Cotton Catchment Communities CRC

Scoping the Selection of Baseline Socio-economic Indicators for Cotton Communities

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Purpose of this report

This report summarises the results of collaboration between research staff from CSIRO Sustainable Ecosystems, the Institute for Rural Futures, and NSW Department of Primary Industries on the Project: *Scoping the selection of baseline socio-economic indicators for cotton communities*. The scoping study contributes to sub-program 2 (Demographic and Social Change) of Program 3 (Community) of the Cotton Catchment Communities CRC.

Background

In the discussion of possible socio-economic topics at the 'Industry and Community' meeting at UNE in April 2005, a strong consensus emerged that a necessary component of research in this area would be to select a set of indicators that could be used to track the economic and social condition of cotton communities over the life of the CRC and beyond. Such indicators could have a variety of uses, including:

- helping the industry to monitor its influence on the rest of the community;
- helping the community to monitor its influence on the industry;
- helping stakeholders in both community and industry to understand the changes they were undergoing; and
- helping both industry and community manage these changes and interactions.

Main Project Aims:

- To scope the selection of socio-economic indicators for cotton catchment communities
- To engage stakeholders in those communities in the identification of issues relevant to the sustainability of their livelihoods
- To engage stakeholders in the definition of indicators relevant to their communities.

Methods

Stage 1: Background literature review

The project drew on a brief literature review of recent developments in methods of assessing community socio-economic condition. In particular, the 'sustainable livelihoods' framework, and the rationale for basing indicators on the measurement of several forms of capital, were explored. As well, previous IRF work for the Cotton R&D Corporation on developing socio-economic indicators for the cotton industry is relevant (Reeve et al 2003).

A framework for considering cotton livelihoods

In considering flexible frameworks for scoping the development of social and economic indicators relevant to cotton communities, we decided to explore the *sustainable livelihoods framework*. Importantly, this framework builds on the 'four capitals' approach developed by several writers. This approach has proven relevant to understanding social dimensions of landscapes throughout the world (e.g Pretty 1998;

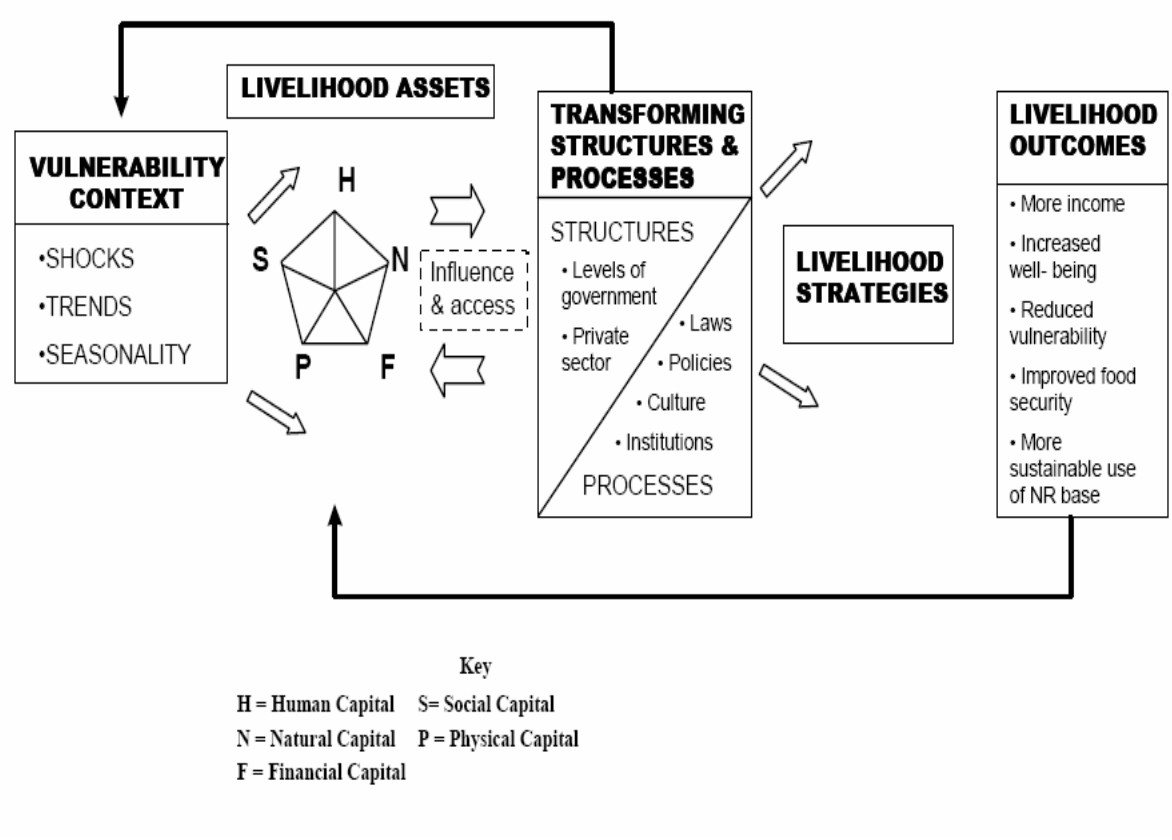
Eames, 2005), including rural Australia in general (Cocklin and Dibden 2005) and rural New South Wales in particular (Stayner, 2003). (See Appendix 1).

