

Options for Understanding Regional Dynamics in Northern Australia: Standalone summary

Tropical Savannas CRC Regional Modelling Scoping Study Standalone Summary

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The Regional Dynamics Scoping Study reported here was carried out for the Tropical Savannas CRC in 2002–03. The project encompassed a substantial literature survey, a workshop of experts with knowledge of the north, several different exploratory model developments, and a collation of basic profiling data for savannas. Here we distil some of the lessons from all of these activities, recognising that their logic emerges from the details to be found by reading the whole report. We then propose elements of a potential research program for the TS–CRC’s consideration.

This document summarises the full project report¹. It is also available as a stand-alone resource that can be used as an agenda or background paper for subsequent decision-making. To this end, it draws on the report to (i) briefly recapitulate the reasons why one might want to consider regions as systems and study their dynamics, and (ii) re-state what features might need particular focus in such a study of savanna (or indeed any ‘outback’) regions; it then (iii) outlines some key research areas that could contribute to this study, and discusses how these might be taken forward.

1.1 Summary: Regional dynamics and the savannas of northern Australia

Why is it valuable to consider regions as *dynamic systems*? Examples abound of investments in one sector which have ignored the flow-on effects to another sector, resulting in less net economic benefits than expected. Planners are more sensitised to such issues today—as seen for example in the debate about the Adelaide to Darwin railway and its indirect effects on trucking companies and local employment, or the Coronation Hill mine debate with its net social and environmental impacts—but the tools for analysing these interlinked factors as a *system* are still limited. When the indirect effects are to be assessed in non-financial domains—such as the environment, human health, social or cultural impacts—it is even harder to make defensible cases, yet society is increasingly demanding such assessments.

Part of the problem is that human systems do not stand still: they change as people, their institutions and environments react to changing circumstances. In this sense the *systems* are *dynamic* over time. Feedback loops and downstream effects are the rule rather than the exception. A major area of research and practical endeavour today is therefore in studying regions as *dynamic systems* in order to contribute to regional decision-making. In many cases just an increased awareness of the systemic effects of investment is sufficient to improve the debate about particular decisions. New tools and approaches, however, enable planners and communities to include more quantitative scenario analyses in their decision making.

The trend towards paying more attention to the regional scale is worldwide, driven particularly by the increasing devolution of responsibilities to regions everywhere. So, given the much greater research capacity in more heavily-populated regions, why study savanna regions in this regard? Why not just wait for the results from other regions? The problem is that there are features of savanna regions which are not shared by the more studied areas of the world and Australia – low population density obviously, but also high environmental variability, remoteness from markets and centres of power, significant indigenous issues, and so on. Hence studies emphasising these features will not emerge from other regions. At the same time, given limited resources, the TS–CRC should focus specifically on studies that address problems that will not be dealt with elsewhere, which means that these studies must be based on a clear understanding of the special features of savanna regions.

Even given all this, why should the TS–CRC invest in such research, rather than expecting some other organisation in the tropics to take this on? This research is by its very nature synthetic across disciplines, institutions and sectors. Other agencies *should* take on some of the issues raised below, but individual agencies will inevitably tend not to take a systemic view, at least at first. The TS–CRC is a crucial facilitator of this integration.

Given this rationale for research into regional dynamics, what are the implications of the special features of savannas in terms of regional function, and what needs to be known about those implications?

¹ Stafford Smith et al. 2003. Options for Understanding Regional Dynamics in Northern Australia. Tropical Savannas CRC Project Report, July 2003, CSIRO, Alice Springs.

1.1.1 Key drivers of savannas that set them apart from other rural regions of Australia

A regional dynamics approach highlights some key drivers which are most important in savanna regions and yet which are poorly understood because they are not strongly shared with regions elsewhere in Australia. As argued by Stafford Smith (Section 3), debate about future directions in the savannas is increasingly polarised between productivist and post-productivist value systems (Holmes 2002)², effectively setting supporters of economic development against supporters of non-market values. The integrated trade-off challenge that emerges is to balance the impacts of economic development on non-market values (i.e. to take an integrated bottom-line view) while recognising that non-market values will not be sustained in any case if there is no economic future in these regions. The sustainable livelihoods paradigm of five capitals (financial, physical, environmental, social and human, possibly also institutional) is one of several didactic devices for ensuring that values are considered in an integrated way in trade-off thinking.

