grass roots

Newsletter of the Grassland Society of Southern Africa

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The future of South African Dairy Farmiing

Fire and grassland productivity

***Glyceria maxima*: invading our wetlands**

Agricol Farmers' Day

Editorial

Dear Members

Alien invasive plants, as we all know, are a serious threat to the healthy functioning of ecosystems all over the world. Yet too often attention is focused on the obvious woody and shrubby weeds such as the wattles, lantana or chromolaena. Invasive herbaceous weeds can be just as destructive but can escape the attention of all but the specialists who study them. As Donovan Kotze wrote in the previous issue of *Grassroots*, an invasive aquatic grass, *Glyceria maxima*, has become a threat to the Drakensberg ecosystem. In this issue, he gives more detail about the ecology of the plant and the implications if it is not controlled.

On a different note, progress is now well under way for next year's Congress. The Congress and the Journal are the two most important products of the GSSA, and also, respectively, our largest source of income and our largest expense. Professionally run Congresses of the highest standards will ensure that the reputation of the GSSA, as a top-quality organisation for agriculturalists and ecologists, will be maintained, and will ensure the long-term future of the Society.

So, enjoy your holidays, and let's hear your news and views next year.

Alan

The Grassland Society of Southern Africa is dedicated to the advancement of the science and practice of range ecology and pasture management.

We welcome any contributions to the Grassroots, *in the form of news, informative articles, reports, short research notes, scientific papers and letters to the Editor. Email alan.short@dae.kzntl.gov.za or admin@gssa.co.za or fax 033-3559 605 or 033-390 3113*

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Upcoming events

From www.gssa.co.za

The 5th KNP Science Networking Meeting
Deadline for registrations: 16 February 2007
Date: 16 - 20 April 2007
Venue: Skukuza Goldfields Auditorium, Kruger National Park
Contact: Jackey Deacon
dot@mpu.co.za
082 447 1570

SANSOR Annual Congress 2007
Date: 3 - 4 May 2007
Venue: Spier Estate Conference Centre, Stellenbosch
Further details will be announced in February 2007

21st Annual Conference of the Society for Conservation Biology
Date: 1 – 5 July 2007
Venue: Nelson Mandela Metropolitan University, Port Elizabeth
Website: www.conbio.org/2007

The sixth extinction - conserving zoological biodiversity: 33rd meeting of the Zoological Society of Southern Africa
Date: 8 - 11 July 2007
Venue: North-West University, Potchefstroom
Website: www.natural-events.com/ZSSA/

4th World Environmental Education Congress
Dates: 2—6 Jul 2007
Venue: International Convention Centre, Durban
Early Bird Registration Deadline: 15 January 2006
Website: http://www.weec2007.com/

Grassland Society 42nd Annual Congress: Twenty-first Century Challenges in Range and Forage Research
Date: 16 - 20 July 2007
Venue: Eden Grove, Rhodes University, Grahamstown
Contact: admin@gssa.co.za.
Website: www.gssa.co.za/congress2007

XXVIIIth International Union of Game Biologists Congress
Deadline for submission of abstracts: 15 February 2007
Deadline for early registration: 2 June 2007
Date: 13 - 18 August 2007
Venue: Uppsala, Sweden
Website: http://www-conference.slu.se/iugb2007/

Council News

The Council met at Irene, 12th October 2006.

The reports from Congress 41 at Bela-Bela indicated that it was a financial success. A more professional approach to running the Congresses is bearing fruit.

The organisation of Congress 42 is well under way, and the website is now up and running (see page 21). A scientific committee has been chosen, and post-congress tours (arranged by Andrew Ainslie) are planned.

The Thicket Forum has agreed to a joint Congress with the GSSA at Congress 42. A number of other special symposia have already been proposed, and any further proposals are welcome. A strong effort will be made to attract pasture scientists to the Congress.

The Council discussed whether the GSSA had the right to propose changes to draft legislation on behalf of Members, and whether the Council has the expertise to do so. The Expertise Database could be used to identify relevant Members who have the expertise to comment on particular draft legislation. Once comments have been received, the right person needs to be chosen to carry the comments to the relevant authority. Luthando Dziba, Leslie Brown and Andrew Ainslie will carry the process forward.

Freyni du Toit and Khanyisile Mbatha have worked on updating the Expertise Database by developing a new, user-friendly electronic and paper questionnaire. The format will be finalised at the next Council meeting in January and placed on the website. The Expertise Database is for the use of members who are looking for advise in a particular field.

A page will be set up on the website for Members to apply for funding from Trust.

The GSSA Society is now formally registered as a public benefit organization and for VAT. The first tax return for the Society was completed in November 2006. The registration as a non-profit organisation is still being processed.

There are four new Trustees of the GSSA Trust, plus Winston Trollope, who will stay on for another term as Chairman. The new members are Alan Short, Chris Dannhauser, Klaus Kellner and John Clayton. Mark Hardy, as GSSA President, is the final Member of Trust.

A new full-colour roll-up banner for the GSSA has been produced, to be used at functions where the GSSA is to be represented. Members who wish to use the banner and GSSA flyers for a display should contact the Administrator.

The Future of Dairy Farmers in South Africa Conference

Cedara College

13 November 2006

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The Milk Producers' Organisation (MPO) recently organised and sponsored a conference aimed at getting milk producers together to discuss a strategy for the way forward for the dairy industry in KwaZulu-Natal. Consultants Derick Broom and Jeff Every painted a bleak picture of the future for dairy in South Africa. Threats to milk producers include financial insecurity, the threat to land resources in the form of land claims, the land redistribution policy (30% by 2014), undervalued land and global warming. Other concerns are the effect of AIDS on labour and the threat of farm attacks (more farmers have been killed in South Africa than the rest of Africa combined).

The most immediate threat to dairy farmers was identified as small and declining profit margins. In 1973 dairy farmers experienced an average cash flow margin of R1.50 per litre. By 1986 this had dropped to 80c per litre. In October 2006 the average cash flow margin on a litre of milk was 20c. Farmers believe they are in the middle of a "price squeeze" between increasing input costs (maize, fertiliser, labour), which average around R1.75 per litre, and decreasing prices offered by distributors and processors. The benefits of increased efficiency in production are being realized by the distributors who pay producers between R1.56 and R2.03 per litre (the 22c per litre decrease in the milk price paid by distributors was not passed on to retailers such as supermarkets). The low cost of importing milk (especially powdered milk) has exacerbated the problem as local farmers are struggling to compete with subsidised legal imports (e.g. UHT milk is duty free) as well as illegal milk imports. Reconstitution technology has improved to the extent it is nearly impossible to tell the difference between "fresh" milk products and those made with powdered milk.

