Grass Clippings

Native grasslands and grassy woodlands newsletter

September 2002 **Number 15**

Grass Clippings is an occasional newsletter to provide brief updates on initiatives and activities aimed at conserving and managing grassy ecosystems.
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What's new?

It has been some time since the last *Grass Clippings* came out, and to those of you who have inquired about its health and rumours of its demise, thank your for your concern. The length of time passed since edition 14 has meant that this one is rather bulky, so we're trying to keep reports brief. However there are some articles that were begging to be included.

There have been some changes. Helen Ryan, the Grassy Ecosystem Networker, has left the position at VNPA and gone to oversee the development of a Conservation Management Network in the Broken-Boosey Catchment. (see WWF/NHTgrants below.) Helen has been missed, but there's no doubt that she as gone to a worthwhile job. She has been replaced by Donna Smithyman, the erstwhile Donna Boyle of NRE's Geelong office.

Vanessa Craigie took a three month secondment to NRE Port Phillip office, but there were still grassland issues popping up there as well.

National and General Issues

WWF/NHT Grassy Ecosystems Grants - Third Round of Grants Announced

On 8 August 2002, it was announced that $471,498 had been allocated to fund 28 projects in SE Australia. There is also one high priority grassland project from Queensland which was included in this round. The projects will improve management and protection of around 4,700 hectares of grassy ecosystems through long-term management agreements, improved site planning and on-ground conservation activities, including 40 kilometres of fencing.

The largest single grant, for $76,240, supports the conservation and management of grassy ecosystems on the Victorian Lowland Plains. A $59,850 grant supports the development of the Broken Boosey Creeks Conservation Management Network to encourage land managers, state agencies and local governments to work together to protect and manage threatened vegetation communities. Two other small grants in the Murray region will provide $4,950 for the West Boort Landcare Group, to protect species rich grasslands in two reserves, and to restore connectivity between the reserves via roadside corridors, and $2,900 for the Lake Charm Landcare Group to restore severely depleted grasslands in the area as well as threatened plant species including Hairy Goodenia (*Goodenia lunata*) and Bush Minuria (*Minuria cunninghamii*).

For more information, see the Environment Australia website at www.nht.gov.au/projects/grassy or the WWF site at www.wwf.org.au

Third round projects:

State	Title	Funding
NSW	Murray ROC Roadside Vegetation Management- Grassy Ecosystems	39,400
NSW	Tarengo Leek Orchid, Captain's Flat Cemetery	251
NSW	Grassy Ecosystem Regeneration Incentive Trial and Research	5,000
NSW	Conservation Management and Protection of Aberdeen Common Grassy Woodland	5,000
NSW	Bega Valley Endangered Ecological Community Joint Management Agreements	11,500
NSW	Management for Conservation of Biodiversity in the Grassland Communities of the Moree Plains	25,645
NSW		**86,796**
SA	Management of Ecologically Significant Grassy Reserves Hatherleigh and Southend	3,000
SA	Tatiara Grassy Reserve Protection Project	5,250
SA	Conservation of Grassy Ecosystem Reserve in the Upper South East of SA	21,540
SA	Developing Appropriate Management Methods for Willison Road Grassy Woodland	3,875
SA	Conservation of Grassy Ecosystems of the Mount Lofty Ranges Eastern Flanks	38,100

SA	Burra Mine Site National Trust Native Grasslands Project	7,942
SA	Conservation of Grassy Ecosystems in the Beetaloo Catchment	25,650
SA	Kanmantoo Allocasuarina Woodland & Themeda Grassland Protection	10,000
SA		**115,357**
Tas	Grassy Woodland Restoration in Launceston's Bushland Reserves	7,700
Tas	Evaluation of Management Practices of Native Grasslands, incorporating improved/ sustainable management of remnant Grasslands Containing Populations of Threatened Species	20,800
Tas		**28,500**
Vic	Grassy Conservers 3	76,240
Vic	Bochara Station Ground	770
Vic	West Boort Grassy Reserves and Roads	4,950
Vic	Preservation and Protection of Lake Charm Landcare Grassland Site	2,900
Vic	Best practice management of Wimmera Buloke Grassy Woodland Remnants	17,800
Vic	Conserving Gippsland Grasslands through Community Alliance	6,266
Vic	Gorgeous Groundsels and Wonderful Wrinkleworts at the Bannockburn Cemetery	3,960
Vic	Native Grassland Conservation of Private Property	14,500
Vic	Protecting Native Grasslands within Ararat Rural City	19,609
Vic	The Gippsland Plains Conservation Management Network. Adaptive Management and Training	37,200
Vic	Managing the Broken-Boosey Creeks Conservation Management Network	59,850
Vic		**244,055**
Qld *	Cambooya Regional Ecosystem Reserve- grassland	7,600
Qld		**7,600**
National Total #		**482,298**

* While Queensland is not usually included in the Grassy Ecosystem Grants Program, this project was included in this round due to its high conservation value.

The final amount approved for 2001/2002 is $482,298 - $10,800 = **$471,498**. $10,800 was returned to WWF as a result of a cancelled project from a previous financial year.

The Federal Government press release that announced the awarding of these grants painted a glowing picture of the Program and its achievements. Now the latest word from Canberra is that WWF's application for further funding for another round of the Grassy Ecosystem Grants Program has been refused. Any further grants are now in the hands of NHT2.

