Geoff and Joy's property will be used for field days and to demonstrate riparian restoration and promote the successful operation of the floodgates by local landholders.



Photo: Floodgates at the head of Swan Creek, Grafton



## Looking after a rainforest remnant

Rainforest communities usually have a high diversity of plant species and thick canopies. They commonly grow in warm areas with high rainfall and are often found in fertile soil along sheltered gullies and creek lines. In the past, rainforests in northern New South Wales have been widely disturbed for agricultural and urban development, leaving scattered pockets of rainforests. The larger remnants are now mostly preserved in National Parks and State Forests. Many landholders are actively managing and enhancing smaller remnants of rainforest on their properties for environmental, productivity and aesthetic benefits.

Bill Tweedie and Sue Riley's 'Cloudlands' is a fine fleece Cashmere goat farm at Mullumbimby. The 10 hectare property has a 750 metre tributary of Wilsons Creek flowing through it and is part of the Richmond River catchment. The creek bank on Cloudlands is covered in a mix of riparian rainforest vegetation including red cedar (*Toona australis*), red bobble nut (*Hicksbeachia pinnatifolia*), yellow carabeen (*Sloanea woollsi*) and blue fig (*Elaeocarpus grandis*). The riparian zone was weed infested when Bill and Sue bought the property in 1996. The weeds, including camphor laurel (*Cinnamomum camphora*), small leaved privet (*Ligustrum sinense*), tobacco bush (*Solanum mauritianum*) and lantana (*Lantana camara*) were competing with the native plants for light, nutrients and water and were slowly encroaching into the productive grazing land.

### Weed control

Bill and Sue decided to manage the weed problem by fencing the area and using bush regeneration techniques to selectively control the weeds intermingled with the native plants.

The creek bank, riparian zone and a small adjoining gully were fenced off with mesh to exclude the goats while allowing the passage of native wildlife over the top. Bill and Sue received \$1,200 per kilometre towards the fencing material from Greening Australia's Fencing Incentive Scheme.

They covered the additional material costs and labour to construct the fence. Fencing was followed by periodic weed control using bush regeneration techniques — cut, scrape and paint and applying concentrated herbicide such as glyphosate. The lantana and privet were treated with the scrape and paint technique while the camphor laurels were stem injected and left standing. The dead trunks were then removed and laid across some of the undulating hills on Cloudlands — acting as erosion control devices by dissipating the flow of water runoff and preventing landslips. As the weeds were removed natural regeneration occurred. This was enhanced with supplementary planting of rainforest species from tube stock.

### Long term conservation

Bill and Sue are investigating entering into a voluntary conservation agreement with the NSW Department of Land and Water Conservation (through the Native Vegetation Incentive Fund) to protect the riparian rainforest area on Cloudlands. The agreement includes advice on active management and funding for some ongoing weed control.

Also on Cloudlands is a 50 square metre tropical lowland rainforest remnant that includes sandpaper fig (*Ficus fraseri*), lilly pilly (*Acmena smithii*), native hard macadamia (*Macadamia tetraphylla*), white cedar (*Melia azedarach*) and cudgerie (*Flindersia schottiana*).



The remnant was invaded by a similar array of weeds to the riparian zone and the weeds are being managed with the same technique of excluding stock, removing weeds, allowing natural regeneration and revegetating with rainforest plants.

### **Improving biodiversity**

Bill and Sue are active members of the Wilsons Creek-Huonbrook Landcare Group, which aims to implement recommendations from the Byron Shire Flora and Fauna Study. This includes enhancing biodiversity and creating wildlife habitat and corridors. The rainforest remnants on Cloudlands contain various wildlife habitats including tree hollows, rocks, fallen logs, leaf litter and flowering shrubs. Over 70 bird species, 25 reptiles species and 10 other native vertebrate species (including possums and koalas) have been recorded on Cloudlands. Bill and Sue are encouraging further native wildlife to the area by creating wildlife corridors to link pockets of remnant vegetation on their property. They have been gradually removing blocks of pines (*Pinus radiata*) planted by a previous owner and allowing natural regeneration of native plants. They have also planted over 200 trees including grey gums (*Eucalyptus propinqua*), forest red gums (*Eucalyptus tereticornis*) and tallow woods (*Eucalyptus microcorys*) as a potential koala corridor.

### **Propagating local species**

The Wilsons Creek - Huonbrook Landcare Group has its own nursery where landholders propagate and grow plant material collected from the local area. Sue spends about one day a week working in the nursery and has propagated most of the plants used for revegetation on Cloudlands. In 2000 the Wilsons Creek - Huonbrook Landcare Group received a grant from the NSW Environment Protection Authority as part of the

NSW Government Litter Prevention Campaign. The grant enabled the Landcare Group to produce litter education material for the local schools and a community newsletter advocating litter reduction.

### **A productive future**

In the past 5 years, Bill and Sue have preserved three hectares of remnant rainforest vegetation and significantly increased their farm productivity. The flock of goats has tripled in size, despite several fatal attacks by wild dogs. Bill and Sue now have a maremma sheepdog that has been trained to live with the goats and deter the wild dogs. Weed management continues to be an ongoing activity on Cloudlands and the goats assist by eating flower and seed heads of most weed species at different times of the year and in various stages of the weeds reproductive cycle. This reduces the annual replacement of weed seed reserves in the soil and assists with long term control of weeds. Bill and Sue hope to continue to increase their stocking rate while creating additional wildlife corridors to link the rainforest remnants on Cloudlands.

Bill Tweedie and Sue Riley's cashmere goat farm at Mullumbimby contains some significant rainforest remnants. By reducing weeds, excluding stock from sensitive areas, planting local native species and well timed grazing they are conserving their rainforest and benefiting from increased stocking rates.



## Local level catchment planning in northwestern NSW

Catchments are areas of land that naturally drain into a common watercourse. They are determined by topographic features in the landscape and can range in size from large regional catchments to small local sub-catchments. Catchment boundaries are often used to plan and undertake regional environmental and resource management activities.

### Protecting local waterways

Elizabeth and Douglas Mailler have a 1,540 hectare mixed farm 'Kilgowla' at Bellata. Kilgowla has two creeks running through it and has several remnants of native vegetation. The Maillers run sheep, crop wheat and other cereals and are active members of the Manamoi Landcare Group. In 1997 the Manamoi Landcare Group received some landcare funding through the Commonwealth's Natural Heritage Trust to prepare a strategic plan for the Upper Manamoi and Little Bumble Creek Catchments. The plan aims for neighbours to manage the whole catchment together to maintain and improve the productivity of the country for future generations. The Manamoi Landcare Group developed the plan by hosting community workshops and field days to bring together and involve landholders in the catchment planning process. Initially maps were prepared of the resources in the catchment and major conservation issues were identified. These conservation issues were grouped into several categories including surface water use and management, native vegetation, weed management, pasture management, soil management and pest management.

The Landcare group then established management options and strategies to combat these issues, including timeframes for on-ground work and preliminary project costings.

They also identified individual actions that could contribute to the overall approach to catchment management. Outcomes of the Upper Manamoi and Little Bumble Creek Catchment Plan fit into a regional Gwydir - Barwon Catchment Plan and have been adopted by Elizabeth and Douglas through their management activities on Kilgowla.

At Bellata, Elizabeth and Douglas Mailler are actively involved in catchment management on their mixed farm and in the local area. They use contour banks, drainage lines, ground cover planting as well as crop rotation. These techniques prevent excess runoff, increase soil moisture and reduce sheet erosion. A venture into farm forestry is also helping protect the environment.

### Managing sheet erosion

The Bellata area is flat to undulating with a mixture of soils that are prone to sheet erosion. Sheet erosion occurs when layers of soil are gradually removed from the soil surface by water or wind. To avoid sheet erosion on Kilgowla, Elizabeth and Douglas have constructed low earth mounded contour banks in their cropping paddocks.



The banks are positioned across the direction of overland water flow to catch and divert any runoff. Excess runoff travels down a controlled waterway into dams and natural creeks where it can be slowly released into the soil. The contour banks and drainage lines have also been grassed over to minimise wind erosion of bare soil. The Maillers practice conventional and conservation farming techniques, including crop rotations, short fallow periods and minimal tillage. These techniques help prevent sheet erosion by reducing soil disturbance and encouraging the use of available moisture by retaining ground cover vegetation.

### **Conservation via farm forestry**

In 1998 Elizabeth and Douglas diversified into farm forestry as part of their mixed farming system. Farm forestry plantations can protect the soil against sheet erosion, provide shade and shelter for stock and lower the water table while providing a future income from the timber. An area was prepared before planting by fencing to exclude stock, deep ripping single lines and spraying to control weeds. In the autumn the Maillers planted 500 silky oaks (*Grevillea robusta*). Silky oak is a fast growing cabinet timber species that should be mature and ready for harvesting in about 30 years. Tube stock trees were obtained from a local nursery and a NSW State Forest nursery. As silky oaks are naturally found in warmer coastal areas of NSW, tree guards were placed around the seedlings to provide some protection against frosts. The plantation is growing well and the Maillers are planning on reintroducing stock once the trees are established.

### **Greening Australia trial**

Greening Australia also has a farm forestry species trial on Kilgowla. In February 2001, 1,200 tube stock were planted. Greening Australia

provided the plants and will monitor the growth rate of the trees. The Maillers are responsible for the day-to-day management of the plantation and will own the final timber products. Information obtained from the trial including the growth rates of certain species and their farm forestry values will be collated and distributed for use by landholders with similar climatic and soil conditions to those on Kilgowla.

### **Making a difference**

Elizabeth and Douglas have been actively involved in the Manamoi Landcare Group and in preparation of the local Upper Manamoi and Little Bumble Creek Strategic Plan. The Landcare Group is continuing to implement the plan and improve landholders' conservation knowledge and skills by holding seminars and demonstrations on topics such as farm forestry and pest management. The Maillers' activities on Kilgowla, including constructing contour banks, practicing conservation farming techniques and their involvement in farm forestry are contributing to a regional approach to sustainable catchment management.



Photo: Silky oak farm forestry plantation on Kilgowla



## Controlling erosion along the Tuross River

Water ski and fishing boats frequently use the Tuross River causing erosion problems on properties along the river foreshore. The wash of boats constantly lapping at the riverbank, combined with natural river processes and changed sediment loadings has caused erosion of up to 7 metres at spots on the foreshore of 'Gannon Point Farm' in just 11 years.

### Repairing the riparian zone

The riparian zone is the area between the land and water, and often includes the riverbank and adjoining vegetated strip that filters and traps sediment and nutrients. Gannon Point Farm is a 160 hectare property located on the Tuross River near Moruya. Until the recent deregulation of the dairy industry, the property had been a dairy farm for over 100 years. Sandra and Robert McCuaig bought the property in 1990. It is currently leased to John and June Waddell to fatten vealers. The property has 3.5 kilometres of river foreshore and is at the tidal limit of the Tuross River (with water still salty).

The extent of riverbank erosion alarmed the McCuaigs, so in 1992 they started revegetation of the riparian zone in attempt to get tree roots to stabilise the riverbank and slow erosion. Sandra and Robert set a target to plant at least 100 trees each year in autumn or spring. The Australian Trust for Conservation Volunteers (now Conservation Volunteers Australia) assisted with tree planting on several occasions.

Sandra and Robert McCuaig have a farm on the Tuross River. Recreational use of the river and other factors are damaging the riverbanks. By revegetating the riparian zone the McCuaigs aim to reduce the erosion occurring along the riverbanks.



Photo: Riverbank erosion on the Tuross River



### **Working together**

In 1998 Gannon Point Farm was involved in a project with four other properties, coordinated by local Landcare and Rivercare Officers. The initial project planned to use floating booms to minimise wave wash on the river and help to control erosion. However, after seeking technical advice from the Department of Land and Water Conservation, the booms were seen as being ineffective on the tidal, flood prone site. A river riparian revegetation project was adopted instead with the aim to slow erosion while allowing for natural river processes to continue.