Clem Sunter is a well-known strategic-planning advisor and co-

From left to right: Jeff Every, Clem Sunter and Derrick Broom. Picture courtesy Farmers' Weekly

author of "The mind of a fox" and "Games foxes play". He spoke on the different options facing dairy farmers. Due to globalisation, the world market is far more competitive than it has been in the past. Essentially, the biggest player wins. This is evident in the textile industry, where China's production costs are one tenth that of those in the West and Chinese imports are crippling local textile industries. It is therefore important that dairy farmers assess their situation and adapt their strategies to survive. Options include adding value personally, i.e., moving down the product chain and expanding product ranges. Rebranding milk as a "drink of choice" (i.e., generic advertising) would increase the customer base as would a move to exploit untapped African markets.

Clem stressed the importance of defining what "winning the game" would be for milk producers and then choosing an option with measurable outcomes.

The panel discussion focused on the threat imports are to the future of the KZN dairy industry. Economist and consultant Derick Broom suggested one way of achieving an increased profit margin would be to demand an increase in the milk price to the true producer import parity price. It was agreed that lobbying for an import tariff increase would not meet with success as this is not government or international trade policy.

While a few decisions were made in terms of the way forward, the meeting concluded (as have many similar meetings in the past) without a strong action plan. Many positive suggestions were made but farmers appeared to feel powerless to change their current situation. One was left with the impression that dairy farmers are afraid of change, afraid to take responsibility for their situation and once again they would be waiting for someone else to take up their cause.

Agricol Farmers Day at Mooi River

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Agricol (Pty) Ltd in Kwa-Zulu Natal hosted a Pasture Information Day, in conjunction with AFGRI Producer Services at Weston Agricultural College in Mooi river the 11th of October 2006.

About 25 farmers from the surrounding area attended the day, along with 38 Grade 11s from Weston College. Earlier in the year Agricol and AFGRI approached Weston Agricultural College and offered to donate some ryegrass seed and fertilizer to sow into kikuyu for winter grazing. Weston welcomed this and offered their venue for a farmers day to be held later in the year.

Agricol sponsored eight varieties, covering 0.25 of a hectare each and AFGRI in Mooi River sponsored the fertilizer to be used. Graham Caldecot lent his Connor Shea seed drill and planted the seed into the existing kikuyu.

The trial area was put into rotation and used and treated the same as all the other pastures on the farm.

Later, due to staff changes Weston suffered the loss of their farm manager, Mr. Manie Louw, to greener pastures, and pasture management on Weston suffered accordingly.

But all was not lost, as Mr. Bruce Blaker, a well known dairy farmer from Colenso, stepped in to help Weston out until Mr. Louw could be permanently replaced.

When spring came there was just too much grass and too few cows to graze it all, and thus some of the paddocks outgrew the rotation. Lots of early spring rains did not make things any easier.

However, on the 11th of October the Pasture Information Day went on. Jan Coetzer from Agricol said a few things on the product range and also talked about some new exciting crops and varieties from Agricol. Mr. Hugh Smith from Kynoch also gave a good insight into how to manage your soils for better fertility. After the talks there was an opportunity for the guests to visit the trial site, after which a lunch was given by the capable catering people form Weston College.

All in all, there were a few hiccups through the year with regards to staff changes and the problems that go with it, but Agricol plans to have another day such as this with Weston Agricultural College and other such institutions, in an attempt to give something back to the farming communities and thus also maintain a healthy triple bottom line.

Short-term influence of fire in a semi-arid grassland on (7): defoliation

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Introduction

Fire not only has a short-term influence on productivity of the ecosystem, but may also have a major residual effect on the next growing season, depending on successive climatic conditions and post-fire management (Zacharias and Danckwerts 1999; Snyman 2004a). Unfortunately, unplanned or accidental fires in the drier sweetveld areas cause large-scale fodder flow problems resulting in mismanagement of the grassland. Therefore, fire can seldom be isolated from its association with grazing. This association is responsible for much of the controversy surrounding the use of fire in southern Africa. In spite of this, there is very little quantitative information on the effects of post-fire grazing on the recovery of fodder plants (Everson 1999, Snyman 2003; 2004b). Although grazing management following burning can clearly have a major impact on the stability of the grassland ecosystem (Everson 1999, Hardy *et al*. 1999, Zacharias and Danckwerts 1999) it is unfortunately poorly documented with still a paucity of knowledge on certain principles on which it is based (Scott 1984, Trollope 1984, 1989 and 1999). Two decades ago, for example, results obtained by Barnes and Dempsey (1992) showed that there is a need for drastic revision of current post-fire recommendations specifically for southern Africa, which is still a current problem. The period allotted for grassland recovery after burning in the drier areas specifically, is an aspect requiring urgent in-depth research. Information on the impact of fire on productivity, phenology and survival of vegetation is also important for adjusting stocking rate and ensuring sustainable utilization of the grassland ecosystem. This knowledge will contribute towards the prevention of further grassland degradation (Snyman 1998), especially in the ecologically sensitive arid and semi-arid areas, where accidental or unplanned fires are more the rule than the exception. The purpose with this study was therefore to investigate the short-term influence of different times of defoliation after burning, on the productivity and survival of grasslands in a semi-arid climate.

Procedure

The research was conducted in Bloemfontein (28°50'S; 26°15'E, altitude 1 350m), which is situated in the semi-arid (summer annual average 560mm) region of South Africa. The study area is situated in the Dry Sandy Highveld Grassland (Grassland Biome) with a slope of 3.5%. At the start of this study the grassland was in good condition (veld condition score was 92% of that of the benchmark site) and dominated by the climax species *Themeda triandra*, with *Eragrostis chloromelas* and *Elionurus muticus* also occurring relatively abundantly. The soil is a fine sandy loam soil of the Bloemdal Form (Roodepoort family – 3 200). Clay percentage increases down the profile from 10% in the A-horizon (0 to 300mm depth), to 24% in the B1-horizon (300 to 600mm) and 42% in the B2-horizon (600 to 1200mm depth).