Websites

The **Grassy Ecosystems Network Website** can be accessed through the Environment Australia website at:
www.ea.gov.au/land/bushcare/contacts/grassnet.html

On the website you'll find all the back editions of *Grass Clippings*, a variety of articles and reports relevant to grassy ecosystems and detail about the network.

Also don't forget about the **GrassEcol** email discussion group. To subscribe simply send the following message to this address: *majordomo@life.csu.edu.au*

subscribe GrassEcol <your email address>
end

If you have any trouble contact Ian Lunt at ilunt@csu.edu.au

Nature Foundation SA National Forum 2002.
Partnerships and Planning: Nature Conservation on Private Land conference, Adelaide 12-15 August 2002.
Proceedings of this conference (papers, abstracts, presentations) are available on the Net at:
www.naturefoundationsa.asn.au.

NEW!

Managing Native Grasslands Booklet

David Eddy, WWF Australia, has produced a 20-page A4 full colour booklet on managing native grasslands. It's free, and available via the WWF website, www.wwf.org.au, or email David at deddy@wwf.org.au.

NSW & ACT Southern Tablelands Natural temperate grasslands

The Commonwealth has listed the **Natural Temperate Grasslands of the Southern Tablelands of NSW and ACT** as an Endangered Ecological Community (EEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). A Recovery Plan is being prepared.

Definition
Grasslands of the Southern Tablelands were formerly widespread in the tablelands. They are now highly fragmented. The Southern Tablelands are defined as the region that encompasses the lowland parts of the ACT and the following Local Government Areas: Crookwell, Mulwaree, Goulburn, Gunning, Yass, Yarrowlumla, Tallaganda, Snowy River, Cooma-Monaro and Bombala.

Samples of this community are generally found on the cold, poorly drained low-lying country of the tablelands, or on rolling basalt downs of the Monaro.

These grasslands provide habitat for a wide range of fauna and flora species, many of which are also listed as threatened. Very good samples of the community are found on travelling stock reserves, cemeteries, crown reserves and road easements. Some excellent examples have also been retained under various management regimes on private land holdings.

Some of the recovery actions that have been undertaken are:

1. Identification, mapping and vegetation surveys in remnant sites
2. Establishment of grassland reserves
3. Implementation of protection mechanisms
4. Establishment of long-term monitoring sites

5. Preliminary studies of the impacts of burning and other management regimes
6. Provision of advice to landholders
7. Extension activities including field days workshops, seminars, site visits
8. Production of a Grassland Flora guide
9. Input into catchment management boards.

A Conservation Management Network that will assist property owners to conserve samples of grasslands and grassy woodlands on private lands is being set up. It is expected that the existing incentive programs (with funding for fencing, etc) will continue to help conserve this Endangered Ecological Community.

For more information, please contact Rainer Rehwinkel, NPWS Queanbeyan, ph. (02) 6298 9745 email rainer.rehwinkel@npws.nsw.gov.au.

What does listing under the EPBC Act mean?

The purpose of listing a community under the EPBC Act is to help prevent its further decline and, ultimately, to assist community efforts toward the recovery of the community.

One of the results of this listing is that farming activities and developments that are likely to have a significant impact on the listed community will need to be assessed and approved by the Commonwealth Minister for the Environment.

For Farming Activities?

Examples of farming activities that will be regarded as enlargement, expansion or intensification of use and therefore may require referral under the EPBC Act include:

- Clearing or ploughing the listed ecological community for the purposes of cropping; and
- Conversion of the listed community to improved pastures, agroforestry or other tree planting activities

Importantly, a listing triggers the ability to prepare a recovery plan that will set guidelines for its protection. A recovery team, made up of experts and community representatives prepares the recovery plan. The Recovery Plan lists actions identified that have been undertaken or need to be undertaken for the long-term protection of the community.

What's on in the States?

Victorian Major Rail Projects

Linear reserves (i.e. roads, rail reserves, travelling stock routes) contain some of the best and most diverse remnants of grassland flora. In Victoria, their history of regular and frequent burning has meant that they are refugia for many highly threatened grassland species. For the last three years, NRE has been undertaking surveys along all Victorian rail reserves, to update information on biodiversity values. Almost all rail reserves (with the exception of some of the north-eastern lines) have been surveyed and a list of "Sites containing threatened species and significant native vegetation on Victorian Railway Lines" has been compiled by NRE.

There are a number of major projects that are about to commence or are planned on Victorian rail lines. Over the next year, will works will commence on:

- Regional Fast Rail Project - upgrading lines from Melbourne to Bendigo, to Ballarat, to Traralgon, and to Geelong Fibre optic cabling works are part of this project and are due to start before the end of 2002. All sites of National and State significance on the rail reserves are due to be fenced prior to works.
- Converting broad gauge lines to standard gauge - Geelong-Ballarat, Ballarat-Mildura, and Ouyen-SA border. Works are due to start early next year.
- Re-opening or upgrading lines for passenger traffic between Melbourne and Mildura, Cranbourne-Leongatha, Traralgon-Bairnsdale, Maryborough-Ararat.

Inside the next three years, works are planned to commence on converting many broad gauge lines in the north west and north-east to standard gauge.

These works, and the associated cabling and siding construction, have the potential to severely impact on a range of national and state threatened species and communities.