The total cost of the project (over the five properties) was almost \$50,000, with 25% of the funding coming from the Commonwealth's Coastcare program, 25% of the funding from the local Eurobodalla Shire Council, 25% from the local Catchment Management Committee and 25% from the landholders of the five properties. The Coastcare and Council contribution included materials such as tree guards and equipment hire. The Catchment Management Committee's inkind contribution included propagation of the trees using local seed by the Friends of the Eurobodalla Botanic Gardens (volunteers) and assistance with planting of the trees by high school students from Narooma and Moruya. The landholders inkind contribution included site preparation, planting and maintenance. On Gannon Point Farm the McCuaigs fenced 550 metres of riverbank using permanent fencing to exclude stock and prepared the area for planting via deep ripping plant lines and spot spraying weeds.

About 1000 trees including swamp oak (*Casuarina glauca*), forest red gum (*Eucalyptus tereticornis*), mahogany gum (*Eucalyptus botryoides*) and black wattle (*Acacia mearnsii*) were planted, watered, mulched and protected with tree guards on Gannon Point Farm. Regular maintenance of the area includes slashing between the rows of trees and spraying to reduce competition of weeds.

### **More drastic measures needed**

Gannon Point Farm has now had over 3,500 trees planted on it with a 95% survival rate and two kilometres of the river and lake foreshore has been revegetated. Despite this success, at some spots on the property, the river foreshore is still eroding at about one metre a year. Sandra and Robert are currently exploring different methods for controlling the erosion on their property, including the possibility of having a section of the Tuross River proclaimed as a boat 'no wash' zone.



Photo: Area of revegetation on Gannon Point Farm



# Conservation farming for increased profitability

Bruce and Roz Maynard run a 1400 hectare property 'Willydah' at Narromine with Bruce's parents Audrey and Raby. During the past decade the Maynard family's approach to farming has evolved — changing from a conventional wheat and sheep property to a beef cattle fattening and finishing operation. Willydah is managed using a whole farm plan incorporating a time control grazing system with saltbush plantations, fodder crops, and preserved areas of native vegetation. These gradual changes have led to an increase in farm productivity and profitability.

## Re-assessment and planning

In 1987 the Maynards developed a strategic farm plan and started experimenting with conservation farming practices including minimal tillage. Crops were grown for three years followed by four years of lucerne rotation in order to avoid periods with bare soil and increase soil organic matter. In 1991 the Soil Conservation Service prepared a property plan for Willydah. This included mapping soil types, land classes, watercourses, existing structures, stock / vehicle laneways and areas for potential natural resource management such as windbreaks and revegetation sites. The property plan was utilised by Bruce and Raby when they started planting old man saltbush in late 1991. Old man saltbush (*Atriplex nummularia*) is a native perennial fodder plant that was planted on Willydah to introduce a productive shrub layer into the landscape. The saltbush was planted from local seedlings using a vegetable planter pulled by a tractor. Bruce and Raby initially planted in a block pattern following paddock boundaries, which created a monoculture of vegetation. To increase the diversity of species in each paddock the Maynards adopted an alley-farming pattern for subsequent saltbush plantings.


Bruce and Roz Maynard have evolved their approach to farming, adopting an alley-farming pattern and cell grazing technique. They have managed to increase stocking rates while improving biodiversity and are currently linking remnant vegetation and wetlands to create wildlife corridors.

The pattern has rows of saltbush three wide with 20 metre grass strips between rows. Planting of saltbush on Willydah has continued, with almost 50 hectares being planted in the alley-farming pattern. These plantings are a key part of the grazing system.

## Forging ahead

Bruce attended a 'Grazing for Profit' course in 1994. This introduced the concept of cell grazing and by 1995 the Maynard family had sold their sheep and wheat harvesting machinery and increased their herd of cattle. The steers and heifers were run using a cell grazing system with seventy paddocks, averaging a size of 20 hectares. Water troughs were placed in each paddock and access laneways created using electric fencing.





Bruce and Roz have substantially expanded the farming operation, tripling the head of stock being run per hectare. A thousand to thirteen hundred head of cattle are now run as a single herd that is moved on average every one to three days depending on the available feed and the growth rate of plants. This creates a high grazing impact on the paddock vegetation three or four times a year, followed by a break for regeneration. The paddocks on Willydah contain a mixture of annual and perennial, exotic and native grasses including wallaby grass (*Danthonia sp.*), windmill grass (*Chloris truncata*), and common wheatgrass (*Agropyron sp.*). Bruce and Roz are aiming to create a natural system of complex grasslands, with 100% groundcover and mostly perennial species, while making an increased income. This system will also assist with lowering the water table and improving water quality.

### **Advanced sowing**

The Maynards stopped conventional cropping in 1996 and Bruce developed a technique termed 'advance sowing' which he uses to grow fodder to supplementary feed the cattle. The technique involves a combine seeder being used to dry sow crop seed directly into existing pasture. The combine has been modified to allow shallow planting of seed with the soil surface only just being broken. This allows use of lighter machinery than conventional cropping, involving minimal soil disturbance and eliminating compaction and soil erosion problems. Sowing is done in the dry before the autumn and spring breaks allowing use of the area by stock while the seed remains dormant. Once it rains stock are excluded to allow plant germination. They are reintroduced when the plants have grown sufficiently.

The advance sowing technique may not produce a crop every year, however it has been used successfully and profitably by the Maynards to grow oats, barley, sorghum and phalaris at a low cost of about \$8 per hectare (for seed and machinery).

### **Long term goals**

In 2000 Bruce and Roz entered into a voluntary property agreement with the NSW Department of Land and Water Conservation to protect, enhance and manage 200 hectares of remnant open woodland scattered across Willydah. The 15 year agreement provides funding to fence areas of remnant vegetation along old crown roads and revegetate 100 metre wide corridors to link clumps of remnant vegetation and wetlands. Fencing has been completed and revegetation, including direct seeding and planting tube stock has been trialled to coincide with available soil moisture. A variety of woody vegetation including understorey species have been introduced with mixed success. Planted species include gums (*Eucalyptus sp.*), wattles (*Acacia sp.*), belah (*Casurina sp.*), hakea (*Hakea sp.*), hopbush (*Dodonea sp.*) and saltbush (*Atriplex sp.*). Bruce and Roz plan to collect seed from remnant vegetation on Willydah for further revegetation. They are also considering different management options for the vegetation corridors and remnants such as controlled grazing and burning.

The Maynards have combined concepts and management ideas from various farming and grazing systems to establish a low input, high return operation on Willydah. They aim to have 30% of the property covered in woody vegetation, with 15% already preserved as native vegetation and 15% to be planted to saltbush alleyways. Bruce and Roz plan to continue to diversify the species on their property, while increasing their stocking rate.



# Restoring rivers in the Nambucca catchment

The Nambucca catchment is located on the North Coast of New South Wales and includes a 47 kilometre valley that drains into the Nambucca River and eventually into the South Pacific Ocean at Nambucca Heads. The Nambucca River is about 76 kilometres long in the main straight and is made up of several smaller creeks and tributaries including Taylors Arm, Missabotti Creek, North Arm and South Arm.

## Collapsing riverbanks

Robert and Margaret Young have a mixed farm at Bowraville, where they grow seasonal vegetables, fodder crops and graze cattle. The 130 hectare property 'Flying W' has about 1.5 kilometres of North Arm frontage, which is part of the Nambucca River system. When the Youngs bought Flying W in August 1964 the river had a series of 6 to 8 metre deep, fish-filled waterholes each holding more than 3 megalitres of water. During the late 1960s Robert and Margaret first noticed changes in the riparian zone on Flying W, with the vegetation suffering from dieback and slight riverbank erosion. In times of flood, fast flowing water was travelling down the river, collecting sand and gravel and depositing it on the inside bends as the water flow dissipated. The deposited gravel puts pressure on the outside banks and causes collapse erosion. Collapse erosion involves sudden failure and slumping of the riverbank, often creating steep cliff faces. This process was causing loss of valuable grazing land and gradually making the river wider and shallower on Flying W and on many other properties with frontage along the Nambucca River.

## A self-funded solution

Robert and Margaret foresaw the productivity and ecological problems with the continued erosion of the riverbank, so they started a long-term project to manage riverbank erosion on Flying W. Initially a front-end loader and excavator was contracted and the river physically realigned to its original flow. This involved moving gravel and sediment from the deposited point bars to the opposite riverbanks. Surplus gravel was removed and sold to the Council for construction of local roads.

Robert and Margaret also used the funds raised from the gravel sales to assist in financing the construction of erosion control devices by the Department of Water Resources. Log sills were built out of a series of timber logs bolted together and secured with long wooden stakes at the base of the eroding cliff faces. The sills protected the banks from further slumping by dissipating water flow and capturing eroding soil and sediment. The banks were then revegetated to help hold the soil together and stabilise the banks.

The Youngs have planted hundreds of trees and shrubs in the riparian zone on their property, including wattles (*Acacia sp.*) and tea trees (*Leptospermum sp.*). Some of these plants have been washed away in flood events and have had to be replanted. Hundreds of hours have been spent controlling riverbank erosion on Flying W — work funded by the sale of surplus gravel.

Gravel extraction is still taking place on the Nambucca River along Taylors Arm, requiring permission and permits from the NSW Department of Land and Water Conservation.

### **The scour of scour erosion**

Another riparian problem that has arisen is scour erosion. This has occurred where large trees have fallen into the river, changing the watercourse. Scour erosion involves layers of soil gradually being removed from the riverbank by the flow of water. In 1973 a government work-for-the-dole scheme involved clearing of all small riparian vegetation along North Arm. The larger vegetation, mostly river oaks (*Casuarina cunninghamiana*), were left and many of these slumped into the river in a flood event during 1974, altering the watercourse in one section. The fallen trees also caused local turbulence and changed the ecology of the river on Flying W by gradually filling in fish holes with gravel and sediment. Another flood event in April 1989 caused several more river oaks to fall into the river on Flying W, changing the watercourse again. This problem can be difficult to manage due to the strict regulations in NSW relating to removal of native vegetation from riparian areas.

The river frontage at Robert and Margaret Young's mixed farm at Bowraville was eroding at a significant rate. They have used physical realignment, bank stabilisation, log sills and extensive replanting to successfully tackle the problem.



Photo: Robert and Margaret Young in the riparian zone on Flying W

### **Getting involved**

The Youngs are involved in the Nambucca Valley Environment Society and are members of the Goalloma Landcare Group. They have hosted several field days and river walks with landholders from the local area and surrounding river catchments. Some members of the Landcare Group have accessed NSW Rivercare funding and are involved in riverbank erosion management projects. Robert and Margaret have assisted with physical construction of groynes and tree planting on some of these projects. They have also been involved in controlling wild dogs through cage trapping and mound baiting, and controlling fireweed (*Senecia linearifolius*) and Parramatta grass (*Sporobolus indicus var. africanus*) through target spraying.

### **The big test**

Riverbank erosion is a process that cannot easily be controlled. The activities on Flying W demonstrate the successful management of riverbank erosion. During 2001 two major floods occurred on the North Coast of NSW. Robert and Margaret did not experience any riverbank erosion on their property during either of these floods. The Youngs plan to continue monitoring the river height and potential of erosion in the riparian zone on Flying W.



## Native revegetation by direct seeding

Direct seeding of native plants involves drilling seed into the soil on a revegetation site. It is a minimum tillage operation and allows a mix of native species to be easily and cost effectively grown from seed. Success of direct seeding is dependent upon adequate site preparation including weed control and viable seed stock. Direct drilling is often done opportunistically to take advantage of seasonal rainfall, as optimal levels of soil moisture and soil temperature are essential for seed germination.