The term *livelihood* has become popular in the development literature as more encompassing than terms such as *employment*, *industry* or *income* (Ellis 2000). Furthermore, the concept identifies the links between economic activity and the social impacts or 'livelihood outcomes' from those activities. The concept of livelihood has been defined by Chambers and Conway (1992 p 7) as follows:

> A livelihood comprises the capabilities, assets (including material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base.

The concept of livelihood has been developed further as a framework (see Figure 1) and has been applied to analyse the effects of different sets of activities within natural resource management (Carney 1998; Scoones 1998; Woodhouse et al. 2000).

Figure 1 The Rural Livelihood Framework (source Carney 1998)



In planning the fieldwork phase of the scoping study, we discussed the potential for this conceptual framework to inform the overall process of developing indicators of livelihood outcomes, such as changes in wellbeing. Whilst the discussions were only preliminary, we believed there was a case for drawing on this framework as part of the conceptual background for further work.

The 'four capitals' approach is one aspect of the livelihoods approach (focusing on 'livelihoods assets' in Figure 1) and is further explained in Appendix 1.

Stage 2: Focus groups

Consultations were conducted in the five communities where local government provided financial support for the CRC (Milmerran, Inverell, Narrabri, Narromine and Warren). These consultations were concentrated on Narrabri, Narromine and Warren, where they identified and prioritised the industry-related issues of concern to the communities. Narrabri was selected for testing a method of mapping the issues in, and socio-economic condition of, cotton communities using systems thinking techniques as represented in a conceptual model developed with VENSIM software.

Three focus groups were held in Narrabri in September 2005 involving a total of 23 participants in addition to the four research staff, with representatives from the following organisations (in alphabetical order):

- Australian Cotton Research Institute
- Cargill Grain & Oilseeds
- Cotton Growers Association
- Cotton Research and Development Corporation
- Narrabri College of Technical and Further Education
- Narrabri Community Services
- Narrabri Shire Council
- Narrabri Youth Services

Stage 3: Analysis

Following the fieldwork component discussed in stage 2, staff from CSIRO Sustainable Ecosystems and IRF conducted a 'rapid appraisal' of the Narrabri data from the focus groups. This involved distilling potential indicators from the discussions in the focus groups and exploring potential ways that they may be linked through a systems thinking process facilitated by Russell Gorddard. This process resulted in a list of indicators and a conceptual model using VENSIM software.

Findings

Narrabri

A 'rapid appraisal process' was applied to the information collected in focus groups, and resulted in the following list of variables. Figure 2 provides a conceptual model of the key issues and the apparent relationships between them in the Narrabri region, based on the community consultations. **Orange** variables (listed below) were

identified as potentially important issues to track. The *influences on* these variables (the sources of arrows leading to them), and possible *measures of* these variables are listed in Appendix 2.

- cotton acreage
- cultural diversity and community groups
- education quality
- housing affordability
- human disease risk
- image of cotton
- population
- quality of life in the region
- range of business
- skilled labour
- unemployment
- water use

