

fix -  
see disc  
not  
humble c off

A Review of

EFFECTS OF DISTURBANCE AND GRAZING BY CATTLE ON THE DYNAMICS  
ON HEATHLAND AND GRASSLAND COMMUNITIES ON THE  
BOGONG HIGH PLAINS

R. J. Williams, School of Botany, University of Melbourne, Victoria  
B. H. Ashton, Department of Botany, Monash University, Victoria  
Aust. Jnl. Botany, 1987, 35:(413-31)

A Review by

R. W. Condon, B. Sc. Agr., F.A.I.A.S.  
Rangeland Consultant  
formerly Special Soil Conservationist,  
N.S.W. Soil Conservationist  
Member former Kosciusko State Park Trust  
Co-Chairman Snowy Mountains Soil  
Conservation Conference

The above paper reports the results of reseach into the dynamics of heathland and grassland in undisturbed heath, grassy heath and grassland and on sites disturbed by cutting and laying snowgrass (Poa hiemata syn. Poa caespitosa) litter, and by removing all surplus vegetation and litter (the latter two treatments being an attempt to simulate natural situations).

Plots were one metre square and were replicated five or ten times in both grazed and ungrazed areas. The aim of the paper was to examine the factors affecting the establishment of shrubs within both heathland and grassland communities and to assess the role which grazing by domestic livestock may have.

The review has been undertaken following an inspection of large areas of sub-alpine grassland and woodland country in the Kosciusko National Park (KNP), where grazing by domestic livestock has been prohibited since May 1958, and in nearby areas of similar elevation and geological origins in country privately owned and on which summer grazing by cattle and/or sheep has been continued for at least 120 years.

Suffice to say at this stage that the latter country is much superior, in terms of diversity of species, than the similar nearby country in the KNP from which fire and grazing have been excluded for nearly 30 years and which, for that reason, has become an ecological disaster.

Before commenting on the findings as discussed in the Williams and Ashton paper, it is necessary to look critically at research of this nature in general, and recognize its inability to take into account all the interactions and interdependences which take place in the natural environment, and its inability, especially over a 3-year period, to account for all the catastrophes and favourable combinations of circumstances which may occur in the natural situation over time.

In this particular case, one must<sup>also</sup> recognize the limitations of a one metre square plot as being able to cater for real-life spatial considerations. It must also be said that one metre square bare areas are somewhat rare in the KNP and nearby grazed areas, except for those caused by feral pigs.\* It can be said that the authors have recognized these limitations and have been able to take them into account in developing their conclusions. There are, however, two important aspects which this research, and indeed all research of an ecological nature, has not been able to, or not tried to, take into account - viz. differential grazing intensities in so called 'grazed' plots or areas, and the effects of fire and of prolonged lack of fire. They are discussed briefly below.

\* There has been no mention of feral pigs in any of the Victorian literature - from which it must be assumed that they are not present in the Victorian alpine regions. It must also be asked whether this may be due to the presence of cattle and the associated human presence - and whether, if these two influences are removed from the high country foreshadowed as national park in Victoria, the cattle will be replaced by a more effective causal agent for erosion - as has been the case in KNP in N.S.W.

## Differential Grazing Intensities

The authors have recognized that cattle are most unlikely to visit a one metre square plot in closed heath, confining their attention to the vicinity of cattle pads and trails. In the case of grassland and grassy heath, although there is plenty of room for cattle to move freely, the intensity of grazing on any area will depend upon the attractiveness of the pasture and particularly as determined by the senescence of the snow grass sward. Although much is made of the supposed effects of grazing, there is never any qualification as to what kind of grazing other than that it is continuous through the 5-6 months of the summer.

There has been no consideration <sup>in the research literature</sup> of the benefits which might accrue from short term heavy grazing as a means of promoting diversity of species by allowing recovery in the 'regeneration niches' (Grubb, 1977) which might be created by such an approach to grazing. Nor is there any consideration of the effects of deferring grazing, on a rotational basis, until herbaceous species have flowered and seeded.

Grazing in alpine regions, although limited to 5-6 months of the summer season, can only be regarded as various levels of continuous grazing, mostly light, sometimes moderate and, in limited areas, probably heavy. Continuous light grazing has long been recognized as an effective means of ensuring the disappearance of the most palatable species in a pasture mix, and allowing the species on the low end of the palatability scale to proliferate. Heavier levels of continuous grazing accelerate the process.

Any consideration of the effects of grazing on the dynamics of heathland and grassland communities must take into account what happens in the broader scale grazing situation.