The project also highlights some critical structural issues which underlie the interplay of these viewpoints and which influence the outcomes of private or public investments:

- There are **intrinsic biophysical and socio-economic structural constraints** on what options are open to different regions. These need to be understood to allow regional communities to be realistic about what they can control or change and what they must design systems to live with. Particular highlights include environmental variability, externally driven markets, low and mobile populations, the significant indigenous component of the population, as well as rapidly changing communications technologies and connections to the rest of the world.
- There are also **extrinsic economic forces at work which limit options** or demand special design consideration, like changing international market prices, energy costs, labour costs, globalisation, and tendencies towards agglomeration driven by critical mass and economies of scale. While these forces are common to all regions, they play out differently in remote areas in terms of their influence on relative prices and production costs on the distribution of economic activity (with potential problems of ‘fugitive capital’), and in investment strategies intended to affect these relationships. Although agglomeration is driven by economics and markets, it also plays out in policy and in social institutions.
- By contrast, there are also political trends **towards de-centralisation and local empowerment**, with the potential for some conflict between demands for cost-effectiveness (agglomeration) and socially desirable outcomes (devolution) if the drivers of each are not understood. Understanding this conflict will steer regions away from some sterile lobbying and enable them to focus on capturing opportunities (where real competitive advantages exist).

Any useful integrated framework for understanding regional dynamics therefore needs to be able to encompass these issues in one or more linked conceptual models, and ensure that these linkages are founded on an understanding of how the underlying drivers play out in the social, economic and biophysical environments in which northern communities live.

1.1.2 What general approach could encompass the issues?

In a dynamic view of where a region might be headed it is necessary, but not sufficient, to incorporate an integrated bottom-line accounting of impacts. The problem is that different actors in the regional community (and outside it) respond differently as a result of their belief systems, so that a dynamic view (which has feedbacks over time) must take some account of this. This then raises one of the most difficult problems in studying integrated human/environment systems, related to the ‘middle order number’ problem of classical physics (and Heisenberg’s Uncertainty Principle)—outcomes in small populations are driven by effects which can be neither generalised statistically, nor sufficiently simple as to be modelled individualistically.

To be more specific, most economic models use ‘simplifying’ assumptions like rationality, perfect competition, full employment, and ‘general equilibrium’ to make predictions. Although some of these assumptions adequately approximate the observed reality in ‘western’, urbanised economies, many fail in isolated, rural economies with large indigenous populations and a focus on non-market values.

² Holmes, J. 2002. Diversity and change in Australia’s rangelands: a post-productivist transition with a difference. *Transactions of the Institute of British Geographers*. 27: 362-384.

Parallel examples can be found in political theory or concepts of efficient resource development and service delivery based on assumptions of large, statistical populations. At the same time, an extreme anthropological view in which every individual is a case study that is unique and cannot be replicated does not hold out any hope for predictability. Given the increasing responsibility being placed on regional groups to envision their own futures, this condemns them to a continuing inability to assimilate an understanding of regional dynamics which could contribute to their deliberations, and leaves them subject to continued dominance by the most effective lobby groups and dis-empowering policy processes.

Caricatured, an anthropologist's view on change is opposed to that of the conventional economist, contrasting the uniquely evolving views of individual actors with a simplistic, statistical, rational economic decision maker. The individualistic actor defies generalisation and prediction, while the monolithic *Homo economicus* obscures differentiated action. Any realistic approach to regional dynamics must come to compromises between these views. This points towards cutting-edge research, appropriate to the TS-CRC's strategic role; but also more soberly to the need to break the problem down into some achievable elements which can provide useful contributions while the whole is being developed.

