Future Use of Sunshine Coast Cane Landscapes

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SEQ Catchments
Healthy land – healthy water

August 2006

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A Report to SEQ Catchments

Geoff McDonald, Sarah Park, George Antony, Peter Thorburn,
Steven Dawson and Ben Harman

CSIRO Sustainable Ecosystems
St. Lucia
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Executive Summary

The situation

In 2003 the Moreton sugar mill in Nambour closed, removing a market for the district's 120 cane growers who had been harvesting cane from 9800 ha of assigned caneland. Some growers have already diversified, but many are finding the choices they face very difficult due to the relatively small size of most farms and the limited range of known viable alternative crops. Many farmers see selling their land as a retirement asset.

The cane lands are adjacent to the rapidly growing urban areas of the Sunshine Coast and are sought after for housing and other urban purposes. However, the new SEQ Regional Plan prohibits urban development on most of the caneland and the Maroochy Shire Council has consistently made its policy clear that all efforts should be directed towards identifying a rural future for these lands.

This report

The mill closure creates the need for a strategic approach to the future of the Sunshine Coast region cane landscapes. The research reported here is to inform planning and management by all stakeholders including cane growers and other landholders, local and state governments and the community as a whole. The research assesses rural land use options including the future for growing cane for sugar or other products, alternative commercial agricultural and forestry enterprises and finally potential "green" land use options beyond agriculture, such as conservation and recreation.

For cane, the project quantifies productivity and economic returns using a combination of grower survey and modelling information. The plant suitability model (PlantGro™) identified the maximum range of possibly suitable crops, which was narrowed to those that local experience showed are possibly viable. For these crops further information was collected on agronomy and economic analysis of costs and potential returns.

The research identifies the natural assets of the cane landscapes and the services they provide such as flood storage, habitats for fish, improvement of water quality, open space for recreation and scenic amenity. These ecosystem services are important to the tourist industry that underpins the local economy, to the fishing industry and to the well-being of residents.

The report outlines a scenario for a positive rural future for the cane landscapes taking account of the suitability of land for agriculture and of the current or potential future ecosystem services the landscapes might provide.

Much of the detailed technical descriptions and details are contained in a companion Technical Appendix.

Findings

Most of the farms are small (median 60ha), making economic returns from broad acre cropping (including cane) difficult to achieve.

Much of the land, approximately 7000 ha is flood prone, poorly drained and land owners face a limited set of farming or forestry opportunities. The balance of the land approximately 3000ha is suitable for a wide range of crops.

A rural future could be a combination of the following:

- Cane supply to BioCane Limited as a processed stock food or for cattle feed and mulch on about a third of the area.
- Farmers with the well-drained fertile soils diversify into specialty field and horticultural crops, value-add on-farm and support farm tourism by on-farm accommodation and farm gate enterprises.
- Outdoor recreation activities increase including land and aquatic trails, riparian access and themed recreation parks that use a bush setting such as horse or trail bike riding
- Some former cane land is converted to wetlands for the purpose of waste water polishing while at the same time achieving biodiversity outcomes.
- Maroochy Shire continues to make strategic land purchases for the purpose of protecting endangered species habitat and ecosystems and to support riparian restoration.

1 Background

1.1 The situation

The majority of the Australian sugar industry is located on the coastal landscapes of Queensland and northern New South Wales. Market fluctuations and industry restructuring, workforce demographics, environmental scrutiny and pressures from urban encroachment, amongst other issues, all conspire to challenge the future viability of many sugarcane regions. The cane land is often adjacent to coastal urban development and the land is hotly contested for urban and other purposes.

Cane in South East Queensland is grown in coastal and hinterland areas of the Sunshine and Gold Coasts. In 2003 the Nambour sugar mill (Moreton Mill) closed, removing a market for the district's sugarcane production that had existed for over a hundred years. In 2003, 120 farms supplied the mill harvesting 8000 ha of cane off 9800 ha of assigned caneland. The mill employed 110 workers and a further 60 transport workers were employed during the crush. By 2005 there were only approximately 80 cane farms left managing an unknown cane area approximately 50% of the peak crop area.

The mill closure directly affected cane-farming families and indirectly affected a much broader cross section of the Sunshine Coast's community and economy. The 500,000 tonne sugarcane industry contributed an estimated $17m to the local economy directly and up to $53m indirectly.