## Fire

Apart from a recent attempt by Leigh et. al. (1987), fire seems to have been an unmentionable subject in alpine ecological research. In Victoria, this has probably been the case since the devastating fires of 1939 when the mountain graziers were seen as a convenient scapegoat (Jameson, 1986). The Victorian high country has been fortunate in that it has had a form of grazing (albeit primitive) to maintain the sub-alpine and alpine environments in a 'near natural' condition. In N.S.W., the absence of both fire and grazing from sub-alpine regions has created an ecological disaster in which the minor species have largely disappeared under the weight of continuously accumulating senescent and dead snowgrass foliage with the opportunities for re-appearance receding in the absence of a means of creating 'regenerative niches'.

If alpine ecological research is to have any meaning at all in relation to the 'natural' alpine and sub-alpine environments, it must consider the place of fire in fashioning these environments before European settlement. That consideration must aim at restoring the natural environment to a regime as close as possible to that which applied before the Aboriginal concept of land management was disturbed by European settlement.

Any consideration of the results of the research by Williams and Ashton must be qualified by recognition of the fact that fire has been absent from these environments for many years. Any attempt to understand the 'dynamics' of the grassland and heath vegetation communities without considering the effects of fire can lead to only a very limited understanding.

Williams and Ashton are concerned with changes in the relative proportions, in the Bogong High Plains, of three broad vegetation communities: -

- (a) Closed heathland normally on the steeper and rockier terrain with species such as alpine mint bush (Prostanthera cuneata), alpine orites (Orites lancifolia), phebalium (Phebalium squarrosum) and alpine grevillea (Grevillea australis) as dominants.
- (b) Grassy heathland with a mosaic of snowgrass and patches of heath on moderate slopes with the Grevillea australis as the dominant shrub but with plentiful asterolasia (Asterolasia trymalioides), alpine hovea (Hovea longiflora) and golden shaggy-pea (Oxylobium ellipticum)
- (c) Grassland on gently undulating country but much exposed to wind and frost with the snowgrass Poa hiemata as the dominant. It is significant that there is no mention of the presence of the herbaceous species in the grassland, other than an impressive list of colonisers of bare ground in Table 5. One must assume that they were absent or insignificant in the snowgrass sward, a condition similar to that in the KNP where fire and grazing livestock have been absent for nearly 30 years; and in stark contrast to the situation in the nearby Snowy Plain and Upper Gungarlin catchment where there is a wealth of herbaceous species and a crop of alpine wildflowers each summer. It must be wondered whether the level of cattle grazing is so light that the snowgrass is becoming over dominant at the expense of the wildflower species.

Williams and Ashton point to many recorded examples of shrub increasing in the presence and absence of grazing and acknowledge that the expansion of heath on the Bogong High Plain has created potential management problems in increasing the fire risk and reducing the value of the pastoral resource for grazing. They refer to references by graziers that cattle grazing controls the spread of heath and promotes the growth of snowgrass.

However, they refer to research by Carr and Turner (1959a and 1959b and Carr 1977) which has led to the conclusion that the breaking up of the snowgrass sward by insect attacks, cattle activity and wind leads to the development of bare patches that "are recolonised more successfully by shrubs and herbs than by snowgrass" and that "shrub seedlings have little chance of establishment if bare patches do not develop".

The field trials of Williams and Ashton "were designed to examine the establishment of both shrubs and snowgrass on variously disturbed experimental sites" commencing in March 1980. The ungrazed plots were within exclosures of 0.5 ha and 4 ha with ringlock mesh fencing. The grazed plots were nearby in the areas having free access to cattle.

The plots were established in March, 1980 and observations continued for three years to 1983. The results, as published, appear to throw a good deal of light on happenings in the heath and grasslands. This review lists many of the statements made and the purported research findings and discusses them in the light of reality as seen in the KNP and nearby long-grazed sub-alpine areas. There are deficiencies in the simulation of bare ground such that the results cannot be regarded as reflecting reality, at least in the broad scale grazing situation.

- (1) Page 425 - para. 1 under "disturbance regime and the establishment of shrubs"

There was negligible establishment of shrubs either as seedlings or vegetatively on plots where bare ground was minimal, whereas on bare ground plots substantial establishment of shrub seedlings took place.