The project's workshop argued for a well-structured integration between some level of new understanding of individual actors which is tailored to savanna conditions, and the application of some tried and tested analytical techniques. A logical set of issues that emerged from this discussion were, in summary:

- i. One core element of an integrated model must be **population dynamics** in lightly populated regions, at least tracking indigenous and non-indigenous populations separately, and understanding drivers of inter-and intra regional movements.
- ii. A framework is needed to ensure that **multiple values** are considered, for example using the five capitals of the sustainable rural livelihoods approach plus institutional processes as a didactic device, encompassing the diversity of non-market values regarded as important in savanna regions.
- iii. The **diversity of actors** must be considered, as at least actor groups related to a 'necessary but sufficient' set of syndromes of significantly different impacts and responses; these need particularly to encompass those groups driven by financial incentives compared to those driven by other, non-market, values.
- iv. The ways in which **different actors affect the different capitals**, and in which changes in those capitals feed back on the actors, must be determined at an appropriate level of detail.
- v. **The effects of agglomerating influences** of globalisation in financial, social and institutional terms must be understood, as well as the interactions between these influences and various policy-related options particularly related to regionalisation and self-determination in remote regions.
- vi. A useful set of **key socio-economic health indicators** for savanna regions is needed, on the understanding of which appropriate **dynamic regional models** may be built, to assist with informing investment decisions.

Explorations into several of these areas during this scoping project (see Sections 4, 5, 6 and 7) led us to propose an integrated research framework, which will not answer all questions but seeks to target those critical elements of the understanding needed to deal with issues that are unlikely to be dealt with by researchers working outside the remoter regions of Australia.

The framework encompasses:

- i. establishing some basic datasets and community-based priorities,
- ii. focusing research on key areas of enabling knowledge, the need for which emerges from the discussion summarised above, and,
- iii. developing a suite of tools with greater predictive or explanatory power for planning effective investment in remote regions.

Although this discussion focuses on savanna regions, a considerable part of it applies to any of the remoter outback regions of Australia and their service towns; the differentiation is primarily between these regions and the settled agricultural and peri-urban rural regions of Australia (*cf.* Stafford Smith

2000)³. While there are some features specific to savannas (especially in the environmental domain), the result is that these conclusions may often also be relevant to the Desert Knowledge CRC; co-investment in some areas might be sought, as noted below.

³ Stafford Smith, M. 2000. Landscapes, land users and linkages in Northern Australia. Proceedings of Northern Grassy Landscapes Conference, Katherine, Sept 2000. 9pp. (on CD-ROM publication)

1.2 Options for a research program

The following general research areas emerged from this scoping study. The remainder of this document therefore provides the basis upon which these proposals are made. The proposed research areas are presented here so that this section and can be distributed and read independently from the body of the report.

We present them as seven main areas in three groups, with some specific project definition in each (see Figure 1 below). Each research area could independently provide benefits to decision makers. While there would be synergies between some research areas, it will not be feasible to implement all areas at once (or perhaps even within the life of the TS–CRC), so it is fundamentally a stakeholder and research management decision as to which areas should be implemented first or at all. However, the present study does suggest that in several cases, once the decision has been taken to carry out a particular research area, one would logically wish to implement many of its sub-projects.

