

Introduction

This report for the second North Australia Program (NAP-2) of the Meat Research Corporation describes the livestock production resources of northern Australia. It brings together the available information about these resources in terms of the pasture types, their condition, livestock production capability, productivity and problems; it attempts to co-ordinate this information over northern Australia to allow parallels to be drawn across the region and differences to be put into perspective.

Integrating the information for northern Australia in a coordinated manner should allow better definition of: regions or areas of potential for development; areas at risk of degradation if certain developments take place; resource and production issues; problem definition at region or local area levels; and priority setting for research and development.

It should also provide a basis for establishing strategies which will dovetail with funding of research and development from other sources such as the National Soil Conservation Program and CSIRO's National Soil and Water Care Program, as well as with institutionally-funded research.

No such broad-scale review of the condition of northern Australia's grazing lands has been carried out since that of Woods (1983) entitled *Land Degradation in Australia*. The information contained in that document was originally compiled in 1975 from a wide range of contributors. Although a useful review, it suffers from considerable non-uniformity in the depth and manner of the subject treatments and some serious misplacement of information within it.

This report uses the following main themes to address the nature and condition of the livestock production resource:

- definition of sustainability and degradation
- description of the pasture resources in map and table form
- assessment of their present condition and capability
- strategies for maintaining the condition of the resource, and of livestock production
- the problems and research priorities.

1 Sustainability and degradation

The definitions of sustainability and degradation used in this report need to be understood; they are defined fully at the front of the report, and explained in this section. We define *sustainability* as the long-term maintenance of the livestock production resources and environment to enable viable livestock production. *Degradation* represents an undesirable change from sustainability, and is considered at two levels—*deteriorating* and *degraded*.

Sustainability simply means maintaining a prescribed level and direction of productive capability over time. In terms of sustainability of livestock production in northern Australia, an holistic approach must be taken because long-term maintenance of productive capability depends on the many parts of the total production environment—the ecosystem, physical, social, economic, cadastral, legal and personal constraints. Although the main objective should be the maintenance of the biological integrity of the ecosystem, these other constraints influence the environment in which this must be carried out.

Measurement of output of livestock products alone is not a sufficiently sensitive indicator of the sustainability of the production system because, being the final product of a complex and dynamic set of governing factors, livestock production is well buffered. It may often be some time after one or more of the elements within the system has significantly deteriorated that animal production begins to fall.

On the other hand, placing the emphasis on sustainability of the livestock production resources and their environment should lead to sustainable livestock production. This shifts the emphasis from productivity improvement as the main objective to efficiency of production at a sustainable level.

Degradation results from an undesirable change in one or more of the elements which govern a desirable sustained system. The issue is not only land degradation (though this is perhaps the most vulnerable and visible element) but whole system degradation.

Degradation is considered here under two states: the first is referred to as '*deteriorating*', and is considered to be readily reversible through improved property management and following a return to years of average or above-average rainfall; the second state is referred to as '*degraded*', where the system can only be brought back to an acceptable steady state with difficulty. This recovery is generally outside the bounds of economic management, or it cannot be done at all.

There will always be periods of deterioration of the production resources resulting from seasonal and unpredictable annual fluctuations of climate. Differing levels of resilience in the resource to perturbations in different systems lead to different manifestations of system instability.

Agriculturalists and land managers must understand how to reverse these short-term trends to a long-term sustainable level. The resource may not necessarily be in the same state as it was before the perturbation, but, if it satisfies the criteria that it is at a balanced and satisfactory equilibrium which is not further degrading, it should be considered in an acceptable state. The shift from *Themeda triandra* to *Heteropogon contortus* in the north-eastern tropical tallgrass pasture system is an example of acceptable change, and there are other systems in which acceptable exotic species are naturalising.

In developing a procedure for assessing the condition of the pasture resources of northern Australia, we have used a multi-factorial approach to try to achieve an holistic, long-term description of condition states.

Using the three criteria of vegetation condition, soil condition and management capability, it has been possible to get a satisfactory and objective definition of the three states indicated—pristine or desirably sustained, deteriorating, and degraded. This also links conceptually with the 'state and transition' model of Westoby *et al.* (1989).

The first state—pristine—is not widely obtainable with domestic grazing on pasture lands, but it may be relevant to certain reserves and national parks. More usually a desirably sustained, but modified, equilibrium of productive species is a satisfactory state.

The second level—deteriorating—is marked by some increasing disturbance which places the pasture at risk of transition to a less productive, degraded state. The risk of this transition is not always apparent, as disturbed pasture communities may, at first, show no loss of productivity, or even enhanced productivity. But unpredictable events, such as drought, may push such a community unexpectedly beyond the critical threshold of transition into the third—degraded—state in which the community cannot be regenerated or stabilised.

It is important that the assessments of degradation at the second (deteriorating) and third (degraded) condition states be kept distinct. They must not be added together to make unqualified statements such as '60% of Australia's grazing lands are in a state of degradation'. These two states are clearly distinct in terms of the problems of resource management and their solutions.