The research was conducted on 18 plots of 100m^2 each, with an edge effect of 5m around every plot. The five treatments included fire burning against the wind (back fire), with the wind (head fire) (Trollope 1978), a control with no burning taking place, as well as two years of defoliation (first and second years following the fire). Within each year there were also four different defoliation times (October, December, February and April). The layout was a 3x4x2 (burning x defoliation x years) factorial experimental design (using a split plot with sub-samples per plot) with three replications for each burning treatment and four for defoliation months. The treatments were allocated randomly to and within the plots. The experimental design for the defoliation treatments is illustrated in Figure 1. Half of the burn plots were burnt on 30 August 2000 and the other half on 23 August 2001. Every plot was therefore only burnt once during the trial period. The control has only been cut simultaneously with the burning treatments to a height of 30mm. The head and back fire treatments were applied on the same day to ensure that the two types of fires were comparable over a similar range of environmental variables. The burning treatments were applied when the soil and grass fuel were initially very dry and then spring rainfall thoroughly wetted the soil causing the grass sward to become relatively green. Burning took place in the morning with a light wind blowing. To limit the fire to every burnt plot, the plants surrounding each plot were cut short and soaked before burning. The plots were excluded from any grazing over the three year trial period. At the end of each grow-

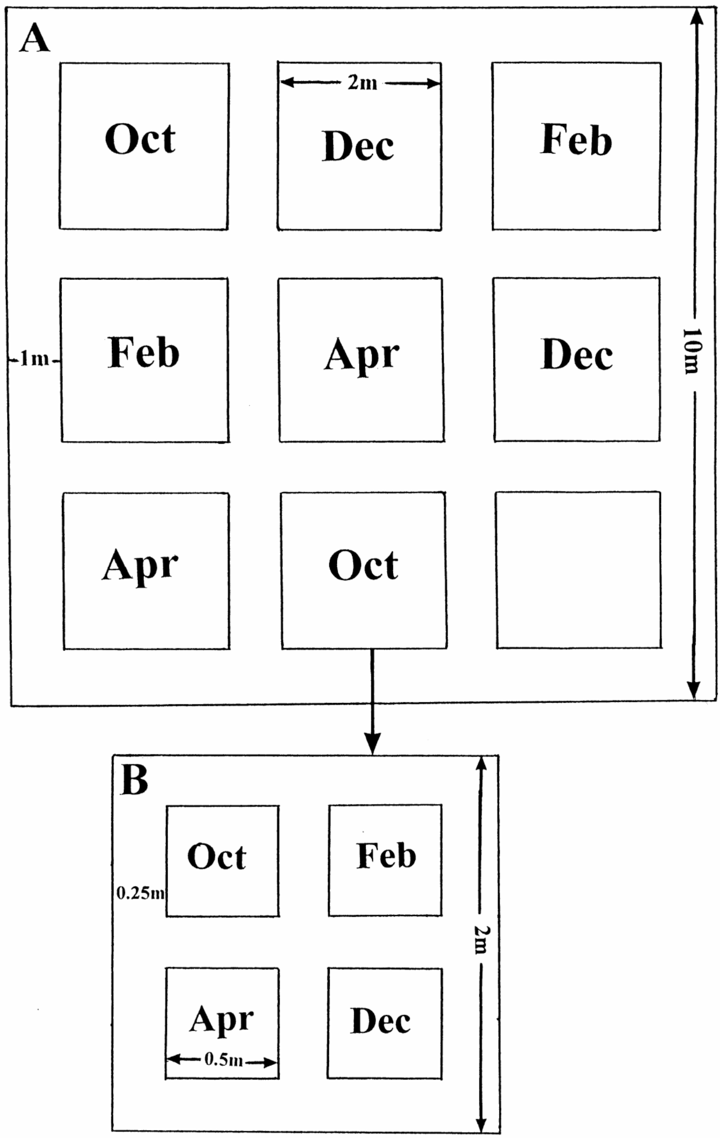

Figure 1: Layout of the defoliation treatments as carried out during the 2002/03 growing season. A = First defoliation (2001/02 growing season) and B = Second defoli-ation (2002/03 growing season).

ing season, every treatment was harvested to a height of 30mm.

The grassland was defoliated to a height of 30 mm every second month over the growing season (October, December, February and April) in nine (4m^2) quadrats randomly selected within every plot (100m^2 each), during the 2001/02 growing season. It is important to bear in mind that, although half of the grassland was burnt during August 2000 and the other half in August 2001, the defoliation treatments were applied during the same season (2001/02) for the first time. The plots which were burnt in August 2000 were therefore defoliated for the first time during the 2001/02 growing season, after a full growing season's rest. In contrast, the grasses for the August 2001 burn were defoliated the same growing season following the fire (2001/02). As the plants in the fire treatments of the two separate burning years (August 2000 and August 2001) were defoliated the same year for the first time after the fire, variation of climate on productivity was therefore eliminated. In order to determine the carryover effect of defoliation on productivity, the plants in the nine quadrats (4m^2 each), which were defoliated one and two years after the fire during the 2001/02 growing season, were defoliated again the following growing season (2002/03) for the second time, also at the end of the above mentioned four months. This was done by defoliating the plants in four randomly placed quadrats (0.25m^2) within the defoliation quadrats (4m^2) of the pre-

Table 1 Tuft mortality (%) for the head and back fire two months after burning. Data are means and standard errors of 60 plants for each species.

Species	Tuft mortality (%)	
	Head fire	Back fire
Cymbopogon plurinodis	71.87 ± 5.121	78.84 ± 4.353
Digitaria eriantha	58.82 ± 3.142	59.99 ± 3.122
Eragrostis chloromelas	60.22 ± 3.263	58.62 ± 3.100
Eragrostis superba	61.13 ± 3.312	63.06 ± 3.421
Elionurus muticus	69.88 ± 3.451	69.47 ± 3.264
Panicum stapfianum	71.60 ± 3.662	65.17 ± 3.543
Sporobolus fimbriatus	60.51 ± 3.291	61.42 ± 3.412
Themeda triandra	73.47 ± 4.016	79.10 ± 5.665
Triraphus andropogonoides	55.03 ± 2.961	56.73 ± 3.041
Average	**64.72**	**65.82**

vious year (Figure 1). The production of the burnt grassland during April, when all grasses were dormant and killed by frost was taken as the control in determining the production loss due to defoliation regardless of burning. The fire behaviour during this trial was described in detail in previous publications of Grassroots.

Two months after the fire, 20 tufts of the dominant grass species per plot were monitored for die-back due to fire. This was accomplished by separately copying the dead and living parts of every grass tuft on a transparency, after which the area per species was determined by means of a leaf area meter. The dead parts were expressed as percentage of the living parts. To accurately determine the living and dead parts, the tufts were cut just before monitoring.

Water-use efficiency (WUE) is defined as the quantity of above-ground phytomass production per unit of water evapotranspired. Evapotranspiration (Et) was quantified by the soil-water balance equation (Hillel 1971). Rainfall (P) was measured daily with rain gauges. The change in soil-water (DW) was calculated following Moore *et al*. (1988), where (+) indicated an increase and (-) a decrease in the amount of water within the root zone. The soil-water content was determined gravimetrically by means of a Veihmeyer tube at 50 mm depth intervals in all treatments (5 samples per treatment) with each defoliation. Due to the fact that deep drainage (D) only occurs under extremely high rainfall conditions (Snyman 1998) in the semi-arid grasslands, it was excluded for the purposes of this study. Runoff values (R) obtained from grassland in different condition classes adjacent to the burning plots (Snyman 1999) on the same slope, were used for the unburnt and burnt grassland. The basal cover of the unburnt and burnt grassland was on average the same as that of the good and moderate rangeland condition classes respectively (Snyman 1999). Evapotranspiration was therefore calculated as follows:

$$Et = P - R + DW$$

where P is precipitation, DW is the change in soil-water content and R = surface runoff.