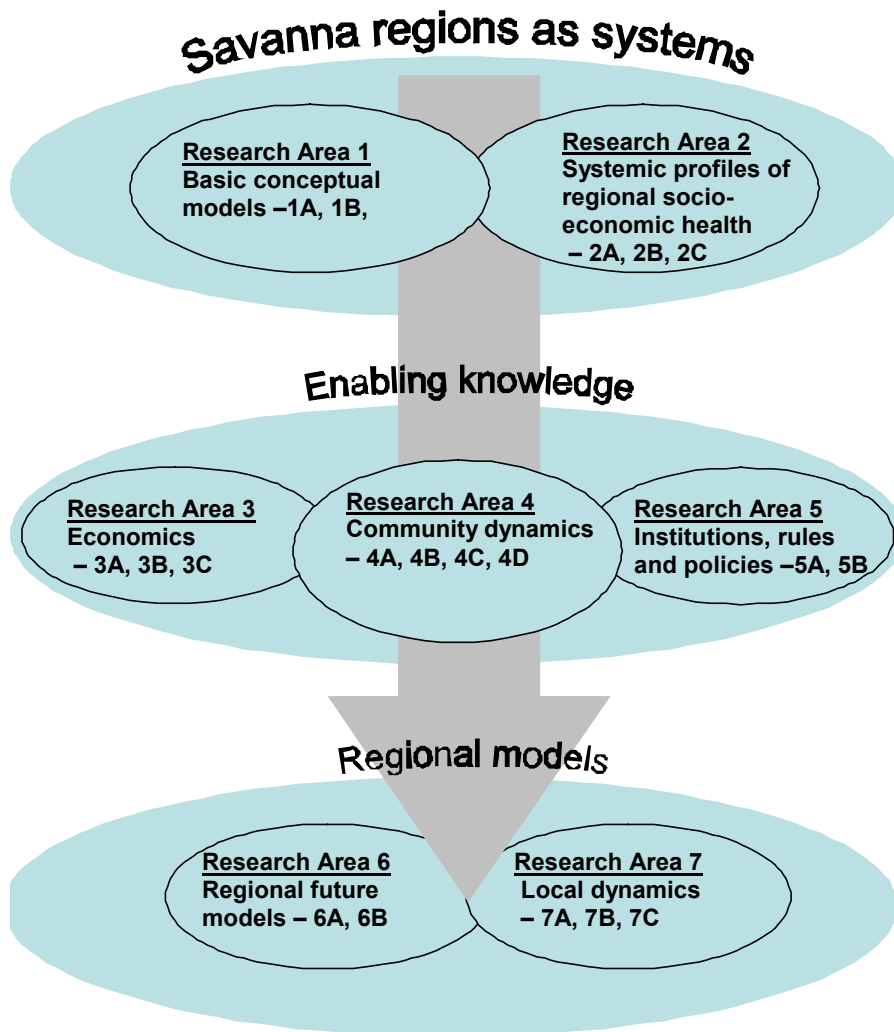


Figure 1 Savanna regions as systems with seven main research areas organised in three groups. Research areas are discussed in detail in the following subsections.

1.2.1 Savanna regions as systems: basic conceptual models

This is an underpinning research area, which the scoping study has already initiated but lacked the resources to progress with full consultation. It will simultaneously provide an understanding of the issues that drive different sections of the community, a defined scope for the remainder of the work proposed here, and some initial clarity on what a sensible categorisation of actor groups may be.

Goal: To develop a commonly agreed, conceptual model of the systemic linkages between indicators of integrated savanna health derived from community consultation.

Task 1A: Community consultation (using a previous natural resource management model of engagement, Whitehead et al. 2000⁴) of indicators of integrated savanna health as perceived by different stakeholder groups (NB: without an attempt to homogenise these, beyond recognising genuine overlap/ duplication).

Task 1B: Develop a conceptual systems framework for all of these, which incorporates the drivers and outcomes of change in all indicators, and highlights three key sets of factors: (i) fast variables impinging on day-to-day experience; (ii) slow variables which are crucial precursors to change in the indicators of concern to stakeholders; (iii) contextual variables (very slow variables) which determine how slow variables act out.

Comment: Some iteration between Tasks A and B may be required to prioritise and fine-tune the variables of concern, and also to achieve the ancillary outcome of developing the northern community's capacity to think about their regions systemically. The recognition of value in this may depend on some implementation of Research Area 2. Note that the purpose is *not* to force all actors to accept one set of indicators but rather to develop a set which (i) satisfies and informs key purposes of and debates among different actors and (ii) is informed and enriched by a systemic understanding of the relationships between relevant fast and slow variables (developing the understanding of which may well highlight further basic research questions about causation).

1.2.2 Savanna regions as systems: systemic profiles of regional socio-economic health

Historically indicator lists tend to be plucked from participants' pet paradigms; this research area seeks to build on a formal systemic framework to provide more meaningful indicators of regional function which are embedded in a process of understanding how they interact with one another. While long-term primary data collection for monitoring should not be the role of TS-CRC, there is a significant research endeavour in setting up a system, linking it as much as possible to existing data collection, and providing rigorous justification for some possible changes in collection priorities among collecting agencies.

Goal: In the appropriate partnerships, establish a sustainable data collection/collation, interpretation and dissemination system for regional profiles focused on issues critical to savanna health.

Task 2A: Develop an explicit set of critical indicators from the outcomes of Research Area 1, taking care to balance short and long term concerns ('fast and slow' variables), with an intelligent categorising into (i) items that are already collected, (ii) items that can be confidently indicated by some other existing measure, (iii) items that could be indicated by another existing measure but require research to confirm an appropriate causative or reliable correlative link, and (iv) items that require new data collection. The rationale for (iv) needs strong explanation (which may have to be balanced by a recommendation to cease collecting some other items).

Task 2B: Undertake research to justify the causative/correlative value of promising measures (Point iii and perhaps part of Point iv in Task 2A). [Note this is an ill-defined task due to the uncertainty of its extent at this stage; the purpose is to assure this type of important research a home, but in fact many results may emerge from Research Areas 3 and 4, Enabling knowledge.]