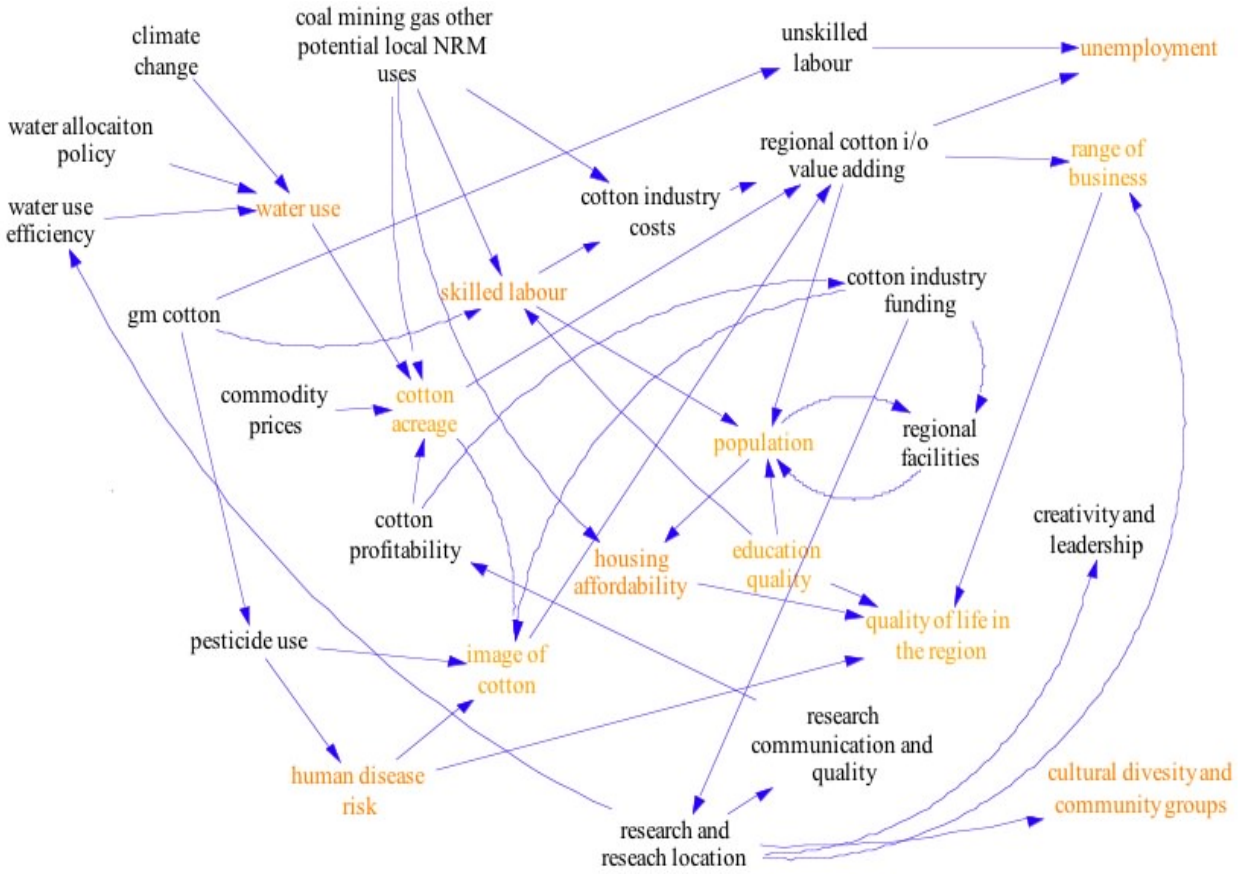


Figure 2 Overview of relationships between key influences on the region

Possible indicators for the Narrabri region

Indicators are data that describe the condition of a system; in this case, the key social and economic conditions in communities serving the cotton industry. The interpretation of indicators depends on understanding how the system works. For example, a person's age, weight, blood pressure, cholesterol and blood sugar levels are partial indicators of their health status. But the *interpretation* of these indicators has to be based on the theory of how the indicators are linked, via cause and effect, to health outcomes such as cardio-vascular risk. Since theories are subject to continual testing and refinement, the relevant indicators may be redefined over time. Communities are complex socio-economic systems, and the interpretation of indicators of their socio-economic condition depends on an understanding of the causes and consequences of community wellbeing. Therefore, the indicators proposed here will need to be refined as we learn more about how they reflect the condition of the industry and its communities. As baseline indicators, they are not intended to track all the significant or relevant changes; others will be added over time, as new technologies, unforseen events and so on emerge.

Figure 2 (above) is an attempt to map some of the important cause-effect relationships in the Narrabri community. Accordingly, we now make some suggestions regarding how these indicator variables may be linked to other factors important to the socio-economic condition of the community.

1. Cotton area planted, by locality and type of cotton.

Area of cotton planted may be the best single indicator of the scale of the industry in the region, and of the potential impact of the industry on the economic and social condition of the communities in the region. However, the geographic area needs to be defined. There are three urban centres in Narrabri Shire (Narrabri, Wee Waa, and Boggabri) and year-to-year changes in cotton area planted are not likely to be equally reflected in the economic condition of each of these. As well, cotton grown outside Narrabri LGA also generates economic effects in the Narrabri community, to the extent that businesses in Narrabri have economic linkages with those properties. Hence, it would be useful to know the ways in which cotton growers in Narrabri Shire and adjacent LGAs have economic linkages with each of the towns in the region. This could take the form of a survey of cotton growers to determine the locations where farm business and household spending takes place, the amounts spent in each place, and the locations where other household needs (eg., medical, educational, recreational) are met.

Over time, changes in technologies used within the cotton industry (both on-farm and in ancillary service industries) will change the relationship between area grown and socio-economic effects in communities. For example, changes in the types of cotton grown (GM, conventional *vs* Roundup Ready etc), since they use different amounts and types of inputs, has implications for the economic and social effects experienced in the local community. In particular, the trend towards RR cotton has greatly reduced seasonal labour requirements, and there have been significant effects on seasonal spending in many communities (caravan parks, hotels, supermarkets, convenience stores).

Cotton area planted depends, in turn, upon a range of variables such as water availability, commodity prices of cotton and alternative crops, the price and availability of all inputs, and changing technologies. It is clear that water availability is currently the most important of these, (see 12. Water use/availability, below).

A related indicator suggested is the proportion of total farm gate value of agricultural production represented by cotton. This gives some indication of the relative importance of the cotton industry, relative to other farming industries, in the local community. There may, however, be inter-industry differences in the their levels of spending in and social connection with the local communities. Data on farm-gate values of output of the various agricultural industries, and other useful farm-level financial data, were previously collected annually in Agricultural Censuses, but these data are now collected much less frequently.

2. Cultural diversity, community groups

This refers to the demographic diversity of the Narrabri community that results from the presence of a culturally diverse workforce attached to several research institutions on the area, and also results from the relatively highly educated and high income workforce (compared with other towns associated with broadacre farming). It also recognises the contribution that such a workforce makes to the existence of a wide range of sporting, social and cultural activities. Accordingly, potential measures include the percentage of the resident population born elsewhere, and the range and viability of community groups.

3. Educational quality

The range and quality of schooling choices available in the community is frequently mentioned as one of the key variables that influence the attraction and retention of employees in the rural communities. This is likely to be even more true of employees in the cotton industry and its ancillary industries. Accordingly, possible indicator variables might be school enrolments, retention rates for students and teachers, and the number of students travelling outside the area for higher secondary schooling.