Without the option for growers to mill their crop locally, cane growers face an immediate 'crisis'. Some growers have already diversified; others are finding the choices they face very difficult.

Views about the future of the sugar industry are diverse and polarised, ranging from the optimistic to pessimistic. The optimistic view is that the current downturn is temporary, and that, in time, alternative markets will be found to secure the future. The other view maintains that alternative uses of cane land must be found, including some such as urban use, which would permanently end the Shire's association with the growing of sugarcane.

Despite a plethora of research studies on the environmental, social and economic aspects of the region over the past decade, none show a clear and viable future direction for the cane growers or for sustainable alternatives. The mill closure and the changes in the Queensland sugar industry have resulted in the need for a strategic approach to the future of the Moreton region cane lands.

The low lying, flood prone land of the district is suited to the production of sugarcane, and the extensive coastal cane lands became an important part of the character and scenic amenity of the Sunshine Coast. Agriculture, especially sugarcane is the dominant land use on the coastal lowlands, interspersed with a few distinct settlements, including Nambour, an administrative centre and location of the former Moreton sugar mill. Views across the coastal lowlands to the Blackall Ranges are valued by the Shire's urban residents and by tourists.

Figure 1 The Sunshine Coast cane landscape region

1.2 Research purpose and scope

The primary purpose of this research is to provide an *objective* assessment of land use options in cane growing landscapes of the Sunshine Coast. This is to underpin informed debate in the community and by policy makers and to provide a framework for a proactive response to changing land-use. It is hoped that the framework and the findings will be used to inform statutory State and Local Government land use planning instruments.

The research combines economic and ecological perspectives to uncover innovative and sustainable future options. The most important research elements are systematic agronomic assessment of agricultural and forestry possibilities and ecoservices assessment of the cane landscape to canvass the widest range of future options including "new forms of green." These ecoservices include providing water quality, open space, scenic amenity, flood mitigation and fisheries habitat. We present details of the design, development and implementation of this integrative framework and its application to the Sunshine Coast sugar-growing region.

The study includes:

1. Evaluation of Sunshine Coast cane landscapes in terms of rural production and environmental goods and services values.
2. Strengths and weaknesses of the existing cane industry, including market trends and alternative products derived from sugarcane and potential cane futures
3. Identification of alternative diversified farming and forestry activities and their evaluation in social, economic and environmental terms
4. Identification of possible "new forms of green", non-farming activities in the cane landscapes including conservation, recreation and environmental services provision.

The research focuses on developing rural land use scenarios for the cane landscapes now that the sugar industry has a limited role in supporting cane growing. The scenarios reviewed are:

1. Cane growing for sugar production
2. Cane growing for other products
3. Other agriculture and forestry activities
4. Other types of green rural land use

Each scenario was evaluated in terms of economic, social and environmental sustainability and is presented with a productivity focus to inform landholders.

Results of the study can be used to improve property management planning programs used by canegrowers and other landholders within caneland areas. The study will translate into on ground outcomes through the early involvement of canegrowers in establishing the scope of the study, and the provision of incentives for growers to participate in the development of enterprise-level property management plans. It will also be an invaluable tool for Local and State authority land use planning.

1.3 Research methods

1.3.1 Activities

Agriculture and forestry alternatives

The project builds on a substantial body of recent and current work on natural resources and agriculture in the region. Most important among these are Burgess and Ellis (2006), *Land Suitability Framework for the Sunshine Coast*, Department of Primary industries and Fisheries (DPIF), 2004, *Thinking outside the square,* Maroochy Shire Council, *2005, Biodiversity Strategy.*

For **cane**, the project quantifies productivity and economic returns using a combination of grower survey and modelling information including predicted attainable yield assessments using the APSIM model.

For **other crops**, the project conducted a biophysical assessment of suitable crops using PlantGro™ to identify the maximum range of possibilities and then refined the number of crops using a grower questionnaire.

- Collected further information on agronomy, harvestable products from DPIF, extension staff, and other expert opinion,
- Estimated average yield for the region using information from PlantGro™, APSIM, expert opinion and current growers in the region
- Conducted an economic analysis on a selection of crops/enterprises at farm level (but did not assess potential markets).

Ecosystem goods and services

Most of the caneland in the Sunshine Coast occupies low-lying land on the floodplain of the Maroochy River and tributary streams. Furthermore, cane fields occupied a substantial proportion of the tidal floodplains of these rivers. Coastal floodplains are highly productive ecosystems and are essential for economic activity and ecosystem sustainability in the coastal zone. Understanding the ecosystem services of floodplains therefore is a critical aspect of analysing the values and impacts of land use alternatives.