### Importance of paddock trees

Since 1994 Bryan and Dinah Ward have owned 'Illawong', a 160 hectare property at Tabletop near Albury. They run fine wool merino wethers and grow a few crops. The undulating Tabletop region receives about 700 millimetres of rain annually. The property is scattered with paddock trees including red box (*Eucalyptus polyanthemus*), apple box (*Eucalyptus bridgesiana*), white box (*Eucalyptus albens*), Blakelys red gum (*Eucalyptus blakelyi*) and yellow box (*Eucalyptus melliodora*). These trees provide shade and shelter for stock, habitat for wildlife and various aesthetic benefits, while managing rising water tables and preventing soil erosion.

### Preparing to plant

The Wards recognised the importance of paddock trees and decided to use them as revegetation sites on their property. In 1994 they started to fence off clumps of paddock trees and direct seed an understorey of various trees and shrubs.

This involved preparing the sites by fencing to exclude stock (costing about \$1,600 per kilometre) and spraying to control weeds (costing about \$18 per hectare).

A direct seeder was hired and lines were direct drilled using about 350 grams of mixed native seed per kilometre resulting in a thick understorey layer. Survival rates of direct seeded plants are often low. This must be considered when calculating quantities of seed needed to achieve the desired density of revegetation.

Preparation of a site before direct seeding is very important to allow the best opportunity for successful germination and growth of plants. Bryan has found positive results when weeds and grass have been controlled through spraying with glyphosate in spring and autumn then resprayed with glyphosate and miticide in the following spring — prior to direct drilling.

Award winners, Bryan and Dinah Ward, have had great success direct seeding native plants around paddock trees on their property near Albury.

They have also used direct seeding to improve areas on other farms in the region.

### Sourcing seed and protecting regional biodiversity

The seed used by the Wards in their initial direct seeding projects had to be obtained via mail order from companies in Sydney and Western Australia. In later projects seed was obtained from the Greening Australia Seedbank in Albury.



The seedbank provides local, mixed native plant seed that has been treated to prevent fungal disease and insect attack and tested for viability for around \$280 per kilogram. Advantages of using locally native seed include helping to preserve the regional biological diversity. Bryan and Dinah have several areas on Illawong that should provide mature seed for revegetation projects during the next couple of years.

In 1998, the Wards secured the long-term lease of a Rodden III direct seeder. The direct seeder has three boxes for different sized seed and is pulled by a 4WD vehicle. A disc breaks and removes a few centimetres of topsoil and seed is released from the first two seed boxes. A two-prong tyne covers the seed with soil. Larger seed from the third box is then released and covered by a press wheel that firms down the whole area. The selection of the seed mix depends on the individual site and the desired outcome. Bryan and Dinah usually use about ten different species including: wattles (*Acacia sp.*); gum trees (*Eucalyptus sp.*); grevilleas (*Grevillea sp.*); tea trees (*Leptospermum*) and paperbarks (*Melaleuca sp.*). It takes about 12 minutes to direct seed one kilometre of prepared ground and the Wards have direct seeded over 50 kilometres (about 20 hectares) of mixed native seed on Illawong. Bryan and Dinah hope that the direct seeded areas on Illawong will resemble natural coppices of preserved native vegetation in the future.

### **Local knowledge**

Bryan has done some contract direct seeding for Greening Australia and landholders in the Murray region, with over 675 kilometres being direct seeded in the past four years.

This experience has taught the Wards that in their region:

- spring is the optimum time for direct drilling
- 250 grams per kilometre of viable mixed native plant seed is adequate for revegetation
- some seed can remain dormant for up to five years before germinating, and
- direct drilling in a helix pattern provides more natural looking growth than drilling in straight lines.

### **Experimenting with care**

Bryan and Dinah are currently experimenting with management of direct seeded areas on Illawong. They have crash grazed with stock and are considering using a slow burn on some areas of direct seeded trees. In 2000 the Wards started a trial on the growth rates and benefits of direct seeded plants compared to conventional tube stock in their region. A Green Corps team (youth conservation labour service managed by Conservation Volunteers Australia) planted an area of native tube stock next to an area that Bryan had direct seeded. Results are not available from the trial at this early stage. Research by Greening Australia has found that revegetation using direct drilling has numerous benefits over revegetation using tube stock, including cost effectiveness, providing a stronger root system and being more resistant to drought.

### **Award winners**

Bryan is a representative on the Riverina Highlands Regional Vegetation Committee and both Bryan and Dinah are members of the Mullengandra Landcare Group. They have set a goal to have 30% of Illawong covered with native vegetation. Bryan and Dinah Ward were the Bronze Award winners in the Landcare Primary Producer category of the 2001 NSW Landcare Awards for their work direct seeding native plants.



## Establishing a dairy wastewater recycling system

Dairies are hosed down twice a day after milking to remove manure and urine from the yard and shed area. About 50 litres of water, per cow is required each day. The wastewater produced contains high levels of nutrients and organic matter. If this waste water is released into the environment it can pollute waterways and contribute to increased algal growth.

### Taking action

Under the *Protection of the Environment Operations Act (1997)*, dairy farmers are required to retain wastewater within their property boundaries and prevent it from entering and polluting drains, watercourses and groundwater. The Act is administered by the NSW Environment Protection Authority and local councils. They have the power to issue on-the-spot fines to polluters. Dairy waste water recycling systems have been adopted by over 70% of dairy farmers in NSW (NSW Dairy Corporation, 1999).

### A two-pond system

Murray Sowter operates 'Judson Park', a 60 hectare dairy with 200 milkers near Moss Vale. Murray recently built a new dairy that includes an effluent recycling system designed by NSW Agriculture. Wastewater from the dairy shed and yard area flows into a concrete solids trap. The wastewater then flows via a PVC pipe into a 4.4 metre deep anaerobic pond where solids and organic matter are broken down and sediment settles. It then flows into a second 1.2 metre deep aerobic pond where it is further treated.

Murray Sowter's dairy at Moss Vale utilises a dairy effluent system that prevents runoff polluting the environment. The system recycles effluent as fertiliser for pastures. With assistance from NSW Agriculture and the Sydney Catchment Authority further farm developments will demonstrate a range of water improvement strategies.



### **Effluent as fertiliser**

The wastewater in the second pond is free of solids and can be used to irrigate pasture using normal irrigation equipment without the risk of blockages. The irrigation area required (no runoff to the environment is allowed) is determined by the nutrient, hydraulic and organic loading of the soil. On Judson Park up to 30 hectares of pasture will be irrigated with recycled dairy effluent using a travelling irrigator. The nutrient level of the treated effluent is still high and provides fertilising properties for the pasture. The irrigated area is generally withheld from grazing for 7 to 10 days and calves are totally excluded.

### **A funded project**

Sydney Catchment Authority has a catchment protection incentive scheme to improve water quality in the Sydney catchment. Murray obtained some funding under the scheme to construct his dairy effluent recycling system (including the pump) and to plant trees for revegetation. Under the scheme Sydney Catchment Authority may fund up to 50% of the total cost of the work while the landholder contributes the balance.



Photo: Newly completed dairy at Judson Park



Photo: New aerobic pond under construction at Judson Park

### **A showcase dairy**

NSW Agriculture and the Sydney Catchment Authority are developing Judson Park as a demonstration farm. This will involve completion of a whole farm plan, upgrading laneways, reviewing fertiliser practices, assessing drainage and undertaking revegetation. Judson Park will be used for field days and other events to showcase ways to improve water quality while utilising the nutrient-rich dairy effluent resource as a fertiliser.



## North coast cane farmer tackles acid sulfate soils

Potential acid sulfate soils contain iron sulfides that can create sulfuric acid when exposed to air. These soils are often covered with water or soil and usually only become a problem when drained or disturbed. Once exposed to the air, the resulting acid moves through the soil, acidifying soil-water, groundwater and surface water. Acid sulfate soils can lead to poor water quality and loss of agricultural production. There are many different factors which influence acid sulfate soils and management techniques are often site specific.

### Frightening findings

Jim and Elizabeth Sneesby's 80 hectare cane farm 'Sunnyside' is located at Bagotville in the Tuckean Swamp area, which drains into the Richmond River. In 1996 soil samples were taken from all cane farms in NSW and analysed for acid content at 0.5 metre and up to 1.2 metre depths. This survey found that about 50% of cane farms in NSW are underlain with potential acid sulfate soils. These conclusions resulted in drainage management plans being produced for each farm and the NSW Sugar Milling Cooperative developing a set of 'Best Practice Guidelines for Acid Sulfate Soils'. Areas of alluvial topsoil on Sunnyside had a pH as low as 3.5 and areas of subsoil had a pH as low as 3 (pH is a unit for measuring acidity or alkalinity of soil and water where seven is neutral, lower numbers are more acidic and higher numbers are more alkaline).

### Tackling the problem

In an attempt to manage areas of acid sulfate soils on their property, Jim and Elizabeth have been involved in a drain modification trial with their local landcare group, Tuckean Landcare. In 1997 the Landcare group successfully applied for funding through the Commonwealth's Natural Heritage Trust to trial methods of combating acid sulfate soils in the Tuckean Swamp. The funding required 50% input by landholders including an inkind labour contribution.

North coast cane farmers, Jim and Elizabeth Sneesby are tackling acid sulfate soils by modifying drains, spreading lime and preventing soil erosion.





On Sunnyside 600 metres of cane drain were laser levelled and physically modified using a hired excavator to make the drains shallower and wider. Soil from the shoulder of the drains was used to lift the floor of the drains above the acid layer. The drains were limed at five tonnes per hectare using a spreader borrowed from the local sugar mill. The overall drain modification cost was about \$65 per 100 metres, providing numerous benefits including:

- faster runoff of surface water;
- reduced waterlogging;
- improved water quality;
- improved machinery access in wet weather;
- fewer weeds; and
- more cost effective bank vegetation management through allowing use of a tractor and slasher.

The effect of lime is not permanent and will have to be reapplied to the drains every 12 to 14 months depending on weather conditions, at a cost of about \$250.



Photo: Jim Sneesby (left), Michael Wood from Richmond River County Council (middle), and Chrisy Collins from NSW Agriculture (right) at Sunnyside

The result from the drain modification trial on Sunnyside has been very positive with a substantial increase in the soil pH to 5.5 and improvement of the quality of the water leaving the property.

### **Other measures**

Jim and Elizabeth are also protecting water quality by preventing soil erosion. They have retained a small patch of native vegetation on their property to act as a trap to prevent sediment loss, preserve biodiversity and control spray drift. They also practice crop rotations, minimal cultivation and have short fallow periods.

### **Helping others**

The Sneesbys have seen the success of laser levelling, drain modification and liming to manage acid sulfate soils and are considering treating other drains on their property in a similar manner. They are continuing work with the Tuckean Landcare Group and the cane industry to develop other projects addressing acid sulfate soils in the Tuckean Swamp, including modified stock management to reduce grazing pressure and floodgate trials.



## Reducing rabbits in the western division

The European rabbit (*Oryctolagus cuniculus*) is native to Spain and northwestern Africa, and was introduced to the western division of New South Wales in the 1850s. Rabbits thrived in the environment and reproduced quickly leading to rabbit plagues and significant landscape changes. Rabbits compete with stock for food and water and denude the land of vegetation. The creation of warrens (harbours) destroys soil structure, resulting in massive soil erosion and movement, and the creation of sandhills. Various methods of rabbit control have been used over time including baiting, trapping, shooting, the myxomatosis virus that was introduced in the 1950s and the rabbit calicivirus that was introduced in 1995. These methods have had varied impacts on rabbit populations, with rabbit warren ripping being the most effective and widely used method of harbour destruction.

### Rabbits in plague proportions


Ron and Joan Hoare manage several properties in the southwestern region of NSW with their sons Jim and Bernard. In 1979 the Hoares purchased 'Tin Tin', a 21,860 hectare property, where they run sheep, Murray Grey cattle and opportunity crop wheat and barley. The property has several large dry lakebeds and two artesian bores. A rabbit plague occurred in the region during 1974. When Ron and Joan purchased Tin Tin it was covered in rabbits and rabbit warrens. The property supported five families of trappers who hunted and trapped rabbits for sale of their skins and chilled carcasses. The rabbit population on Tin Tin has flourished and declined over seasons with a consistently large population remaining and impacting on the productivity of the property.

