**Report on International Rangelands Congress**

**26 July – 1 August 2003**

**Durban, South Africa**

This was the $7^{th}$ International Rangelands Congress, and the third which I have attended, the others being, Delhi in 1989 and Montpellier in 1994. There were over 500 delegates from 27 countries, mainly Australia, the USA and South Africa. There were very few delegates representing the UK (mainly from the Macaulay Institute) and DfID in particular, despite the fact that the LPP funds a number of projects in, or relevant to, the rangelands. The meeting followed the usual format with a ½-day plenary session followed by 2 full days of concurrent symposia. Overall, there were 20 symposia broken down under 3 main themes: Rangeland Biology, Rangeland Management and the Socio-Economics and Politics of Rangelands. One thing which struck me was how the Congress had moved from one which mainly addressed issues of livestock production and "weed" control, to one tackling issues of multiple stakeholders managing rangeland to meet a range of objectives. For example, there were sessions on wildlife, biodiversity, water, common property issues and rangelands as systems for multiple land use and livelihood support. I will highlight the new aspects coming from each theme and indicate new areas which would benefit from increased funding.

Rangeland Biology

There is now an acceptance that change is the norm within rangelands, be this spatial or temporal, climate or human induced. Much effort is being made to assess the consequences of change for land use planning, and, using global climate change models to predict weather (rainfall in particular) and its impact on livestock and human livelihoods with the improvements of modelling and global climate change models, there is a great opportunity to develop more strategic forecasting, which can help policy makers and range managers to manage proactively for future resource variation.

Other than that, many papers and posters used remote sensing to extrapolate their findings to the broader scale and there was a call for larger scale experimentation to address the issue of natural resource heterogeneity on the buffering capacity of ecosystems to climatic and human induced perturbations.

I presented a poster on behalf of the team working on the DfID funded "Environmental variability and productivity of semi-arid grazing systems" (R6984 ZC0078) project entitled "Modelling the spatial patterns of resource use and dry-season survival of livestock in semiarid grazing systems" (see abstract below).

Rangeland Management

The main message coming from the management theme of the congress was that rangelands can no longer be seen as only providing fodder for livestock, but are integrated multiple use

resources. As such, there was a call for future research to address issues of the trade-offs between alternative objectives for rangeland resources and the development of integrated multi-objective models. Not only was it clear that there needs to be a closer link between rangeland resource users with different objectives, but also linking rural and urban objectives for flow-through goods and services provided by rangelands, e.g. water.
It was good to see how much research was now going on in communal lands to provide information for the co-operative management of natural resources. This information has to be simple and context specific and requires scientists to simplify the results they derive from their studies of complex rangeland systems. This has not been achieved previously, and has led to much rangeland research not being taken up in the past.

Finally, in this theme, there was a call, mainly from the Australians, for rangeland researchers to integrate more closely with society in general and rangeland resource users in particular to produce a learning society, which co-operates to meet the challenges of the future. The quote used to depict this was from an Australian aboriginal saying to a rangeland scientist, "if you are here to help me, then piss off (sic). If you're here for us to help each other, g'day".

The Socio-Economics and Politics of Rangelands

It was clear that there has been some, though not dramatic, progress made in linking biological and socio economic-political approaches to studying rangeland issues, which has converged around communal resource management and rural development issues. It was emphasised that livelihoods have to be central to the development agenda in rangelands with an emphasis on a diversity of land use (not just livestock), livelihoods to be based on natural resources. As would be expected for a conference in Southern Africa, the main talking point was the re-distribution of land which was pro-poor and where legislation ensured that it was clear where management responsibilities lie.

As a final point, from a personal perspective, very few black African or indigenous peoples from other continents attended the conference, and very few, only 2 that I heard made presentations. This may reflect the cost of the conference or, amongst other things, that rangeland research is still the domain of the white male (me included) which still has not fully got to grips with dialogue with the people whose livelihoods they purport to support.

**Satellite Workshop on *Rangelands at equilibrium and nonequilibrium***

At a satellite workshop prior to the International rangelands Congress entitled, Andrew Illius gave a paper entitled 'The definition of nonequilibrium and the role of key resource – an ecological perspective'. About 70 people attended the workshop, including almost all of the key players in the dispute over how semi-arid and arid rangelands function.

The paper presented results from the modelling exercise by Illius & O'Connor (2000) which was a part of the Browse Project (R6984 ZC0078 Environmental variability and productivity of semi-arid grazing systems). The paper addressed, and largely settled, the controversy over the role of key and nonequilibrium resources in supporting livestock populations in semi-arid grazing systems. The abstract is reproduced below.