4. Housing affordability

This can change fairly rapidly in communities experiencing growth or decline, and may be a good barometer of local economic conditions. The ABS Population Census has data on mortgage and rental payments, but for greater currency these would have to be supplemented by Real Estate Institute data on sales prices and rentals.

5. Human disease risk

Regardless of the factual basis or scientifically verifiable linkages between chemical use by the industry and human health problems, the public perceptions of linkages, and any local disease outbreaks has the potential to represent a key obstacle to the standing of the industry in the community, and was mentioned as matter of concern in our consultations with communities. Therefore, it would appear desirable the indicators include measures of the local and community incidence of human health problems that might in any way be linked with chemical use. Given the declining use of chemicals, and the increasingly stringent protocols surrounding their use, it would be interesting to track this over time.

6. Image of cotton

Indicators might be based on locally collected attitudinal survey data. For example, local perceptions of the contribution of the industry to community economic and social wellbeing.

7. Population

Population change is perhaps the most widely-used indicator of changing community condition. Simple counts of total population, however, are not as meaningful as tracking changes in particular segments of the population. As a minimum, the changing age and sex distribution of the population should be included as an indicator. For example, the population aged 14 and under, and 65 and over should be separately tracked, as well as the dependency ratio (population aged 14 and under plus those aged 65 and over, as a percentage of those aged 15 to 64). Census data needs to be supplemented by intra-censal estimates, surveys of school leavers, and staff turnover of major employers.

8. Quality of life in the region

Although regularly mentioned in community consultations, quality of life (QoL) is an imprecise 'catch-all' term which needs to be elaborated into a number of specific components. An enormous literature exists on the measurement of QoL. ABS does construct indexes based on socio-economic data for local government areas and below (SEIFA). It would be possible to construct alternative QoL indexes from a range of locally available statistics, but the composition of such indexes is likely to vary from community to community, making comparison between different cotton growing regions or communities difficult or impossible.

9. Range of businesses

In smaller places (such as Narromine and Warren) it would be possible to construct a complete count of all businesses, by type, and to track their changing levels of activity and employment by annual survey. ABS Population Census also provides data on employment by industry, but only at 5-yearly intervals.

10. Skilled labour

The difficulty of attracting and retaining skilled labour was a key issue raised in all communities where consultations took place. Employment agency data, as well as surveys of major employers, could provide such data.

11. Unemployment

Unemployment by age, sex, occupation and skill level are relevant. Local Centrelink and employment agencies could provide data on this indicator.

12. Water use

Allocations of surface and groundwater in the region, and volume of off-allocation flows extracted, are likely to be correlated with cotton acreage. Changes in water use per crop hectare over time are an indication of changing water use efficiency.

Issues in the Macquarie Valley cotton region

The communities of Warren and Narromine were also visited, and consultations conducted with staff of local authorities, cotton industry stakeholders (growers and ancillary industries), and local business people.

There were significant differences between the two communities in terms of the issues raised. In Warren, the advent of Roundup-ready cotton, coupled with reduced areas planted owing to very low allocations of surface water in recent years (and the absence of groundwater) has meant a large reduction in economic flows through the town. Of particular importance has been the very large reduction in demand for seasonal labour, which has reduced the household income of local residents who had relied on such work. We received anecdotal evidence that the loss of this supplementary source of income has led to an increase in the incidence of depression and its consequences. *This suggests that an important indicator to track would be the incidence of depression and related problems in community health statistics*.

The lack of seasonal work has also had an effect on businesses that cater for itinerant workers, such as caravan parks, hotels, and the like. Annual surveys of selected businesses could provide data for an indicator of this influence.

In Narromine, by contrast, the availability of some groundwater, the lower relative share of cotton in total agricultural production, and the proximity of the expanding regional centre of Dubbo, have ameliorated the effects of reduced surface water allocations. Indeed, informants in Narromine reported strong economic growth and residential building activity in Narromine over the past two years. Our inspections of the business and industrial areas of the two towns, noting recently closed and recently opened businesses, new building activity, and apparent business expansion, appeared to confirm these reports.

Sources of data for demographic and socio-economic indicators

The ABS Census of Population and Housing generates a vast array of high quality data that could be used for constructing potential indicators. Census outputs for Local Government Areas available free online include: Basic Community Profiles (33 tables); Expanded Community Profiles (49 tables); Indigenous Profiles (29 tables); Usual Residence Profiles (28 tables); Working Population Profiles (19 tables) and Time Series Profiles (22 tables). In addition, Basic Community Profiles (33 tables) are available for urban centres (eg, Narrabri) and ‘rural localities’ (eg Trangie). Examples of indicators that can be derived from ABS Census data are shown in Tables 1 and 2.

There is no single or standard set of socio-economic indicators of community wellbeing. Bray (2001) proposes a set of social indicators for regional Australia, some of which are represented in the following Tables, from which further indicators for cotton communities could be chosen. Indicators should be chosen to balance the need to track the issues and circumstances of particular cotton communities, while allowing useful comparisons with both other cotton communities and rural communities in general.

Table 1. Lower Namoi

Basic socio-economic profile indicators for the Lower Namoi cotton growing region.

