African Lovegrass (ALG) Control Workshop

Proceedings

Kosciuszko 2 Coast Project Partners
12th Dec 2008

at the BHA Reserve 'Scottsdale', Bredbo, NSW

Summary

The three aims of the ALG Control Workshop were:

- Gather and record critical information on ALG from attendees
- Establish a workgroup for future dialogue on ALG
- Discuss possible ALG trials for Scottsdale and other suitable properties (K2C region)

The ALG Control workshop heard many opinions and raised many questions. These notes serve to capture the critical information provided. In relation to the three workshop aims:

- A catalogue of available relevant work has been initiated and a library of documents will be established. This listing will be sent out to each attendee and the K2C website will provide future public access to this information
- A database containing contact details of ALG workshop attendees and those invited but not in attendance has been developed. These contacts will be sent the proceedings of the workshop and will have the option to add colleagues or be removed from the contact list
- Each of the presenters provided insights based on either strict scientific protocols or informal observations and in so doing provided a well rounded understanding of the characteristics and behaviour of ALG. Significant information appeared to be available in managing ALG in conjunction with livestock production; however there appeared to be less work undertaken to determine effective ways to prevent or reverse ALG spread into native pastures and conservation areas.

  Hence, on the understanding that the plant phenology be well understood, that past trials be considered and that overarching goals be defined (conservation, restoration or primary production) before new trials are initiated, an initial listing of possible trials for the K2C region was established.

Contents

Background: Why run a Workshop?

Each of the 10 partners in the Kosciuszko 2 Coast (K2C) project have broad experience in natural resource management in the region and see the encroachment of ALG as a major threat to priority conservation areas. K2C partners accept that ALG does provide some benefit to pasture based livestock grazing regimes and that the grass has been used effectively to stabilize soil in erosion gullies and roadside batters.

The ALG Workshop was run to get input from a range of people who have ALG experience or responsibilities from government officers, scientists, agronomists and landholders that manage it on a daily basis.

Background: What is the K2C Project?

The Kosciuszko to Coast (K2C) project works directly with landholders to identify, restore and extend alpine, wetland, grassland, woodland and forest ecosystems between Mt Kosciuszko and the coast. Across this extensive landscape of approximately 1200 square kilometres, K2C partners will focus on vegetation communities known to be in serious decline being Montane Swamps, Box-Gum Woodlands and Natural Temperate Grasslands.

It is the aim of the partnership to increase the resilience and extent of these landscape systems to mitigate their decline and restore habitat for all native flora and fauna, especially those listed as threatened.

Working across tenures and using a range of land management tools and incentives, including property acquisition, conservation agreements, revolving property purchases, voluntary management agreements and incentives, K2C partners will engage landholders, community groups, business and government agencies in a strategic and coordinated approach. Through its work, K2C efforts contribute to the continental-scale programme to extend landscape connectivity all the way from the Victorian Alps to the Queensland Atherton Tablelands under the Great Eastern Ranges Initiative.

Background: What is the current status of ALG?

African Lovegrass (*Eragrostis curvula*) is gazetted a class 4 weed under the Noxious Weed Act 1993. It is known to have between 7 and 13 cultivars but there is difficulty in telling between them except for the height difference in the tall and short variety. ALG has been found to occur in every state and territory across Australia. It has also entered many countries worldwide. In the Cooma Monaro region ALG has successfully colonized many 1000s of ha to replace much of regions open grassy woodlands and native grasslands.

Welcome & Introduction – Lauren Van Dyke – K2C Project Facilitator:

- K2C encompasses working with landholders/managers to re-connect and strengthen resilience in fragmented vegetation types across all land tenures in the K2C project range
- Regions of focus include: box gum woodland, natural temperate grasslands, wetlands, bogs and springs, snow gum woodlands and riparian areas
- Bush Heritage Scottsdale property; 1300 ha, purchased as part of K2C project and is possible site for future ALG field trials
- Outcomes of the proceedings are to gather and record critical information on ALG, establish a workgroup for future dialogue on ALG and discuss possible ALG trials in the K2C region

Workshop outcomes:

In seeking to meet the workshops three aims the attendees agreed:

- A catalogue and library of available relevant work will be established and sent out to each attendee and interested parties

Action: Peter Saunders to coordinate – initial draft by 30 Dec 2008

- All invitees/attendees will to be sent workshop proceedings via email addresses provided

Action: Lauren Van Dyke to coordinate – proceedings to be emailed out by 30 Dec 2008

- A listing containing contact details as provided by ALG workshop attendees and those invited but not in attendance will be developed. These contacts will have the option to add colleagues or be removed from the contact list. The list will not be publicly available.