In each treatment soil temperature was recorded two weeks after defoliation at approximately 14:00 and during the week of 4 November 2001 on an hourly basis up to a depth of 50mm with mercury thermometers. Two thermometers were placed in every fire treatment plot and unburnt grassland. These two thermometers within a plot were further divided into the defoliation and non-defoliation treatments.

Results and discussion

Tuft die-back

The head and back fires did not influence the tuft die-back much differently for all the species (Table 1). Notably, those grass species forming large tufts like *Cymbopogon plurinodis* and *Themeda triandra* had the highest percentage die-back per tuft. With the back fire treatment, these two species exhibited still higher die-back. The higher fire intensity accompanying more combustible material and also the slower movement of the back fire, is a possible explanation (Snyman 2004b). *Panicum stapfianum* was also very sensitive towards fire especially in case of the back fire.

The least tuft die-back occurred in grasses with smaller tufts, like *Digitaria eriantha* and *Eragrostis chloromelas*. Even the back fire which was supposed to have a higher fire intensity close to the soil surface (Snyman 2004b), caused lower tuft die-back in *E. chloromelas* than the head fire which is cooler close to the soil. *Triraphus andropogonoides* with its visibly hard appearance was the least sensitive towards fire. Many seed culms of this species were not totally destroyed by fire, especially the back fire.

Aboveground phytomass production

The rainfall for the defoliation season (2002/03) was 504mm, with that of the preceding two seasons, 573 and 611mm. The rainfall of all the seasons following burning did not differ much from the long-term annual rainfall of 560mm for the study area.

The main aim of this study was quantifying the impact of defoliation on burnt grassland and therefore the production data on the unburnt grassland was not presented in detail, which is available in the publication of Snyman (2003). The productions of the head and back fires which differed non-significantly (P > 0.05) from each other for all the defoliation months and over seasons, are therefore presented as averages for the head and back fires in Figure 2. All grasses were dormant (killed by frost and no further growth took place) with the April defoliation and therefore these production data was taken as control in determining the production loss due to defoliation regardless of burning (Figure 3). The grassland which was defoliated the same growing season (2001/02) after the fire during October, December and February, still had a lower (P <0.01) production than the April (control) defoliation, as measured during the subsequent season (2002/03) for all the defoliation intervals applied (Figure 2A). Defoliation during October right after the fire, decreased production from October to April of the subsequent growing season with as much as 48% to 28% (Figure 3A). The later during the growing season the grassland has been defoliated right after burning, the smaller the influence of defoliation on the subsequent productions within and between seasons. As expected, for every defoliation month following right after burning, production cumulatively increased during the subsequent growing season (2002/03) (Figure 2 A and B).

The production of the October defoliation, after the grassland has rested for a full growing season following the fire, was for October, De-

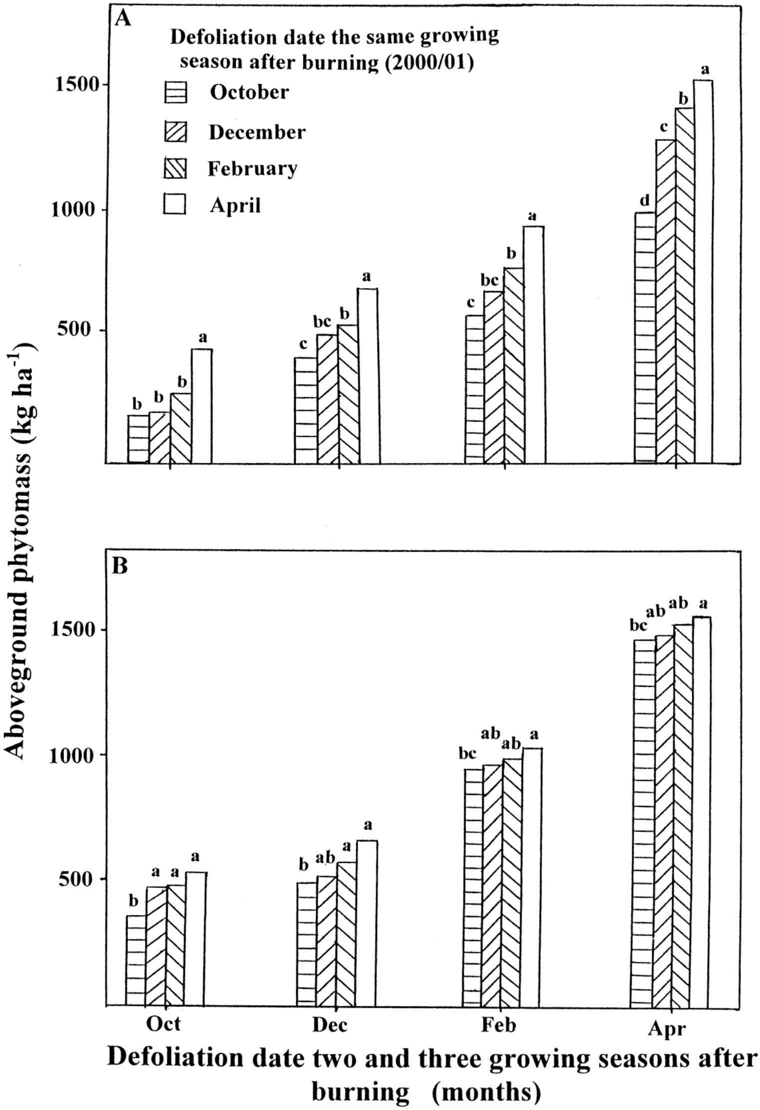

Figure 2: Aboveground phytomass production (kg/ha) of the burnt grassland obtained for various months after burning during the 2002/03 growing season. This included the production of two (A) and three (B) growing seasons after burning, when the grassland was defoliated the subsequent season (2001/02 during the same months. Bars within a month with different superscripts differ significantly (P< 0.01).