Profile Indicators	LGAs	
	Narrabri	Walgett
Value of cotton prod'n as % of agricultural prod'n, 1997	60.2	49.7
Population 1991	14,653	3,595
Population 1996	14,101	3,290
Population 2001	13,817	3,155
% change 1991-1996	-3.8	-8.5
% change 1996-2001	-2.0	-4.1
Demographics		
% aged 14 and below	23.3	23.1
% 15-64	64.3	65.8
% 65 +	12.4	11.1
Dependency ratio (a)	55.4	51.9
% Aboriginal or TSI	7.8	11.8
Labour force		
Unemployment rate (%)	8.1	7.2
Unemployment rate 15-19 (%)	17.5	14.5
Unemployment rate males 20-44 (%)	10.2	7.7
Participation rate	65.3	69.8
% labourer and related workers	11.4	15.6
% employed in agriculture, forestry and fishing	25.4	45.0
Education		
% left school year 10 or less (b)	59.6	56.9
% left school year 9 or less (b)	25.3	23.7
% with no qualifications	62.7	65.9
Social		
% families with weekly income <$300	5.1	4.9
% rental housing	27.8	28.6
% fully owned housing	41.7	43.0
% households with no vehicle	8.6	9.2
% separated or divorced	9.3	8.9
% single parent families	13.8	12.4

	Towns		
	Narrabri	Wee Waa	Walgett
Population 1991	6,694	2,030	2,091
Population 1996	6,419	1,860	1,970
Population 2001	6,245	1,816	1,826
% change 1991-1996	-4.1	-8.4	-5.8
% change 1996-2001	-2.7	-2.4	-7.3

(a) Population aged under 15 or 65 and over, as a percentage of those aged 15 to 64.
(b) Includes those who never went to school.

Table 2. Macquarie Valley

Basic socio-economic profile indicators for the Macquarie Valley region.

Profile Indicators	LGAs	
	Narromine	Warren
Value of cotton prod'n as % of agricultural prod'n, 1997	26.1	49.7
Population 1991	6,697	3,595
Population 1996	6,523	3,290
Population 2001	6,621	3,155
% change 1991-1996	-2.6	-8.5
% change 1996-2001	1.5	-4.1
Demographics		
% aged 14 and below	24.6	23.1
% 15-64	62.5	65.8
% 65 +	12.9	11.1
Dependency ratio (a)	60.0	51.9
% Aboriginal or TSI	14.5	11.8
Labour force		
Unemployment rate (%)	8.5	7.2
Unemployment rate 15-19 (%)	26.7	14.5
Unemployment rate males 20-44 (%)	9.0	7.7
Participation rate	62.7	69.8
% labourer and related workers	13.9	15.6
% employed in agriculture, forestry and fishing	34.0	45.0
Education		
% left school year 10 or less (b)	58.2	56.9
% left school year 9 or less (b)	24.8	23.7
% with no qualifications	63.9	65.9
Social		
% families with weekly income <$300	5.2	4.9
% rental housing	25.8	28.6
% fully owned housing	44.2	43.0
% households with no vehicle	9.2	9.2
% separated or divorced	11.1	8.9
% single parent families	15.6	12.4

	Towns			
	Narromine	Warren	Trangie	Dubbo
Population 1991	3,378	2,036	991	28,064
Population 1996	3,486	1,909	951	30,102
Population 2001	3,548	1,786	940	30,937
% change 1991-1996	3.2	-6.2	-4.0	7.3
% change 1996-2001	1.8	-6.4	-1.2	2.8

(a) Population aged under 15 or 65 and over, as a percentage of those aged 15 to 64.
(b) Includes those who never went to school.

Indicators based on maintaining capital stocks

Because ABS Censuses are conducted only every five years, other sources must be found for indicators that track year-to-year changes. Examples of indicators for cotton communities that could be updated annually from local data, (either existing or primary sources) using the 'four capitals' framework, are now suggested.

Built Capital

refers to the built environment and anything else that has been made by humans, whether in private or public ownership; it includes the physical assets of businesses and households, as well as public physical infrastructure such as roads, buildings, and other facilities.

- Total value of Council Building Approvals and completions, by category (residential, other)
- Council capital works and maintenance program budgets by category (roads, other)
- Capital works and maintenance budgets of major public and non-profit sector agencies (schools, hospitals, recreational groups).
- Business establishment/closures
- Private business investment in built capital (collected by annual survey), especially including the cotton growers and ancillary industries.

Human Capital

refers to the knowledge, skills, and general capacities of individuals.

- Enrolments at schools and other educational institutions in the region
- Employee turnover: origin/destination of changes in employment, by skill level, at major employers in the region (council, medical facilities, schools, major private sector employers).
- Destination of school leavers (local employment/unemployment, further education, employment elsewhere).
- Numbers of pension and benefit recipients, by category.

Social Capital

refers to 'features of social organisation, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit.' Social capital focuses on the capacities of groups of people and their interactions, to distinguish it from human capital, which focuses on the capacities of individuals.

- Key community-specific events reflective of engagement of the cotton industry in the rest of the community; e.g., Cotton Cup (Warren).
- Membership in and activity of key community groups, such as Chamber of Commerce, sporting clubs, school P&Cs.
- Support for key community events
- Crime rates (inverse measure of social cohesion)

Natural Capital

refers to the status and capacities of the bio-physical systems of a region or community, whether or not they have been modified by human intervention, such as forests, agricultural land, and river systems.