Action: Peter Saunders to coordinate – initial list developed and email confirming listing to be emailed by 30 Dec 2008

- All invitees / attendees / other interested parties will be sent future ALG material through emails, post and will be able to access information via materials posted on K2C website www.k2c.org.au . This ongoing dialogue will achieve the aim set out by K2C partners. Those not keen to receive such correspondence can nominate to be removed from email/mail list.

Action: Lauren Van Dyke to coordinate – agenda item for K2C working group Jan 2009 meeting

- K2C partners to receive input from workshop on possible future trials to be conducted in the K2C region – consider or prioritise trials under headings of conservation / conservation and primary production / primary production

Action: Lauren Van Dyke to coordinate – initial listing (in accordance with Annex E) to be provided to the K2C working group Jan 2009 meeting

Action dates added post workshop

Annex A

Program:

9.00 am	Arrive & Morning Tea
9.30 am	Welcome from K2C facilitator, introduction and potted history of ALG
9.45 am	Introduction around the table from attendees – each attendee giving tight summary of their involvement with and knowledge/observations of ALG
10.30am	Bush Heritage ecologists, Sandy Gilmore & Matt Appleby, on need for ALG suppression and future consequences on conservation landscapes
11.00am	Key Presentation from Jennifer Firn - Spatial Ecology Lab, The Ecology Centre, The University of Queensland on ALG trials and current perspectives on ALG control
11.45am	John Buma (Spray Contactor) & Peter Saunders (Stock agistor, Scottsdale) to discuss ideas on chemical and grazing treatments
Mid day	Lunch – with caterer Kari Blythe
1.00 pm	Open discussion on what can and should be done to control ALG both in situ and regionally
2.30 pm	Visit ALG sites on 'Scottsdale'
3.30 pm	Finish

Annex B

List of Attendees:

Bill Johnson (BJ):	Previous PhD ALG, local landholder
Brett Jones (BJ*):	Senior Weeds Officer, Cooma Monaro Shire Council
Bruce Davison (BD):	Coastcare and Landcare member, Bega landholder
Chris Chambers (CC):	Local landholder
Chris Fowler(CF):	Local landholder, Secretary local Landcare group
Colin Groves (CG):	Senior Weeds Officer, Bombala Council
David Eddy (DE):	Monaro region grassland expert
David Ryrie (DR):	Local Landholder
Douglas Alcock (DA):	Livestock Officer, DPI, Cooma
Tom Ryrie (TR):	Local landholders
Glen Norris (GN):	Bush Heritage Operations Manager, Melbourne
Heidi Davison (HD):	Coastcare and Landcare member, Bega landholder
Jennifer Firn (JF):	PhD candidate, UQ, ALG growth trials (Key Presenter at workshop)
Jim Arnold (JA):	President of Natural Sequence Farming group
John Buma (JB):	Southern Spraying Service; weed management (Presenter workshop)
John Field (JF):	Senior Lecturer, ANU
Kerry Pfeiffer (KP):	Southern Rivers CMA (K2C Partner)
Kieran Styles (KS):	Conservation and Heritage, ACT Government (K2C Partner)
Lauren Van Dyke (LVD):	K2C Project Facilitator and host of workshop
Leigh (L):	Bush Heritage visitor
Luke Pope(LP):	District Agronomist, DPI, Cooma
Margaret Ning (MN):	Friends of Grasslands (K2C Partner)
Mark Eggleston (ME):	Local landholder
Mary Appleby (MA):	Southern Tablelands Conservation Management Network
Martyn Noakes (MN):	Local Landholder
Matt Appleby (MA*):	Bush Heritage Ecologist (K2C Partner)
Peter Fogarty(PF):	Private consultant, previously with DLWC
Peter Saunders (PS):	Agistment contractor with Scottsdale (Presenter at workshop)
Rebecca Byrne (RC):	ANU graduate student (note taker)
Robert Smith (RS):	Technical assistant with DPI ALG field trials
Roger Roach (RR):	Weeds Advisory Officer, Cooma Monaro Shire Council
Sandy Gilmore (SG):	Bush Heritage Ecologist (Presenter at workshop)
Sarah Sharp (SS):	ACT Government
Stuart Burge (SB):	Private agronomist, Cooma district
Will Goggin (WG):	Local landholder
Wybe Reyenga (WR):	Bush Heritage Volunteer with past ecological experience
Yvonne Noakes (YN):	Local landholder

Those invited but who were not able to attend provided input prior to the workshop via telephone conversations, email, and postal communication.

Annex C

Introductory comments from attendees:

PS: Currently working with BH and FOG to discourage ALG through a grazing regime on Scottsdale which involves monitoring.

MN: Friends of Grasslands, currently working with many landholders to forms of ALG through Friends of Grasslands however the agency has no management responsibilities.

KF: the SRCMA has a focus on preventing ALG invasion.

