PILBARA LAND REHABILITATION GROUP

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Co-ordinator Mary Fletcher
565 Emma Street
KARRATHA WA 6714
ph: 091 43 5807
fax: 091 43 5940

Co-ordinators note

My apologies for the delay in getting this newsletter to you.

We have added several new contacts or members to the mailing list during the last 6 months which highlights the increasing activity and awareness of land rehabilitation in the Pilbara. Our mailing list now has approximately 61 members on it, with most of them being directly industry related (ie. employees of mining companies, seed merchants or consultants in the Pilbara).

NEXT MEETING

The next meeting will be held near Onslow on Urala station on the 10 and 11 of April. The field trip will examine the rehabilitation along three gas pipelines; WAPET, BHP Griffin Shore Crossing and Doral Resources Tubridgi Line. The BHP and WAPET rehabilitation include beach crossings while Doral Resources is inland rehabilitation. Astron Environmental (Vicki and Peter Long) have undertaken the rehabilitation on behalf of each of these companies and will lead the field trip.

Participants will arrive at Urala by 11 am on Monday the 10th. The field trip will depart from Urala at 11.15 am and will include the BHP rehab and a tour of the gas plant. Please bring you own lunch and drinks for Monday. We will return to Urala in the late afternoon for a few drinks and a BBQ provided by Astron and BHP. Accommodation will be in air conditioned units on Urala station. On Tuesday we will tour the WAPET and Doral Resources rehab and have the PLRG business meeting. A picnic lunch will be provided by Astron and BHP on Tuesday.

We expect to wrap the day up by about 3 pm. If people have items for discussion for the meeting please let me know. There are several sub committees which will report progress to the meeting. Group organisation will also be discussed (ie time for a management committee or new co-ordinator?).

Further notice will be given once the program is finalised, however **keep these dates free as they are definite.**

INTERNATIONAL CONFERENCE ON ENVIRONMENTAL AND WASTE MANAGEMENT IN THE MINING AND ENERGY INDUSTRIES

Report by Steve Vellacott, Dept of Environmental Protection

Workshop on Tailings "Dams"

A one day workshop on tailings "dams" preceded the international conference on environmental and waste management in Perth over August 29- September 2.

The workshop was organised by the Department of Minerals and Energy (DOME) Western Australia. Much of the material presented by the department was an abbreviated version of workshops arranged specifically for the mining industry itself.
The key issues arising out of the workshop were:

1. The word "dam" should not be used when talking about tailings management because it implies that the structure is there to hold water, or fluid, whereas it should be a structure which will retain solids and remain stable for centuries after abandonment.

2. Tailing structures are often the most expensive post mine rehabilitation item.

3. There have been several cases of structural failures and/or environmental problems (eg dust, saline leakages) associated with old tailing structures in Western Australia. However, there has not yet been any catastrophic failures resulting in death as has occurred in other parts of the world.

4. Planning for location and design of tailing structures is critical. Geological and hydro geological investigation is usually essential prior to siting. Rectangular and square designs are probably usually going to be less effective and less stable than circular or curved walls.

5. Current DOME conditions require the surface of tailings structures to be covered with 0.5 metre of waste rock before a growth medium is laid on the surface. The mining industry is not satisfied that this condition is appropriate or acceptable to them. However, there appears to be no demonstrated workable alternative.

6. Monitoring of leakage is important. Very careful hydrological investigations are required to determine the optimal positions for monitoring bores.

7. Reworking of tailings is always a possibility. Design and co-disposal of wastes must bear this in mind, but design and management for very long term stability should not be compromised.

8. Monitoring the occurrence of Cyanide in tailings structures is very problematical because of the tendency for cyanide to be found in numerous forms (chemical species). Although it is generally believed that cyanide is reasonably quickly attenuated in clays, this is not always the case. Some tailings in the Kalgoorlie

goldfields have been found to contain high levels of cyanide some 50 years after abandonment.