Task 2C: Establish a demonstration data collation, interpretation and dissemination system as partnership among those agencies most likely to continue sustaining it. Interpretation may be

⁴ Whitehead, P. J., Woinarski, J., Jacklyn, P., Fell, D., and Williams, D. 2000. Defining and measuring the health of savanna landscapes: a north Australian perspective. Tropical Savanna Discussion Paper; TS-CRC, Darwin.

simple (particularly initially), or may involve some interaction with the products of Research Area 6. Dissemination processes are essential, but some of these are already in place through these agencies.

Comment: There is a role for the TS–CRC to initiate and illustrate this process, but for the system to be sustainable it must be embedded in existing agencies; hence the TS–CRC’s role should be principally facilitatory. An appropriate partnership is an essential development here. Clearly the intent is to build more systemically on the existing substantial efforts in this general area, adding value to these, and not treading on turf. In this regard there is also a potential for co-investment with the National Land and Water Resources Audit and particularly its Australian Collaborative Rangelands Information System developments.

1.2.3 Enabling knowledge: economics

The key features of savanna (and other remote) regions highlight the hypothesised importance of capital flight, agglomeration and the significance of non-market values as economics-related issues which require close attention in these regions. Also important, is the middle order number problem indicating that one may often (but not always) need to apply approaches that are different to those which would be appropriate in more densely populated regions.

Goal: To develop an understanding of how to apply economic methodologies legitimately in savanna regions, and to quantify some baseline economic statistics of relevance to understanding the economics of remote regions.

Task 3A: Identify appropriate methodologies (given limited datasets) and apply them to case studies in a variety of regions with different characteristics to determine what economic multipliers result from different activities.

Task 3B: Apply existing non-market valuation techniques to a variety of landscape uses to generate some order-of-magnitude understanding of the relative value of these to society; a specific project would be to make a pilot comprehensive assessment of the value of different land uses to society, including indigenous traditional land uses, which would help validate public investments in sustaining land uses through Landcare, investments in indigenous land use, and other ‘stewardship salaries’.

Task 3C: Develop simple economic models of regions that could be used to inform decisions about which regional industries and business systems could be promoted in order to obtain different outcomes. The first step in this task is to explore a wide range of existing economic models to determine whether or not their assumptions fail in savanna regions.

Comment: While some development of new methodology (e.g. for non-market values) is occurring widely and would not be a competitive research endeavour in the savannas, building capacity in the application of such methods may be important for TS–CRC. The exploratory application of the methods in order to better quantify the significance of these factors is certainly urgently needed, although it may be possible to promote some of this work in existing agency activities. In this regard, Task 3A might be an expected task of economic development agencies in the north anyway. Task 3B certainly takes issues beyond the current skill base, and could in any case benefit from pilot studies which establish how to do this in remote regions. Task 3C is a novel dynamics modelling exercise, albeit relatively narrowly in the economics domain, which the TS–CRC would need to be responsible for (and which requires data from the previous tasks) in partnership with agencies to help direct investment approaches.

1.2.4 Enabling knowledge: community dynamics

There are both statistical and anthropological aspects to how people make decisions about where to be and what to do there – the behaviour of individuals plays a major but neither statistical nor easily predictable role in the outcomes, and there can be sudden changes in the balance of different actors in communities that lose a mine or gain an influx of tourists. There is a resulting need to understand actors’ decisions in more detail, while still seeking generalities and predictability. Small populations and their marked mobility at several time scales also pose special problems for projecting demography, and consequently for planning where infrastructure will be needed in a few years. This is not demography for its own sake, but rather in the context of understanding what makes regions and communities more or less attractive to people, what drives their capacity to adapt to extreme

conditions, and the impacts of their resulting decisions on resource use and economic opportunity. The focus is on people as individuals and loose-knit groups or human communities.

Goal: To understand the drivers and implications of decisions about location and livelihood activities for different groups of actors in savanna regions.

Task 4A: Understand what categories of actor groups are usefully discriminated in different regions, through an analysis of their influence on and responses to the different capitals of the sustainable livelihood paradigm. This task is aimed at informing the appropriate level of resolution for regional models that deal with interacting interests.

