

**PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY  
BIENNIAL CONFERENCE**

**Official publication of The Australian Rangeland Society**

**Copyright and Photocopying**

© The Australian Rangeland Society 2012. All rights reserved.

For non-personal use, no part of this item may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior permission of the Australian Rangeland Society and of the author (or the organisation they work or have worked for). Permission of the Australian Rangeland Society for photocopying of articles for non-personal use may be obtained from the Secretary who can be contacted at the email address, [rangelands.exec@gmail.com](mailto:rangelands.exec@gmail.com)

For personal use, temporary copies necessary to browse this site on screen may be made and a single copy of an article may be downloaded or printed for research or personal use, but no changes are to be made to any of the material. This copyright notice is not to be removed from the front of the article.

All efforts have been made by the Australian Rangeland Society to contact the authors. If you believe your copyright has been breached please notify us immediately and we will remove the offending material from our website.

**Form of Reference**

The reference for this article should be in this general form;  
Author family name, initials (year). Title. *In*: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

For example:

Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite (*Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15<sup>th</sup> Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

**Disclaimer**

The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.



*The Australian Rangeland Society*

DEGRADATION AND POTENTIAL FOR RECOVERY IN SOME CENTRAL  
AUSTRALIAN RANGELANDS: I. SOILS AND LANDSCAPE.

D. J. Tongway<sup>1</sup> & M.H. Friedel<sup>2</sup>

<sup>1</sup>CSIRO Division of Wildlife and Ecology, Canberra.  
<sup>2</sup>CSIRO Division of Wildlife and Ecology, Alice Springs.

**ABSTRACT**

We studied three sites in Central Australia with a range of use by cattle to see whether the soil had lost its capacity to support the vegetation assemblages present prior to grazing, and also to investigate whether degradation processes might reverse if stocking policy is changed. On the most heavily utilised sites, the soils were unstable and infertile and the landscape had lost nearly all its capacity to trap and use scarce resources effectively. The moderately utilised site had lost some of the soil/landscape productive potential, but could improve given good seasons and light stocking.

A site which had been de-stocked for 10 years had stable, fertile soils and a number of means in the landscape of capturing and utilising scarce resources such as water, top-soil and organic matter.

**INTRODUCTION**

The calcareous shrubby grasslands of Central Australia are highly preferred grazing for cattle. As a consequence, there has been heavy utilisation of the pasture, and the landscape has received persistent trampling and/or treading by cattle.

In these circumstances, can we assess or predict whether vegetation change is reversible by changes to stocking management, or not, because the condition of the soil as a habitat for grazed species has been degraded or destroyed?

To answer this question, we need to understand how physiographic features, vegetation and soil properties control scarce resources such as water and organic matter in relatively undegraded systems, then investigate how those processes and properties have altered in pasture which are perceived to be degraded.

**METHODS**

We selected three areas with a range of grazing histories for our study: Site 1, 0.3 km from a dam and actively grazed; Site 2, 4.5 km from the dam open to grazing; and site 3, a similar distance from a dam as site 2 but having been fenced off and ungrazed by cattle for 10 years. At each site we set up a transect about 300 m long running directly down the maximum slope. The transect was divided into a number of strata using geomorphic and soil surface descriptors to discriminate the strata and to infer their functional attributes (eg run-off slope, sand bank, depositional zone etc). An accurate levels survey was made at 1m intervals along the transect and the data used to plot the landform shape, and locate the strata on it. Soil samples were taken in triplicate at random positions in each landscape stratum and analysed later in the laboratory for organic carbon, nitrogen, available phosphorus, pH and electrical conductivity. Soil respiration measurements adjacent to the soil sampling sites were also made, over a 24 hour interval.

**RESULTS AND DISCUSSION**

Table 1 indicates the landscape strata types identified at the three sites and characterises their size and soil stability.

Some very unstable soil surfaces are the exclusive domain of Site 1 (nearest dam), whilst the most stable soils are on Site 3. In addition,

the relative areas of unstable soil decreased from Site 1 to Site 3; stable soils showed the opposite trend.

In terms of nutrient pool sizes and biological activity, soil strata assessed as most stable were also more fertile. Soil respiration values for Site 1 are unable to be used, as erosion has exposed richly calcareous surfaces which gave off copious amounts of CO<sub>2</sub> when wet, due to decomposition of limestone by rain which is effectively acid.

These soil and landscape data are supported by plant life-form, palatability and productivity data which is reported in a complementary presentation (Friedel and Tongway).

Taking these approaches together, it is possible to attribute pasture condition to underlying soil properties which affect pasture growth, as well as germination/establishment likelihood. The physical models of ecosystem function permit the judgement to be made about reversibility of pasture condition by stock management alone within an appropriate management time frame. We can specify when more interventionist measures must be made to rehabilitate the soil resource and give pasture species a chance to establish.

Geomorphic Unit	Site 1	Site 2	Site 3
Run-off Slope	51% very unstable	75% moderately stable	51% stable
Sandy Colluvial Sheet	36% very unstable	zero	zero
Sandy Banks	13% unstable	15% moderately stable	zero
Sandy Hummocks	zero	10% moderately stable	26% Moderately stable
Depositional Zone	zero	zero	23% very stable

Table 1. Relative proportions of geomorphic strata and soil stability on the three study transects.