Although this result fits the expectation that shrubs establish on those sites which have been bared, it does not match the experience in sub-alpine areas in KNP at the head of the Murrumbidgee and Eucumbene Rivers in the area north and south of Rules Point, nor in the former grassland generally north-east, east and south-east of Mountain Jagungal in the country comprising the headwaters of the Geehi and Tumut Rivers. In the latter area it is reported that dense shrub to 2m high now covers some 50% of the landscape (confirmed by examination of airphotos) in country which was largely free of shrubs in the early 1960's. This and the Long Plain area around Rules Point have been closed to grazing livestock since 1958. The grassland areas not taken over by shrubs are covered with tall thick dead snowgrass foliage. There are no "holes" or bare spaces in this cover other than occasional areas dug over by feral pigs in recent years and in and around the wombat "warrens".

Examination of an area of several hectares of shrubs near Rules Point showed an area of about 20 metres diameter with long dead shrubs which were apparently the original point of colonization near the top of a rounded ridge of only 2-3% slope. It is conceivable that the almost flat top of the ridge may have been stony and relatively bare at some point in the past to enable the initial colonization by the now dead parent shrubs. Shrubs to 30 cms height, decreasing to 20 cms, extend out for 200 metres from the centre with an area of 40 metres diameter halfway to the edge currently supporting shrubs to 15-20 cms - all in dense senescent snowgrass but no bare spaces (see photo No. )

In another area in snowgum woodland on the Great Divide on the Grey Mare Trail south of McKeahnies Creek, dense shrub covers over 90% of an area in which locals recall being able to drive a mob of 1,500 sheep through short grass under the snowgums - but which has since been closed to grazing since 1958 (see photos

It would seem that in real life on the broadscale, in the sub-alpine country of granitic origin between 1,400m and 1,800m (4,500-6,000 feet) it is not necessary to wait for bare spaces in the snowgrass sward for shrubs to establish. The shrub *Grevillea, bossiae* and *hovea*, and others, will establish quite readily in dense senescent snowgrass standing to 20-30 centimetres high.

It is well-known that cattle at <sup>moderate</sup> ~~high~~ grazing rates will slow the rate of scrub encroachment. It is also well-known that it needs fire to open up country taken over by shrubs to allow the snowgrass to re-establish. A small fire over about 15ha or so has done this very effectively in the Farm Ridge area east of Jagungal, an area of dense shrubs to 2m high being burnt about 7 years ago and now (before the recent 10,000ha fire in the same area) re-established to snowgrass.

The reasons for the high rate of establishment of shrubs, grasses and on the unrealistically prepared bare ground plots are discussed under item (4) below.



(2) Page 425 - para. 2 under "disturbance regime and the establishment of shrubs"

"In both grasslands (and heathlands) bare ground is formed by the activity of cattle as a result of grazing, trampling, urine scalds and deposition of dung".

There are many points in the above statement which must be challenged.

#### Deposition of Dung

It is difficult to accept that deposition of dung creates bare ground. Depending on whether the beast is walking in the act or standing still, the ground is "covered" to at least 1 centimetre thick in the small patch dropped while walking, or to 2-3 centimetres thick for patch dropped from a standing position.

In the course of time, cowpats break up and disintegrate as the material weathers and the plants are able to break through. The cowpats create a small area of increased fertility for a few years but this form of re-cycling plant nutrients is infinitely preferable to having nutrients tied up in dead snowgrass foliage for 30 or more years awaiting for the inevitable fire to create the regenerative niches to restore the ecosystem to some degree of normality.

#### Urine Scalds

After about 12 hours of slow vehicle travel through sub-alpine grassland grazed for 120 years plus, including many stops for on-foot inspections, no one in a party of 5 people have observed what could be regarded as a 'urine scald'. People who have worked with cattle all their lives in the mountains have never seen anything in the way of bare ground that could be regarded as a 'urine scald'. One has to wonder whether the authors are trying to impress impressionable city folk with what can only be regarded as figments of their imagination.

*But see Wilks note attached.*

### Trampling

Again in 12 hours of slow vehicle travel through country that has been grazed each summer for 120 years by sheep and cattle, nowhere did the inspection party see bare ground that could be ascribed to cattle trampling. This is country currently carrying cattle at about one beast to 1.2ha. There was one site where cattle had crossed a small creek at a point where the associated bog vegetation was at its narrowest where one could see cattle hoofmarks left over from the previous year but in no way could this be said to be bare ground (see photo ).

It is conceivable that bare ground could be created by cattle trampling in a yard situation, or at points of concentration such as gates and mustering paddocks on a stock route, but it is difficult to conceive of trampling damage at normal stocking rates.

### Grazing

The above remarks in respect of trampling apply also to grazing by cattle and sheep.

It is difficult to conceive of bare ground being created by the process of removal of the vegetative parts of snowgrass or the herbaceous species that cattle are able to get their tongue and teeth around. Although the action of a cow grazing is mostly pulling and cutting, <sup>live</sup> snowgrass is too well rooted to be pulled out by the roots and most of the herbaceous species have a prostrate base with with an upright seed- / <sup>stalk</sup> and are likewise not easily pulled out by the roots.