LP: working within a consulting role for weed management for landholders, recognises that a greater understanding of ALG is required, and hence is soon to re-publish an updated guide to ALG.

DA: works mainly with livestock and their nutrition so currently running field trials at Bredbo to examine and develop improved palatability and quality of native feed.

YN: although the pigs she breeds consume ALG, she is exploring methods of removal.

DE: Has knowledge of ALG associated more with its invasion of Grasslands in Cooma/ Bredbo region and in terms of distribution and abundance of ALG is keen on potential influences for it's invasion.

JB: As a contract weed sprayer, focuses largely on conservation areas where native ecosystems and grass species are to be treated with care. Accordingly has conducted field trials using a Carpet Wiper to apply glyphosate at varying concentrations and levels of proximity to the ground surface to determine the most effective method to control weeds with minimal effect on natives.

WR: Volunteer with BH and keen to see some results.

GN: Has the role of communicating with BH stakeholders in the region regarding ALG.

L: Keen to learn more.

BJ: Looking to work within a consultancy role for ALG control.

CG: within his role at Bombala Council he has observed ALG invasions to consist mainly along roadsides and some as paddock strewn in the shire.

RR: within a consultancy role for landholders.

CC: landholder keen to learn more and who has been controlling Lovegrass vehemently.

JF: within her PhD has run trials concerning the establishment mechanisms and both early-intervention and curative control methods for ALG.
SB: within a consultancy role for landholders in the shire, also involved in field trials for the past 21 years near Lanyon to research management approaches for removal of ALG, with success in raising the DSE from 4 to 10. Also involved in the introduction of a containment line for ALG. Also the author of Best Management Practice for Management of ALG (produced in accordance with Meat and livestock Australia). Concludes that ALG is difficult to remove!

CF: landholder, secretary of Landcare group.

WG: landholder at Bredbo

SG: In work as a Bush Heritage Ecologist has focussed on the larger picture when managing ALG, working with the communities as a whole which are under threat from ALG in terms of prevention of invasion, rather than a specific ALG focus.

JA: while the local NSF agency he is involved with has not yet applied the principles of NSF in the role of ALG management, there is potential for such development.

BJ: In completing his PhD in 1971, developed Console Lovegrass as well as completing studies on palatability of ALG and the successional stages of the weed invasion system, as well as analysing competition, water use, weediness and management strategies. Observed the wider focus, assessing the absence of ALG in creating opportunity for other invasive species which may be of greater detriment to native ecosystems. An outcome of this research was that perhaps ALG is not as threatening as generally thought in perspective with potential invaders.

PS: within the agistment contract for Scottsdale observed the changing distribution and abundance of ALG over the past 2 years, commenting that there is perhaps a greater amount of Themeda australis (Kangaroo Grass) present in some areas, comparative to the population previously. He operates under a Time Control Grazing management strategy.

JF: suggests a weed is a plant out of place, arising from an imbalance in an ecosystem and that some management strategies need to be analysed in developing an ALG control program including Time Controlled Grazing regimes to discourage overgrazing of palatable native species, which includes domestic, feral and native grazers, also characteristics of ALG need to be researched such as palatability, growth and tolerance (of dry and nutrient poor conditions).
ME: as a local grazier he has successfully sowed improved pasture to assist in the removal and prevention of ALG infestations, through closing the window of opportunity for ALG to take advantage of unoccupied sites.

DR: as a landholder has an interest in using ALG for grazing.

HD: has explored ALG as pasture along with rotational grazing on the property, emphasising the importance of maintaining soil biology health, and thus the turnover of ALG. Has also used mowing of ALG and fertiliser application to create higher nutrient feed, and hence higher performance cattle; which are selected to cope with new diet.

BD: suggests that ALG is a most important pasture species, as it is productive over a longer time frame through tolerance to drought when other species are low in biomass, which promotes an evident cattle weight gain. It is important to analyse the reason for ALG invasion also; which is related to low nutrient and humus levels, so through improved soil management and increased soil fertility, ALG may be discouraged or removed.

SS: within a consultancy role with the ACT Government, she is concerned about local soil and native ecosystem fertility, with a main interest in developing sound research for ALG concerning control management so that positive measures can be taken.

KS: within his role with Conservation and Heritage, he suggests that there is potential for ALG to be utilised effectively as a pasture species to gain benefit from its presence, as opposed to contributing resources purely towards the removal of ALG.

DE: within a consultancy role, and having previously worked with the Department of Land and Water Conservation, he suggests that ALG is 'holding the country together' as the region has had a tough past and as a result is very degraded, which without such a tolerant and aggressive grass species may be subjected to further erosion and loss of native species.

MA*: as an ecologist for the region, he is focussed on managing sites in which ALG is not present for the wellbeing of their diversity.