9. Acid drainage from tailings is a serious long term problem where sulphide ores are involved. If different ore types are treated over the life of a mine, very detailed records need to be kept and good planning is required to ensure that tailings with a potential for causing low pH leachate are properly stored so they can be neutralised or contained.

10. We have all got a very long way to go in developing reliable techniques for establishing long term vegetation communities on the surface and slopes of tailing structures.

Conference

In addition to the workshop, papers on tailing management were also presented at the conference. One paper on tailing management based on a mine development in Montana illustrated the use of huge wicks which draw moisture out of tails at a great rate. The wicks are possible alternatives to systems which are dependent on a centralised decant apparatus. Tailing management in the catchment of the Amazon River were also explained. Until just 10 years ago, tailings at Pitinga in Brazil were discharged directly to a major tributary of the Amazon.

The conference was a very valuable exercise, revealing a wealth of information from overseas and around Australia. People are welcome to contact me if they want more information on any of the papers or a list of the papers presented. Myles Hyams (attended conference for HI Tom Price) and Steve Van Leeuwen (CALM-presented a paper on revegetation) might also be worth contacting as the conference was divided into 3 separate concurrent streams.

INVITING TROUBLE: INTRODUCED PASTURE SPECIES IN NORTHERN AUSTRALIA

W. M. Lonsdale. Australian Journal of Ecology (1994) 19, 345 -354.

Lonsdale surveyed the history of exotic pasture introductions in northern Australia to compare the rate of introduction of useful species with that of weeds. Between 1947 and 1985, 483 exotic grasses and legumes were intentionally introduced into the region. Of these, only 21 (5%) came to be recommended as useful, while 60 (13%) became listed as weeds. Seventeen of the useful plants were also weeds, leaving only 4 species (<1%) that were useful without causing weed problems. 43 (9%) were weeds that had no recorded use. Lonsdale argued that a new form of assessment is required before exotic plant species are released into the Australian environment as pasture plants.

The list of weeds is shown below:

Exotic pasture species released into northern Australia between 1947 and 1985 that are listed as weeds, or as useful, or both

Species	Accessions	Origin	Useful?
Weed Grasses			
Andropogon gayanus	33	Africa	Y
Axonopus compressus	2	America	N
Bohriochloa pertusa	5	Asia	N
Brachiaria decumbens	4	Africa	Y
Brachiaria mutica	5	Africa	Y
Bromus unioloides	1	America	N
Cenchrus biflorus	2	Asia	N
Cenchrus ciliaris	46	Asia	Y
Cenchrus setiger	12	Asia	Y
Chloris barbata	2	Asia	N
Chloris gayana	26	Africa	Y
Dichanthium aristatum	2	Asia	N
Echinochloa colona	1	Africa	N
Echinochloa crus-galli	2	Widespread	N
Eragrostis curvula	6	Africa	N
Eragrostis tenuifolia	1	Africa	N
Erharta calycina	1	Africa	N
Hyparrhenia rufa	7	Africa	N
Melinis minutiflora	11	Africa	N
Panicum maximum	31	Africa	Y
Paspalum dilatatum	1	America	N
Paspalum notatum	20	America	N
Paspalum paniculatum	1	America	N
Pennisetum clandestinum	2	Africa	N
Pennisetum pedicellatum	5	Africa	N
Pennisetum polystachion	9	Africa	N
Pennisetum purpureum	6	Africa	N
Sorghum almum	2	America	N
Sorghum bicolor	98	America	N
Stenotaphrum secundatum	1	America	N
Urochloa mosambicensis	15	Africa	Y
Urochloa panicoides	1	Widespread	N
Non Weed Introduced Grasses			
Digitaria eriantha	9	Africa	Y
Paspalum plicatulum	11	America	Y
Setaria sphacelata	16	Africa	Y