NRE is continuing to survey sites, and enter all information onto the NRE Biosites database. NRE is negotiating with Dept of Infrastructure and assorted rail operators and contractors to minimise impacts to threatened species, to remnants of grassland communities, and to other areas of non-threatened but protected native vegetation, via Flora and Fauna Guarantee permits, works conditions and on-site meetings. Current EPBC referrals for the rail works have given undertakings that no Nationally Significant site will be touched.

Land purchases and new Victorian reserves

Six blocks of private land were purchased by the State government in 2001 and added to the Parks Victoria reserve system. these blocks are in the north east, Gippsland, central north and far west.

Balmattum Conservation Reserve is 221 ha of Plains Grassy Woodland and Plains Grassy Woodland/ Gilgai Wetland Mosaic between Euroa and Violet Town in the Riverina bioregion.
The property is known habitat for the Grey-crowned Babbler (*Burhinus grallarius*) and Bush Stone-curlews (*Pomatostomus temporalis*), both endangered species in Victoria. Nearly 100 indigenous plant species occur on the reserve and the adjoining roadside. The reserve supports the nationally endangered Fragrant Leek-orchid (*Prasophyllum suaveolens*), as well as two species of State conservation significance (Swamp Billy-button *Craspedia paludicola* and Buloke *Allocasuarina luehannii*). The site is unique because it is at the eastern edge of the Riverina and contains temperate species not found in existing Riverina reserves.

Terrick Terrick East Grassland Reserve is located north of Mitiamo, in the Riverina bioregion. The 214

ha of Northern Plains Grassland contains populations of nationally significant flora: the vulnerable Chariot Wheels (*Maireana cheelii*) and Slender Darling-pea (*Swainsona murrayana*), as well as number of species of State and regional significance. It is one of the most important sites for the nationally vulnerable Plains-wanderer (*Pedionomus torquatus*) in the Victorian Riverina and also provides habitat for the Brolga (*Grus rubicunda*). The grassland is near the largest single area of native grassland on the northern plains within the Terrick Terrick National Park.

Bendoc Grassland and Grassy Woodland is located near Bendoc, in east Gippsland. The particular Montane Grassland and Grassy Woodland community found on this site, in the State's far east, is not conserved or even mapped anywhere else in Victoria. The floristics, geology and altitude of the grassland are significantly different from other montane grasslands and grassy woodlands recorded in Victoria. It is one of the most intact examples of Monaro Plains grassland in Australia, which were once widespread across the Monaro Tablelands of New South Wales to the north.
The 233 ha site supports over 110 native plant species, including the threatened Hairy Anchor-plant (*Discaria pubescens*) and Number Nine Wire-grass (*Aristida calycina* var. *calycina*).

Green Hills Grassland is located at Gillingall, north of Buchan, in the South East Corner bioregion. This 97 ha reserve protects one of the last and largest remaining stands of native Montane Grassland within East Gippsland. Over 100 indigenous flora species have been recorded on the property, including largest population in Australia of the nationally vulnerable Austral Toad-flax (*Thesium australe*), a species which is semi-parasitic on Kangaroo Grass. Two additional species of national significance are the Hairy Anchor Plant (*Discaria pubescens*) (rare) and the Slaty Leek-orchid (*Prasophyllum frenchii*) (vulnerable).

Burrah Burrah Grassy Woodland is located at Bornes Hill, north of Dunkeld, in the Victorian Midlands bioregion. the 69 ha reserve has been added to the Grampians National Park, which bordered it on three sides. It contains a large number of 69 ha of vegetation types, including part of the only known site of the Alluvial Terraces Herb-rich Woodland/Claypan Ephemeral Wetland Mosaic in the State. It is known habitat for the State endangered Great Egret (*Egretta alba*) and the threatened Brolga (*Grus rubicunda*).

Parrie Yalloak Grassy Woodland lies on the eastern side of the Grampians National Park. The 128 ha property comprises mainly Plains Sedgy Woodland and considered one of the highest quality areas of this woodland in the western Victorian Midlands.

Cooma grassland reserve opened

A grassland reserve was opened on the outskirts of Cooma, NSW. The reserve was established by FOG with Threatened Species Network funding with other sources of funding being NHT (through WWF Australia's grassland conservation project in the region), DLWC (through state regional funds) and Cooma-Monaro Shire (weed control funds).

The reserve has been fenced, sign posted, much woody weed control undertaken (Hawthorn and Sweet Briar) and a colour information flyer produced. The reserve is the first (and flagship) site established as a member of the fledgling Monaro Grassland Conservation Management Network. FOG's input with management of the reserve continues in conjunction with the Council.

Contact David Eddy Monaro Remnant Native Grasslands Project phone 02 6257 4010, email deddy@wwf.org.au for more information.

Tasmanian Roadside Vegetation Management System

Greening Australia Tasmania has developed an integrated set of field markers, field guides, standard specifications and mapping database being developed to assist road managers in Tasmania to protect the full range of vegetation values found on roadsides.

The system can be used to identify and protect conservation values such as threatened species and habitats and also broader natural resource management values such as weeds, windbreaks, genetic resources for revegetation and revegetation areas. It is envisaged that the road owner decides, with its constituents, the range of values it will protect.