RS: as a technical assistant with DPI he as been involved in trials on native grasses as pasture species in the region.

LVD: suggests that agricultural areas are only a part of the region, and there are also fragile ecosystems such as native grassland areas which need to be managed for ALG and other invaders. There is therefore a need to assist each other in the agronomic use of ALG to improve the areas it affects. While ALG is an effective stabiliser for the soil, through its tolerance to drought conditions, a choice of how much ALG is present would be good…but do we have a choice? Pointed out that Malcolm Campbell (absent) suggested in phone

conversation that continued research into ALG control ALG is necessary, as it is a ‘dangerous plant’. Other references have included ALG being referred to as a ‘perplexing, aggressive’ invader of bushland, “a friend and foe’, an ‘opportunistic species’ and has its values agriculturally as with small amount of rain it thrives as a pasture.

Annex D

Presentations:

Sandy Gilmore, Bush Heritage ecologist, Presentation

In his role as a Bush Heritage Ecologist, Sandy is developing the Scottsdale Management Plan for as well as conducting research regarding the ecology of the region and the plants it contains. A focus is on plants' role in feeding an ecosystem, rather than simply the abiotic characteristics of a site, which leads to a holistic management strategy to allow individual adaptations and variations of plants, such as root morphology etc.

The objectives encompassed in biodiversity conservation include ecosystem functions, well adapted viable species populations, balanced/integrated communities (specifically complementary species), natural perturbation regimes (such as fire) as well as ongoing evolution of this plan through adaptive management.

Management decisions involve compromise, in that reducing the prevalence of a weed may be perceived initially as beneficial, however there are complex consequences involved. Implicit decision making or a 'gut feeling' is required to effectively manage a property in avoiding agendas or bias etc.
'Forecasting' may be used to detect change in a management plan, which must then be quantified and communicated, monitored and assessed and ultimately attribute causes to what is being examined.
Factors for consideration in management regimes including finance, prioritising objectives and tasks and consequences of conservation.

It is important to recognise the interconnectivity of monitoring, land resource surveying, simulation models in the development of planning.

Modelling management plans is essential as each system of species is complex and is impacted by varying influences, such as land management practice and climate and abiotic factors. Data should be representative for a comprehensive examination of each system, and the results extrapolated for corresponding sites.
Explicit models are useful to communicate the process of data collection and management.

Long term climatic data may be of use in developing a management plan, as well as mapping soil moisture and topography to examine the relationship between species and terrain, water and soil properties, such as length of growing season, physical constraints and species distribution; such mapping is planned for Scottsdale.

Indicators are important for decision making, such as species distribution and abundance in response to management practices, which again relates to the dichotomy of the components of a system and compromises which must be made.

Trait classes (size, morphology etc.) mean that patterns of co-occurrence vary. Also capacity of resources and productivity has a relationship with 'allocation rules', so a more fertile site will produce greater resources.

Ecological monitoring points are distributed so as to gather a range of field site data types within the area.

One conclusion would be that Yellow Box may have an allelopathic effect on ALG from observations, which doubles as a reduced fire risk area.

Putting species in an ecosystem context allows better insights, feedback for adaptive management and BHA performance feedback.

Scottsdale consists of 90ha of native temperate grassland, 363ha of grassy box woodland and 5ha of cleared woodlands.

There is a need to map the condition of grasslands and woodlands for physical and management differences, such as the impact of grazing, which has in cases reduced ALG biomass but increased its' productivity.

The potential for change perhaps lies with Yellow Box woodlands as one of the cheapest 'fixes' for biodiversity (as they discourage ALG growth), however, there is a need to quantify the risks for each method,

number and weight of each outcome (common versus rare species or increasing infiltration rates versus weed presence), cost alternatives and weigh the balance for decisions.

Questions/Comments

BJ: Is there potential to leave ALG to grow un-hindered so that it may continue to utilise the nitrogen supplies present and with time remove its own source of nutrients? Or perhaps slash the ALG and remove it as hay, which also removes the nitrogen? Of the opinion that models relating to seed dispersal mechanisms and success are not necessarily required to predict ALG presence, as the environment which provides potential for ALG may be assessed incorporating slope, aspect, drainage, management (grazed/cleared/disturbed etc.)

KP: There is a persisting monoculture of ALG in the Bega valley which has been undisturbed for long periods of time. Many weeds are 'nitrophilic', so the addition of soluble N will not necessarily promote natives' return over weed invaders. Grazing can be attributed to providing an appropriate site for ALG and other 'pioneering grasses', as phosphorus and nitrogen are cycled through grazing, urine and manure.

PS: Is there a categorisation of common and 'decreaser' species?
Within native species ecosystems, the low growing forbs are damaged predominantly with disturbance as the taller weed species overshade them discouraging re-emergence, so the smaller species tend to be 'decreaser'. Are there examples of dormant sites where ALG has been phased out?