Again in 12 hours of slow travel through country grazed each summer for 120 years plus, no evidence of plants being pulled out by cattle grazing or bare ground created by cattle grazing was observed - nothing but fresh green - healthy and vigorous grasses and <sup>forbs</sup> in direct contrast to the large volume of senescent and dead snowgrass and very sparse forbes in ungrazed areas in the nearby KNP.

The only area that did have formerly bare ground, now being colonised by sheep sorrel (Acetosella sp.) and other herbs amongst the tussocks of snowgrass, was a former mustering paddock where stock were held in large mobs before being taken in to, and later out of, the snowlease grazing country. This area is currently well covered with snowgrass, but with a range of herbaceous species in addition to the sheep sorrel which is still the most frequent herb. This recovery has taken place under the pressure of continued grazing.

The inspection party did see however, large patches of bare ground, up to 500 sq. m. in size which could be attributed to wombat activity on steep short slopes above streams; and one area which was particularly susceptible to continuing rabbit activity, being the first area out of the snow each spring.

In putting forward 4 spurious methods by which cattle are supposed to create bare ground, the authors are stretching the credulity of practical minds and risking their own credibility - but no doubt making a favourable impression on those seeking to discredit cattle grazing in the high country.

Cattlemen with a life-time of experience in the Victorian alpine regions take exception to the nature of the statements attributing bare ground to cattle activity, leaving it to <sup>belonging</sup> ~~the~~ <sup>be</sup> part of the propaganda designed to show cattle up in a bad light.

- (3) Page 425 - second para. "disturbance regime and the establishment of shrubs" - line 7

The conclusion from the William and Ashton research is that because of the supposed propensity of cattle to create bare ground, the potential for scrub encroachment is ever-present on grazed areas. This is said to support the conclusions of a host of earlier researchers in the Victorian and N.S.W. alpine regions.

The experience in KNP is that the potential for scrub encroachment is greatest on ungrazed country. This is not so much because of the absence of cattle, but because of the absence of fire since 1958 and earlier. It is considered by people with long practical experience of the Bogong High Plains, that the encroachment of shrubs in that area has been due to two factors - the total absence of fire since 1939, and the gradual reduction of stock numbers to the point where they are not able to have any influence on shrub encroachment.

In contrast, there is very little shrub in the grazed sub-alpine country in N.S.W., except in the snowgum woodland areas on the ridge tops. In this country, the landholder is reluctant to burn for fear of causing a dense regeneration of snowgum seedlings. However, landholders who have burnt small patches under mild conditions have been able to do so without causing massive regeneration of snowgum. In a very few places, shrub is encroaching down-slope out of the timber into grassland.

(4) Page 426 - para. 1.

The snowgrass litter trial (in which the snowgrass foliage was clipped to ground level and the clipped material laid over the square metre plot and held down with netting) has shown that if the litter remained intact and covers the base of the cut snowgrass plant, the vegetative recovery of the snowgrass is relatively rapid. It is expected that the plots will revert to a closed sward of snowgrass and other herbs.

It is presumed that the regeneration of snowgrass is from the base of the tillers. If the tillers were not killed by the clipping, this would be a very unrealistic simulation of case moth damage, this causing 100% death of snowgrass plants over the area affected and not leaving live culms of snow grass at soil surface level.

The inspection in the N.S.W. sub-alpine areas revealed no examples of death of snowgrass due to case moth, certainly not in the grazed country where it would stand out clearly from the fresh green of the general grass and herbage cover.

The inspection party did find several areas of case moth damage near the summit of Mount Twynam (around 2,200m) ranging in size from 30 centimetre diameter to 100 square metres. Even on the smaller areas, the wind was gradually removing the dead snowgrass foliage and in several instances had exposed the soil over areas of 10-20 centimetre diameter. In some, an occasional plant of snowgrass or silver snow daisy or other herbs had established.

The inspection also revealed bare areas of similar slope and size (presumably as a consequence of case moth damage in previous years) in which litter was completely absent, in which the wind had removed several centimetres of soil,

leaving a fine gravel to 5mm diameter which was often blown in to one corner if there was a wind funnel effect on the downwind side of the bare space. Again, there was colonization by occasional herbs but little likelihood of complete recovery although the edges were generally well stabilized by over-lapping snowgrass which will probably gradually creep in from the edges. There was certainly no colonization by shrubs, these being virtually completely absent from the summit of Mount Twynam.