Field markers are placed on roadsides to alert road workers to the different management practices that are best for each area of vegetation. Field guides provide a brief, portable quick reference guide to the management practices coded on the markers via pictures and colours. The detail of the management practices is contained in standard specifications.

Spatial information on the location of the markers and the associated management practices is stored in the mapping database. This database can be used to collect and display information. It is designed so that a worker can produce a schematic map for just the section of road they will work on and particular activity they will be performing. For example, an operator can access for one road, or a section of one road, just the information about how slashing is to be conducted.

The whole system is management activity based rather than "natural resource type" based for easy use by road workers with no natural resource management training. It has also been designed so that it is easily used by all of the organizations working in road corridors. This includes organizations and contractors who work across many different regions. It is envisaged that the system will be adopted Statewide.

For more information contact Alister Clark email alisterc@tas.greeningaustralia.org.au, phone 03 6223 6377.

The Eastern Hills Grassy Ecosystems - Mount Lofty Ranges South Australia

The Eastern Hills Grassy Ecosystems Project (EHGEP) began in July 2001. Managed by the Nature Conservation Society of SA and funded through the WWF/NHT Community Grassy Ecosystem grants, it focuses on the eastern flanks of the Mount Lofty Ranges. The aims are to increase awareness and improve the management of woodlands and grasslands in this fascinating region.

The region was once dominated by grassy ecosystems ranging from red gum to *Eucalyptus odorata/porosa* woodlands and *Lomandra effusa* grasslands in the drier eastern side of the ranges. Much of the area is now developed in one form or another, with grazing being the dominant land use. High quality remnants are few and far between. However from our experience so far, it is clear that there are substantial areas of native pastures. A change to more sympathetic management practices will have very positive results on both the health of the native biodiversity and in moving the farming systems towards a higher level of ecological sustainability.

Interest in the project has been strong particularly amongst the newer landholders in the region. There are many people out there who are strongly committed to restoring the natural ecology and biodiversity of the land. In quite a few cases people have bought the land with the sole intent of returning it to something like what it was in the past. Quiet a few of these landholders are keen to pursue an adaptive management approach in association with the Eastern Hills Grassy Ecosystems Project, trialing different management regimes on their properties in an attempt to identify the most successful strategies for the future.

The EHGEP has had substantial support from various land management organisations in the region, including the Mount Lofty Ranges Catchment Program, the Local Area Planning Program and very importantly from the South Australian Farmers Federation (SAFF). A partnership group has been formed to provide a medium for cross agency communication, lobby power and integrated management.

The involvement of the Farmers Federation is very welcome: approximately 85% of farmers in SA are members. SAFF has not traditionally focussed on native grassy ecosystems and their new involvement is a welcome relief to the drought of interest in this significant issue. SAFF and this project are intent on encouraging the Department of Primary Industries to commit more staff time to this issue; at present there is only one officer advising the farming community on the management of this important natural resource in the Southern Agricultural Region.

In its initial stages the project is focussing on awareness raising and has run a number of well attended workshops in the project region. We have tried at all times to keep the attention on the broad biodiversity issues, considering the whole picture of animals and habitat, not just the plants. However there has been great interest in basic identification of grassland plants, with a very low level of awareness of even the very common native grasses in farming pastures.

In a recent initiative we have been looking at the vegetation corridor along the Adelaide to Melbourne railway line. A number of significant remnants have been identified. In association with the Buffers for Biodiversity the project is looking at assisting the landholders along the railroad to protect a significant corridor of grassy ecosystems. What gives this project such potential is the condition of the adjoining grazing properties where the management regime has been sympathetic to the native vegetation.

For more information contact Tim Read, Phone (08) 8391 2510 or email grassyml@ncssa.asn.au

South Australia's Upper South East Grassy Ecosystem Conservation

All readers are no doubt familiar with the plight that faces grassy ecosystems. The South East region of South Australia is no different. The Biodiversity Plan identified that there are six threatened grassy communities in the region.

Kerry Gilkes has recently started as the project officer for the conservation of grassy ecosystems in the upper South East of South Australia. This project is funded through the NHT/WWF grassy ecosystems grants and administered by the Nature Conservation Society of S.A.

The main focus of the project is to improve the understanding of the importance and management of native grassy ecosystems. The project involves starting from the ground up, very few people are aware of native grasses and grassy ecosystems, let alone their importance.

Work to date has focused on conducting workshops and discussions with landholders on basic identification and best practice management.

The first workshop run in 2001 was highly successful. A group of over 30 people went on a field tour to identify native orchids and learn more about grassy ecosystems. More recently, a native grass identification workshop with Ann Prescott, a well known botanist, was recently booked out but another is planned for November.

The District Council of Tatiara, one of the two district Councils in the area that Kerry works, are participating keenly in the project. The Council owns a number of grassy woodland reserves, and Kerry is helping to develop management plans for these areas. Council workers attended basic native grass identification workshops in 2001 with a follow up workshop again this year.

Local Councils are beginning to realise just how important these remnant areas are. The Council owned Commons that surround a number of towns in the Tatiara Council area are grassy woodlands, and form habitat for a number of threatened species, including the locally endangered bush-stone curlew.

Kerry hopes that the increased knowledge of the importance of grassy ecosystems will lead to more areas being managed appropriately.

"We are just beginning to realise that the management of these critical remnants is more than simply putting up a fence around the area. Helping landholders to understand simple management principles is critical to the long term survival of our grassy remnants."