Sandy: Overseas work shows that in undisturbed grassland disappears to be replaced by Couch etc.

Anon: Are there predominant dispersal or growth promotion agents?
Sandy: There is evidence elsewhere of fire triggering ALG growth, otherwise it is difficult to predict large spread capacity along roadsides; perhaps nutrient accumulation or transport by vehicle.

SB: Scottsdale has been extensively cropped previously, which can be attributed to ALG presence on the property.

BD: Could cattle camps be contributing to an absence of ALG?
MA: There is evidence of cattle camps under different tree species; however it seems that ALG is predominantly discouraged under Yellow Box.
Anon: Cattle prefer not to camp under Yellow Boxes as limbs fall readily, so absence of ALG due to allelopathic features.

Jennifer Firn – PhD candidate, UQ

ALG is a C4 perennial grass, globally distributed with varying value according to how it was introduced and managed. Introduced to Australia in late 1800s unintentionally, where it has grown readily on sandy, acidic soils in variable rainfall environments. There are seven agronomic types and it is possible to manage ALG adequately (through burning, grazing, mowing etc.) There are several types of ALG on Scottsdale.

Some of its' characteristics are low palatability and digestibility, crude protein content particularly when tissue is mature, drought tolerant, (eg. proven cases of increase in abundance of ALG with drought), easily spread as high fecundity (high seed production and over 90% germination rate in the lab; high compared to native species).

'Glasshouse Competition Trial' was conducted to determine competitiveness with native species, using different nutrient levels and water contents, using Kangaroo and blue grass over a period of 6 months. Specifically, pulsed and continuous water systems and low and high nutrient levels were applied as variables. Also the variables of delayed planting for 4 weeks and simultaneous planting were used.

The results as a competition index (relative growth rate measure) show that: native grasses generally decreased in growth with Lovegrass neighbours, except under specific conditions for each native grass species.
There was little difference between delayed and concurrent planting.

Where natives were growing first and ALG planted afterwards, there was a decrease in the relative growth rate of ALG.
SO…ALG can suppress the growth of natives, but relationship varies, as in established native communities ALG is not competitive.

A field trial was also conducted on a cattle property, with similar rainfall properties to Scottsdale; sandy soils (derived from sandstone), managed as a low input native grass pasture farm, previously without ALG which is now infested. The impact of grazing and non-grazing was assessed, which required the exclusion of native and domestic grazers (with 'jumper' and 'digger' proof fences). A buffer was included for all plots. The variables used were fertiliser (2kg/ha), herbicide (glyphosate), slashing and native seed addition.

The results proved that: Herbicide reduced ALG the most over time and increased native species abundance, however grazed and fertilised treatment produced similar results to the control.
There were instances of other weed species invading also (Mayne's Pest, C4 forb), which was initially at a present at a low abundance prior to the treatments. In dry versus wet conditions, the effect on ALG is that herbicide was more effective at reducing the relative abundance of Lovegrass, (in dry conditions), and in the wet year grazing was the most effective regardless of the other treatments.
Fertiliser has the potential to increase the palatability of ALG which would allow a shift in grazing pressure onto it, in conjunction with strategically timed grazing. The combination treatment of grazing and fertilizer addition reduced the abundance of Lovegrass without the need for further treatments such as herbicides and slashing, increased the abundance of native grasses and prevented the invasion of another exotic weed species Mayne's Pest. Overall this was the most effective treatment, particularly within the good rainfall growing season.

It is important to vary control methods according to rainfall patterns. Also, adding competitive native species seeds may assist to prevent secondary invasion of ALG following treatment and the colonization of other undesirable weed species.
In terms of the future? Similar trials should be conducted across multiple sites, and the information compiled for a comprehensive overview.

Questions/Comments

KP: The viability of ALG seed is observed to be 80-90% germination success, however most species have a survival plan using hard and soft seed, is this tendency present in ALG?

Jennifer: ALG did not portray dormancy as the seed coat is quite thin. ALG strategy is, that once it germinates, it will grow and does not temper its growth depending on conditions like the two native species studied. It will struggle to grow, but grow anyway. ALG has a quick growth time frame.

ME: What of the viability of ALG after 3 years?

Jennifer: ALG seed longevity appears to be 3 years, as it is a very small seed, but there have been no specific experiments conducted to date. ALG has an early production of seed in response to rain.

JF: What of the viability after passing through a ruminant?

Jen: ALG seeds appear to be viable for 14 days during digestion, however, there has been no research conducted concerning germination success after passing.

SG: The Ian Lunt et al. paper that suggests a framework for grazing in conservation only recommends grazing for conservation under two scenarios in particular under productive conditions?

