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**THE EFFECTS OF CATTLE
GRAZING ON VEGETATION
DIVERSITY AND STRUCTURAL
CHARACTERISTICS IN THE
SEMI-ARID RANGELANDS OF
NORTH QUEENSLAND**



**THESIS SUBMITTED BY
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IN OCTOBER 2001**

For the degree of Doctor of Philosophy
in Tropical Plant Sciences
within the School of Tropical Biology
James Cook University

“IT IS NOT THE CRITIC WHO COUNTS, NOR THE MAN WHO POINTS OUT HOW THE STRONG MAN STUMBLED, OR WHERE THE DOER OF DEEDS COULD HAVE DONE BETTER. THE CREDIT BELONGS TO THE MAN WHO IS ACTUALLY IN THE ARENA; WHOSE FACE IS MARRED BY DUST AND SWEAT AND BLOOD; WHO STRIVES VALIANTLY; WHO ERRS AND COMES SHORT AGAIN AND AGAIN; WHO KNOWS GREAT ENTHUSIASMS, GREAT DEVOTIONS, WHO SPENDS HIMSELF IN A WORTHY CAUSE; WHO, AT THE BEST, KNOWS IN THE END THE TRIUMPH OF HIGH ACHIEVEMENT; AND WHO, AT THE WORST; IF HE FAILS AT LEAST FAILS WHILE DARING GREATLY, SO THAT HIS PLACE SHALL NEVER BE WITH THOSE COLD AND TIMID SOULS WHO KNOW NEITHER VICTORY NOR DEFEAT”

- Attributed to Theodore Roosevelt

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ABSTRACT

The semi-arid rangelands of tropical North Queensland have suffered a major decline in land condition since arrival of Europeans. This includes erosion and soil loss, the widespread loss of native perennial tussock grasses and the widespread invasion of exotic plant species; some accidental, others introduced to help stem the process of land degradation. It has often been stated or implied that cattle grazing is an important factor in the land degradation process; a suggestion supported by various research projects. The present research examined impacts of grazing on various characteristics of plant communities in the semi-arid rangelands of tropical north Queensland. Characteristics examined included diversity, functional groups, ground cover and tree dieback.

The diversity and composition of a pasture is usually determined by abiotic effects such as soil and climate, and secondarily by the nature of grazing. However, the present study demonstrated that, in some cases, grazing played an equally important role in determining species assemblages. Grazing generally resulted in a decline in the abundance of:

- native perennial tussock grasses
- exotic pasture legumes, and
- palatable species

Grazing caused an increase in:

- exotic grasses
- forbs
- native legumes, and
- unpalatable species.

Impacts of grazing on diversity were dependant on the dominant grass species and its palatability. When native palatable and perennial grasses such as kangaroo grass (*Themeda triandra*) and black spear grass (*Heteropogon contortus*) dominated, intermediate levels of grazing resulted in an increase in diversity since the grazing released other plant species from competition. Where the dominant grass was a less-palatable exotic grass species such as Indian couch (*Bothriochloa pertusa*) or buffel grass (*Cenchrus ciliaris*), grazing reduced diversity since grazing reinforced the dominance of those grass species. *Cenchrus ciliaris* itself was identified as having a deleterious effect on species diversity, independent of grazing pressure.

The responses of functional groups such as annual grasses were dependant on levels of palatability, which may have varied from site to site. The effects of cattle grazing on many functional groups were less pronounced in areas grazed only during the dry season, in contrast to areas grazed continuously throughout the year.

Grazing had a deleterious influence on ground cover. While intermediate grazing caused a level of decline in ground cover that was beneficial to many species, heavy grazing may result in scalding and erosion. An exception to this is where grazing reinforced the dominance of *Bothriochloa pertusa*; the spreading stoloniferous habit of which can result in increased ground cover.

During this research, widespread dieback of ironbarks (*Eucalyptus crebra* sensu lat.) was observed throughout the semi-arid rangelands on a range of soil types and grazing regimes. In contrast to previous research, the present study found a correlation between cattle grazing and the dieback of *Eucalyptus crebra*, although dieback occurred to some degree even in the absence of grazing. Large trees were more susceptible to dieback than small saplings, which, in some cases, may have benefited from grazing by the removal of competing herbaceous species from their proximity.

The present research showed that with prolonged heavy grazing, transitions in states of land condition might occur which would be irreversible without major inputs. It was recommended that achieving sustainability of the grazing industry in both economic and conservation terms would involve the regular monitoring of several land condition parameters. This would identify economically feasible opportunities for pasture rehabilitation from opportunistic de-stocking or changing the seasons of cattle grazing. The present study noted that diversity and land condition were optimal under a regime of intermediate disturbance, and that this level of disturbance occurred with macropod grazing. Likewise, the provision of cattle exclosures adjacent to pastures allowed a source of seed for recolonisation of native perennial tussock grasses where those species had been otherwise eliminated by the excessive overuse of grazing.

Limitations in this study were discussed and recommendations for future research priorities were made.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

- *: Introduced species
- ANOVA: Analysis of Variance
- BLURNG: Blue Range study site
- CSIRO: Commonwealth Scientific Industry Research Organisation
- DBH: Diameter at Breast Height
- EPP1: Epping Forest National Park study site #1
- EPP2: Epping Forest National Park study site #2
- JCU: James Cook University
- JERVOIS: Jervoise study site
- KHILEA: Kangaroo Hills East study site
- KHILWT: Kangaroo Hills West study site
- KIRK: Kirk River study site
- LCKDAM: Lucky Downs dam study site
- LYSHN: Leyshon View study site
- MTLEY: Mt Leyshon mine study site
- PAJING: Pajingo mine study site
- QDPI: Queensland Department of Primary Industries
- RSHTN: Rishton mine study site
- TABTOP: Table Top study site