Kerry can be contacted on bull@seol.net.au or phone 08 8766 0027.

Management, research and new ideas

Growing Healthy Wool on Healthy Pastures

Land and Water Australia (LAWA) and Australian Wool Innovations (AWI) have given the Department of Primary Industry, Water and Environment (DPIWE) and the University of Tasmania a grant to investigate the management of native vegetation in regions used for growing wool. This project will run for five years with the aim of determining the best management practices for land management, wool production/quality and conservation.

The project has 2 main components:

1) *Integrating biodiversity conservation into sustainable grazing systems*.
2) *Valuing riparian (streambank) vegetation as a part of sustainable grazing systems*.

Please contact Louise Gilfedder, Michael Askey-Doran (DPIWE) 62 338011 or Jamie Kirkpatrick (UTAS) Ph 62 262463 for more details on the project.

Native grass as an interow 'cover crop'

From Grass Notes Number 7 (Native Grass Resources Group)

Prue Henschke and Leon Holmes, from Barossa and Mt Pleasant in South Australia have been trialing *Danthonia* (Wallaby Grass) interow in their vineyards. They have found the *Danthonia* remains as a short green tussock during winter and the seed heads emerge in Sept/Oct ripen throughout summer and can be harvested then slashed to create a straw mulch. This mulch helped retain soil moisture over the hot months of January and February.

The *Danthonia* has proved to be quite easily to establish and matures to a healthy sward within 18 months. The harvested seeds are scattered over chemically farrowed and control burnt, lightly raked soil in July/August then left. With positive results to date, the Holmes have employed contractors to direct seed a larger proportion of their vineyard.

Other native grasses *Aristida* (Brush wire grass), and *Chloris* (Windmill grass) are also being tried. These are 'C4' grasses and have the advantage of being Round-Up resistant, which is useful for the control of winter weeds.

Effects of Fire on some native plants and communities

Two myths about fire and native plants seem to have emerged recently:

- Native plants are resistant (or "adapted") to fire.
- Occasional burning is "good" for native grasslands (and grassy understories) as it opens up the stands and gives smaller plants, e.g. orchids and lilies, a chance.

We have called them "myths" because the generalisations lack supporting experimental evidence. They may, of course, be true in some instances. But a review of all the scientific literature on the effects of fire on native plants (and there is a lot of it) is not proposed here. We merely want to record a few of our experiences with experimental burns over the last ten or so years.

Sifton bush (*Cassinia arcuata*).
Plants were killed by moderately hot fires (in spring 1989, autumn 1990 and spring 1990) that lingered around the base of the plant. However, these fires are also likely to stimulate regeneration from seed, particularly on low fertility sites where competition from other plants is low.

Red grass (*Bothriochloa macra*)
A cool burn (there was little fuel) in mid September 1991 *appeared* to cause little damage but resulted in synchronous ripening of seedheads the following summer.

Warrego grass (*Paspalidium jubiflorum*)
Plots burnt in early spring (1994 or 1995) had similar numbers of Warrego grass plants to unburnt plots when measured the following autumn. Whether individual plants survived the fire, or died and were replaced by new seedlings, was not determined.

Kangaroo grass (*Themeda triandra*)
Themeda plants in plots burnt in late May 2000 had fewer seeding culms and *apparently* lower density the following summer than did those in unburnt plots. There were more exotic herb species ("weeds") in the burnt plots than in the control plots. Similar results were reported by McDougall (1989).

Tussocky poa *(Poa sieberiana)*
A burn in mid April 2000 *apparently* had no effect on the density, health or seeding in the following spring/summer. However, there were marginally more exotic herb species in the burnt plots than in the control plots.

Red-anthered wallaby grass (*Chionochloa [Joycea] pallida*) and others
Approximately 40 red-anthered wallaby grass plants were tagged prior to a relatively hot management burn in April 1999. Other plants growing near the grasses were also tagged and monitored after the fire. As some tagged plants were not burnt, there were some standards ("controls") against which the effects of burning could be compared. Results are presented below.

Although none of the wallaby grass plants was killed by the fire, none seeded in spring/summer 1999 and their growth was subdued compared to the unburnt plants, which did seed. As was expected, all burnt sifton bushes died but large numbers of new seedlings were present a year later. Other

noteworthy effects of the fire were: (1) the regeneration of all glycine plants and (2) the lack of regeneration of strangle-vine, a species which can often be seen "smothering" plants, even trees, on low fertility sites.

Some of these results may be at variance to what others have observed. Possible reasons for this include:

- All of the results reported above were from sites where domestic livestock were excluded.
- All burns were carried out in autumn and/or spring and outside the official fire-danger period. And, of course, fire intensities varied from site to site and season to season.
- Seasonal conditions following the burns were variable; no season is exactly the same as another.
- Most of the experimental sites were located on the upper (c.500 m A.S.L.) inland slopes of NSW.
- Ecotypic variation within species, e.g. Warrego grass of the slopes is quite different to the one on the inland plains.

Clearly, it's very important to record the conditions under which observations of native plant behaviour are made. It's then up to scientists to peel away the various layers contributing to variability so that at some time in the future, predictions can be made with more confidence.