### Experimenting with warren ripping

In 1994, the Hoares were among the first landholders to use a small ripper pulled by a tractor to rip rabbit warrens in western NSW. Rabbit warren ripping usually involves dogs running over an area to drive rabbits into their warrens. Warrens are then ripped between 0.5 and 1.5 metres deep and about three metres beyond the visible warrens in a crisscross pattern using multi-tyne equipment. The areas are then smoothed off.

When Ron and Joan Hoare purchased their property near Balranald rabbits were in plague proportions. Their determination to rid the property of this pest by warren ripping has increased valuable stock feed and improved biodiversity.

In 1995 the rabbit calicivirus was introduced and was very successful at controlling rabbits in their warrens. The rabbit calicivirus combined with rabbit warren ripping has been found to be about 98% effective in controlling rabbits in the western division of NSW.



In 1995, the Homebush Landcare Group received a Bureau of Rural Sciences grant to experiment with warren ripping to control rabbits. Ron is the president of the Homebush Landcare Group, which has members from 24 properties in the Balranald region and plays a regionally important social and conservation role. The group used the grant funding to map locations and approximate numbers of warrens using a GPS. They then targeted these areas by ripping the warrens. Additional funding was obtained through the National Landcare and West 2000 programs and used to purchase a five tyne ripper for use by members of the Landcare Group on their properties. The ripper was designed for the specific purpose of rabbit warren ripping and can be pulled behind a 4WD vehicle. Monitoring of the use of the equipment has shown that it costs about \$7.50 to rip a rabbit warren in the Balranald region.

### **A model of success**

Work by the Homebush Landcare Group has been very successful and was used as the model for setting up the South West Rabbit Control Group in 1996. The South West Rabbit Control program operates in the lower Murray Darling Catchment over 170 properties in four Rural Lands Protection Board areas (Hillston, Broken Hill, Balranald and Wentworth). The program is funded through the Commonwealth's Natural Heritage Trust and West 2000, and provides landholders with 50% of funding for rabbit warren ripping. Landholders input the additional funding, which may include an inkind labour and fuel contribution. Since 1996, the South West Rabbit Control Group has ripped an impressive 240,000 rabbit warrens.

### **Valuable feed**

Ron and Joan have ripped over 20,000 warrens on Tin Tin, hiring a contractor for three years to help with this enormous task. Since removal of the impact of rabbits, the paddocks on Tin Tin are now covered in plants that provide valuable stock food including bimbale box (*Eucalyptus populnea*) bluebush (*Maireana spp.*) and saltbush (*Atriplex spp.*). The Hoares decided not to increase their stocking rates with the improvement of their land. They opted to keep stock numbers low, allowing stock to be kept on farm during times of low levels of on-ground fodder and during droughts. Tin Tin has to be regularly checked for rabbits and warrens are re-ripped annually as part of the long-term management of rabbits.

### **Other improvements**

During 2001, the Hoares obtained a water-use efficiency grant from West 2000 Plus, which required 50% input from the landholder. The grant was to cap an old bore and put in new pipelines to distribute water to the four or five stock watering points in each paddock. Significant amounts of water should be saved through reduced water leakage from the bore head and reduced water evaporation from bore drains that have been replaced with pipes.

Ron and Joan have noticed significant changes to vegetation on Tin Tin since the control of rabbits. The property now has patches of Mitchell grass (*Astrelba sp.*), umbrella grass (*Digitaria sp.*) and a variety of native orchids. The Hoares are planning to get some vegetation and bird surveys done on Tin Tin to determine the increasing diversity of flora and fauna with the successful management of the rabbit populations. The Homebush Landcare Group is planning to develop interpretive signboards with photos and text explaining their rabbit warren ripping operations. These signboards will be placed in prominent locations along property boundaries on main roads.



## Managing cypress pine in northwestern NSW

White Cypress pine (*Callitris huegelii*) is a native evergreen tree that has regenerated naturally on many properties in northwestern New South Wales. It can be a problem as it grows prolifically from seed, forming dense stands that prevent grasses and groundcover plants from growing. Cypress pine also has valuable timber that is hard, light, resistant to termites and used for construction, flooring and decorative woodwork. Active management of Cypress pines can allow for timber production while improving grazing potential and increasing biodiversity.

### A growing concern

Robert and Toni McLeish have a 1620 hectare grazing property 'Kurrajong Hills' at Upper Manilla, where they run cattle and a Bed and Breakfast. The property is scattered with native vegetation including several remnants of grassy white box woodland (*Eucalyptus albens*) and about 160 hectares of Cypress pine. In 1991, when the McLeishs bought Kurrajong Hills, it had areas of Cypress pine regrowth that were up to 40 years old. Unfortunately the Cypress pines had reached stand lock up with sites fully occupied by tree crowns that had stopped growing. The dense monoculture of Cypress pines and lack of groundcover was causing soil erosion in the steep country and difficulties when mustering stock.

### Selecting the best

Robert and Toni decided to take an active approach to the regrowth on their property. In 1995 they thinned ten acres (four hectares) of Cypress pine to a six metre spacing following the NSW State Forests Cypress Management Guidelines.

The guidelines explain that for timber production, the trees need to be crowded during the initial growth period to allow for formation of straight logs and then thinned to encourage new growth, allowing for the potential harvest of small logs within 30 years. The McLeishs selected the straightest trees with best form to be left and removed the others using a chainsaw. Thinning was a slow and labour intensive process due to the density of the Cypress pines. Selected branches were also removed to reduce the formation of knots in the timber. The thinnings were left on the ground and laid across the slopes. This technique prevents erosion by slowing the flow of water and allowing soil and seed to build up and pasture to establish.

Strategic management of regrowth, by Robert and Toni McLeish, on their property at Upper Manilla has allowed groundcovers to re-establish and biodiversity to be improved. The Cypress pines should also mature into harvestable timber.



Photo: Robert McLeish at Kurrajong Hills

### **Mixed blessings**

Within 12 months of the thinning operation, the standing Cypress pines had started to grow again and the groundcover level had increased to about 70%. Groundcovers included a mix of native and exotic grasses and patches of coolatai grass. Coolatai grass (*Hyparrhenia hirta*) is a perennial exotic grass from Africa that spreads quickly displacing native and more desirable exotic grasses. The McLeishs are managing coolatai grass on Kurrajong Hills through strategic grazing. Stock are being given urea licks to assist with digestion of the dry grass. Robert and Toni are also active members of the Manilla Landcare Group, which is undertaking research to try and establish control techniques for coolatai grass.

### **A refuge for wildlife**

In 2000, Robert and Toni entered into a Wildlife Refuge agreement with NSW National Parks and Wildlife Service for Kurrajong Hills. Wildlife refuges are areas where native plants and animals are protected. The voluntary agreement involved the McLeishs completing a plan of management for their property with assistance from NSW National Parks and Wildlife Service staff. The plan divided Kurrajong Hills into areas requiring different management techniques including conservation zones and general farm management zones. The conservation zones include riparian strips, vegetation corridors and two native vegetation remnants that the McLeishs had previously fenced. The general farm zones include areas of Cypress pine regrowth that could be thinned to increase biodiversity and improve wildlife habitat. Preparing the management plan involved a fauna survey that identified a range of native wildlife including echidnas, possums, kangaroos and wallabies. The survey also found turquoise parrots (*Neophema pulchella*) and squirrel gliders (*Petaurus norfolcensis*), which are both vulnerable species under the *NSW Threatened Species Conservation Act 1995*.

The wildlife refuge status on Kurrajong Hills provides Robert and Toni with protection of their native flora and fauna without imposing any major restrictions on normal farming activities. The environmental and productivity benefits of Cypress pine management have led the McLeishs to consider thinning more of their Cypress pine regrowth country. This would depend on obtaining consent to thin under the *NSW Native Vegetation Conservation Act 1997* and the economic benefits compared to the costs of thinning.



## Grazing native grasslands on the Monaro

Temperate native grasslands are naturally found in the Monaro region of the Southern Tablelands in New South Wales. The region typically has rocky soil, high altitude and experiences low unreliable rainfall and periods of extreme low temperatures. The landscape usually has a tree cover of up to 10% and the native grasslands are dominated by kangaroo grass (*Themeda australis*), red anther wallaby grass (*Joycea pallida*), wallaby grass (*Danthonia spp.*), corkscrew grasses (*Stipa spp.*) and snow grasses (*Poa spp.*). The region has been used for grazing by stock for the past 150 years and is the habitat of a variety of mammals and birds. Urban and agricultural development including grazing pressure has resulted in some areas of native grasslands becoming highly fragmented and the loss of some species. Many landholders are actively managing the areas of native grassland for conservation and stock fodder.

### Some rare finds

Bob and June Wilkinson are fifth generation farmers on 'Quartz Hill', a 2350 hectare property south of Cooma. The property is run as a sheep and cattle grazing enterprise, and has large patches of diverse native grasslands. Native grasslands found on Quartz Hill include wallaby grass (*Austrodanthonia spp.*), red grass (*Bothriochloa macra*), kangaroo grass (*Themeda australis*) and tall spear grass (*Stipa bigeniculata*). Native grasses are often perennial, drought resistant and help to stabilise the soil. They can be palatable for stock and cope with periodic grazing. NSW National Parks and Wildlife Service surveys on Quartz Hill have identified over 50 native grassland and forb species in several paddocks including several regionally rare and significant species.

Species include silky swainson pea (*Swainsona sericea*), hairy buttons (*Leptorhynchus elongates*), pale everlasting (*Helichrysum rutidolepis*), blue devil (*Eryngium rostratum*), hill daisy (*Brachycome aculeate*) and emu-foot (*Cullen tenax*). Quartz Hill also has small patches of the Monaro golden daisy (*Rutidosia leirolepis*) that is classified as a vulnerable species under the *Environmental Protection and Biodiversity Conservation Act (1999)*.



Photo: Monaro Golden Daisy at Quartz Hill



### Conserving native grasslands

The Wilkinsons are actively managing the native grassland on Quartz Hill through strategic grazing with some paddocks being destocked or conservatively stocked while native grasses flower and set seed from October to January. Some paddocks with areas of native grassland have been lightly spread with fertiliser as part of overall pasture improvement. This has enhanced the diversity of native grass species in these paddocks. *Poa tussock (Poa sieberiana)* is a native grass that is dominant in some paddocks on Quartz Hill. When it dries out it becomes unpalatable and has little nutritional value for stock. These paddocks are being managed by the Wilkinsons through strategic grazing to encourage palatable new growth of the native tussock.

There are also a few weed problems on Quartz Hill with serrated tussock (*Nassella trichotoma*) and African lovegrass (*Eragrostis curvula*). These weeds are currently managed using spot spraying with glyphosate-based herbicides.



Photo: Sinclair, June and Bob Wilkinson

### Regenerating snowgum woodlands

Bob and June have also been preserving areas of paddock trees on their property by using fences to exclude stock and allowing natural regeneration to occur.

On their sheep and cattle grazing property near Cooma, the Wilkinson family are actively managing native grasslands using various grazing and fertilisation methods.

Nine areas of snow gum (*Eucalyptus pauciflora*) have been fenced off on Quartz Hill. The first was fenced in 1951 and others fenced off in 1975, 1989 and 1991. Natural regeneration in these areas has been very slow due to climatic and soil conditions, however, native grasses and young snow gums are growing and the areas are being used by a variety of fauna. Native plants found in these areas include mountain cactus pea (*Bossiaea riparia*), Behr's Swainson-pea (*Swainsona behriana*), grass trigger plant (*Stylidium graminifolium*), billy button (*Craspedia variabilis*), shrubby rice flower (*Pimelea glauca*) and the regionally significant, creeping hop bush (*Dodonaea procumbens*).