Jennifer: This is correct but the framework is meant only as a coarse level management so my interpretation is that productivity can be increased at sites with management strategies and strategic grazing. This can act to increase grazing pressure on the invader if it is responsive to increased productivity as was shown in my field trial results. By manipulating the nitrogen content and timing grazing in a wet year, grazing pressure on African lovegrass can be increased.

Peter Saunders - Agistment of cattle on Scottsdale

Scottsdale was in the past heavily grazed over many decades, until more recently, running a small number of sheep and has now become densely infested with ALG, which is a fire concern. A time controlled grazing regime has since been introduced to reduce fuel load and perhaps help to control ALG.

Records are kept regarding paddock size, rotation times, number of head grazing, grazing days (in DSE) and grazing intensity (standard animal units/ha; ranging from 2 to 8).Peter and Friends of Grasslands designed and currently undertake monitoring to measure changes in ALG distribution and abundance as well as other species present, recorded using transects and 20 by 20 m species surveys.

John Buma – Southern Spraying Service

As a contract weed sprayer for more sensitive areas such as NP, reserves and conservation areas, John was asked in 2006 to assess the weeds present on Scottsdale, and he found that ALG was present in cultivated areas. Trials were conducted using a Carpet Wiper, applying glyphosate in May of 2007, with the objective not to decimate the whole population within the paddock, as some rare natives included in the system, but to target ALG.

Some considerations while using the Carpet Wiper and glyphosate are:
The soil stored seed-bank remains viable. Carpet Wipers are expensive (<$13,000), cumbersome, and time-consuming with a boom of 2.2m which requires many passes.

The trials revealed a decrease from 90% to ~45% ALG and an increase of native species.
Flupropanate (FP) trials may be possible in future however there is a high residual remaining in the soil, which as a benefit suppresses ALG germination for ~2 years, which allows natives to return (Red grasses, Themeda and Danthonia are most resistant). The effect of FP on native species is another potential trial. It should also be noted that the less FP used, the better (working at 1L/ha).
Another consideration for potential trials is to examine the impact of the matt of dead ALG remaining after spray as surface waste on germination of both natives and ALG.

The influence of fire is another potential trial topic, as the matt of ALG biomass would be eliminated.
Monitoring prior to and during herbicide treatments is integral, and post-treatment observations would expect to see native regerminating along with some ALG after 3 years, and following that possibly the competitiveness of ALG with natives.

Following discussion/points made by audience:

Timed Controlled Grazing (TCG)will not eradicate ALG
ALG cannot carry enough stock in a good season therefore TCG will fail to keep ALG from seeding.
Rotational grazing has to be very short term. (No regraze of high value species)
Organic additives and grazing mgmt can alter the palatability of ALG.
TCG of ALG does not necessarily turn it to an ALG monoculture.
Biodiversity on CMA sites, Berridale, on tussock grassland is lower under nil grazing, also under set stocked, but under TCG biodiversity is higher – questionable?
Perenniality increased under TCG
Biodiversity increased under TCG
Rotational grazing differs in number of cell, can be really strategic.
Balance stock numbers with carrying capacity overgraze or undergraze detrimental.
Grazing strategically for the plants you want.
Need to understand the ALG plant phenology.
Fire the enemy of SOM.
Increased slash, increased ground cover, increased soil moisture content.
If widespread ALG, manage it, use higher stocking rates.
ALG trial was conducted near Tharwa (4 paddocks + 1 control) over 100 acres. Using 4 DSE and added Mo Super and Sub Clover and increased to 10 DSE. Centre of ALG plant dies, diversity increases.
Herbicides (Malcolm Campbell) rates, correct experiment calibrate equipment and replicates – work done.
Stock dung has viable ALG for 4 or 5 days, barriers to stop movement of seed, quarantine stock, sacrifice paddock.

Use of flupropanate to suppress ALG seeds. ALG is light dependent; grows outward from central tiller, has aerial tillers.
Maintain ground cover to suppress germination/ingress.
Perennial exotic pasture (sown, resown) will suppress ALG.
In low ALG areas grazing management, containment lines, roads, river.
Light granite (sandy, acid, sodic) soils are a real problem.
70% absentee landholders, TCG & weed control not viable.
Weed is a symptom of low fertility so herbicide is not a cure.
Increasing soil fertility can control ALG.
N, P, pH low in native grasslands.
pH can be very low for ALG, dig P out of very low nutrient (mycorrhiza) very low N and can handle higher nutrients (palatability).
ALG will not grow in neutral alkaline soils, basal soils, cracking soils, deeply rooted (>2 metres) little hydraulic lift, not work of surface root system, surface, SOM oxidation.
Of the C4 grasses ALG very efficient with H2O
ALG high biomass production/ photon/ H2O.
ALG weakness are shade, waterlogged, neutral, alkaline soils, doesn't float (unviable).
ALG seed can/can't pass through cows, not sheep.
ALG seed not attractive to ants.
ALG doesn't blow as much as we think - it is vehicle distributed.
Riverbanks are disturbed land.