While natural capital is not within the scope of this study, indicators might include:

- areas in specific land-use categories, such as private farm land (native pasture/woodland; improved pasture; dryland cropping; irrigation); areas in vulnerable ecosystem types; areas in residential and urban use
- urban water quality measures

Conclusions and future work

This report has listed a series of key variables that track the socio-economic condition of the cotton industry and its communities in selected regions.

The industry plays a dominant role in the town of Narrabri, supporting skilled employment and promoting cultural diversity by attracting researchers from other cotton growing regions. While this project limited its focus in the Namoi region to the town of Narrabri, previous research done by one of the team (CARE & IRF, 2003) has shown that there are important differences in the socio-economic issues facing, and condition of, the several communities within that region. Similar differences were revealed in this study between communities in the Macquarie Valley region.

While it was possible to identify a number of specific factors that are changing the economic and social conditions of cotton communities, and thus to identify a large number of indicators that could be tracked in order to monitor these changes, our work was only a *scoping* study, and focused on the selection of baseline indicators: a limited set of variables that give an overall impression of the socio-economic condition of cotton communities. Issue-specific indicators will need to be added to be track the changing relationships between specific sources of impacts and their effects in the industry and community.

It was evident from our work that cotton communities face a number of challenges. The issues are complex; for example, a region may simultaneously experience both a skilled labour shortage and unemployment. Some of the issues relate to the specific nature of the cotton industry. Others are similar to the challenges facing much of rural Australia, including maintaining educational quality and choice, attracting and retaining skilled employees, providing for an increasing range and sophistication of social and environmental amenities in order to attract and retain the sort of skilled employees it needs, and retaining sufficient population to ensure that important community functions and services remain viable.

Future work might focus on *extending the methods used here to all cotton communities*, and on *continuing annual collections of the key indicators*. This will allow comparisons between all cotton communities, over time, and the analysis of the reasons for differences. Comparisons with rural communities comparable in other ways but not associated with the cotton industry will throw some light on the specific contribution of the cotton industry.

It might also be worth considering whether research projects on new technologies that have the potential to result in significant changes to the economic and social structure of the industry and its communities might be required to identify these impacts, and for the industry to fund research on the socio-economic impacts of particular technologies. This would allow these impacts to be monitored, documented and better managed.

It is important for the industry to remain aware of changes that are occurring in its communities, and to understand how much the industry itself is responsible for these changes, in order to manage these impacts better. It is also important for the industry to understand how rural communities in general are changing, in order to anticipate and manage the effects of changes originating outside the industry.

To summarise, future work should:

- Extend these methods to other cotton regions and communities
- Conduct annual collections of the key indicators.
- Track the trends in the indicators over time in cotton communities
- Identify and analyse reasons for differences
- Compare the magnitude of and trends in the same indicators in rural communities *not* associated with the cotton industry
- Count and track indicators of the four kinds of local 'capital'

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Appendix 1

Community sustainability: The 'four capitals' approach

1. How can we improve the capacity of communities to manage sustainably?

[*Sections 1 and 2 draw on Stayner (2003)*].

Without going into the various meanings of *sustainability*, in this context we are interested in the capacity of a community to continue to satisfy the needs of its residents. Communities are complex systems that provide economic, social, environmental, and cultural goods and services that contribute to residents' wellbeing. Some of these goods and services are provided by 'the market', while others are not. They are all created by combining and converting the *flows* of services from *stocks* of various forms of *capital* into *outputs*. *Capital* can be seen as a stock of something that is not used up all at once but delivers its services over time. To the extent that a community's capital stocks are being depleted and are not being replaced, the services flowing from these capital stocks will also decline over time, and the sustainability of the community may be in question. Conversely, to the extent that a community's capital stocks are growing, its capacity to generate flows of goods and services will also grow, as will its ability to sustain community wellbeing into the future.

2. What are the forms of capital?

- ***Natural capital*** refers to the status and capacities of the bio-physical systems of a region or community, whether or not they have been modified by human intervention, such as forests, agricultural land, and river systems.

- ***Built*** *(or* ***produced***) ***capital*** refers to the built environment and anything else that has been made by humans, whether in private or public ownership. It includes the physical assets of businesses and households, as well as public physical infrastructure such as roads, buildings, and other facilities.

- ***Human capital*** is the knowledge, skills, and general capacities of *individuals*.

- ***Social capital*** refers to '*features of social organisation, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit.*' Social capital focuses on the capacities of *groups* of people and their interactions, to distinguish it from *human capital*, which focuses on the capacities of *individuals*.

Two other forms of capital are also sometimes identified:

- *Institutional capital* refers to the formal and informal *rules* by which society functions; for example, legal and administrative frameworks and norms. These are often functions of 'the state' or the wider society, although they often have local manifestations in people, organisations and physical facilities.
- *Financial capital* refers to the funds available to individuals and groups in a community. Financial capital can be thought of as *potential* capital, in the

sense that these funds contribute to community wellbeing only when they are converted into other forms of capital that generate flows of services.