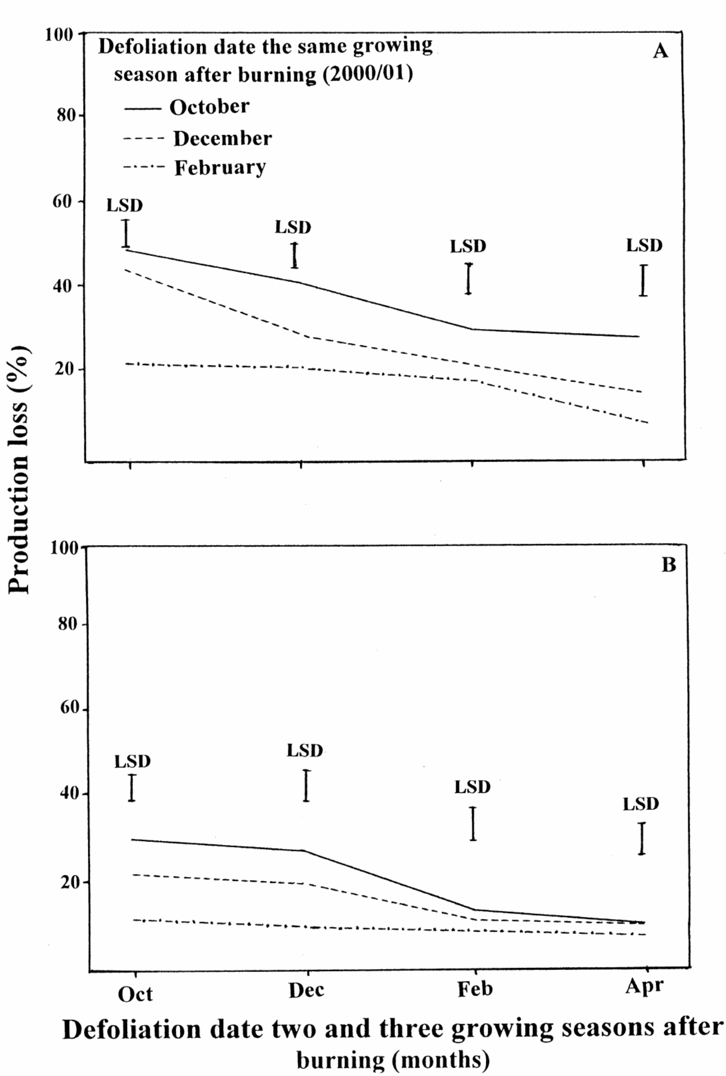

Figure 3: Production loss (%) of the burnt grassland due to defoliation regardless burning, obtained for various months following fire during the 2002/03 growing season. This included the production loss two (A) and three (B) growing seasons after burning, when the grassland was defoliated the subsequent season (2001/02) during the same months. Least significant difference (LSD) is calculated at the 1% level.

cember and February of the subsequent year (2002/03) significantly (P <0.01) lower than that of the April (control) defoliation (Figure 2B). This production loss after a rest of a full season, varied between 32% and 12% for the October to April defoliations the subsequent growing season, due to the October defoliation (Figure 3B). In contrast, the production of the December and February defoliations the subsequent season, which were not defoliated for a year following the fire, differed non-significantly (P > 0.05) from that of the April (control) defoliations. It further seems as if the production loss due to an October and December defoliation of burnt grassland, only started leveling out after the grassland has not at all been defoliated for a full growing season after the fire (Figure 3A and B). In contrast, the February defoliation directly following the fire had the lowest, but also a constant production loss the subsequent growing seasons (Figure 3A and B), regardless of receiving a season's rest or not. The production loss due to defoliation during February after the grassland has rested for a full growing season, varied only 8% to 11% for the September to April defoliations the subsequent season.

Water-use efficiency (WUE)

Regardless of whether the grassland rested for a full growing season after the fire or not, the April defoliation converted water most efficiently (P <0.01) into phytomass than all the other defoliation periods (Figure 4). The grassland which was not defoliated for a full growing season following the fire, for all defoliation periods, used water more (P <0.01) efficiently than when already defoliated the same season after the fire.

The October defoliation, regardless of receiving a seasonal resting period after the fire or not, had the poorest WUE for all the defoliation times. After the grassland rested for a full growing season, the WUE between the different defoliation times started differing less (P > 0.05) from each other. On the other hand, the February and April defoliation right after the fire, used water significantly (P <0.01) more efficiently than the October and December defoliations during the same growing season. The very high WUE occurring after the grassland rested for a growing season and was only defoliated during October for the first time, can be ascribed to the very high rainfall falling over this period during August 2002. For example, the rainfall of this month was nine times that of the long-term average for this month. In contrast the WUE increased as the grassland was defoliated for the first time after the fire later in the season.

Soil temperature

Averages are used in the discussion as soil temperatures differed non-significantly (P > 0.05) between head and back fires over the first 50 mm depth. The hourly soil temperature measurements conducted during the week of 4 November 2001 for the

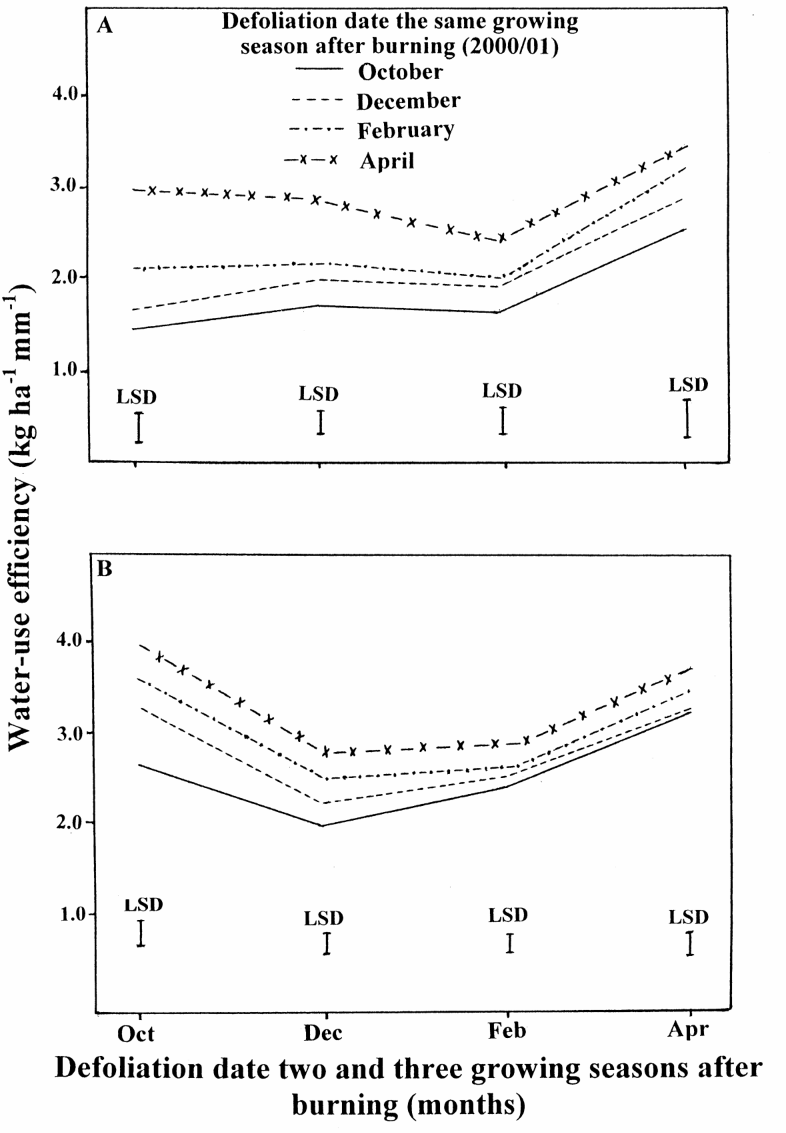

Figure 4: Water-use efficiency (WUE) (kg/ha/mm) of the burnt grassland obtained for various months after burning during the 2002/03 growing season. This included the WUE two (A) and three (B) growing seasons after burning, when the grassland was defoliated the subsequent season (2001/02) during the same months. Least significant difference (LSD) is calculated at the 1% level.