Annex E

Open Discussion:

BJ: The biggest challenge is to improve the biodiversity status of the individual site, which is dominated by weed species (Couch, vipers' etc.) thus converting the landscape back into a non-agricultural landscape should be a priority. This may be done by managing the interface between infested and non-infested areas and defining our objectives is integral.

MA: On Scottsdale there are three distinct areas of ALG status; ploughed land which is ALG dominated, good condition grassland which need to be protected, and intermediate areas with partial ALG cover and a range of different species. Of lowest priority are the areas which are dominated by ALG.

SG: We should examine not just the difference in occurrence of species, but the biological attributes of each species and which other species they co-exist with so that we may determine priorities for seed collection of natives for revegetation.

KP: The agricultural activities currently practiced at Scottsdale are contradictory to the conservation goals of management, so the establishment of dense native trees to return the site to woodland would be beneficial, along with stock exclusion of the property.

MA: Revegetation is seen as a low priority for affecting change on the property, excepting for small areas at low cost.

BD: Fertility of the site should be of high importance in any trial as an integral part of the future of ALG; Time Controlled Grazing and mowing maintain nutrients in the system and should be practiced on the property.

SS: The nature of the site provides good potential for trials.

DA: We should ultimately aim to exclude ALG from where it has not yet invaded, so the focus should be on the native ecosystems and competitor species and managing those rather than just worrying about ALG.

BJ: There is not a large amount of evidence that in the absence of disturbance ALG is invasive, so perhaps a trial for Scottsdale would be to measure how invasive ALG is. An example would be to monitor roadsides which are left largely undisturbed.

JB: There are areas on Scottsdale which have not been disturbed, where ALG is present, simply through transport from other areas.

SG: Themeda australis patches which have experienced mild disturbance such as vehicle tracks may be enough to promote semi-invasion of ALG.

SB: There is limited environment in the region which is undisturbed through occurrence of grazing, so perhaps trials could explore the best management for grazers using temporal and input factors.

KS: The focus should perhaps be on densely infested areas for grazing, while high conservation areas are managed by grassland agencies.

MA*: We should consider that the trials are also looking at other K2C regions not just Scottsdale.

ME: Perhaps we should attack infested areas with competitive species and grazing, which will keep dense ALG populations low and make the task of removing ALG overall, easier.
KP: Grazing pressure applied to the lower part of the property currently is not congruent to introducing competitive species; a double knockdown approach and rotational grazing could be utilised to put pressure on ALG.

LP: ALG control through herbicide application is a known factor, we know how to replace ALG with other species however we don't know how to sew a well established native grassland area which could be a

potential trial. Also 'living' with ALG is an important aspect for landholders so perhaps a change in management values should be promoted.

KP: Feed supplement may be utilised through winter when grazing stock on ALG.

BJ: Phalaris, cocksfoot etc. when planted in formerly untouched sites will disturb the site if they die, allowing ALG to invade. The window or interface between one ecosystem and progression to the next is integral to manage. It is best to manage the property in halves sometimes, according to densities of infestation and site characteristics etc. So against ploughing everything up and revegetating, as the window is open for ALG invasion.

JB: Weed control aims to not decimate all species but change the balance.

BD: Rotational grazing on the property has allowed native species to grow.

HD: A 'refractometer' measures the dissolved juices in the pasture and sugar content in relation to health for cattle and palatability; cattle won't graze at less than 1% sugar, but some pasture has been measured up to 8%.

BD: A monoculture of ALG may be avoided in rotational grazing as less ALG created by deterring selective grazing, lets in more light for other species to grow.

BJ: Un-grazed areas tend to have low biodiversity, as well as in heavily grazing areas however where the system is lightly grazed there is greater biodiversity.

JF There is a factor of 2 biodiversity increase with rotational grazing as well as soil carbon and organic matter, which influences biota, which influences water infiltration etc.

DA: The rotational grazing definition relies on the species of pasture; balance stock numbers with carrying capacity, so there is not an absolute definition of cell grazing or set stocked, so analyse the data rather than adhering to definite rules of grazing.

KP: Burning seems to have no benefit on ALG in the Bega region other than to delay the actual plants germinating.

DE: Fire treatment has been observed to lead to an acceleration of ALG development (40% panicle open) in their region.

SS: Does ALG control us or do we control it? The 'trashy state' of ALG is dominant in this region and we should focus on the physiological aspects of the plant itself rather than on the outcome.