Within each of the four broad categories of capital there are many specific capital items, which are combined with specific items of other forms of capital to generate an *output* - market and non-market goods and services. The diversity of capital items makes it difficult to aggregate them into quantitative measures of capital, except perhaps for produced capital, where the dollar values of the assets of public and private sector enterprises appear in their financial accounts. Some types of capital are intangible; their existence is only evident through the services they generate. This adds to their measurement difficulties. Therefore, it is not practical either to collect precise quantitative data on all the items of capital that may be relevant, or to undertake a comprehensive stock-take of a community's capital.

The four kinds of capital, when combined, generate a wide range of outputs that are important to and valued by a community. Indeed, as economic and social life become more sophisticated and complex, the range and complexity of the outputs that people need (or seek access to) in order to manage their lives also increase.

Many rural communities have a declining capacity to provide a full range of this expanding set of outputs and functions. Thus, as well as losing some of their existing functions, they may not acquire all the newly emerging ones. In other words, they can no longer provide - if they ever did - for all the needs of their residents. This need not mean that they are not 'sustainable'. Rather, the challenges for these places are:

- how to choose which functions/outputs will continue to be provided locally;
- how to maintain, create or import the various forms of capital that combine to meet community needs; and
- how to get the most out of the stocks of capital that they do command.

3. Applying the capital stocks framework

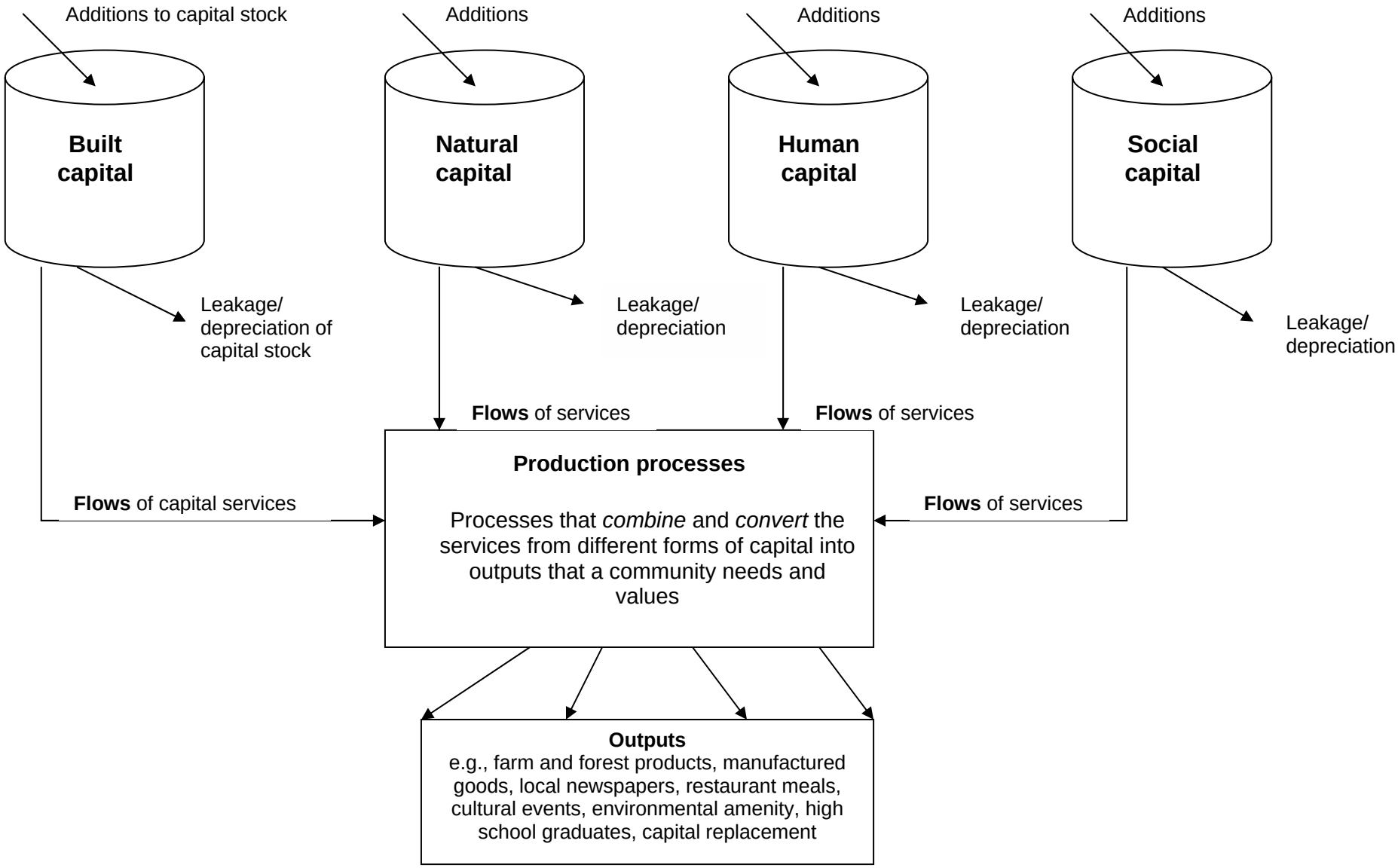
The following diagram illustrates the role of capital in producing the wide range of things that a community wants and needs. The four 'barrels' represent stocks of the four kinds of capital. These stocks may be augmented by additions, or depleted by leakages. Over time, these stocks generate various flows of services of one kind of another. For example, Council graders generate road maintenance services (hours of operation). General Practitioners (GPs) generate flows of consultations, a Shire Hall generates usage hours, while a forested catchment might generate timber, clean runoff for a town water supply dam, and environmental and recreational amenity.