Weed Legumes			
Aeschynomene americana	5	America	N
Calopogonium mucunoides	24	America	Y
Centrosema brasilianum	9	America	N
Centrosema pubescens	24	America	Y
Centrosema virginianum	10	America	N
Clitoria ternatea	44	Widespread	N
Crotalaria goreensis	1	Africa	N
Crotalaria grahamiana	1	Asia	N
Crotalaria medicaginea	1	Asia	N
Crotalaria spectabilis	1	Asia	N
Crotalaria zanzibarica	2	Africa	N
Desmodium intortum	2	America	N
Desmodium tortuosum	4	Asia	N
Indigofera suffruticosa	1	America	N
Leucaena leucocephala	11	America	Y
Lupinus angustifolius	1	Temp.	N
Macroptilium atropurpureum	23	America	Y
Macroptilium lathyroides	16	America	Y
Melilotus alba	2	Temp.	N
Melilotus indica	1	Temp.	N
Neonotonia wightii	18	Africa	N
Stylosanthes guianensis	45	America	Y
Stylosanthes hamata	17	America	Y
Stylosanthes humilis	27	America	Y
Stylosanthes scabra	34	America	Y
Stylosanthes viscosa	12	America	N
Trifolium repens	1	Temp.	N
Vicia sativa	2	Temp.	N
Non Weed Introduced Legumes			
Centrosema pascuorum	17	America	Y

Origin is the evolutionary origin (given by Mabberley 1987), as opposed to the source of the cultivars used. 'America', 'Africa', and 'Asia' refer to the tropics and sub-tropics of those continents. 'Temp.' includes all temperate or subtropical regions of Europe, America and Asia; 'Widespread' are widespread tropical species, exotic to Australia, but of unknown origin.

SEED OF LOCAL PROVENANCE

Mike Cooper, Land Rehabilitation Officer, Division of Parks and Wildlife, Hobart, Tasmania.

Summarised from Australian Journal of Soil and Water Conservation, Volume 7 Number 4, November 1994.

Mike Cooper rehabilitates small areas of disturbances in National Parks in Tasmania. He supports use of local seed in rehabilitation but claims there is no evidence to support the view that use of seed from a different provenance may be harmful. He states that natural gene pools extend to include many provenances and cover quite large areas. Gene pools are affected both by agents of dispersal and by natural selection. Sites which have resisted natural revegetation for many years present a rigorous selective regime.

Reasons often cited for using provenance seed include:

1. Provenance seed will probably survive. Compared with seed from other areas, seed of local provenance is more likely to germinate, survive and grow. However there are exceptions where a site has been radically altered.

2. To preserve biodiversity. This is particularly important in areas where biodiversity has been significantly reduced by clearing, logging and grazing. In these circumstances local seed should always be used.

3. It may be harmful to introduce outside genes into a local gene pool. Cooper states there is no evidence that this is the case. So little is known about what constitutes a provenance that there is no guarantee that seed purchased is indeed *provenance seed*. Cooper suggests the term *local seed* should be used.

Cooper speculates that if the harmful effects of introducing seed increases with the number of seeds introduced , then there will be a quantity of seed below which the harmful effects are negligible or acceptable. He argues that in small areas of rehabilitation the amount of seed required in comparison to surrounding seed stocks will have minimal effects on the local gene pool.

He also speculates that harmful effects could follow from small discrete seed introductions (ie like an infection). Damage may occur when a special type of gene enters the pool, this damage could occur whether the seed was introduced from 100 km or 1 km away. If this is the manner in which introduced genes wreck a gene pool, then the damage will probably occur whatever precautions we take, or it has probably already occurred.

Cooper maintains that gene pools may have a much greater geographical extent than a single provenance and gene dispersal and interchange probably occurs between widely separated provenances. Gene pools change through mutation and dispersal and relative gene frequencies are determined by selection. He states that natural selection generally has a far greater influence on local gene frequencies than any inflow of genes.

Seed pooled from a wider area (a few kilometres) will have more genetic variability and hence more adaptability to site conditions.
In rehabilitation there are often strong selection pressures due to site conditions which are generally very different to the surrounding area. This will often cause the local gene pool to be altered and a new local provenance will evolve. The introduction of a more varied gene pool can often result in quicker rehabilitation.