- The project uses a hybrid of CSIRO and the Millennium Ecosystem Assessment models as a framework to identify and classify the natural assets and ecosystem services the floodplains and adjacent lands used for cane provide.
- For most of these services evaluation criteria were developed to assist specify the magnitude of services provided. Where possible these were quantified using information from biophysical research in the district.
- The contribution and impact of cane and other land uses on the provision of ecosystem services and the potential for rehabilitation or enhancement was assessed.

The concept of ecosystem services is relatively new and has very demanding information requirements. While there is substantial body of biophysical information available for the cane landscapes, very little of this information has been analysed from the ecosystem services perspective. The major obstacles to be overcome were to provide measures of the production function for ecosystem services to allow valuation of the (net) total, average and marginal value of ecosystem services to production, maintenance, assimilation services in the landscape and equally challenging, to attribute economic and cultural values to those services.

1.3.2 Consultation and engagement

The project built on Maroochy Shire Council's previous major community consultation activities associated with the *Cane Futures Project* and *Maroochy 2025 Visioning* both of which involved substantial community wide consultation about future development of the cane landscapes.

The consultation and steering group activities for this project incorporated the core outcomes of those activities and concentrated on detailed input from the cane industry and local, state and Australian Government agencies. For this purpose the project was guided by:

- This Panel OUM, SDI assisted in refining the scope of the study and ensured that it provided a whole-of-government and whole-of-community response to land use pressures.
- *Sunshine Coast Reference Group* Centrelink, SDI, cane landowners, BioCane Limited, NRM SEQ, Maroochy Shire Council, CSIRO, DNRMW, DPI&F, SIRP RAG South, Sunshine Coast Environment Council, Sunshine Coast Canegrowers Assoc.

(See Appendix 1 for membership and meeting dates for these committees).

Three "Information exchanges" were held at Yandina to which all cane growers and other local landholders were invited. Approximately 75 people attended on each occasion.

1.4 Planning Context

1.4.1 The Maroochy Shire Council Cane Futures Project

In 2003 Maroochy Shire Council (MSC) sponsored the *Cane Futures Project* which brought together cane growers, rural producers, all levels of government and the broader shire community in pursuit of a sustainable solution to the dilemmas created by the closure of the local sugar mill (Maroochy Shire Council, 2003). The project's main outcome was a *Preferred Vision* for the caneland and initiation of actions to deliver it. This vision has three components:

Vision 1: Retention of cane

'Due to the lack of viability of the local sugar industry causing the closure of the mill, a portion of crops are transported to neighbouring mills. Development of new technologies and products produced from cane has created a new, intensive local plant established in Yandina, serving a catchment of 4,000 + hectares. The plant produces a diverse range of bio-technology products including bio-plastics, pharmaceuticals, sugar fibres, organic sugar and ethanol. This provides the benefits of improving the quality of the life for growers in the region, maintaining and enhancing environmental quality and increases the influence of the domestic cane market. The community recognises and values the role of the cane industry and Government policies have supported structural changes.'

Vision 2: Short-term diversification

The approach considered diversification of crops in the short-term, designed to enable rapid diversification, thereby minimising the immediate economic impact on cane growers whilst not preventing the development of long-term solutions, nor closing the door on cane growing.

'The region is now a profitable mixed agricultural precinct which is competitive in the marketplace and meets the short-term cash flow needs of growers and related businesses whilst investing in long-term sustainability. A variety of short-term options have now been put in place: some cane is transported to Maryborough; a number of different crops have been planted – some grain; tea tree; ginger. In places horticulture is flourishing and there is now a profitable trade in silage of cane and corn and in mulches. These are possible because an emphasis has been placed on meeting market demand and on utilising local diversification and maximising potential synergies. A number of longer-term initiatives are underway: farms are supplying amenity and environmental services to community and being paid for them. The community and government have supported these developments. The overall result for farmers is that there has been no net loss of rural land, the incentive to sell farms is gone, and there is greater certainty for farm incomes.'

Vision 3: Sustainable agriculture in the long-term

This approach considered the possibilities for sustainable agriculture in the long-term.