- (5) Page 4 - first paragraph under "vegetation changes on the bare ground plots" first sentence.

Numerous seedlings (of shrubs) established in these plots even though successful seedling establishment is relatively uncommon in alpine and sub-alpine regions (quoting several references from overseas).

One has to ask if the cover was realistically bare in the bare ground plots if they were merely clipped to ground level to remove above ground foliage. In this situation one would expect that there were be thousands of seeds of a wide range of species in the top 3-4 centimetres of such a surface, plus near ideal conditions (as far as sub-alpine can be near ideal).

This is confirmed by the large numbers of shrubs (12), grass (8) and forbs (23) species and two sedges, these being listed in Table 5 (page 420) as species colonizing the bare ground plots. The presence of seedlings of the two sedge species (Carex), which subsequently died, suggests near ideal conditions for germination. The fact that all but two of the total of 45 species was observed to regenerate by vegetative means as well as from seeds suggests that the conditions in the simulated bare ground plots was most unreal.

It is further confirmed by the count of 50 plant species per square metre plot not counting the more numerous herbs (Table 6 - page 421). What the authors have done in

endeavouring to simulate bare ground is to create a "regenerative niche" for the large numbers of seeds which have been waiting, perhaps for 20 years or more, for such an opportunity to reproduce the plants from which they were shed.

If one is to simulate "bare ground" as would be found in the natural state, one should at least rake over the soil to about 1 centimetre, blow all the fines away with a reverse vacuum cleaner, repeating this process at least twice and then giving the exposed surface a good

Given such treatment, one would expect subsequent germinations to confirm the conclusions of the overseas research (as stated above).

One wonders also, in view of the stated propensity of cattle to create bare ground by the four methods discussed previously, why the researchers were not able to find enough bare ground so created in the vicinity, at least in the grazed areas. This author can assure readers that this would be impossible in the Snowy Plains and Upper catchment areas other than <sup>occasional</sup> areas of bare ground created by wombats and feral pigs. On the other hand, there would be no difficulty in finding bare ground created by feral pigs within the KNP. Of the several sites two years old and more examined casually, there was no sign of shrub seedlings.

If this author's assumptions as to the nature of "bare ground plots" are correct, the attempt at simulation of bare ground can only be described as unsimulated farce.

(See

(See item 16)

- (6) Page 426 - first paragraph under "and vegetative changes on the bare ground plots" - second last sentence.

"Amen (1966) suggested that some alpine species may be stimulated to germinate by scarification from soil particles during freeze-thaw episodes on bare ground".

Again, one *has* to stretch the imagination to conceive that frost-heave, under Australian alpine conditions, could generate enough pressure to enable soil particles to "scarify" seed. This author's observations on frost-heave effects suggests that the needle-ice lifts up a small block of soil about  $\frac{1}{2}$ -1 centimetre thick. Then, as the ice melts, the block of soil is lowered to the surface and tends to fall apart into granules which roll gently down the slope, if steep enough, or form a layer of granulated soil on the surface. It is difficult to conceive that these gentle actions could scarify the seed enough to stimulate germination.

The reasons for the high number of seedlings on the bare ground plots in this situation are discussed in item 5 above.

- (7) Page 426 - first paragraph under "vegetative changes on the bare ground plots" - last sentence.

"Trampling of bare ground by stock may stimulate the germination of shrubs  
..... "

Again, the authors are casting around for reasons for the high germination rate (refer again to item (5) above) and, one suspects, seeking to implicate cattle as a convenient scapegoat. If there are plenty of seeds sources nearby and the bare ground is not down to the B horizon, herbaceous species in particular are readily able to colonize bare ground.



Repeat!!

(7) Page 426 - third para. under "vegetation changes on the bare ground plots".

In this paragraph, the author's are again casting around for a reason behind the high establishment rate on the bare ground plots. They have come close to the mark in that it "may have been related to the coincidence of a number of events e.g. (more than) adequate seed supply, environmental conditions (in the relatively undisturbed soil).

It is considered that the factors listed under item (5) would be more relevant than the several possibilities explored in this paragraph.

(8) Page 427 - second full para., last sentence (under "vegetation changes on bare ground plots").

As "... local patterns of dominance may depend upon past patterns of accumulation of seed in the soil".

The paragraph discusses the range of results recorded on the bare ground plots in closed heath. One would have to agree that under the conditions pertaining on the simulated bare ground plots in this experiment, that seedling dominance would depend very much on past patterns of accumulation of seed in the soil. There should be no need to canvass other possibilities.