### Promoting diversity

Bob and June recently split Quartz Hill into two 1175 hectare properties for their sons Dunbar and Sinclair. Dunbar runs Angus cattle and is planning to convert his property into an organic beef production enterprise. Sinclair runs sheep and breeds Angus cattle on his property. They conservatively stock and use a rotational grazing system to control weeds and the enhance areas of native grassland. The Wilkinsons plan to continue promotion of growth of diverse native grasslands in the paddock and remnant areas on Quartz Hill for agronomic and environmental benefits.



## Against the odds — managing riverbank erosion on a dairy

Riverbank erosion is a process that involves water flow causing soil movement in the landscape. Erosion can impact on water quality, degrade aquatic systems and cause loss of valuable agricultural land. Scour and collapse are the two major types of riverbank erosion. Scour occurs when sediment is gradually removed from a riverbank and collapse occurs when a riverbank suddenly fails and slumps. Lack of vegetation and unrestricted access to a river by people and stock can increase susceptibility of a river to bank erosion.

### Massive slump prompts action

Tony and Jill Wilson manage a 65 hectare property at The Risk, near Kyogle. The Upper Richmond River flows through the dairy property and during the past 9 years the Wilsons have experienced extensive riverbank erosion with soil loss occurring in every flood. In 1993 a 100 metre long and 25 metre wide erosion slump occurred, leaving a steep cliff face. This prompted the Wilsons to take action and begin to manage riverbank erosion on their property.

Tony and Jill are members of the Cedar Point Landcare Group and in 1994 the group received funding through NSW Rivercare to control riverbank erosion. The Department of Land and Water Conservation administered the funding at 2:1 with landholders contributing labour, materials and additional costs. A Rivercare Officer designed a project to manage riverbank erosion on an S bend on Tony and Jill's property. The project involved earthworks to batter down the riverbanks and channel water flow away from the cliff towards the middle of the river and revegetation to stabilise the soil and control erosion.

In October 1994, during a period of low flow, a contractor with a bulldozer and scraper completed the earthworks. This was followed by revegetation of the riverbanks. Children from The Risk Public School planted 1,200 trees including river she-oaks (*Casuarina sp.*), forest oaks (*Allocasuarina sp.*), wattles (*Acacia sp.*), bottlebrush (*Callistemon sp.*) and water gums (*Eucalyptus sp.*).

Severe riverbank erosion on their property near Kyogle prompted Tony and Jill Wilson into remedial action. Although much of their hard work was destroyed by a drought and floods, the couple have made significant progress in controlling this problem.

### Drought and floods destroy efforts

During 1995 The Risk area experienced a severe drought that killed most of the planted trees. Then two floods in quick succession resulted in the top half of the S bend reverting to its original flow, leading to further riverbank erosion. The bottom of the S bend stayed relatively intact with water flow being diverted away from the cliff. The continued riverbank erosion was disappointing for Tony and Jill who had made significant contributions of time, resources and money to the project.





### **Funding for a new approach**

During 1997 Tony and Jill were able to access some additional NSW Rivercare funding to continue their erosion control activities in response to the damaging impact of floods on their initial projects. The new project focused on the top half of the S bend and involved reshaping the river, constructing groynes and revegetation. A groyne is a physical structure that is built along an eroded bank and extends into the river — slowing the velocity of water flow and trapping sediment. The Wilsons established ten groynes consisting of six metre steel posts driven three metres into the ground by a pole driver. Brackets were welded onto the posts and timber rails tied on at radiating angles. The riverbanks were revegetated with similar riparian species used in the 1994 project. Students from Kyogle High School, neighbours and friends planted 1,800 tube stock and three kilograms of mixed seed was direct sown onto the riverbanks.

### **More flood damage**

On Christmas Eve in 1997 a major flood event of one metre occurred in The Risk area. This caused significant damage to the Wilson's project. Many of the plants and piles of material, including timber, were washed away. No major floods occurred in 1998 and the area grassed up and the banks started to stabilise. There were several small flood events during 1999 that led to large pieces of debris damaging the groynes.

### **Start of success**

Tony, Jill, members of the Cedar Point Landcare Group and members of the local community put in an extraordinary effort to try and control riverbank erosion on the property. The continual activities demonstrate that successful erosion control can be a long-term process. The river has now formed a deep channel away from the cliff and soil falling from the cliff has accumulated below. The riverbanks are covered with grass and some of the direct seeded plants have become established and are assisting to stabilise the soil.



Photo: Jill Wilson and Bob Jarman (Landcare Co-ordinator) with one of the groynes constructed on the Upper Richmond River



# Salinity and erosion management in the northwest

Dryland salinity involves the rising of groundwater aquifers towards the soil surface. The groundwater may contain high levels of salt that can build up in the plant root zone and on the soil surface. This leads to the death of less salt tolerant plant species and loss of agricultural productivity. Gully and riverbank erosion are processes that involve water flow causing soil movement in the landscape. Erosion can impact on water quality, degrade aquatic systems and cause loss of valuable agricultural land. Dryland salinity and erosion have the potential to become major conservation and production problems in northwestern New South Wales.

## Solving scalds

Ted and Vicky Sutton have two properties in northwestern NSW near Tamworth. 'Bective West' is a 285 hectare cattle and cropping property with a five kilometre tributary of the Peel River flowing through it. The property had several salinity scalds when the Suttons purchased it in 1996. Salinity scalds are hard, bare patches of earth where the soil surface has been damaged by salinity. Ted used a tractor and ripper to break up the scalds and promote natural regeneration.

The Suttons recognised the potential problems associated with the rising water table. They realised the value of surface vegetation in the use of excess surface water and controlling erosion.

They are planning to enhance the natural regeneration that has occurred on the scalds by planting deep-rooted salt tolerant species such as tall wheat grass (*Agropyron elongatum*) and saltbush (*Atriplex sp.*). Ted and Vicky have also decided to grow perennial pastures to use excess surface water while providing palatable fodder for their stock.

## Pasture trials

The Suttons are involved in two Meat and Livestock Australia pasture trials with North West Sustainable Grazing Systems to address the decline of productivity and sustainability in grazing lands. The first trial involved planting a range of sub-tropical pasture species. The different species' growth rates and nutritional values are monitored. The trial site on Bective West has been planted with bambatsi panic (*Panicum coloratum*), purple pigeon grass (*Setaria incrassata*), premier digit (*Digitaria eriantha*) and Rhodes grass (*Chloris gayna*) and has been used for sustainable grazing landholder field days.

Ted and Vicky Sutton's property near Tamworth has several salinity scalds and gully and riverbank erosion. The Sutton's are managing these problems using salt tolerant and perennial plant species while increasing the value of their property.



Early indications from the trial show that sub-tropical pasture species will grow in the region provided that good quality seed is shallow sown when subsoil moisture levels are high. The trial is continuing and Ted and Vicky are hoping that the introduction of new high water-use crop varieties may avoid salinity problems in the future.

The second pasture trial is a three-year pasture species management trial where the groundcover levels under conventional grazing, cell grazing and rotational grazing systems are being monitored. Ted and Vicky are practicing rotational grazing in one of their paddocks. Early indications point to fewer weed species in systems managed using cell grazing or rotational grazing.

### **Tackling erosion**

Soil erosion is another common problem in the undulating landscape in northwestern New South Wales. Gully and riverbank erosion often occurs when concentrated flows of water remove soil along natural ridgelines and watercourses. Extensive gully erosion has occurred on Bective West, which is being managed by increasing groundcover levels to bind the soil together and slow the flow of surface water. The Suttons have also been involved in a gully erosion control project with their Landcare group.

The Landcare group obtained some funding through the Commonwealth Natural Heritage Trust to construct a concrete flume and revegetate an eroded spillway on a neighbouring property. Riverbank erosion has occurred on Bective West as a result of the upstream construction of a bridge, realigning water flow in the river towards a bank. This has resulted in extensive riverbank erosion and the formation of steep cliff faces. Ted and Vicky are considering various management options for the area including excluding stock and revegetating the riverbank to stabilise the soil. They have already fenced in an area around a small billabong, which has regenerated naturally with a variety of native species.

### **Increasing values**

The various activities being undertaken on Bective West by Ted and Vicky to manage dryland salinity, gully and riverbank erosion are increasing the agronomic and environmental values of the property.



Photo: Ted Sutton in pasture species trial area on Bective West



## Managing gully erosion in the Burrinjuck region

Peter and Faye Southwell have a 485 hectare merino stud, 'Fairview', in the Burrinjuck region near Yass. The Burrinjuck region was extensively cleared in the early 1900s, resulting in severe gully erosion problems. Gully erosion is usually the result of running water removing thin layers of soil and cutting channels through the landscape. The water travels along natural flow lines and tends to increase in velocity where vegetation has been removed. Fairview is located in the upper Jugiong catchment and has Bogolong Creek flowing through it for about ten months of the year. During the past ten years a staggering five metres of land has eroded away on Fairview. The Southwells have been involved in various activities including revegetation and physical works to try and manage the gully erosion.

### Planting natives

In 1995 the Southwells started planting trees from local plant nurseries in corridors along the fence lines of their property. They could see the value of planting trees to assist with erosion control while providing shade and shelter for stock, habitat for wildlife and improvements to the aesthetics of the area. By 1998 Peter and Faye were propagating native trees and shrubs with seed collected from small remnants of native vegetation on Fairview and have now planted between 3,000 and 6,000 trees from tubestock and direct seeding.

### Direct seeding

The Southwells became involved in the 'Burrinjuck Webs of Green — Vegetation Protection and Enhancement Project' in 1998. The project provided funding (up to \$1,200 per kilometre) to fence and improve areas of native vegetation.

Peter and Faye isolated an eight kilometre strip of remnant vegetation with electric fencing. They sprayed to control weeds and direct seeded with various local native understorey plant species including wattles (*Acacia sp.*) and grevilleas (*Grevillea sp.*). Due to ideal soil temperature and soil moisture for seed germination direct seeding on this site was highly successful.

Peter and Faye Southwell's merino stud had severe gully erosion. Fencing to promote revegetation, direct seeding and creating a wetland are some of the methods they have used to address the problem.



Photo: Peter Southwell with his constructed wetland on Fairview



The direct seeder hired from Greening Australia can be difficult to obtain in times of moist planting conditions because of high landholder demand. Other sites on Fairview have been direct seeded to coincide with availability of equipment rather than optimal environmental conditions, resulting in disappointingly low survival rates. Peter is currently working with a few friends to design and build their own direct seeder from an old rabbit poison spreader for on-farm revegetation projects.

### **Active participants**

Peter and Faye are active members of the Burrinjuck Landcare Group. In 1999 the group applied successfully for a Commonwealth's Natural Heritage Trust grant for erosion control management over several properties. As part of the project numerous small gullies on Fairview were fenced off and allowed to regenerate. The natural regeneration was very successful and the banks of the gullies are now dominated with young gum trees (*Eucalyptus sp.*). The Southwells plan to direct seed these areas in the future to introduce a more diverse shrub layer. Peter has also used a backhoe for erosion control work on the small gullies including changing the flow of minor watercourses and constructing overflow diversion areas.

In January 2001 the Southwells were involved in a major earthworks project to slow the flow of water along Bogolong Creek. A 15-megalitre wetland was built at the head of an eroding gully on Fairview. The wetland captures water flowing along the creek with a large earth wall. A pipe was inserted to slowly release the water into Bogolong Creek.

This dramatically reduced the velocity of the water flow, preventing further gully erosion. Construction of the wetland was similar to that of a dam, involving a D6 and D7 bulldozer working for six days to build the earth wall. The earth wall has been direct seeded with native red grass (*Danthonia sp.*) and poa tussock (*Poa sieberiana*), and areas surrounding the wetland will be revegetated with a mix of dryland and aquatic native species during spring 2001. The wetland area will be permanently fenced off and alternative watering points provided for stock.

### **Financial help**

The Southwells received some financial assistance for construction, revegetation and maintenance of the wetland area from the Bidgee Banks Project. The Bidgee Banks Project is a riparian zone restoration initiative funded through the Commonwealth's Natural Heritage Trust and managed by Greening Australia ACT. It aims to improve water quality in the Murrumbidgee catchment by providing advice and incentives to landholders. Funding under the project usually requires 50% input from landholders and is available for activities such as fencing to exclude stock, riparian revegetation, erosion control earthworks and alternative stock watering.