Task 4B: Study how different groups of actors interact and how the decisions reached supposedly by regional communities are driven by different groups. How do these processes alter over time in small communities subject to ‘state and transition’ changes in community dynamics (compared with equilibrial-type dynamics in larger populations)? Apply interactive tools for exploring how different actors make decisions, such as experimental economics tools, in savanna cases to understand what drives actor decisions.

Task 4C: Study the drivers of the attractiveness of remote regions: analyse net immigration and turnover at the regional scale in the demography of small populations, paying attention to the differences between groups (particularly indigenous/non-indigenous) within these regional communities. This task is typically at a Statistical Local Area scale, thus providing a savanna-wide understanding with regional resolution, on a decadal timescale.

Task 4D: Understand the drivers of the mobility of local populations within regions, particularly between urban centres and remote settlements (whether indigenous or non-indigenous). This task would aim to understand what makes individual communities and remoter towns attractive to live in on a one to 10-year time scale, with the goal of informing decisions about where and how to deliver services.

Comment: Task 4A could be initiated as an outcome of Task 1A, and may lead to follow-up work not yet fully understood. Tasks 4B and 5A move toward an explicitly Australian outback sociology that understands how to live with the social drivers arising from the settlement patterns of Australia with its coastal population centres. The outcomes are important for social planning, the provision of family services, education and health, which in turn underpin the attractiveness of regions. The TS–CRC has a role in promoting this type of research in conjunction with university partners since no one else is likely to take it up until the initial returns become clear. Tasks 4C and 4D incidentally require an understanding of the limitations to regional census data accuracy, particularly on remote communities, and their implications for demographic modelling. There appear to be significant problems with census data on locally mobile populations (e.g. indigenous communities); this is a concern for ABS, the Australian Grants Commission and various state Treasuries.

1.2.5 Enabling knowledge: institutions, rules and policies

Agglomeration affects social decision making processes. The fundamental issue is to understand how small remote groups of people interface equitably and comfortably with larger population centres, both within remote regions with urban service centres, and between rural regions and state or national institutions.

Goal: To understand the factors creating conflict and tension when remote communities interact with larger population centres, and guide decisions aimed at reducing these tensions.

Task 5A: Develop an understanding of how basic social dynamics among players are affected by the scale and connectivity of different communities, and consequently to what degree policy and social agglomeration is an inevitable outcome of social dynamics in remote areas (cf. economic agglomeration). For what scales and patterns of communities can these effects be countered by minor subsidy as opposed to requiring fundamental rearrangement of interaction rules? To what extent are these problems of any remote community and to what extent are they exacerbated by cross-cultural concerns?

Task 5B: Build a better understanding of how the design and implementation of institutions and governance structures affects regional dynamics by creating potentially different outcomes from apparently similar starting points. This is particularly important in terms of how remoter population centres link with centralised governance systems such as urban centres or state governments, and should inform the resilience of different systems, their

capacity to adapt, and the flow on effects on attractiveness for habitation and investment. This probably requires a series of workshops to bring relevant theoreticians and practitioners together to define common questions, and then a series of case studies targeting parallel design and outcome questions.

Comments: Task 5A is quite basic research which has never been applied in a remote community context; as with Task 4A, some initial investment is needed to prove its potential. Task 5B is focused on the impacts of institutions on regional dynamics; this should be distinguished from a large body of work that is needed on institutional design and governance effectiveness which is outside the ambit of this regional dynamics area but is fundamental to regional natural resource management as well as the provision of services, and is one core concern for the DK–CRC.

1.2.6 Regional models: regional futures models

There is an overriding contextual need to understand where different regions of the savannas are headed in general terms, so that more detailed investigation and investments can be tailored to suit each region's future options. Thus there is a need for some models with savanna-wide scope and regional resolution, which help to inform regional communities of their options, and the likely implications of different broad-brush investment strategies. We see two general time scales here, one related to long-term visions and the other to medium term strategies; the focus is particularly on inter-regional opportunities and investment. Both first require a careful assessment of the strengths and weaknesses of existing approaches.

Goal: To inform the integrated bottom-line trade-offs involved in major investment decisions and smaller systemic investment patterns at a between-region scale, and to enable regional communities to put their region in context (though *not* to predict the future!).