P.S. the "fine print" attached to some of the observations reported above can be found in:

McDougall, K.L. (1989). The re-establishment of *Themeda triandra* (Kangaroo Grass): implications for the restoration of grassland. *Arthur Rylah Inst. for Env. Research Tech. Rep. Series No.* **89***.*

Semple, W.S. and Koen, T.B. (1993). Some effects of fire on the survival of sifton bush (*Cassinia arcuata* R. Br.). *Rangeland J.* 15(2), 320-30.

Semple, W.S. & Koen, T.B. (2000). Increasing the frequency of *Paspalidium* in natural pastures of Central Western NSW. *Proceedings of the First Stipa Native Grasses Association Conference, 16-17 March 2000, Mudgee, NSW.*

Semple, W.S, Koen, T.B. & Waterhouse, D. (1997). Consequences of some one-off events and exclosure on a red grass (*Bothriochloa macra*) – wallaby grass (*Danthonia eriantha*) pasture in the Central West of NSW. *Rangeland J.* 19(2), 206-15.

For more information contact Bill Semple bsemple@dlwc.nsw.gov.au, or Ian Cole at the NSW Dept. of Land and Water Resources.

Table 1: Effects of an April 1999 fire on tagged plants at Mudgee, NSW. Survival as at March 2000 (Semple and Cluff, unpublished data)

Species	**Survival of burnt plants (n = no. of plants burnt)**	**Survival of unburnt plants (n = no. of unburnt plants)**
Red-anthered wallaby grass (*Chionochloa pallida*)	100% but none flowered in 1999 (n = 33)	100% and all flowered in 1999 (n = 5)
Sifton bush (*Cassinia arcuata)*	0% (n = 9) but many new seedlings were evident	80% (n = 5)
Blackthorn (*Bursaria spinosa)*	100% re-sprouted from base (n = 5)	100% (n = 1)
Ausfeld's Wattle (*Acacia ausfeldii*)	33% re-sprouted from base (n = 3)	100% (n = 1)
Strangle-vine (*Cassytha* sp.)	0% (n = 3)	100% (n = 2)
Glycine (*Glycine* sp.)	100% (n = 4)	100% (n = 1)

Remember way back to *Grass Clippings* No. 13 (if not, it will be on the Grassy Ecosystem website, see front cover for address). This article is the final installment of the series by Christine Jones Rangelands Officer, DLWC, PO Box 199a, Armidale, NSW, 2350. cjones@dlwc.nsw.gov.au

THE GREAT SALINITY DEBATE: PART III

Soil organic matter: past lessons for future learning

Getting the basics right

In Parts I and II of this series, the issues of groundcover and its management were examined in a historical context. For Part III, the role of soil organic matter and the types of disturbance regimes required to enhance it, will also be placed in a historical perspective. It is important to understand where we've been in order to find a way forward.

The productivity and health of agricultural land depends on i) inherent landscape capability ii) long and short term seasonal effects iii) soil condition and iv) land management practices. The first two factors are beyond our control, the latter two are of fundamental significance for the future of rural Australia.

Have you noticed that we spend an inordinate amount of time and energy mapping landscapes and trying to predict the weather, all the while just "hoping" that soil health and land management skills will somehow find their own way? Land of even the highest productive potential can deteriorate rapidly under inappropriate management. Conversely, the health of degraded landscapes can improve markedly under regenerative management.

Processes such as dryland salinity, soil structural decline, nutrient decline, erosion, sedimentation and

the eutrophication of waterways, all derive from inappropriate disturbance regimes which reduce the quality of perennial groundcover and, as a consequence, the levels of organic matter in and on the soil.

Intermittent disturbance regimes

In ecological terms, a "disturbance" is something which affects the growth or reproduction, or rearranges the order, of the components of an ecosystem. For example, mowing your lawn, spraying herbicide, using fertiliser or pulling out weeds are disturbances. Australian native grasslands cannot tolerate unremitting disturbance regimes, such as continuous grazing, or broadacre cultivation. Nor do they thrive when there is no disturbance at all. For maximum health and productivity, an intermittent disturbance regime is essential. Intermediate levels of disturbance also foster high levels of biodiversity, which give plant and animal communities the necessary resilience to cope with natural disturbances such as drought and fire.

Following the extinction of our megafauna thousands of years ago, the functioning of Australian landscapes became dependent on the interactions between the environment, aboriginal people and small native animals. The dietary requirements of native fauna such as dunnarts, planigales, potoroos, bandicoots, echidnas and bettongs included (depending on the species), grasshoppers, beetles, cockroaches, spiders, termites, ants, larvae, worms, small invertebrates, tubers, seeds, berries, herbs, roots, resin and fungi. The activities of these insectivorous/carnivorous/omnivorous animals were essential to maintaining the health of grassy woodland ecosystems, particularly soils.

Of particular importance to an understanding of soil health, is to recognise that at the time of European settlement, there were many thousands, indeed millions, of mouse-sized to rabbit-sized, nocturnal, ground foraging mammals, which turned the soil over while searching for a wide variety of foods including insects and fungi. These animals were not grazers. Aboriginal people also dug the soil in small patches to obtain yam daisy (*Microseris lanceolata*) and other tubers. Although the patch disturbances created by native animals and aboriginal people accounted for only a small percentage of the landscape in any one year, over longer time scales virtually all of the soil would have been turned over, providing an uneven surface and incorporating organic matter. Our environment was skillfully "managed" for sustainable production in keeping with the overriding influences of long and short term seasonal effects.