### **Waiting for rain**

Construction of the wetland on Fairview is complete and Peter and Faye are waiting for rain to inundate the area and test the wetland's effectiveness in controlling gully erosion. An island has been created in the middle of the wetland to provide habitat for wildlife. It is hoped that seasonal fluctuation in water level will encourage use of the area by birds and fish for breeding. Peter is a keen fisherman and is planning to stock the wetland with native fish for recreational use.



## Establishing agroforestry on a mixed farm

Agroforestry is the cultivation of timber trees in conjunction with other agricultural activities. Establishment of a agroforestry operation requires extensive planning with selection of suitable sites, choice of tree species and investigation of potential markets. The trees also require periodic management such as thinning, pruning, weed control and fertilising. Many landholders in New South Wales are diversifying their farming enterprises into agroforestry for timber, agronomic and environmental benefits.

### Multiple benefits

Adam and Pam Wettenhall have 1,820 hectares in three blocks near Deniliquin. 'East Tolans' is a 485 hectare mixed farm near Blighty, where the Wettenhalls run cattle and sheep, dry crop canola and wheat, flood irrigate rice and have several agroforestry plantations. They also practice crop rotations, direct drill and undersow crops with lucerne to assist with managing rising water tables (a problem in the area). Adam and Pam first started planting native vegetation on East Tolans in clumps along the driveway to provide shade and shelter for stock, encourage native birds and insects, protect against soil erosion and assist with managing dryland salinity. Species planted include wattle (*Acacia sp.*), Hopbush (*Dodonea sp.*) and bottlebrush (*Callistemon sp.*).


In 1996 the Wettenhalls started experimenting with agroforestry on East Tolans by planting tree belts along the fencelines for timber, agronomic and environmental benefits. They planted tree species that had forestry potential and proven success growing in the area including six hectares of spotted gum (*Corymbia maculata*), six hectares of forest red gum (*Eucalyptus tereticornis*) and six hectares of flooded gum (*Eucalyptus rudis*).



Photo: Adam Wettenhall in the native seed orchard on East Tolans

Tube stock were obtained from a local nursery and planted with assistance from Stuart Sizer, a local agroforestry consultant. Adam and Pam staggered the planting times of the agroforestry plots with the expectation that when the trees mature, timber harvesting can be staggered. This will prolong the benefits from the farm shelterbelts and protect the soil.

In 1997, the Wettenhalls planted 10 hectares of spotted gum on one of their other properties near Deniliquin. The paddock has sandy soil and had been rejected for irrigated rice production.



Adam and Pam Wettenhall have diversified into agroforestry on their mixed farm near Blighty. Irrigation of some plots has accelerated growth of the trees. They have also planted a native seed orchard, fenced several native vegetation remnants and direct drilled understorey species.

### **Water recycling**

The tree belts resulted in high survival rates and once established, Adam and Pam started an irrigation trial on several of the agroforestry plots. East Tolans has an irrigation water recycling system where 100% of drainage from the irrigated country is captured in water storages for reuse. This improves water-use efficiency and minimises seepage into the groundwater table. Water was siphoned out of a drainage channel and used to flood irrigate some of the agroforestry plots. This was continued periodically during the establishment of the trees. The irrigated trees have grown noticeably faster than other trees.

### **Establishing a native seed orchard**

In 1998 Adam and Pam planted a 20 acre (8 hectare) native seed orchard, in conjunction with Greening Australia, to provide seed for future revegetation projects on East Tolans and other properties in the region. The area was fenced off to exclude stock from eating and trampling the plants and a variety of local tree, shrub and groundcover species were planted as tube stock or direct seeded. The seed orchard is still establishing with some of the tube stock being about knee-high and the direct seeded plants slowly germinating. Some of the plants will be selectively culled to preserve certain desirable characteristics in the seed produced and stock will be reintroduced to the area once the trees are established. Seed collection from the more mature plants should be possible in a few years.

### **Enhancing remnants**

The Wettenhalls have also fenced off several areas (up to 10 hectares) of remnant vegetation on their properties to allow natural regeneration to occur. Some of these areas have been enhanced by direct drilling in spring with understorey plant seed collected in the local area.

### **A growing success**

After the successful growth of agroforestry trees on East Tolans, the Wettenhalls planted a further 14 hectares in an agroforestry woodlot during 2000. Weeds were cleared from the area and the soil cultivated to form mounded beds. Adam, Pam, their son Tom and a team of contractors planted about 12,000 tube stock from a local nursery in a block pattern. This pattern was selected for ease of management and for future harvesting. A variety of timber species were planted including silky oaks (*Grevillea robusta*), ironbarks (*Eucalyptus sp.*) and river red gums (*Eucalyptus camaldulensis*). Also during 2000, the Wettenhalls planted two hectares of river red gums surrounding blocks of rice.

Agroforestry trees generally take about 30 years to become mature for harvesting, depending on the species and climatic conditions. The long-term nature of agroforestry investments makes them ideal to be part of a diverse agricultural operation. Adam and Pam are pruning some of their initial plots to encourage growth of knot free timber and hope to start harvesting timber in the next fifteen years.

The Wettenhalls would like to continue development of agroforestry ventures on their properties but are limited by irrigation water restrictions. They are interested in exploring the potential of water for irrigation of agroforestry plots being in addition to normal irrigation water allocations.



## The search for a biological control of woody weeds

The encroachment of woody weeds is a major conservation issue being faced by landholders in western New South Wales. Woody weeds are unpalatable native plants that inhibit the growth of other plants such as grasses. They reduce the carrying capacity of the land and cause conservation problems such as erosion and habitat loss.

### Weed warriors

Mal and Nancy Robinson are actively involved in exploring controls for woody weeds on their 33,000 hectare property, 'Ellerslie' near Enngonia, in western New South Wales. The sheep and cattle grazing property is scattered with woody weeds including hop bush (*Dodonaea sp.*), turpentine (*Eremophila sturtii*) and budda bush (*Eremophila mitchellii*).

In 1977 Nancy observed that insects on woody weeds at Ellerslie were causing distortion and death of certain species. This greatly interested the Robinsons who had experimented with various controls for woody weeds including mechanical removal, burning and chemical control with only limited levels of success. Over time they observed tiny native insects thinning the native woody weeds.

### Getting the funds

In 1994 the Robinsons with their local Landcare group (Cuttagoa Catchment Landcare) successfully applied for funding (under the National Landcare Program through the Western Catchment Management Committee) to employ an entomologist to conduct a trial of biological control agents on woody weeds. This funding was renewed through West 2000 allowing the project to continue until October 2000. The funding was met 50:50 by members of the Landcare group, both financially and through an inkind labour contribution.

In western New South Wales Mal and Nancy Robinson were having limited success in eradicating woody weeds on their grazing property. After noticing native insects thinning weeds they began their search for a biological control of this widespread problem.

In 1994 Nancy won a Churchill Fellowship to tour USA for three months to look at woody weed control techniques. This provided background information on the successful use of biological agents in the control of weeds.





David Sparks (the entomologist employed by the project between 1994 and 1999) began the research work with identification of over 30 species of insects with potential as biological control agents on three target woody weeds — hop bush, turpentine and budda bush.

### Two out of three

Although most of the insects were found to be unsuccessful as biological controls, two agents were identified as having the most potential to control specific woody weeds. A native scale insect, *Pulvinaria sp.* was found to control budda bush and ellangowan poison bush (*Myoporum deserti*). A native mite from the *Eriophyidae* family which acts as a poison was found to control hop bush. The host specific agents suck the sap and inject their saliva into the weeds. Woody weeds that are under attack by biological control agents are unlikely to flower or set seed. This allows for the gradual thinning of woody weeds to a controllable level. Unfortunately no specific control was identified for turpentine during the project. However, a combination of insect and chemical controls has produced some longterm results for turpentine.

### Agents on trial

The two identified biological control agents were trialled in western New South Wales over eight properties, including Ellerslie. It was found that the effect of the insects to successfully control woody weeds was dependent on:

- climatic factors;
- number of control agents on the plant; and
- age of the plant.



Photo: Area on Ellerslie where woody weeds are being managed through biological controls in conjunction with mechanical clearing

The 18 month trial ended positively with between 7 and 40% of woody weeds being infested with the scale and mites.

*Pulvinaria sp.* scale was found to have a fast lifecycle of 8 to 10 weeks and have the ability to kill adult woody weeds in months. Unfortunately *Pulvinaria sp.* has to be physically introduced into new areas through moving infested pieces of plant material. The lifecycle of the *Eriophyidae sp.* mite was not determined in the timeframe of the project, however it was found to spread prolifically killing hop bush shrubs.

### Continuing the assault

Despite funding for the project finishing, Mal and Nancy are still exploring the role of woody weed control with biological agents. On Ellerslie, *Eriophyidae* mites are proving to be the most effective control for hop bush.



# Integrating forestry into a Hunter farming system

Farm forestry is the management of trees on farms for commercial purposes. In New South Wales, farm forestry involves the management of plantations and natural forest areas for timber production. Forestry operations allow for income diversification in farming systems. Side benefits of the industry include the provision of shade and shelter for stock, and habitat and food for native fauna. Farm forestry also assists in preventing land degradation such as erosion and salinity.

## Legacies of the past

Rod Fletcher owns a 500 hectare property 'Harris Creek' near Gresford. When the property was purchased in 1987 it had about 50% vegetation cover. The property had been substantially cleared in the 1940s, and was then managed as a grazing property and annually burnt to stimulate new growth of green feed. This management technique encouraged a variety of hardwood regrowth including: narrow-leaved ironbark (*Eucalyptus crebra*), broad-leaved ironbark (*Eucalyptus fibrosa*), forest red gum (*Eucalyptus tereticornis*), spotted gum (*Corymbia maculata*), white stringybark (*Eucalyptus globoidea*), grey box (*Eucalyptus moluccana*) and rough barked apple (*Angophora floribunda*). From 1960 to the early 1990s the regrowth has sporadically cleared for pit props that were sold to local mines. Rod has continued running Harris Creek as a grazing enterprise with several large paddocks catering for 140 breeding cattle. He is gradually increasing paddock numbers and plans to introduce a rotational grazing system.

## Assessing the situation

In 1998 Rod decided to investigate the potential of integrating farm forestry with his cattle grazing. The forested areas on Harris Creek were assessed and the density of trees was found to be about 1500 trees per hectare with low species diversity and structural immaturity.

Many of these areas had reached 'stand lock up' where tree growth stagnates until a gap in the canopy provides space for new growth.

Underneath the trees were patches of bare ground scattered with various native and exotic grasses and a few weeds including clumps of lantana (*Lantana camara*). The lack of groundcover was leading to soil erosion on steep areas of the property and Rod was keen to increase the diversity of native, perennial and palatable grasses on Harris Creek.



Photo: Rod Fletcher in a thinned area of regrowth on Harris Creek



## Sustainable management

Rod decided to adopt an 'active management' approach to the timbered areas. By thinning and sustainable harvesting he aimed to stimulate new tree growth and increase groundcover flora. In 1999, Rod completed a Master Tree Growers Training Course and applied for a clearing consent from the NSW Department of Land and Water Conservation for sustainable management of the natural forested areas on Harris Creek. The application required preparation of a forest management and harvest plan for the property to meet requirements of the *Native Vegetation Conservation Act 1997*.

Harris Creek has about 30 hectares of rainforest in several remnants that have a diversity of plant species including Moreton Bay Figs (*Ficus macrophylla*) and Kangaroo vine (*Cissus antarctica*). The forest management planning process involved defining zones for conservation. These zones included the rainforest gullies and vegetation strips along the two creeks that pass through the property. Rod received some funding through Greening Australia's Fencing Incentive Scheme to construct 8.5 kilometres of fencing around the rainforest remnants, which should be completed during 2002.