Table 2: Average soil temperature (°C) for burnt (first season after burning) and unburnt grassland measured every second hour at 50 mm depth during the week of 4 November 2001 for the defoliated and undefoliated grassland (n = 3). Significant differences between cut and uncut (P<0.01) indicated by asterisks.

Time (hour)	Unburnt			Burnt			LSD Burnt x Unburnt
	Not cut	Cut	LSD	Not cut	Cut	LSD	
05:00	18.13	18.22		18.15	18.25		0.86
07:00	19.24	20.36		22.44	24.14	*	1.21
09:00	21.12	22.32		29.22	31.13	*	1.06
11:00	23.44	24.44	*	31.13	33.22	*	1.42
13:00	25.26	26.41	*	33.27	34.51	*	1.02
15:00	28.17	30.36	*	36.19	37.47	*	1.42
17:00	26.31	27.12		33.16	34.15	*	0.96
19:00	23.22	32.29	*	31.24	33.24	*	1.12
21:00	20.51	20.14		20.3	20.55		0.98
23:00	19.13	19.26		19.22	19.54		0.88

season directly following the fire, showed that the average soil temperature to a depth of 50mm over the day period from 07:00 to 19:00, increased significantly (P <0.01) due to the fire (Table 2). The second year following the fire, the soil temperature was non-significantly (P > 0.05) influenced by fire (data not shown).

Defoliation increased soil temperature significantly (P <0.01) only from 11:00 to 19:00 in grassland which was not burnt (Table 3). However, due to defoliation, in burnt grassland the soil temperature already increased from 07:00 to 19:00 (P < 0.01).

Defoliation significantly (P <0.01) increased soil temperatures up to a depth of 50 mm, two weeks after the October and December defoliations the same season after the fire (Table 3). Where the grassland has not been burnt, defoliation had no significant (P <0.01) influence on the soil temperature. Regardless of defoliation, fire significantly (P <0.01) increased soil temperature to a depth of 50 mm over the full first season following the fire.

Conclusions

In any defoliation study, the dynamic nature of plant responses to defoliating needs to be considered and in particular the process of compensatory growth, or regrowth of defoliated foliage. This process can lead to biomass production in defoliated treatments being equal to, if not greater than undefoliated biomass. The results from the current study indicate that the carry-over effects of defoliation frequencies from one season to another may have the same, or a greater effect on plant production than the treatment within a specific season. Recommendations based on the results of only one season's research should therefore be handled with circumspection. This data indicates that the impact of defoliation on burnt grassland productivity is not necessarily neutralised after one season of rest.

It is also important to consider defoliation or grazing effects within the context of the physiological status of grasses during the period when they are most likely to be defoliated. In this study it was clear that the impact of defoliation during the first half of the growing season is greater than the last half of the season. The general trend noted in this study was that the longer the grassland rested after burning before defoliation, the lesser the carryover effect should be of a decrease in production after a subsequent growing season. In this way a defoliation during October after resting the rangeland for a full growing season, still produced significantly (P <0.01) lower than October, December and February of the subsequent season. Defoliation during December and February just after a fire, will significantly (P <0.01) lower production over the full subsequent growing season only. Grassland in these semi-arid areas should therefore be rested for a full growing season following a fire and also at least not be defoliated for the first part of the subsequent growing season, to ensure

Table 3: Average soil temperature (°C) for burnt (first year after burning) and unburnt grassland, taken at approximately 14:00 on 50 mm depth, two weeks after the October, December, February and April defoliations. (n = 3). Significant differences between cut and uncut (P<0.01) indicated by asterisks.

Month of defoliation	Unburnt			Burnt			
	Not cut	Cut	LSD	Not cut	Cut	LSD	LSD Burnt x unburnt
October	26.5	28.0		33.5	35.5	*	2.19
December	29.5	30.5		35.0	36.5	*	2.22
February	32.0	33.2		37.8	39.0		2.14
April	24.3	25.3		27.3	28.8		2.37

sustainable utilization of the grassland ecosystem. The importance of the correct time of utilization by grazing after burning, in a semi-arid climate, with respect to sustained high production has again been emphasised. Although drought is a normal phenomenon in the arid and semi-arid grasslands of South Africa and seriously limits the agricultural potential of the region accidental runaway fires further contribute towards its increased intensity and frequency.

This study clearly showed that defoliation after burning, does not only impact on the production of the subsequent seasons, but the soil is also more exposed to the natural elements of the environment. Therefore, defoliation increased soil temperature significantly (P <0.01) up to a depth of 50 mm over the first half of the growing season following the fire. Already from 07:00 in the morning the soil temperature, with defoliation, increased significantly (P <0.01) in the middle of the growing season following the fire. The sparser plant cover and large-scale tuft die-back, as well as the decrease in litter accompanying burning, could have been the main cause for this increase in soil temperature.

.Animals as utilisers of burnt grassland in the semi-arid areas should be considered in a follow-up study, in order to complete a more comprehensive picture on the ideal time of utilisation following a fire. Though obtained from cutting trials, this information contributes towards the scarcity of information quantifying the impact of defoliation following burning in the semi-arid grassland areas.

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Calling all Eastern Cape members

Peter Edwards Award: Best Conservation Farmer in the Eastern Cape Province

The Organizing Committee of the 42nd Annual Congress of the Grassland Society of Southern Africa calls for nominations of suitable candidates for consideration for the Peter Edwards Award.

The Peter Edwards Award for the Best Conservation Farmer is presented each year to a land-user situated in the area in which the Congress is held. The Award is presented in recognition of the sound application and practice of the principles of range and forage science and conservation. The aim of the Award is to recognise top land-users in different areas of southern Africa and thereby encourage the wise use of natural resources.

Suitable candidates for the Award should meet the following criteria:

The recipient should be utilising veld (range and/or pasture for domestic livestock production and/or game farming).

Farming practices should include, as far as possible, sound cultural and management practices which are recommended to ensure the optimum economic utilisation, conservation and reclamation of natural resources.

The farmer should contribution to his/her community by way of participation and leadership in study groups, soil conservation committees, organised agriculture, etc.

For more information, visit the Congress website (www.gssa.co.za/congress2007) or contact the GSSA administrator at 033-390 3113.