'Farmers are provided with financial incentives for providing this environment where it is not economically sustainable.' Farmers on rural land are now included in vertically integrated farming systems, providing a great place to live with large areas of environmental habitat, visual amenity, and industry that is providing skilled careers and value-adding chains of local products and brands. Flood retention capacity is maintained, and cane growers have become land managers – of partnerships, differentiated products and services.

1.4.2 The Maroochy Shire planning scheme

Approximately 13,000 hectares of land are designated in Maroochy Plan 2000, as a 'Sustainable Cane Lands' precinct which represents the majority of the cane land. The precinct contains the lowlands within the floodplains of the Maroochy River, extending east from Yandina and the Bruce Highway to Marcoola.

The Sustainable Cane Lands precinct is intended to be protected for sugar cane and other agricultural activities due to the agricultural values of the land, which have been identified by the Maroochy Plan and State Planning Policy 1/92 (Good Quality Agricultural Land). The existence of sugar cane in these areas forms an important part of the rural character of the Shire as do other agricultural pursuits. Urban uses and the fragmentation of land holdings, other than to enhance their long term viability or provide for supporting infrastructure, are not considered desirable or consistent with the intent for this precinct. There are however, a range of activities which are considered compatible with the intent of the Sustainable Cane Lands precinct that do not require council approval. These include:

Agriculture	Animal Husbandry
Aquaculture (minor impact)	Bed & Breakfast
Detached House	Forestry (Plantation Forestry)
Home-Based Business	Roadside Stall (on land not abutting a State controlled road)
Stables	

These preferred uses can be undertaken if they avoid or minimise land use conflicts and retain or enhance the area's environmental values. Development for nature-based outdoor recreation purposes may also be acceptable where suitably sited and designed. An area near Lake Dunethin specifies the potential for recreational facilities.

The precinct includes land which is part of or adjacent to a declared Fish Habitat Area. Fish Habitat Areas are declared by the State government as critical for fish breeding and feeding. It is important that the sustainability and values of the Fish Habitat Area be retained.

Neither urban nor rural residential uses are considered consistent with the intent and desired character of this precinct and applications would be refused.

Furthermore the MSC plan acknowledges that:

- Most of the coastal caneland are flood prone (within the 1 in 100 Annual Return Interval (ARI) flood line)
- Acid Sulfate soils are prevalent on the coastal plain
- Most of the land is considered marginal or unsuitable for horticultural purposes

Encroachment on the caneland can and should be limited and that all efforts should be engaged with the task of identifying a rural future for these lands. MSC has consistently reiterated its commitment to a long-term sustainable rural future for the Shire's cane lands and continues to advocate to the state government for proactive support for the Council's planning intentions.

1.4.3 The SEQ Regional Plan

The SEQ Regional Plan 2005-2026 (SEQRP) came into force in July 2005 (OUM, 2005). It has substantial impacts on the land use futures of the caneland, since it is binding on local government planning schemes and other development control instruments. The plan defines a regional land use pattern consisting of:

- Urban footprint
- Rural Living area
- Regional Landscape and Rural Production Area
- Investigation area

The urban footprint excludes development for urban purposes on most of the caneland, except those areas east of the Sunshine motorway and in proximity to Nambour and other towns, unless there is an overriding public interest. Further, the plan introduces a 100ha minimum lot size for subdivision in the Regional Landscape and Rural Production Area, which will largely preclude any additional subdivision. [1] There is no caneland in the Rural Living Area consequently, subdivision for rural residential development will not be permitted.

Within the constraints of the SEQRP, the existing provisions of the Maroochy Shire planning scheme continue to apply in relation to use rights, development such as building-works, environmental provisions. Applications for development, including subdivision within rural residential zones, ie pre-existing applications, which were properly made before the 27 October 2004 may still be considered by MSC within the provisions of the planning scheme applying at that time, whereas those made afterwards can not be considered. There may be some pending applications in this category although these are limited by a two year "use it or lose it" provision.

In short, the SEQ Regional Plan will permit almost no urban development of the caneland west of the motorway and even on land east of the motorway; the applications will be subject to sequencing and environmental limitations.

Recognising that these broad controls may need refinement to meet local circumstances, the Plan envisages the development of **Rural Precinct Plans** to provide more detail to assist managing regional landscapes and especially rural production areas. At the time of writing, the scope and contents of a Rural Precinct Plan have not been specified by the Office of Urban Management. Given the purpose outlined for them, they could be expected to provide greater detail on local outcomes and variations consistent with the general intent and principles of the regional plan. In particular they will need to accommodate economic and social as well as environmental outcomes.