Rod Fletcher's sustainable management of the regrowth forest on his property in the Hunter is increasing farm productivity while improving biodiversity.

## Gaining consent

In 2000, the NSW Department of Land and Water Conservation granted clearing consent for sustainable forestry on Harris Creek. The consent lasts 10 years and has several conditions including that basal area restrictions are not below 40%. Rod started to plan silviculture techniques to remove suppressed trees and stimulate new growth, while establishing form and encouraging the growth of knot-free timber.

## Planning for growth

In 2002, Rod followed the Harris Creek silviculture plan and thinned two one hectare plots as part of a Greening Australia farm forestry thinning trial. The trial aims to improve timber production and nature conservation by gradually returning regrowth areas to uneven aged stands of trees with diverse understories.

Rod and several Greening Australia staff undertook the labour intensive process of thinning the plots using chainsaws. They were thinned to 500 trees per hectare with basal areas of 23 square metres per hectare and 17 square metres per hectare. Logs were obtained from the large thinnings for use as fence posts and stays on Harris Creek. The small and branched thinnings were left on the ground to assist with soil stabilisation and erosion control while providing habitat for wildlife. A NSW National Parks and Wildlife Service survey on Harris Creek in 2001 found 70 species of birds, 10 species of mammals and a probable new species of myrtle (*Babingtonia sp*). It is hoped that the diversity of flora and fauna species will increase with the farm forestry operation.

Rod is chair of the Hunter Farm Forestry Network that is working to overcome uncertainties with future timber harvesting rights on private property in New South Wales. Rod plans to continue to run cattle and sustainably manage areas of natural forest on Harris Creek.



# Increasing biodiversity on a mixed farm

Biodiversity is the variety of all living forms in an ecosystem, including fauna and flora. Many landholders in New South Wales are preserving and increasing biodiversity on their properties, as part of every day management providing benefits such as increased land productivity and landscape amenity.

## Growing and sowing the seeds

Jim and Rhonda Cameron are actively increasing the biodiversity on their 1,960 hectare property 'Haddon' near Wee Waa, while running a productive mixed farm (wheat, summer crops, prime lambs, wool and cattle). Biodiversity is being increased by preserving flora and by creating habitat for fauna. As an extension to their farm business, Jim and Rhonda operate 'Inland Botanics', a native plant nursery. They collect native plant seed from their own property and other properties in the area. The seed is propagated and the seedlings and tube stock are sold to landholders and landcare groups for revegetation projects.

To meet the growing demand for native plants and seeds, the Cameron's have planted a four hectare seed orchard on Haddon, that includes 3,000 river red gum (*Eucalyptus camaldulensis*) and 3,000 Chinchilla white gum (*Eucalyptus argopholia*). The seed orchard was grown from hiko seedlings and the area prepared 12 months before planting by deep ripping. Some of the trees will be selectively culled to preserve certain characteristics and the first collection of seed should be possible in a few years.

## Creating habitat

A 15 hectare laneway on Haddon has had permanent stock excluded from it for more than nine years as it doesn't contain a reliable water source. A vast array of vegetation has established in the area including trees, shrubs, groundcovers and grasses. It contains fallen logs and leaf litter which provide habitat for a range of different fauna. A section of this remnant was recently used by the NSW National Parks and Wildlife Service as part of a biodiversity survey in the Darling Riverine Plains Bioregion. The scientific survey aimed to provide general indications of species in the bioregion. A range of wildlife was found on Haddon including two pale-headed snakes (*Hoplocephalus bitorquatus*).

Jim and Rhonda Cameron have a mixed farm near Wee Waa. They are restoring and increasing the biodiversity in their region by propagating, planting and supplying native seed, as well as protecting areas of native vegetation by fencing, managing stock and controlling weeds.



### **Saving remnants**

An area adjoining the laneway contains a ten hectare remnant of carbeen forest (*Eucalyptus tessellaris*) — a significant ecological community in the area. The Camerons have entered into a conservation management agreement with the NSW Department of Land and Water Conservation (Native Vegetation Incentive Program) to preserve this remnant. Funding to fence off the area to excluding stock and carry out any necessary management tasks such as weed control, has been provided.



Photo: Rhonda Cameron amongst the farm forestry trial trees on Haddon

### **Enhancing local biodiversity**

The Camerons are also involved in a farm forestry trial with Greening Australia and CSIRO to identify tree species that:

- contribute to local biodiversity enhancement;
- provide commercial forestry returns; and
- grow well in the local climatic conditions.

Tree species in the trial include eucalypts, acacias and casuarinas from the local area, other parts of NSW and from interstate. In September 1999, 2,800 hiko seedlings were planted on Haddon and a 90% success rate was recorded in the first 9 months. The growth rates of the trees have been variable depending upon tolerance to the conditions in Wee Waa which include hot weather and frosts. The highest initial success rate has been found in the river red gums that are naturally found in the area. Eventually the results from the trial will be available for use by other landholders establishing farm forestry plots.

All of these activities on Haddon are increasing biodiversity at a property and a regional level. Jim and Rhonda hope to continue the enhancement of biodiversity on Haddon through undertaking further revegetation projects.



## Planning farm efficiency in the Murray Irrigation Area

A farm plan for an irrigated property in the Murray Irrigation Area aims for maximum water-use efficiency. The aim is to capture 100% of drainage from irrigated country in water storages for reuse. This keeps valuable nutrients on-ground and controls potential water seepage into the groundwater table. It usually incorporates land forming, irrigation layout, drainage reuse, water storage and native vegetation. Landholders are encouraged to prepare Farm Development Plans in the Murray Irrigation Area through a range of incentives being offered via the Land and Water Management Plans, administered by Murray Irrigation Ltd. These include up to an 80% rebate for formation of a Farm Development Plan in the Berriquin District, under the Berriquin Land and Water Management Plan. Once a farm plan is prepared, a landholder is then eligible to claim other incentives including rebates for establishing water re-use systems and water storages. The plans are usually prepared by consultants and cost about \$60 per hectare to complete.

Using a Farm Development Plan, David and Nancy Curtin's mixed farm in southwestern NSW has been modified to maximise water and fertiliser use, while protecting and enhancing the natural environment.

### **Taking water seriously**

David and Nancy Curtin own and operate a 1,215 hectare mixed farm, 'Muskerry', on two blocks near Jerilderie in southwestern NSW. It is part of the Berriquin District of the Murray Irrigation Area. They operate a dryland and irrigated, rotational farming system with merino sheep, rice, wheat (under sown with clover and lucerne), canola, prime lambs and vealers. The Curtins have undertaken a huge amount of work on their property including upgrading their Farm Development Plan in 1998. This led to the construction of two water storages as part of their water reuse system. Before construction, the proposed water storage sites had to be drilled to establish that a thick enough layer of base clay existed to stop any drainage water entering the ground water table through seepage.



Photo: David Curtin and a planted corridor of trees next to an area where he grows rice on Muskerry

### **Increasing productivity and biodiversity**

While completing land forming, pipe laying and water storage construction, David and Nancy experimented with growing trees in shelterbelts to increase productivity and biodiversity on Muskerry. They prepared the soil for tree planting eight months in advance by deep ripping and forming mounds. A variety of tree species were planted in winter and protected with tree guards. The Curtins first started planting trees on Muskerry ten years ago and have now planted five kilometres of trees in rows three trees deep. The survival rate has been mixed depending on the species selected and whether locally acclimatised plant stock was used.

David and Nancy continued vegetation enhancement on their property by fencing an area of native remnant vegetation along a creek line. This allowed for natural regeneration to occur, increasing biodiversity and providing animal habitat. Funding was received through Greening Australia's Fencing Incentive Scheme (up to \$1,200 per kilometre) to fence four kilometers, creating a 32 hectare remnant. Unfortunately only a low level of natural regeneration occurred in the remnant. This may have been caused by a lack of available seed and extreme climatic conditions. The Curtins applied for some assistance through Greening Australia's Murray Catchment Vegetation Enhancement Program (up to \$250 per hectare for purchase of seed or seedlings) to introduce some understorey plants to the remnant through direct seeding. A variety of small trees, shrubs and groundcovers were planted including hop bush (*Dodonea sp.*), wattle (*Acacia sp.*) and senna (*Cassia sp.*).

### **A strategic approach**

Preparation of a Farm Development Plan allows for a coordinated and strategic approach to managing a property. A significant initial cost is involved in establishing a plan, however the positive outcomes are numerous. They include:

- increases in water use efficiency;
- increases in fertiliser use efficiency;
- benefits of native vegetation; and
- protection of the environment through storing and recycling drainage water with a drainage reuse system.



## Increasing farm productivity through conservation

Jeff and Ngaire Bennett have a 182 hectare grazing property, 'Manandawara' at Gundaroo, where they run fine and medium wool merinos. When the Bennetts bought Manandawara it was badly degraded with gully and creek erosion problems, a weedy riparian zone, small salinity scalds, acidic soils and was covered in serrated tussock. Over the past decade Jeff and Ngaire have put in a phenomenal effort to manage these conservation problems and increase their farm productivity.

### Serrated tussock nightmare

In the early 1990s Manandawara and neighbouring properties were covered in serrated tussock (*Nassella trichotoma*) — a perennial weed from South America. It is a prolific seeder that can quickly dominate the landscape. Serrated tussock is classified as a Weed of National Significance in Australia and is a noxious weed in NSW. In 1991, Jeff and Ngaire started to control serrated tussock by broadacre aerial spraying their property with a herbicide containing flupropanate (such as Frenock or Taskforce). After spraying areas on Manandawara were destocked for about a year and actively managed through pasture improvement and revegetation. This included spreading fertilisers, (superphosphate, lime and Envirosoil) and reseeding pasture with puna chicory and a phalaris, cocksfoot and clover mix. Serrated tussock regrowth is continually monitored by Jeff and Ngaire and controlled by spot spraying.

At Jeff and Ngaire Bennett's grazing property at Gundaroo the serrated tussock was such a problem that drastic measures to reduce its dominance were required. Erosion, salinity, acidic soils and weeds have also been tackled by this energetic couple to improve their farm sustainability and productivity.


The Bennetts have found that chemical control followed by active management is allowing them to manage their serrated tussock problem and increase productive grazing area for stock.

Serrated tussock is common in the Gundaroo region and the Bennetts have accepted its control as part of their routine farm management. Their goal is to attack 100 acres (40 hectares) of serrated tussock each year and follow up in areas already sprayed.

### Gullies in rehabilitation

Manandawara has several eroded gullies formed by water travelling down natural flowlines and gradually removing layers of soil. In 1993, Jeff and Ngaire started to rehabilitate two 400 metre long gullies. The gullies were fenced to exclude stock. The gully tops and points along the bases were staked with straw bales to slow the velocity of water flow and to filter sediment.





Areas surrounding the gullies were revegetated with a mixture of native plant species to bind the soil and help prevent further erosion. These gullies have stopped eroding and are now covered in vegetation. A similar technique of excluding stock through fencing and revegetating has been used to manage several small salinity scalds on Manandawara. Salt tolerant species including tall wheat grass (*Agropyron elongatum*) and a variety of native trees were planted and are now growing on the scalds.

Jeff and Ngaire have also been involved in windbreak revegetation projects along their property fencelines. Benefits of the windbreaks include providing shelter and shade for stock, habitat for wildlife and barriers to slow the spread of serrated tussock seed. The Bennetts received some funding towards fencing materials and plants for the windbreaks from Green Grid (a local electricity company), Greening Australia and the Commonwealth's Natural Heritage Trust through their local Landcare group.

In October 2000, the Bennetts planted a thousand native hardwood timber trees as a demonstration plantation with Greening Australia, on the alluvial creek flats of Manandawara. The aim of the plantation is to create a habitat for native fauna while providing a range of timber that can be harvested at intervals according to market demand. Southern blue gum (*Eucalyptus bicostata*), manna gum (*Eucalyptus viminalis*), black wattle (*Acacia mearnsii*) and hickory wattle (*Acacia implexa*) were planted in a scattered pattern as an alternative form of farm forestry design.