The highly invasive *Glyceria maxima* is threatening the Maloti-Drakensberg wetlands

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Glyceria maxima (also known as great mann grass and *Poa aquatica*), occurs in several Maloti-Drakensberg wetlands. Although this species has high erosion control and forage production values, it is extremely invasive. Unless measures are taken soon to curb this species, it is likely to considerably increase in extent and abundance, which will be devastating for biodiversity.

This species should not be intentionally spread or promoted

Synonyms

Glyceria aquatica (L.) Wahlb, *Glyceria spectabilis* Mert. & Koch, *Molinia maxima* Hartman, *Panicularia aquatica* (L.) Kuntze, *Poa aquatica* L. (see).

Common names

Glycérie aquatique (French), great mann grass, reed mannagrass, reed meadow grass, reed sweet grass (English), Wasser schwaden (German).

Description

Glyceria maxima is a perennial rhizomatous grass with unbranched erect stems up to 1.0-2.5 m. Leaf sheaths have prominent midribs and visible transverse veins and leaf blades are shallowly grooved with prominent midribs. Leaf margins have short, stiff hairs which are rough to the touch. Leaves are bright green but sometimes tinged with red. Spikelets are 6-12 mm long and the inflorescence is a panicle which can be opened or contracted and the inflorescence branches have short, stiff hairs similar to those of the leaf margins.

Invasive potential

Glyceria maxima is known to be one of the most invasive grasses worldwide. It is a native of Eurasia, and has become a threat to wetland biodiversity where introduced, including North America, New Zealand and Australia. Its dense monospecific stands are capable of rapidly outcompeting native wetland vegetation. In addition, through its expanding root mat, *Glyceria maxima* is particularly well adapted to growing out into areas of open water, whether in dams, lakes or in flowing streams and rivers. Small streams and those that are not very fast flowing can become completely overgrown. In this manner, the plant works as an ecosystem engineer, with the ability to convert sections of fast-flowing aerobic streams into partially anaerobic swamps. It is of particular threat to native vegetation in permanently saturated areas as well as invading aquatic environments, which is to the detriment of aquatic macroinvertebrates and other fauna.

Glyceria maxima is strongly favoured by human impacts on wetland and aquatic systems. Newly created shallow standing water resulting from impediments to flow, e.g. from road crossings, weirs and dams, provides ideal habitat. Physical disturbance of wetland vegetation also creates "space" into which the grass can more easily invade. Increased nutrients (e.g. through leaching from fertilized fields) further favours the rapid vegetative spread of the plant. Based on the sites examined in the Maloti-Drakensberg, impediments to flow appear to be the most important contributing factor.

Invasion pathways

The seeds appear to be distributed primarily by water, less so by wind, and may also be distributed on the feet of birds, on livestock as well as in mud on machinery. Locally the plant spreads through vegetative expansion, and it is also conceivable that pieces of floating mat broken off by high flows in a river could be transported great distances downstream and then become established.

Potential impacts

Not only are the direct impacts on biodiversity considerable, but the grass also has the potential to result in impacts to the agriculture and sport fishing industries. Although it provides forage, mortality of valuable dairy cattle in the Underberg area have been directly linked to prussic acid poisoning from *G. maxima*. Fish would be negatively impacted upon by *G. maxima* through its impact on the habitat and food supply of the fish.

Reasons for its introduction

The plant is introduced both as a forage for livestock and as an ornamental plant. In South Africa it would appear to have been introduced as a forage species, as will be explained in the following section.

However, in contrast to the situation in New Zealand, the planting of this species was confined to a relatively localized area, and no record could be found of it having been introduced through government channels, i.e. through Department of Agriculture.

Extent in the Maloti-Drakensberg planning area

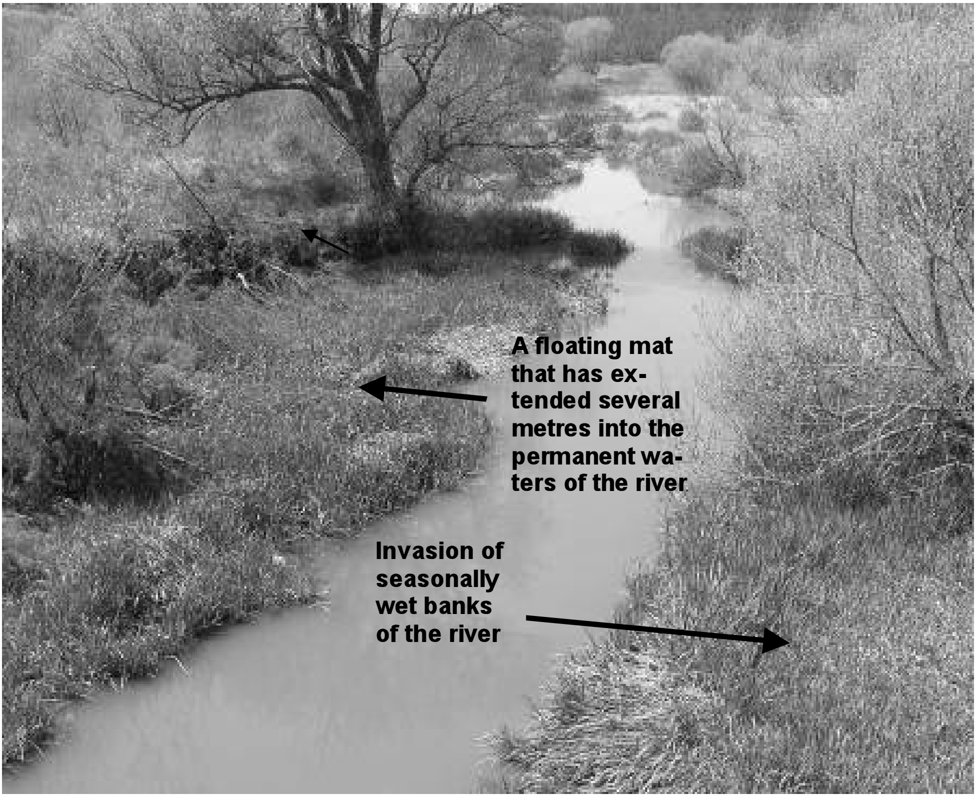
During the course of a Maloti-Drakensberg Project survey of 104 wetlands in the Maloti-Drakensberg planning area, *Glyceria maxima* was discovered in one of the wetlands in the Mkomazi catchment near Mpendle, and was particularly abundant around the margin of a dam in the wetland. Based on further investigation in the field and contacting farmers telephonically, it was located at several other sites, one site also in the Mkomazi catchment on the Luhane River, three in the Underberg/Himeville/Pevensey area in the Mkomazi and Mzimkulu catchments and three sites in the Kokstad/Franklin area in the eastern portion of the Mzimvubu catchment. Although further investigation is required, it appears that it was introduced as a planted pasture grass by a farmer in the Underberg area over 70 years ago. Some farmers have had it on their farm for over 60 years. It was not found in any of the wetlands recently surveyed in the western portions of the Mzimvubu, namely the Mooi River and Wildebeest subcatchments nor has it been located in any catchments north of the Mkomazi. While it is likely to be present in more sites than the eight already identified, its distribution appears to be restricted to a radius of approximately 150 km.