In the longer term, the SEQRP will be formally reviewed in five years, at which time, designations and boundaries may be changed (by parliament). Rural Precinct plans, potentially affecting land use and subdivision in the caneland may be gazetted before then.

1.4.4 The Sugar Industry Reform Program 2004

The Australian Government's announced the Sugar Industry Reform Program (SIRP) in April 2004. One component of SIRP is the Regional and Community Projects fund of $75m over 3 years for regional initiatives and industry adjustment projects which facilitate change in regional sugar industries. The broad objectives of the Regional and Community Projects are to foster partnership approaches, new ideas, industry self-reliance and restructure. Specific aims are to partner projects that enhance profitability and efficiency of farms and mills, promote cross sectoral and whole of systems solutions, pursue alternative business structures, economic diversification and alternative uses for sugarcane, improve environmental management of cane farms, and promote the capacity for change within sugar regions.

1 *Interim Implementation Guideline No.3 Rural Precincts* of the SEQRP 2005-2026 identifies Maroochy Shire's Sustainable Caneland as a "rural precinct" within the Regional Landscape and Rural Production Area. For regulatory purposes, until the final Rural Precinct Guideline is released, minimum subdivision lot sizes are as specified in the MSC planning scheme rather than the blanket 100ha minimum as required by the SEQRP 2005-2026.

SIRP created Regional Advisory Groups (RAG) to develop and implement regionally based plans for improved environmental, social and economic outcomes for the sugar industry. The South RAG (including the Sunshine Coast) commenced in August 2004 and prepared a strategic plan for each of the three mill areas in the southern region covering the Maryborough Sugar Factory mill area, the (former) Moreton Mill area on the Sunshine Coast and Rocky Point Mill Area in the south.

These plans include assessment of the region's capacity to produce and export raw sugar against worse case scenario forecasts, examination of the alternatives for the sugar industry, including alternative crops and alternative economic activities and a program for ensuring the adoption of a whole of industry systems approach for pursuing efficiency, productivity and profitability gains.

In the Strategic Regional Plan for the Moreton district the key premises of the RAG action plan are that a wholly sugar based industry is not viable and that options include a small level of sugar production through the Maryborough Sugar Factory, stock feed production with BioCane Limited, or diversification into other alternative crops or livestock.

The actions recommended by the RAG focus on ensuring that growers have full information about options to decide their own future and the formation of a coordinating group to assist in the dissemination of information and manage the transition process in the short-term. The responsibilities of the coordinating group include informing growers of the opportunities, assisting in the assessment of the opportunities and in monitoring their progress.

Funding support to growers from the Regional and Community Projects they will be contingent on them establishing a sound business case for transition. A broad range of financial counselling services for individual cane growers, cane harvesters and their families is being provided in preparation for a transition, under the Sugar Industry Reform Program. These free financial services include assistance with assessment of current financial position, business planning, information on government schemes and assistance packages and ongoing support.

> "It has been 18 months since the Moreton Mill closed and the RAG is of the view that the future of the Moreton cane growing district needs to be resolved quickly. The success of the transition strategy will be dependent on the participation of growers. Therefore the RAG recommends that the second round of Regional and Community Project funding be used to encourage growers to initiate and commit to this plan." RAG (2005)

2 Ecosystem Goods and Services

2.1 Framework for Evaluating Environmental Services in Sunshine Coast Cane landscapes

Ecosystem goods and services

The natural assets of landscapes provide a flow of "ecosystem goods and services" to sustain and fulfil human life. They are essential. The question posed here is how important are cane landscapes to sustaining and creating life fulfilling services in the Sunshine Coast and beyond?

CSIRO and more recently The Millennium Ecosystem Assessment (MEA) team have provided conceptual frameworks for answering this question[2]. A hybrid model combining the essential features of each and showing the assets and principal environmental services covered in this project[3] is shown on **Figure 2**. It identifies specific natural assets and the services they provide cane landscapes on the Sunshine Coast.