The loss of protective grassland habitat which accompanied the introduction of broadscale, unremitting grazing regimes, resulted in the rapid demise of ground foraging mammals. Their removal from the ecosystem, coupled with eradication programs for dingoes (an essential predator) and grazers such as wallabies and wombats (considered to compete with livestock), created a void into which the rabbit population exploded. This voracious, rapidly breeding herbivore completely devastated what remained of native groundcover and the associated organic matter in many areas of southern Australia.

Over time, other grazers such as kangaroos (previously present in much lower numbers) and introduced predators such as cats and foxes (which occupied the niche of the displaced dingo), added further pressure to an ecosystem on its knees. In the absence of rejuvenating disturbance regimes, Australian soils, already reduced to a relatively inert, compacted state, suffered their final humiliation - broadacre cultivation. The organic matter content of most soils is now so low, and the previous levels so long forgotten, that the fundamental importance of organic matter to ecosystem function, including water balance, is rarely considered.

Soil organic matter - the missing link

When areas were first explored, or newly settled by Europeans, soils were variously described as mulched, peaty, soft, loose, friable and high in humus, even in relatively low rainfall areas. The spongy nature of the soil was frequently lamented. Horses stumbled in the soft conditions and sometimes broke their legs, drays were difficult to pull overland, and much of the rainfall sank straight into the soil to replenish waterways as basal flow, rather than immediately running off to refill the waterholes and creeks being over-utilised by stock.

However, these conditions changed rapidly. There were highly significant increases in sedimentation rates in lakes and lagoons at the time each area was first settled. During these periods of extremely rapid erosion, huge quantities of friable topsoil were lost. These events coincided with the removal of protective groundcover under the inappropriate grazing regimes used for domestic livestock. Prior to settlement, the groundcover was not heavily grazed over wide areas.

Somehow the details of these catastrophic events have become blurred by time. Perhaps the writings from the early settlement period should be compulsory reading? For example, in 1818, John Oxley described the grasslands of the treeless Liverpool Plains as being "of the richest description". In 1842, Leichhardt recorded the constituents of the soils as chiefly "clay and humus" and noted the obvious indications of many small native animals. Now the plains could best be described as "a mosaic of annual monocultures and bare fallows on poorly structured soils, high in clay, low in organic matter and devoid of most living things". The richness of the vegetation, the diversity of the animal life and the high humus content of the soil are factors long since forgotten.

Many of the wells sunk in the Liverpool Plains in the mid 1800s contained brackish water. The saline watertables in those areas today have not come from somewhere else they have simply risen through inappropriate groundcover management. They will continue to rise unless the basic principles of land management are addressed.

Although the Liverpool Plains are about to detach themselves from the rest of Australia and float away on their own saline sea, their problems are by no

means unique. The only factors which differentiate them from other salinity affected parts of the continent are soil type and the seasonality of rainfall, neither of which we can do anything about. However, we can change land management to increase the organic matter content, and hence the water holding capacity, of our soils. Humic materials have a far greater affinity for water than do clay colloids, which in turn have a greater affinity for water than coarse textured materials such as sand. There is no need to despair if you only have sand. You just need more humus!!

Today, most of our agricultural soils are compacted, hard-setting and lifeless. Many contain 2% or less organic carbon, much of which is the non-labile remnant of thousands of years of aboriginal burning, and as such is of no significance as a soil ameliorant. Yet time and again we hear that the organic matter content of soil is not as important as its "nutrient status" (which can apparently be corrected with the addition of fertiliser) and that soil water holding capacity is not as important as "high water use" (which can apparently be obtained by planting trees and introduced grasses). Our ecosystem is a little more complex than that. Were tonnes of fertiliser being applied prior to settlement? Was the landscape vegetated by high water use plants? No and No. So how can those factors restore the balance now?

Have we fallen into the trap of window-dressing a deteriorating landscape because we don't know what else to do? The addition of either fertilisers or high water use plants will do little to bring about the fundamental changes required. Nor will such simplistic solutions revitalise rural communities. **Our current problem is that rain does not properly infiltrate where it falls, nor is it properly held in soil.** On sloping land, the water moves across the soil surface, taking nutrients and fine soil particles with it, and becomes a watertable and sediment problem somewhere else. In flatter parts of the landscape, low levels of organic matter in soils result in far more water being lost to evaporation and deep drainage than is put to productive use.

In comparison to an equivalent area of trees, a healthy perennial grassland will have a greater distribution of roots at depth, higher levels of soil organic matter, higher levels of microbial biomass and greater soil water holding capacity. The reason for these facts not being widely known can only be that their importance has not been appreciated. Because humic materials are continually being generated by the decomposition of grass roots, grasslands regenerate soils far more quickly than do forests, especially if the grasses are pulse grazed (see Part I).

The emphasis to date in salinity research has been on de-watering soils rather than on controlling the movement of water in the landscape. Water is an extremely precious commodity and one which we need to use effectively to improve the productivity of our natural resource base. We lose production **and** we create a problem when water is not held where it falls.