There are dozens of production processes that transform the services from various capital stocks into outputs of goods and services desired by the community. Economists sometimes express the relationships between inputs and outputs quantitatively, and this can be useful. For our purposes, though, the quantitative relationships are less important than recognising that each output is the result of combining specific sorts of each form of capital, much as a recipe combines food ingredients. There is only a limited ability to substitute one ingredient (form of capital) for another, and no single stock of capital can produce output on its own. For example, a GP (human capital) needs access to medical equipment (built capital),

other health professionals (human capital), and support groups for people suffering from specific diseases (social capital) in order to deliver health services.

This model puts the focus on some of the key questions regarding how local people can manage for a sustainable community. Communities need to focus on both the factors that augment and deplete the stocks of capital, and on the processes that convert capital services into community outputs. For example:

- From the point of view of sustaining the community, which outputs and conversion processes are most significant or crucial at a particular time?
- What factors contribute to additions to and depreciation of each form of capital? For example, with regard to human capital, what factors influence a community's ability to attract and retain people with the skills and attributes needed to fill key roles? What roles are played by local schools, businesses, access to on-line courses, adult education and vocational training providers? How many school leavers remain in the community? What roles do in-migration and out-migration of people and skills play in maintaining the stocks of human capital? Are those who leave being replaced by in-migrants of other ages?
- What 'speeds' are the production processes running at? Is rapid growth depleting key stocks of local capital? What is the scope for increasing the throughput of certain production processes without threatening the capacity of the community to maintain its stocks of capital?
- To what extent do *local* processes contribute to the renewal of stocks of local capital?
- If local processes are not able to provide such renewal, can crucial items of capital be imported from elsewhere?


Additions to capital stock
Additions
Additions
Additions
Built capital
Natural capital
Human capital
Social capital
Leakage/ depreciation of capital stock
Leakage/ depreciation
Leakage/ depreciation
Leakage/ depreciation
Flows of services
Flows of services
Production processes
Flows of capital services
Processes that combine and convert the services from different forms of capital into outputs that a community needs and values
Flows of services
Outputs
e.g., farm and forest products, manufactured goods, local newspapers, restaurant meals, cultural events, environmental amenity, high school graduates, capital replacement

Appendix 2

Issues and Indicators

(derived from VENSIM Modelling of Narrabri data)

Issues

[Note: Several of these variables represent phenomena that are already measured in some way, by organisations such as the Australian Bureau of Statistics. For this reason, lists include both available indicators and potential indicators].

1. Cotton acreage

Main influences
Coal mining, gas other potential local NRM uses
Commodity prices
Cotton profitability (i.e. input costs
Water use (ie, availability)

Indicators
Percentage as GM (impact of gm on labour demands)
Percentage of farm gate value in region from cotton
Percentage of rents staying in town eg Gm rents
Water price vs other crops
Farms in financial stress

2. Cultural diversity and community groups

Main influences
Country of origin: cotton industry employees
Age profile of cotton industry labour force

Indicators
Percentage born overseas
Perception of: racial integration and tolerance:

3. Education quality

Main Influences
Number of schools
Availability of teaching staff

Indicators
Number of tertiary enrolments
Number of tertiary courses offered
Secondary enrolments
Age of finishing school

4. Housing affordability

Main Influences
Housing stock availability

Pressure on housing stock from different industries (e.g. Cotton, Coal mining)
Population

Indicators
Amount spent/month on rent and mortgage. by income class
Bed nights in homeless shelters or similar.

5. Human disease risk

Main influences
Pesticide use

Indicators
Data collected by Australian Agricultural Health Unit, Moree hospital

6. Image of cotton industry

Main Influences
Pesticide use
Cotton acreage
Cotton industry support of local community groups and events
Human disease risk

Indicators
Local image: perceived health risk in cotton communities

7. Population

Main Influences
Education quality/choice
"Regional cotton i/o value adding"
Regional facilities
Skilled labour availability

Indicators
Demographics: age profile, sex
School leaver surveys
Employer turnover of staff

8. Quality of life in the region

Main Influences
Education quality
Housing affordability
Human disease risk
Range of businesses
Indicators
SEIFA socioeconomic indices for areas

9. Range of businesses

Main Influences
"Regional cotton i/o value adding"
Research and research location

Indicators
Distribution of employment by industry
Number of business units: business mix >ABS Business register.
Business confidence survey

10. Skilled labour

Main Influences
Demand from alternative sectors/industries (e.g. mining)
Education quality
GM cotton

Indicators
Employer demand for labour
Local Skills survey
National Skills Shortage
Regional Apprentice starts
Local job vacancies

11. Unemployment

Main Influences
"Regional cotton i/o value adding"

Indicators
Unemployment rate: by age group (youth) and skill level.
Employment opportunities by skill and age

12. Water use

Main Influences
Climate change
Water allocation policy
Water use efficiency

Indicators
Total water use surface water
Ground water availability
Off allocation flows