SB: An example property overrun with ALG created 4 25ha paddocks and applied sub-clover (for more nitrogen) and super phosphate and was rotationally grazed and improved animal health monitored. It has been observed that increasing grazing pressure causes the centre of the plant to die allowing other species to grow through it. However, ALG will never be eliminated so there is a need to learn to manage it, not try to remove it altogether. Replicated trial methods are important in field work.

DE: ALG is a highly productive plant which has moved into systems which are of historically low productivity, which means understocking of cattle has resulted in ALG spread.
Kerry: Stock have been found to be the largest vector of ALG seed, which requires good fencing and perhaps windbreaks to prevent wind blown seed dispersal between areas of the property.
MA: The short longevity of the ALG seed appears to be a weakness which has potential to be exploited in management, but are there other factors that could be employed to decrease seed viability.

BJ: The nature of ALG seeds means they are stimulated to germinate with light (cytoblastic). A central tiller allows vegetative spread, and aerial tillers are also produced which grow very tall, fall over and then sprout another plant from there. Maintaining ground cover is an important factor to consider.

BJ: Well established native pastures will stand unless strongly disturbed. An ALG containment line is in the pipeline for development, along with priority areas for quarantine. It is important to assist landholders to develop quarantine for marginal areas at risk of infestation.

KP: A quarantine incentives scheme was run by the SRCMA across three local shires with success.

BJ: The biggest difficulty is the containment line which is best to correspond to council managed areas, so CMSC with either have to give or take some land in management according to the existing shire boundaries.

RR: It is important to remember that 30-40% of CMSC landholders are absentees.

BD: Controlling a weed with herbicide only deals with the symptom, and avoids the cause which is low fertility of the soil, so the 'chemical treadmill' begins as more fertiliser promotes lower soil health, which promotes even more fertiliser etc.

SS: Nitrogen, phosphorus and the pH of the area showed nutrient levels were low in the 1990s, with acidity of 4-6 and such low pH that sites were less prone to ALG.

BJ: ALG is found to be acid tolerant (≥ pH 2), can exist in extremely low phosphorus and nitrogen sites, but grows well with nitrogen also, has mycorrhizae which assists water and nutrient uptake, doesn't like alkaline soil and soils which crack (as can break up the roots). Has a tap root as well as surface roots which collect water and nutrients, is water use efficient, although has weaknesses of water logging and shade. ALG is not as versatile as serrated tussock for example. ALG produces 3.5 million seeds/kg which do not have awns but sheep wool collects it, and it doesn't seem to germinate after digestion. Ants will harvest some seed, but as it is very small it is difficult to locate. ALG seed does not disperse with wind, sinks in water and is too small for birds to pick up however vehicles and animals are common vectors. It is impossible to prevent ALG seeds moving across Australia.

MA: River banks are ideal for ALG growth as they are disturbed consistently by water.
Butchers Paper notes:

Annex F

Broad topics for possible ALG trials in the K2C region:

On the understanding that the plant phonology be well understood, that past trials be considered and that overarching goals be defined (conservation, restoration or primary production) before new trials are initiated, an initial listing of possible trials for the K2C region was established s follows:

1. Species combinations that co-occur or do not occur and under what conditions

2. Functional traits and similarities of species associated with ALG communities

3. Assembly and response rules that structure the communities in order to inform future management decisions

4. Effect of Yellow Box or other natives re shade (high to low radiation site) and allelopathic effects

5. Further study of ALG phenology/physiology

6. Viability of seed in native herbivore dung

7. Effect of soil types/nutrients (under existing ALG patches) ie biotic / physical variations

8. Monitor ALG increase/ decrease in ALG / Themeda grasslands with no disturbances

9. Direct seeding of Yellow Box and understorey species in dense ALG

10. Trial different treatment on existing fringe lines of ALG and native pasture

11. High resolution maps of ALG grassland areas for future special comparison

12. Prioritisation of different grassland ecosystems for K2C / partner resource planning (ALG proportion, endangered associations, endangered/threatened species

13. Effect of managing organic matter to support soil biota on ALG population

14. Strategic Cell Grazing < 3 days to reduce ALG

15. Investigate extent that ALG is invasive in absence of disturbance (grazed, fertilized, cultivated)

16. Cultivate/plant arable land

17. Methodologies for ALG replacement with native grasses and trees

18. Native herbivores acting as vectors

19. Effect of native or feral herbivore pressure (in non primary production scenarios)

20. Multi species trials of above - not just ALG

21. Effects of fire

22. Herbicide use – (type, rates, etc – knockdown / germination suppression)

23. Cultivation of arable land

24. Build on ALG fuel reduction and time controlled grazing presently ongoing within the Scottsdale agistment area - nitrogen cycling; ALG productivity; over sow; continue/adjust/discontinue/transition to post grazing equilibrium

(This listed has been added to since workshop)