Putting it all together

The Australian landscape is more resilient than we imagine, and finding a way forward may not be as hard as it seems. The two essential ingredients for healthy, porous, high water holding capacity soils are:-

i) as close as possible to **permanent soil cover** (plants plus associated litter) to provide protected habitat for soil biota, invertebrates and small vertebrates

ii) an intermittent disturbance regime to both **stimulate** biological activity and provide periods of **rest and recovery.**

Provided these criteria are met, the enterprise choices and the plant species used are secondary considerations, although as outlined in Parts I and II, there are many good reasons for choosing native over introduced, or a combination of the two.

With creative thinking, innovative landholders are finding ways to implement the basic principles of high levels of soil cover and intermittent disturbance regimes into their day to day activities. Some of these are summarised and compared to more conventional approaches in Table 1. There could be limitless combinations and variations on these themes. For example, pulse grazed native groundcover can form a productive base for a variety of cropping, horticultural and silvicultural enterprises. The adoption of these practices does not necessarily require all landholders to be graziers. In the United States, there are full-time businesses based on "renting" livestock for these purposes. Too hard? Take a tour through some salt affected land and think again!

Simplistic solutions

In Part I of this series the tendency for high water use plants to exacerbate dryland salinity by drawing up fresh water and bringing salt-laden water closer to the soil surface was noted. In addition to bringing salt closer to the surface, high water use plants can also over-dry soils. Rain simply runs off dry, poorly mulched soils, or enters deep cracks and passes through to the groundwater without properly re-wetting the topsoil. It is therefore important to recognise that we don't have to increase transpiration rates in order to reduce deep drainage. A better result can be achieved by increasing the water holding capacity of the soil. De-watering soils and restoring water balance are entirely different concepts, but appear to have become confused. Even more worrying is the notion that the apparently "incurable" nature of dryland salinity is justification to live with salt as best we can. However, if we simply try to live with the **symptoms** of an ecosystem out of balance, we will be de-watering saltier and saltier soils until even those options become untenable.

Conclusion

It is widely acknowledged that our vegetation, soils and water are seriously degraded and that this has happened extraordinarily quickly on a geological time scale. Our ecosystems are at the crossroads and the lights are red. Without the participation of rural

communities, the regeneration of Australia's natural resource base will be impossible. But even participation is not enough. Simply planting and/or retaining native perennial plants will not reverse salinisation or any other land degradation process. Much more is required. New attitudes, new ways of looking at the land. New ways of looking at ourselves, and how we interact with the land. We need a deeper understanding of how Australian landscapes functioned prior to European settlement. What were the component parts? How did they fit together? How can we stimulate soil forming processes today?

We don't need any more strategic plans. For most of the landscape, we can make fundamental change without drastically altering traditional enterprises. In some areas, more diversification would be of benefit, and in others more trees and shrubs would have enormous ecological advantages. But there will only be one "solution" to our water balance problems. That will be to support, encourage and reward the landholders who are devising flexible management options incorporating intermittent disturbance regimes to achieve healthy, diverse groundcover, and to increase the organic matter content in and on their soils.

Table 2. The extent to which land use addresses the fundamental requirements for a healthy balanced ecosystem.
OM = organic matter;
WHC = water holding capacity;
C3 grass = winter active e.g. common wheat grass [native], ryegrass [introduced];
C4 grass = summer active e.g. kangaroo grass [native], paspalum [introduced]
Key: - rarely; ☆ sometimes; ★ usually

Land Use	Protective soil cover	Intermittent disturbance	Increases soil OM	Increases soil WHC	Reduces runoff	Increases biodiversity	Chemical free	Summer water use	Winter water use
Conventional agricultural practices									
• Annual winter crop (cultivation)	-	-	-	-	-	-	-	-	★
• Annual summer crop (cultivation)	-	-	-	-	-	-	-	★	-
• Annual winter crop (zero till)	☆	-	☆	☆	☆	-	-	-	★
• Annual summer crop (zero till)	☆	-	☆	☆	☆	-	-	★	-
• **Set stocked annual pasture**	☆	-	☆	☆	☆	-	-	-	★
• Set stocked introduced C3 pasture	☆	-	☆	☆	☆	-	-	-	★
• Set stocked introduced C4 pasture	☆	-	☆	☆	☆	-	-	★	-
• Set stocked native C3/C4 pasture	☆	-	☆	☆	☆	☆	★	★	★
"Living with salt" options									
• Engineering works	-	-	-	-	-	-	★	-	-
• Saline aquaculture	-	-	-	-	-	-	☆	-	-
• Harvest salt	-	-	-	-	-	-	★	-	-
• Salt tolerant plants	☆	☆	☆	☆	☆	☆	☆	★	☆
Simplistic salinity "solutions"									
• Lucerne	-	★	-	-	-	-	-	★	☆
• Vine/shrub/tree monocultures without managed groundcover	-	-	-	-	-	-	-	★	★
Transitional agricultural practices									
• Vine/shrub/tree monocultures in set - stocked introduced C3 pasture base	☆	-	☆	☆	☆	☆	-	★	★
Regenerative agricultural practices									
• Pulse grazed native C3/C4 pasture	★	★	★	★	★	★	★	★	★
• Pulse grazed introd. C3/C4 pasture	★	★	★	★	★	★	☆	★	★
• Direct-drilled annual crops in pulse grazed native C4 pasture base	★	★	★	★	★	★	☆	★	★
• Woody polycultures in pulse grazed C3/C4 perennial pasture base	★	★	★	★	★	★	☆	★	★