It would be fair to say that the paper dominated the workshop. By at last defining nonequilibrium in precise terms, the work distinguishes ‘key’ resources on which the livestock population depends (generally, the subset of dry-season resources selected by livestock) from the remainder. Non-key resources that are selected by animals do not, according to modelling results, determine the carrying capacity of rangelands. They may suffer degradation if key resources and supplements are sufficiently abundant to maintain large numbers of animals, but this degradation does not impact the dynamics of the livestock population.

The policy implications of the work are that dry-season resources need to be husbanded, and that supplementation to maintain livestock numbers may increase the impact on the remaining resources. This could possible reduce the productive potential of livestock during the wet season, but is unlikely to reduce the number of animals that can be carried through the dry season. This is probably the explanation of the conundrum that heavy grazing seems to cause degradation, yet animal numbers do not decline as might be expected.

References:
Illius, AW & O’Connor, T. G. (2003) The definition of nonequilibrium and the role of key resource – an ecological perspective. *International Rangelands Congress, Durban.*

Illius, A.W. & O'Connor, T.G. (2000) Resource heterogeneity and ungulate population dynamics. *Oikos* **89**, 283-294

Professor Iain J Gordon
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**Volunteered Poster Title: "Modelling the spatial patterns of resource use and dry-season survival of livestock in semiarid grazing systems"**

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Abstract
Livestock managers need to cope with the insecurities arising from climatic variation and frequent droughts. Additionally, growing evidence shows that they also need to carefully manage watering points in order to preserve key resources required for the survival of animals when constrained to their dry season range. Imprudent depletion of winter forage can be catastrophic.

Rainfall infiltration and the spatial redistribution of runoff water are the predominant factors determining patterns in semiarid vegetation, but grazing impacts also contribute to the generation and maintenance of spatial heterogeneity. In semiarid rangeland, animals move between places used for feeding and places used for drinking. The localisation of impacts associated with the congregation of animals at water points and the declining grazing pressure with distance from water gives rise to a defoliation gradient termed the piosphere pattern. The major effect of grazing gradients is on forage biomass, providing feedbacks that affect animal foraging and intake and also the redistribution of nutrients and seeds in the landscape.

The prospect of modelling species-habitat relationships arrived with the development of spatially explicit population models. Modelling can provide a way to assess the influence of climatic variability on temporally and spatially distributed resources, the response of animal foraging behaviour to those distributions, and the role of key resources in animal production. Presented here is a recently developed semiarid grazing systems model applied to the question

of piosphere development and the consequences of drinking water location on animal spatial foraging and dry season survival.

Requested session
B2 Managing grazing pressure for sustainable rangelands

**The definition of nonequilibrium and the role of key resource – an ecological perspective**

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The important role played by temporal and spatial heterogeneity in the dynamics of semi-arid grazing systems is well recognised. Highly variable rainfall causes episodic drought-induced mortality in herbivore populations. Livestock populations exploit spatial variation in resource abundance and are dependent on 'key resource' areas during the dry season. In contrast to the earlier view that plants and animals exist in some sort of equilibrium, it is now argued that, due to environmental variability, their populations are governed by fundamentally different, 'nonequilbrial' processes in which plant and animal dynamics are largely independent of one-another. This paper seeks to clarify these concepts, in ecological terms.

We can define 'key resource' in relation to the key factor: given that the key factor determining animal population size is survival over the season of plant dormancy, key resources are those eaten then. In other words, we can posit that key resources limit population size *via* the key factor, and that a reduction in these resources would cause the population to decline. Modelling results show that this is indeed the case: long-term mean animal abundance was very largely determined by the quantity of resources available during the dry season, when the key factor of mortality operates, and scarcely at all by resources available in the wet season.

Environmental variability disturbs the equilibrium that could be reached between consumers and resources under stable conditions. This condition of disequilibrium, arising from climatic variation, is different from nonequilibrium, which could usefully be defined as the absence of coupling between the animal population's dynamics and the subset of resources not associated with key factors. Wet season rangeland can therefore be classed as a nonequilibrium resource, because the animal population's dynamics are not coupled to it. Superabundance of non-key resources is likely to be observed during the growing season, because the animal population is typically limited by scarcer, high quality resources during the dormant season. Diet selection from heterogeneous resources will naturally cause the animal population's dynamics to depend differentially on different resources. But this is not primarily the consequence of climatic variability, and nor can we characterise entire grazing systems in highly variable climates as 'nonequilibrial'.

The extent to which the nonequilibrium part of consumer-resource systems is prone to impact depends on the relative abundance of the two resource types, because animal numbers are regulated by key resources and are not coupled to nonequilibrium resources. Thus, high ratios of key:nonequilibrium resources could support animal populations which are sufficient to result in quite high defoliation intensities of the nonequilibrium resources. An extreme case of this effect would occur if animals were maintained on supplementary food over the dry season. Then, their numbers would tend to become completely uncoupled from range resources, and defoliation intensity of the wet season range would be a function of the numbers maintained.