Task 6A: *Regional stocks and flows model* [timeframe 10–50 years]: this is aimed at ‘what if’ questions over the long term, allowing governments to examine the major resource and economic implications of changing population patterns, and regional communities to see what the outcomes of different future scenarios would be for their region. Such a model could build on existing regional futures modelling for Australia, but focusing down to a regional scale and altering many of the existing components to address the different drivers and implicit relationships in savanna regions.

Task 6B: *Regional business and non-financial livelihoods model* [timeframe 1–10 years]: this would build on the outcomes of Task 3C to understand trade-off implications in terms of population, employment, environmental pressures, etc. between regions with different characteristics across the savannas. It would enable public and private investment to be channelled toward activities most likely to enhance the retention of human, social and economic capital in remoter regions, recognising that there may be substantial differences between regions in the appropriate approaches.

Comments: Models like this have been tried in other forms before and this effort must be (i) founded on the foregoing understanding and particularly the items emerging from Task 1B, and (ii) carried out as a partnership with relevant planning authorities (with other stakeholders as contributors to priority setting) to ensure a direct pathway into use. However, it is clear that models simply lifted from other regions will not meet many of the purposes required in the north because of the factors discussed in this report.

1.2.7 Regional models: local dynamics models

This research area relates to integrated models which have a regional scope but with a resolution related to within-region dynamics; the principle focus is to help inform investment decisions within a region. There are a very large number of possible projects at this scale and the detailed goals of individual projects will depend on the decision-making priorities of target regions. Such projects should call on relevant parts of the research area on enabling knowledge to develop a systems model targeted to the purpose in hand (there is no single comprehensive regional model and this should explicitly *not* be a goal, although there may be useful ‘nuts and bolts’ components that can be used in multiple arenas). Notwithstanding the diversity of possible projects and the need to be led by stakeholder priorities in this regard, the logic expressed in this study suggests that three types of projects should be particularly promoted, as noted below.

Goal: To develop integrated regional dynamics models which address targeted regional decision-making concerns in ways which inform the specific trade-offs between different elements of the five capitals and consequently enhance the value of specific investments in savanna regions.

Task 7A: *Urban service centre/community hinterland spatial demography and services models:* these models integrate the understanding of demographic drivers with the ways in which small and large communities interface on savanna landscape resources. Mount Isa and the Gulf, Katherine and the Victoria River District and surrounds, and Alice Springs and central Australia are all examples of urban centres in remote hinterlands. Each region is faced with the problem of knowing whether they need to plan for population migrating into towns over the coming decades, or should develop service agreements with community government/rural shires to deliver local government services outside town and thereby reduce some services needs on the urban areas. This type of model would draw on the understanding of inter and intra regional community attractiveness as a driver for projected changes, and investigate how different patterns of investments in services might drive and be driven by spatial demographic changes. It would be explicitly sensitive to different modes of function between indigenous and non-indigenous sectors of the population where appropriate.

Task 7B: *Integrated bottom-line models of regional trade-offs in savanna intensification:* these models formally investigate the trade-offs between economic development and non-market values in practical examples of proposed developments. The Daly Waters region, the Ord, areas of the lower Fitzroy River, the Burdekin, as well as new suggestions such as cotton on the black-soil plains of northern Queensland are all examples of proposed or actual intensification of land use with attendant non-market implications. This type of model would draw on the economic enabling knowledge and couple it with communities' different value sets to provide more and balanced evidence in decision-making debates about these types of developments.

Task 7C: *Integrated quantitative analysis of the role of communications technologies* in altering the relationship between remote regions and urban centres: these models would synthesise the implications of ICT in remote areas to help direct the most appropriate investments in this technology and training. It is widely presumed that ICT is a core investment for assisting remote regions, but there is little quantitative evidence for whether the investment should be aimed at connecting remote communities to each other or to urban centres or to markets, nor of the many other systemic impacts of any given ICT investment. These types of models would link an understanding of the social and economic relationships between small communities and urban centres with the aspirations of actors for healthy regions.

Comments: Any one of these models would be a substantial undertaking and, to have any value in decision-making, would need to be undertaken with a wide range of relevant stakeholders. However, it is also worth noting that simple approaches to specific problems like these might usefully be undertaken early on (perhaps with less stakeholder involvement) to gain experience which helps to direct the enabling knowledge projects more precisely. This would result in an iterative process through this entire research framework.

