Sustainable Use of Rangelands in the 21st Century
3rd Milestones Report

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1. Introduction

Our last milestone report showed the structure of our project. It has three main activities: the development of land use scenarios; evaluation of their sustainability; and the development of policy options. We report on those activities in that order. We begin with a summary of trends in land and water resources and biodiversity, then examine land suitability, land use conflicts and compatabilities, and land allocation. Next we report on our preliminary sustainability comparisons, and their social and economic consequences. This is followed by a discussion of theory of regional change and principles for institutional design. Reports on our "adaptive agents" modelling, and on the legal and administrative framework of the West are next. The report ends with a summary of options for policy and institutional change.

2. Status and Trends in Land and Water Resources

Our project contributed to the literature review on biophysical status and trends carried out for the Western Lands Review (Baker and others, 1999) directly as a co-author and also through provision of several datasets and analyses prepared for input in the LUPIS scenario modelling. Subsequent to this review the Murray Darling Basin Committee released an audit of salinity risk for major river systems in Australia. We have modelled the influence on climate change on in crop yield, carbon storage and woody shrub invasion (methods included in appendix F). A synthesis of these three works plus and general overview of the geography is included in appendix A.

3. Land Suitability, Land Use Conflicts and Compatabilities, and Land Allocation

Land suitability and allocation have been the focus of our stakeholder workshops. In section five we outline a theory of a society comprising interest groups competing for scarce resources in a political "market". This view of society and political processes has influenced our approach to the stakeholder workshops. Originally we intended our stakeholders to negotiate a "politically feasible land allocation scenario". In the present circumstances of extreme debt and rural paranoia, and in the light of the theory we are using, this is unwise. Our stakeholders do not have the authority to commit the group they represent to a single scenario; the outcome would depend heavily upon the particular individuals involved, and "the" map, with its territorial undertones, would distract attention from the enormous opportunities for "win-win" solutions. We have therefore adopted an "advocacy" approach to land allocation that is consistent with our view of how the interaction of political processes with ecological systems occurs, and will continue to occur. We have likewise changed our approach to policy and institutional reform (Section 8).

Our current approach to land use planning is still based on the SIRO-MED process and LUPIS. Our approach emphasises the:

- differences in values between stakeholder groups, as expressed in the potential land uses they identified, and the suitability maps of those land uses (appendix B);
- very limited expression of the values of some groups in the current pattern of land use (appendix C);
- the incompatibilities of some land uses on the same tract of land;
- the many possibilities for satisfying diverse values through multiple land use where compatabilities allow.

Appendix B shows maps of suitabilities of forty one actual and potential land uses. Suitabilities are driven by the land use guidelines we developed with our stakeholders, and the importance stakeholders gave them. The matrix in appendix D was developed with our stakeholders to show compatabilities between land uses. Both colour and numbers have been used to assist stakeholders in the matrix interpretation. Primary or allocating land uses are listed in the left column. Compatible land uses are listed along the top row. Compatibilities are indicated at the intersecting cells with compatibility codes indicated in the top left cell of the matrix. Together with the suitability maps for the land uses it shows the potential for multiple use that we wish to convey to our policy makers. LUPIS has been extensively developed so it is can allocate multiple uses based on the suitabilities of sets of compatible uses. Thus a user can "drill down" below the primary land uses of an allocation map to see what other uses can potentially occur simultaneously on the same mapping unit.

The potential for multiple use was advocated by Aboriginal, minerals and tourism stakeholders. For these groups, the mapping units, based on land systems, are too coarse to show the actual extent of the land many of their proposed uses would need to occupy. Thus an important Aboriginal site, a mine or a tourism activity may occupy only a small proportion of a large mapping unit. Some land uses proposed by the three groups also shared the property that they are extensive but largely compatible with many other uses so can therefore co-exist. Traditional subsistence use by Aboriginals and exploration for minerals are examples. For these reasons these three groups preferred their land uses to be secondary to agricultural and conservation uses at the scale of our mapping units. Aboriginal stakeholders expect that in reality some of their sites (those of higher significance) would be managed to exclude other uses within the boundaries of the site.