Not only are the direct impacts on biodiversity considerable, but the grass also has the potential to result in impacts to the agriculture and sport fishing industries.

Presently it appears to be confined mainly to the general area extending from where it was introduced over 60 years ago as a wetland pasture for livestock. If it had been more widespread than this then it was bound to have been discovered sooner or later. It is a conspicuous plant in several respects that is not easily confused with any existing species present in the Maloti-Drakensberg planning area.

It flowers widely and is morphologically quite distinct from any other grass species. Vegetatively it somewhat resembles *Echinochloa* spp. but its inflorescence is distinctly different from species in this genus.

It is tall-growing and forms large, dense stands.



Invasion of a river situation

Its commonly occurs as a floating mat growing out into open water areas, with this unusual ability being unmatched by any other grass in the Maloti-Drakensberg area.

Furthermore, the KwaZulu-Natal portion of the Maloti-Drakensberg, where all the known sites are located, has been botanically relatively intensively sampled. Yet despite this and the conspicuous nature of the species, no records of its occurrence in South Africa existed until very recently. Furthermore, Milton (2004) does not list it as one of the invasive grasses present in South Africa. It is argued that had this species been present more widely, it would have been recognized as something different from known hydric grass species, and it would eventually have been collected and identified. But no such records existed until its recent discovery.

Its potential to invade in the future

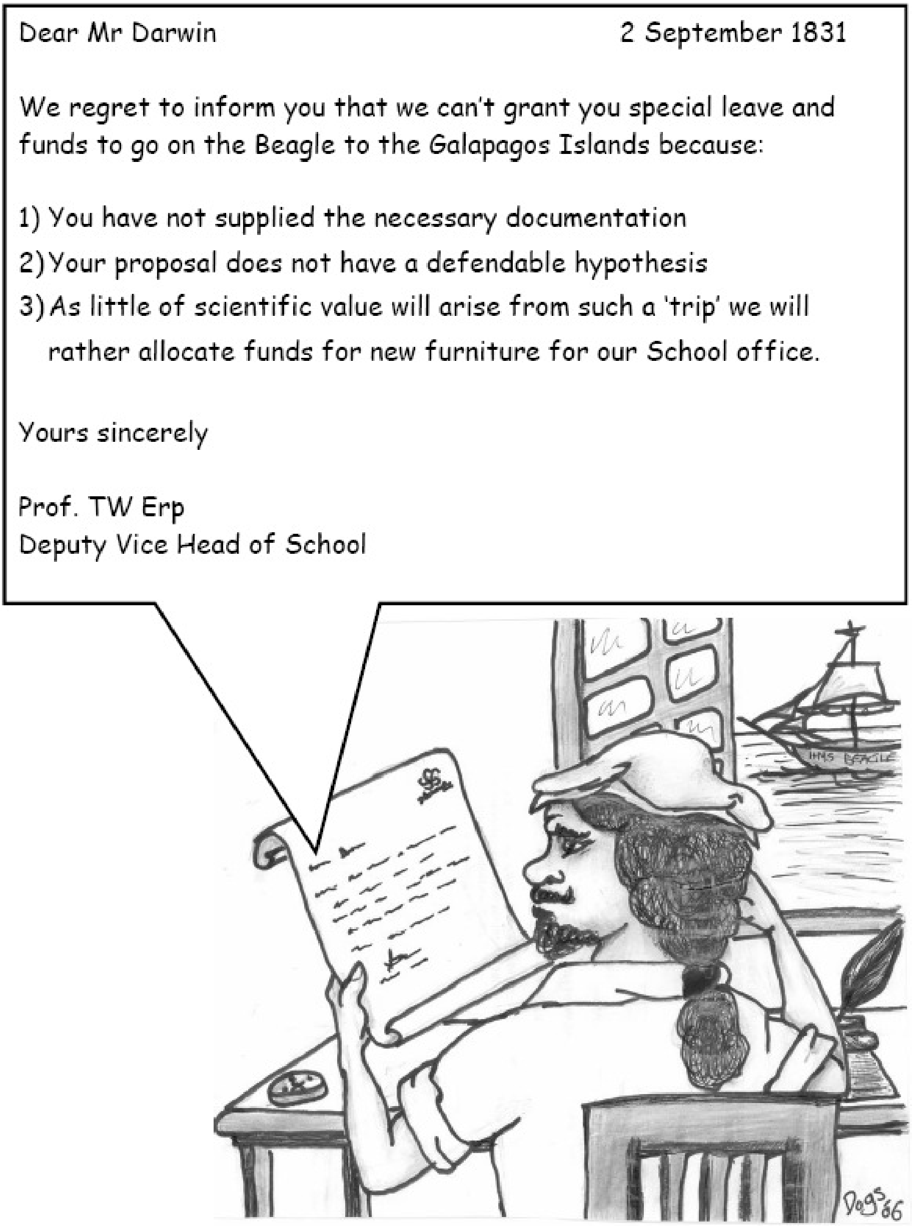
It would appear that much of the distribution of *G. maxima* can be explained through the passing on of vegetative material amongst farmers, but evidence suggests strongly that dispersal has also taken place naturally from some of the sites of introduction. Based on what is reported in the literature, further natural dispersal would appear likely. Given that *G. maxima* is already present in three major catchments, its potential to expand is considerable.

Based on the evidence at the invaded sites as well as that reported in the literature, it is not being melodramatic to say that across a large part of the low to mid altitudes of the Maloti-Drakensberg, *Glyceria maxima* has the potential to radically change the habitat of both palustrine (marsh) wetlands as well as stream/river systems, particularly mid to low order streams that are slow flowing. Thus, it is considered a very high priority that a well planned and swiftly implemented strategy be developed to eradicate this species. A major awareness campaign targeted particularly at farmers is also required.

Control methods

Roundup Biactive or Weedmaster 360 are listed as the permitted herbicide to use against *G. maxima* in New Zealand, and the recommended technique is Foliar spray without surfactants. Dense revegetation with local native species is also suggested to limit re-invasion.

Invasion of a palustrine (marsh) situation


Dear Mr Darwin
2 September 1831
We regret to inform you that we can't grant you special leave and funds to go on the Beagle to the Galapagos Islands because:
1) You have not supplied the necessary documentation
2) Your proposal does not have a defendable hypothesis
3) As little of scientific value will arise from such a 'trip' we will rather allocate funds for new furniture for our School office.
Yours sincerely
Prof. TW Erp
Deputy Vice Head of School
HMS BEAGLE