It is hoped that the wattles (*Acacia spp.*) will be ready to harvest as cabinet timber or firewood in 8 to 25 years and the gums (*Eucalyptus spp.*) will be ready to harvest as flooring timber, sawn cabinet timber and pulpwood in 25 to 80 years.

## **Riparian restoration**

As members of the Gundaroo Landcare Group, Jeff and Ngaire were involved in a Rivercare Project to improve water quality in Gundaroo Creek in 1995. Gundaroo Creek, part of the Murrumbidgee Catchment, runs through Manandawara. The Bennetts fenced the riparian zone (the area between land and water) and developed alternative stock watering points. Extensive natural regeneration of native shrubs has occurred in the fenced-off riparian zone, however some areas have become invaded by cracked willow. Cracked willow (*Salix fragilis*) is a noxious riparian weed that is very invasive and can change the ecology and flow patterns of creeks. During 2001, the Gundaroo Landcare Group became involved in riparian restoration on five properties along Gundaroo Creek. Funding has been obtained through the Bidgee Banks Project for fencing and weed control. The Bidgee Banks Project is a riparian restoration initiative managed by Greening Australia ACT, which aims to improve water quality in the Murrumbidgee catchment by providing advice and incentives to landholders. Weed control along the creekline will include cracked willow control on Manandawara through a licensed contractor stem injecting herbicide into the trunks of the cracked willows. The dead willows will be left standing to help stabilise the creekbank and prevent erosion.

## **A bright future**

The Bennetts have planted hundreds of trees on their property and now run 530 head of merinos and a few lambs. Jeff and Ngaire hope to further increase the stocking rate on Manandawara as they continue to improve the pasture and control serrated tussock.



## Replenishing the riparian zone and establishing hardwood forestry

Bonnie and Tony Walker have two properties in northern New South Wales where they are involved in different farm conservation activities. At Tuckombil the Walkers have a 20 hectare property with 3.5 hectares of avocados ('Niederweningen') and 6 hectares of macadamia nuts ('Iowa'). Barlows Creek flows through 500 metres of the property and eventually drains into Macquies Creek. Reducing runoff and establishing native vegetation along Barlows Creek has been their main priority. At 'Shannan' near Casino a hardwood plantation is preventing soil erosion and increasing biodiversity.

### Between land and water

The Walkers have had the Tuckombil property since 1988. Over time they have become increasingly aware of the important role of the riparian zone in decreasing erosion and improving water quality. The riparian zone is the area between the land and water, and often includes the riverbank and adjoining vegetated strip, which filters and traps sediment and nutrients. Bonnie and Tony have retained grass strips in their macadamia nut orchard to allow for nutrient wash to be filtered before entering the riparian zone. They have also taken part in the NSW Agriculture Irrigation Study, which has involved three probes being located in their avocado orchard providing information on when the trees require watering. The Walkers have used this information to reduce water use, leading to less surface water runoff and fewer disease problems.

The riparian zone along Barlows Creek on the Walker's property has become infested with problem weeds.

Bonnie and Tony Walker have two properties in northern NSW. At one they are restoring the riparian zone, reducing runoff and soil erosion problems while increasing biodiversity. At the other they are using land for a native hardwood plantation in conjunction with NSW State Forests.

The weeds include camphor laurel (*Cinnamomum camphora*), small leaf privet (*Ligustrum sinense*), large leaf privet (*Ligustrum lucidum*) and water primrose (*Ludwigia sp.*) which is a weed in water and on the land. These weeds have been competing with native plants for light, water and nutrients, so in 1996 Bonnie and Tony began removing weeds from the riparian zone. This has involved slow, time consuming work as the weeds are often intermingled with native plants and require control through use of bush regeneration techniques such as CSP (cut, scrape and paint) using a concentrated herbicide such as glyphosate.

Bonnie and Tony have spent more than 200 hours working in the riparian zone on their property in the past two years, which has opened up some areas allowing natural regeneration of native plants to occur.



### **Help from ENviTE**

The Walkers have also had some assistance from ENviTE (Environmental Training and Employment), which provides environmental project labour services on the Northern Rivers through use of a team of trainees (usually eight) and a supervisor. ENviTE has provided over 100 hours of weed control on Bonnie and Tony's property in the past year.

Some areas where natural regeneration has not been successful have been revegetated with locally endemic species. Bonnie and Tony have collected seed from remnant vegetation on their property and from an adjoining council laneway. These remnants contain a diversity of rainforest plants including trees, groundcovers and vines and some regionally significant plants such as arrow-head vine (*Tinospora tinosporoides*). The plants have been propagated in the local Landcare nursery and allowed to grow into six and eight inch pots before planting out. The Walkers are active members of the Tuckombil Landcare Group which is involved in creating wildlife corridors, managing soil degradation and rehabilitating riparian zones in the local area.

### **A five year plan**

Bonnie and Tony have managed to clear weeds from about 25% of the riparian zone on their property and have planted over 600 native plants. They are aiming to eventually have all of the creek rehabilitated and 30% of the property under native vegetation in about five years. Tony has completed a bush regeneration course at the local TAFE, which has provided additional knowledge and skills that will be used in the continued enhancement of Barlows Creek.

### **Working together for future returns**

Bonnie and Tony's 180 hectare property, Shannan, at Dyaaba Creek near Casino has recently been leased to NSW State Forests for 35 years in a joint project to grow hardwood timber. The agreement involves NSW State Forests owning the plantation and any associated products, such as carbon credits. The Walkers retain title of the land, are paid a yearly annuity and can use the area to graze cattle once the trees have reached a certain height (usually after about 2 years). The hardwood plantation on Shannan includes 75,000 spotted gum (*Corymbia variegata*) and 55,000 white gum (*Eucalyptus dunnii*) with trial plots of black butt (*Eucalyptus pilularis*) and Gympie messmate (*Eucalyptus obliqua*). NSW State Forests has prepared the site, planted the trees and will manage the plantation and market the trees. Farm conservation benefits of the planted forests such as the Walker's hardwood plantation include increased biodiversity and prevention of soil erosion.



Photo: Bonnie and Tony Walker at one of the riparian work sites on Barlows Creek



## Establishing tree lots in improved soil

Soil is composed of a mixture of mineral particles (sand, silt and clay), organic matter, water, air and living organisms. The combination of these elements creates different soil types. Each soil type has a different structure, nutrient level and water holding capacity, with some soils being more suitable for plant growth than others.

### Working with clay

Rowan and Kate Pearse's 2,025 hectare property 'Richmond', east of Moree, operates as a mixed farm and feedlot. The property has two basic soil types: fertile black river loam which is high in organic matter and is mostly used for cropping; and weathered red clay which is lower in nutrients and organic matter and is mostly used for grazing cattle.

During the early 1990s the Pearses noticed areas on Richmond where paddock trees were suffering from dieback. This alarmed Rowan and Kate who knew the value of native vegetation in providing shelter and shade for stock. Tests for salt and acidity produced no clear explanations. Rowan and Kate decided to revegetate several sites on the property to replace the dying paddock trees and create windbreaks that could act as wildlife corridors. Most of the areas selected for the tree lots were on the red soil. A technique was developed to improve the fertility of the soil through periodically dozing, ripping and applying gypsum for over three years. Working the soil increased the nutrient and organic matter levels, improved the soil structure and made the soil more suitable for plant growth.

When Rowan and Kate Pearse noticed dieback in the paddock trees on their farm they started from the ground up. By improving the red clay soil before planting woodlots they achieved a high success rate and created shade, windbreaks and wildlife corridors.



Photo: Improved soil on right of fence next to unimproved soil on left of fence on Richmond, Moree



Photo: Kate Pearse in a planted woodlot on Richmond

### **Landcare assistance**

In 1994 the Biniguy Boolooroo Landcare Group, of which Rowan and Kate are active members, received funding through the National Landcare Program for work over ten properties. This provided \$1,200 per kilometre towards fencing materials and trees for revegetation. In spring of 1994, the Pearses planted hundreds of tree seedlings into the improved soil on Richmond. They selected a range of tree species including wattles (*Acacia sp.*), she-oaks (*Casuarina sp.*), bottle brushes (*Callistemon sp.*) and box (*Eucalyptus sp.*) to create a semi-permeable windbreak and wildlife corridor. The seedlings were planted in mixed rows, 7 to 12 trees wide and covered with milk carton tree guards to provide initial protection from hares, rabbits and kangaroos. After heavy summer rain the trees had a survival rate of over 90%. A minor problem arose with a few plant species not being from the local Moree area and having the potential to become environmental weeds. Rowan and Kate plan to remove these individual trees in the future.

### **Success and failure**

Encouraged by this success, the Pearses began to prepare the soil in other areas on their property. In 1996 a second tree lot was planted with species from the local area. These trees were watered for the first six months due to dry conditions, resulting in a high survival rate. Regular maintenance of all tree lots has included in-row cultivation and spraying to slow competition for soil moisture and nutrients from weeds. In 1997 the Pearses organised the planting of a third tree lot using the same soil preparation technique that had been so successful in the previous plantings. A team of volunteers planted the third tree lot while the Pearses were away — unfortunately planting some of the trees incorrectly. Combined with an extreme drought, this planting resulted in a disappointingly low survival rate.

### **A wealth of woodlots**

The Pearses have improved areas of weather-damaged clay soil with low nutrient and organic matter levels to conditions where over 3.5 kilometres of trees have been planted and an impressive 2.5 kilometres of trees have survived. This initially involved high labour and time inputs in working the soil, planting and watering trees and weed control. The areas between the trees are now covered in native grasses — requiring virtually no maintenance. In times of drought these areas will withstand periodic grazing.



## Managing a rare remnant

Peter and Robyn Murphy run a 5,263 hectare mixed farm, 'Killaloe' at Gumble with sheep, cattle, canola and wheat. In 1999 the Murphys purchased an area of neighbouring land 'Woologolong' that contains a large remnant of grassy white box woodland. Grassy white box woodland is a significant plant community of white box (*Eucalyptus albens*), native grasses and wildflowers. It is usually found in patches along the lower western slopes of the Great Dividing Range in NSW and plays an important role in foraging, shelter and breeding of native animals. The area of grassy white box woodland on Woologolong is about 15 hectares of stony hill, which was infrequently used by stock for grazing. It was fenced on three sides and had never been improved with fertiliser.

### Taking action

Via the local media the Murphys heard about the Grassy Whitebox Woodlands — Take Action Now! Project and decided to apply for some funding to manage their remnant. The project assists land managers to protect and enhance grassy white box woodland remnants. It provides advice and funds for fencing of remnants (up to \$1,200 per km for materials) and weed control. Land managers cover any additional costs of materials and provide labour for management. Full control of the area is retained by the land managers.

Peter and Robyn's funding application was successful and in February 2000, a 450 metre fence was built to exclude stock from the grassy white box woodland remnant on Woologolong. The fence was built to include an area of creek line — allowing for future use of the area by stock if necessary. Two animal (native and domestic) exclusion zones were also fenced within the remnant to provide undisturbed scientific monitoring points for plant re-growth.

### An amazing mix

The area of grassy white box woodland on Woologolong has regenerated with an amazing mix of grasses and groundcovers. Over 70 species of native plants have been identified in the remnant, including yam daisies (*Microseris lanceolata*) — a threatened species. It has also been utilised by various birds and reptiles. The Murphys have had a few problems with large mobs of kangaroos congregating in the remnant which have had to be driven out.

### Managing weeds and fire hazards

In March 2001, the grassy white box woodland remnant was grazed with cattle for a short period to control non-native plant species such as phalaris and excess native vegetation posing a fire hazard. Peter and Robyn selected autumn to crash graze the remnant. This timing lessened the impact on the native plant regeneration process as seed would have set in spring and summer.

Peter and Robyn Murphy are using their stock to manage a grassy white box woodland remnant on their property at Gumble.

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