However, if the bare ground plots were prepared as outlined in item (5), the seedlings subsequently present would be of those species grown or carried on to the plot (being those species with mature plants growing in the vicinity) and able to germinate and establish under the conditions usually pertaining to bare ground in an alpine or sub-alpine environment.

In the conditions on the bare ground plots in this experiment, seeds migrating on to the plots from nearby would have little opportunity to germinate in competition with those lying there for years waiting for a circumstance like that provided by the researchers.

(9) Page 427 - fourth full para. - first and **second** sentences (under "vegetation changes on bare ground plots").

(Contrary to the usual expectation) "the cover of snowgrass was relatively high on four of the twenty (bare ground plots) in closed heath".

Although one can agree with the statement that "survival of snowgrass seedlings depends upon adequate protection from the extremes of micro-climate as is found in the lee of shrubs etc.", the presence of snowgrass seedlings depends firstly on having a seed supply in the soil rather than on current input of snowgrass seeds from a grassy patch only about one metre away. The latter of course could have inputted plenty of seed in preceding years. Again, had the bare ground conditions been realistic and prepared as described in item (5), it is probable that there would have been few snowgrass colonists (in accordance with expectations).

(10) Page 427 - last para., being the first para. under the heading "effects of cattle grazing on the regeneration of shrubs, herbs and sedge on the bare ground plots".

"Assessment of the effects of grazing by cattle on both seedling density and vegetation cover was complicated by the strong interaction between grazing and communities."

As the researchers later admit, the results on grassy heath and closed heath are confusing and the discussion which follows (on p. 428) is a canvassing of all the possibilities in an attempt to explain the often contradictory results.

The second sentence raises one of the contradictions - "in the grassy heath plots, the predominant seedling, was the shrub ASTEROLASIA trymaloides, the seedlings of which are damaged by trampling (Carr and Turner, 1990) and Carr, 1977) and (which) may be grazed selectively by cattle."

Reference to Table 8 will show that there was a high proportion of ASTEROLASIA on the grazed grassy heath and that it was also the predominant shrub seedling on the grazed plots in the closed heath whereas there were none at all on the ungrazed plots. Does this indicate that Carr and Turner may have been wrong in 1990 and 1977, or that there was no cattle trampling on the grazed plots to "damage" the seedlings.

This author's expectation is that the result with ASTEROLASIA and all the other shrubs, were a consequence of the seeds stored in the soil under the improperly simulated bare ground plots and that this effect would have over-ridden treatment effects. Hence the long discussion on possibilities under this heading.

(11) Page 428 - first half para. second sentence under "effects of cattle grazing etc. on bare ground plots".

"In (the open grassy heath and grassland communities) cattle movement is diffuse and "damage" to grazed plots is expected to be uniform."

There are several points warranting discussion.

- (a) the use of the word "damage" in the above context betrays the authors' obsession with cattle and damage. Must we assume that "damage" is associated with cattle.

From a completely objective point of view, would not the word "use" be more appropriate.

Is it objectively fair to consider the "low density of ~~Poa~~ seedlings and lower values of all other classes as "damaged". How do we know that it is "damaged". The "lower values" at this time may be beneficial in the long term at that site.

- (b) It is expected that "as the movement of cattle in grazing areas is diffuse that use of the grazed (bare ground plots) is uniform". However, does this expectation have due regard to the behaviour of cattle and their preference for the fresh new growth on the "bare ground plots".

It could be reasonably expected that the presence of the herbaceous and young snowgrass cover on the "bare ground plots" would act like a magnet and that the stocking rate on these bare plots would be much greater than elsewhere in the same "paddock".

It could be expected, therefore, that the use of "bare ground plots" would be much greater (in terms of cow bites per square metre) than the surrounding well grassed areas. This would happen in real life also except that there would be few seedlings (other than herbs) for the cattle to "damage". If there is

greater use of real life bare ground areas, the resultant "cultivation" of the soil by trampling might encourage greater germination and establishment of seedlings.

The possibilities are many and beyond the capacity of available research techniques to sort out.

(12) Page 428 - second para. - last sentence (under "effects of cattle grazing etc. on bare ground plots").

"..... there are no clear patterns to explain why shrubs seedlings were so few in ungrazed plots."

The recorded results for shrub seedlings on bare ground plots on grassy heath and closed heath are very confused and contradictory (see Table 8 - page 424). In both grassy heath and closed heath, shrubs were more profuse on the grazed plots as often as on the ungrazed plots, suggesting that factors other than treatments were influencing results.

(13) Page 428 - third para. second sentence (under "effects of cattle grazing etc. on bare ground plots").