As a consequence of these deliberations minerals and tourism stakeholders did not see it necessary to generate land allocation maps. Aboriginal people did, but on the understanding that the areas shown as Aboriginal would not be as extensive as shown on the map. Pastoral and diversification stakeholders amalgamated at their own request into a single agricultural group. Their allocation map and that of the conservation stakeholders are in appendix C.

4. Preliminary Sustainability Comparisons, and Social and Economic Consequences

In keeping with our advocacy approach to policy, institutional and land use change (Sections 3, 5 and appendix H), we have developed with the National Institute for Economic and Industry Research a set of social and economic scenarios for the West. The scenarios, modelled by NIEIR (1999), are:

- *Continuation of the present arrangements* – "business as usual";

- *Increase in agriculture*. This might include: more efficient use of irrigation water (from rice and cotton into horticulture and acquaculture, for example); more dryland cropping; some yield increases due to the enrichment of atmospheric carbon dioxide, and genetic modification; a shift from medium grade wool sheep to finer or coarser grade animals, to goat farming, and to cattle; and diversification that might include acquaculture in stock tanks, bush tucker, sandalwood, flowers and so on. There is much potential for increased Aboriginal involvement in production;
- *Increase in government spending in the Division*. Spending on Aboriginal cultural heritage, conservation and through the relocation of facilities. This would generate some employment and thus maintain services to an extent;
- *Increase in mining*.
- *Increase in tourism*.

Tables in appendix E summarise the expected bio-physical consequences of one these scenarios. At present the socio-economic scenarios are projected to 2025, the limit of any sensible attempt to project economic trends. The biophysical evaluations are made in 2050 because we wanted to capture the influence of carbon dioxide increase and potential climatic change. These are not expected to have significant effect for half a century. Biophysical indicators will be modelled for 2025, and completed for all scenarios.

Climatic change, carbon dioxide increase and the potential for carbon storage are linked issues. We have assumed carbon dioxide will double by 2050 in every scenario. Modelled crop yields, grazing potential and carbon storage in pasture take account of this through increased water use efficiency known to be associated with such an increase (appendix F). Rainfall and temperature increase are more uncertain, so we have developed indicators with and without these changes. The potential for carbon storage is modelled so we can assess the effects of land use change on carbon dioxide emissions. Method and assumptions are in appendix F.

The economic consequences of the scenarios are in appendix G.

5. Theory of Regional Change and the Principles for Institutional Design

If we are to develop principles from this project that apply to other regions or new circumstances, we must use theory explicitly. We have been using a complex adaptive systems framework to organise a set of disciplinary theories that are proving useful in understanding the history of the West, and identifying solutions to its current problems. This work is outlined in appendix H.

6. The Adaptive Agents Model

Our project worked with Marco Janssen and other members of CSIRO Wildlife and Ecology to explore the usefulness of an abstract model of the links between policies and ecological systems (Janssen and others, in press). This paper describes an adaptive agent model of rangelands based on concepts of complex adaptive systems. The behavioural and biological processes of pastoralists, policy makers, livestock, grass and shrubs were modelled as well as interactions between these components. The evolution of the rangeland system was studied under different policy and institutional regimes that affected the behaviour and learning of pastoralists, hence the state of the ecological system. Adaptive agent models show that

effective learning and effective ecosystem management do not necessarily coincide and can suggest potentially useful alternatives to the design of policies and institutions.

7. The Legal and Administrative Framework

Our project worked with the Western Lands Review to describe the current legal and administrative framework for the Western Division, and the need for change (Abel and others, 1999). Our conclusions are summarised below.