"ACETOSELLA is relatively non-palatable and this may explain its greater relative dominance on grazed plots in both open heath and closed heath."

It is difficult to understand why ACETOSELLA should be more frequent on grazed plots than ungrazed plots unless the grazing has removed the other species and thus allowed more space for the ACETOSELLA to occupy. ACETOSELLA is a vigorous colonizer and its relative dominance would be a matter of relative space to occupy.



(14) Page 429 - first paragraph under the heading "implications for management".

"The establishment of heath species in grasslands on the Bogong High Plain is primarily due to disturbances which cause bare ground, upon which shrub seedlings may establish. Bare ground is a common feature in all communities that are grazed or **visited** by cattle (Carr and Turner, 1959(a), 1959(b); McDougal, 1982)."

This statement does not match the experience in the Snowy Mountains area in N.S.W. - in fact the very opposite applies.

In Kosciuszko National Park, ungrazed for nearly 30 years, there are no bare spaces in the dense senescent snowgrass but shrubs are spreading over extensive areas where there was little or no shrub in 1958. Frequent and sometimes extensive areas of bare ground caused by feral pigs is generally too recent to tell whether this is being colonized by shrubs. Older pig rootings are being colonized by herbaceous species in areas where there is a highly organic surface horizon but less so when that horizon is absent.

With regard to the second sentence in the above quotation, bare ground, (other than that caused by wombats) is a most uncommon feature in the sub-alpine country subject to regular summer grazing over the last 120 years or more. One has to ask why the Bogong High Plains are so different and what proportion of the landscape does bare ground more than 10 centimetres square occupy.

In the third sentence in paragraph one, "..... following such disturbance, and in the establishment of shrub seedlings, further cattle activity will be detrimental to the survival and growth of most shrub seedlings."

The statement would seem to be contradictory to the results set out in Table 8 (Page 425) which shows a high proportion of shrub seedlings on both grazed and ungrazed bare ground plots,

in grassy heath and closed heath.

However, the statement does confirm the inferences by graziers reported at the beginning of the paper that "cattle grazing controls the spread of heath".

The first sentence in the second paragraph under "the implications for management" states that "if cattle are removed from the High Plains an extension of heath in those sites where shrub seedlings have established is likely", as was concluded also by Carr (1977). The authors refer again to the shrub expansion which has occurred at the Rocky Valley and Pretty Plain experimental sites but infer that this expansion is not solely the result of the removal of cattle but a delayed reaction to the disturbances that have allowed shrub seedlings to establish in the first place.

Again, it must be stated that this does not match the experience in the Snowy Mountains area in N.S.W. where the long-grazed country is virtually shrub-free other than by encroachment from shrub-dominant areas in nearby woodlands, and where shrubs are vigorously invading densely grassed areas which have had no disturbances by cattle for nearly 30 years.

Williams and Ashton contend that without the disturbances (supposedly caused by cattle grazing) which facilitate establishment, the extent of expansion of shrub species in the Bogong High Plain would have been much less.

This may be so but there is another factor which has been completely ignored in the study and all the theorising. The Bogong High Plains area has been free of fire since 1939, an agent which is very effective in grasslands throughout the world in returning grasslands to their shrub-free state.

Another factor whose influence cannot be measured is the effect of the reduction in cattle numbers which has taken place on the Bogong High Plains over time. It is reasonable to assume that earlier levels of cattle grazing may have kept shrubs in check and that lowering levels of

cattle grazing has been **only** one of a coincidence of circumstances, including lack of fire, leading to expansion of shrubs.

CONCLUSIONS (final paragraph on page 428 and on to page 429).

The conclusion of Williams and Ashton is that "on the basis of the present evidence, continued grazing by cattle as a means of inhibiting shrub expansion on the Bogong High Plains cannot be recommended. Moreover, because cattle activity both facilitates the exposure of bare ground and alters the pattern of secondary succession on such disturbed micro-sites, the continued grazing of cattle within the Bogong National Park is not compatible with strict values of nature conservation, especially as alpine and sub-alpine flora of Australia has evolved in the absence of intense grazing pressure by herbivores in general and ungulates in particular (Costin 1968, 1983).

Firstly, one must question the quality of the "present evidence" based, as much of it is, on the very questionable nature of the simulated bare ground plots and the very variable results in respect of shrub seedling numbers on bare ground plots in grassy heath and closed heath. As stated previously, the results obtained would be much more a reflection of seed stored in the soil under the "bare ground" rather than the treatments of grazing or non-grazing. The only "evidence" on which such a conclusion could be based is the "cover all possibilities" discussion on pages 427-429 under the sub-heading "effects of cattle grazing etc."

As indicated also at the beginning of this review, the relevance of small scale research to real life situations in ecology is doubtful, particularly in view of the fact that research results in general in alpine and sub-alpine areas, although appearing to favour the researchers (mis) conceptions about cattle grazing, are not matched by what is happening on the broadscale in the Snowy Mountains areas in N.S.W.

Secondly, as has also been quoted previously (item the experience in sub-alpine areas in the Snowy Mountains area in N.S.W. does not support the statement in the conclusion that

"cattle activity both facilitates the expansion of bare ground and allows the pattern of secondary succession on such **disturbed** micro sites.

Thirdly, the experience in the Snowy Mountains Area of N.S.W. likewise, does not support the final part of the conclusion that "continued grazing ..... is not compatible with the strict values of nature conservation".

Removal of cattle and fire from the Koscuisko National Park for nearly 30 years has created an ecological **desert** in which the minor species are at great risk of never being given the opportunity to occupy a "regenerative niche" such as would be created by mild fire and even by the disturbed micro sites which might sometimes result from cattle activity.

In due course, there will be disturbed "mega-sites" when the inevitable wild fire occurs. One such fire in the Mount Jagungal area of Koscuisko National Park burnt over 10,000 acres in three? days before being distinguished by a snow fall? in the middle of January 1988.

However, there will need to be a coincidence of favourable circumstances which will result in a quick protective cover before heavy rains or strong winds remove much of the fine ash and soil - with environmental damage on a scale which must be incompatible with the "strict values of nature conservation".

Finally, one must question the ultimate sub-sentence in the conclusion "especially as the alpine and sub-alpine flora of Australia has evolved in the absence of intense grazing pressure by herbivores in general, and ungulates in particular (Costain 1968, 1983)."

This statement makes no allowance for the role of fire in the evolution of the alpine and sub-alpine vegetation and its influence in providing the "regenerative niches" to ensure the diversity of species and successional stages so necessary to the integrity of a nature conservation system.

Before concluding this review there is one other point which must be considered. There has been much reference in this paper and alpine research literature generally, and particularly from the conservation movement, to "bare ground" and the role of cattle in creating bare ground. This reviewer would, however, pose the following questions.

- (1) How much bare ground is there on the Bogong High Plains?
- (2) What proportion of this is at the higher elevations (above 1,800m - 6,000 feet).
- (3) Have we definite proof that the long standing bare ground was caused by cattle activity or, can we lay much of the blame on the 1939 fires as a triggering agent.
- (4) How much of the bare ground can we attribute to case moth or similar insect damage?
- (5) To what extent has the "new" bare ground increased as a consequence of continued cattle activity?
- (6) Is there much bare ground as a consequence of wombat activity?

One must question also the use of the word "intense" grazing pressure in the final sentence. The reviewer's understanding of grazing in the Bogong High Plains is that it is very light and only in areas of stock concentrations (if there are any in a fenceless paddock) would there be intense grazing pressure.

## REFERENCES

- CARR, S.G.M. (1977). Report on inspection of Bogong High Plains. Land Conservation Council, Victoria.
- CARR, S.G.M. and TURNER, J.S. (1959a). The Ecology of the Bogong High Plains. I - The Environmental Factors and the Grassland Communities. Aust. Jnl. Bot. 7:(12-33).
- CARR, S.G.M. and TURNER, J.S. (1959b). The Ecology of the Bogong High Plains. II - Fencing Experiments in Grassland. Aust. Jnl. Bot. 7:(34-63).
- COSTIN, A.B. (1968). Alpine eco-systems of the Australasian Region. "Arctic and alpine environments". (eds. H.E. Wright and Osburn) - Indiana University Press, Bloomington, Indiana<sup>a</sup>.
- COSTIN, A.B. (1983). Mountain lands in the Australian region: Some principles of Use and Management. Proc. Ecol. Soc. Aust. 12:(1-13).
- GRUBB, P.J. (1977). The Maintenance of Species-Richness in Plant Communities: The Importance of the Regeneration Niche. Biol. Rev. 52:107-45.
- JAMES, B. (1985?). Movement at the Station.
- LEIGH, J.H., WIMBUSH, D.J., et al (1987). Effects of Rabbit Grazing and Fire on a Sub-alpine Environment. I - Herbaceous and Shrubby Vegetation. Aust. Jnl. Bot. 35:(433-64).
- MCDUGALL, K.L. (1982). The Alpine Vegetation of the Bogong High Plains. Environmental Studies publication No. 357, Ministry for Conservation, Victoria.