- Policy development processes and planning tend to be sectoral (e.g. crops, livestock, nature reserves), and uncoordinated. The legislation is a complex mix of old and new, sectoral and integrative. Contradictions impede inter-agency cooperation, and integrated planning and management. Service delivery is not coordinated across sectors, and attempts to coordinate are unlikely to succeed without a more formal approach. Integrated regional planning and development is needed, based on legislative and organisational changes;
- There are arguments for keeping the Western Division as a spatial entity, and for splitting it;
- Community participation in planning is difficult under the current legislative and administrative framework. The extremely complex system of legislative control is not transparent to the general public, nor, in some cases, members of agencies which must administer it;
- The current framework was created to support the development of pastoralism. Other stakeholder groups are not well represented. The vision of the draft National Strategy for Rangeland Management to achieve *diverse social, cultural and economic activities* is unlikely to be fulfilled under the current framework, and changes in the arrangements for participation and community-based planning are needed;
- Land tenure should become freehold on urban land. Rural land should remain leasehold to maintain flexibility. The rental system should be changed so as to better accommodate land uses other than pastoralism;
- Policies that promote diversification of land uses are needed. A variety of instruments is potentially available;
- A stronger and better-integrated regional program of research, monitoring and evaluation is needed to support adaptive regional planning;
- The Western Division could become a model for integrated regional planning for NSW and elsewhere;
- Options for change should be explored and developed in consultation with stakeholders and organisations;
- Judged against resilience criteria, the Western Division is unprepared for global change. Substantial changes to its legal and administrative framework are needed so that rigidity gives way to resilience.

8. Options for Policy and Institutional Changes

Changing policies and institutions is the primary aim of our project. We suspended workshops on this aspect during 1999 while waiting for the Western Lands Review to pass

through NSW Parliament. That is imminent. Our next workshop is in May. We will endorse much of the work of the Western Lands Review (self-endorsement to an extent), and maintain our broader and longer term view of what needs to be changed out West. We are now circulating a paper on proposed changes to policies and laws so our policy makers can respond before the workshop. Appendix I contain these proposals, which are the summarised outputs from previous policy workshops. There are no proposals for organisational changes yet. Following our arguments in appendix H, we prefer participants to make objective proposals for policy and legal change, uninfluenced by the threats associated with organisational change. We predict that departmental territoriality will add much interest to our workshop on implementation strategy.

9. Recent Papers

Abel N. (1999) Resilient rangeland regions. Pp 21-30 In *People and Rangelands: Building the Future* (eds D. Eldridge & D. Freudenberger).VIth International Rangeland Congress. Townsville.

Abel N. & Gachugu M. (1999) Policy, planning and institutions for fostering sustainable use of rangelands. Pp 177-178 in In *People and Rangelands: Building the Future* (eds D. Eldridge & D. Freudenberger).VIth International Rangeland Congress. Townsville.

Abel N. & Langston A. (1999) Biodiversity in the NSW Rangelands. Conference paper Bioidiversity, Outback and Upfront. Broken Hill.

Abel N., Farrier D., Tatnell B. & Mooney C. (1999) A rangeland enmeshed: the legal and administrative framework of the Western Division of New South Wales. Report to the Western Lands Review. CSIRO, University of Wollongong, and DLWC. 81 p.

Abel N., Ive J., Langston A., Tatnell B., Tongway D., Walker B. and Walker P. (in press). Resilience of NSW rangelands: A framework for analysing a complex adaptive system. Pp 59-71 In *Management for Sustainable Ecosystems* (eds P.Hale, A.Petrie, D.Moloney & P.Sattler). The Centre for Conservation Biology, Brisbane.

Howden S.M., Abel N.O.J., Langston A.C. & Reyenga P.J. (1999) *Developing integrated assessment approaches for global change impact analyses*. Report to the Australian Greenhouse Office. Working Paper Series 99/11. CSIRO Wildife and Ecology, Canberra.

Noble J.C., Landsberg J., Langston A.C. & Morton S.R. (1998) Biophysical and cultural values of the Great Artesian Basin: implications for future resource management. In *Proceedings of Outlook 98*. Australian Bureau of Resource Economics, Canberra.