Ecosystem services are critical to life by supporting essential processes, such as the purification of air and water, nutrient cycling and the decomposition of wastes. Ecosystem services are important in regulating or moderating environmental conditions by reducing the risk of extreme weather events, accommodating sea level rise, mitigating droughts and floods, and protecting soils from erosion. Ecosystem services provide inputs for the production of natural products harvested or used

2 The CSIRO and MEA models used closely resemble each other (See Abel and Cork (2003) and Reid (2005) respectively) The MEA model does not explicitly include "natural assets" as does the CSIRO model. This foundation can be added to the MEA model without affecting its structure. The MEA model has four types of ecosystem services – provisioning, supporting, regulating and cultural services. These are similar to the production inputs, maintaining natural assets, assimilation of by-products, and goods and services components of the CSIRO model. The major contribution of the MEA model is to expand the concept of cultural services which are the non-material services provided by natural landscapes.

3 The Technical Report provides a detailed inventory of these assets and services for the Sunshine Coast cane landscapes.

by humans including water, food (crops, fish, forage), fuel and fibre, medicines and so on. These are known as provisioning services. Finally ecosystem services provide an important role in life fulfilling cultural services, non-material aspects of human relationships with the environment including spiritual, aesthetic and educational connections, passive recreation and ecotourism.

Measuring ecosystem goods and services

The first step in applying this framework is to define how economic activity and natural processes are dependent on goods and services provided by the ecosystem through understanding the region's main natural assets. This process results in an inventory of ecosystem services in the categories shown for example on **Figure 2**.

The second step is to measure the response of ecosystems and socio-economic outcomes to the identified ecosystem services. How does a given ecosystem process contribute to the magnitude of the service provided? What are the functional relationships between ecosystem entities and their sensitivity to impacts from land use and other changes?

The third step is to evaluate the significance of that service to economic and cultural outcomes. Valuation is the key to comparisons and to establishing the relative importance of services from a human perspective. Monetary valuation is desirable wherever possible because it is a measure of what people are willing to pay for a good or service. Market valuations highlight the importance or ecosystem services for the economic activities that depend on them and provide quantitative and comparable measure of significance. In practice this is difficult because many services are not traded in markets, have no specific market price and have values that can only be inferred by indirect methods. This is not to say that non-marketed ecosystem services are unimportant just that no explicit market exists for them. To overcome this problem a range of environmental economic evaluation techniques are used to infer a value of ecosystem services by surrogate markets such as real estate prices or "willingness to pay" surveys or quantifying productivity outcomes or cost savings.

Overview of ecosystem goods and services in cane landscape

Most of the Sunshine Coast caneland occupies low-lying land on the floodplain of the Maroochy River and its tributary streams. Cane fields occupy a substantial proportion of these tidal floodplains and adjacent alluvial land. Coastal floodplains are highly productive ecosystems and are essential for economic activity and ecosystem sustainability in the coastal zone. Floodplains provide habitat and food for many species, and a large proportion of commercial and recreational seafood including fish, shellfish and crustaceans, are dependent on estuarine wetlands at some stage of their lifecycle (O'Neill, 2000). Within the floodplains there are intertidal zones containing various species of mangroves that are especially important, supertidal zones with salt marshes and sand flats, extra-tidal poorly drained areas with buffalo grass flats and casuarina communities and totally freshwater areas above tidal limits containing freshwater wetlands, wallum and Banksia communities. (See Anorov, 2004)

Floodplain landscapes have aesthetic values, cultural connections and provide for aquatic water sports and recreation contributing substantially to the quality of life in coastal communities. Many industries rely on the sustainability of floodplains for their economic viability. Agriculture, fishing and tourism industries, amongst others, utilise either directly or indirectly various ecological attributes of floodplains.

Coastal floodplains with their associated wetlands, estuaries and their connected near shore ecosystems are the most ecologically productive components of the global ecosystem. Here, a combination of physical and chemical processes supports the highest level of ecosystem services. Costanza's groundbreaking global study in 1997 showed that on a per hectare per year basis, estuaries contribute services valued at $US22832, seagrass beds $US19904, tidal marshes and mangroves $US9990 and the swamps and floodplains $US19580 (Costanza, 1997). The asset value of these ecosystems generating annual services of that magnitude would be ten to twenty times these values.

While there is substantial body of biophysical information available for the cane landscapes, very little of this information has been analysed from the ecosystem services perspective. Identifying what categories of ecosystem services are important is relatively straightforward. Providing economic values is much more challenging due to the limited understanding of the local production function

for ecosystem services, for example of one hectare of wetland, to allow valuation of the (net) total, average and marginal value of ecosystem services to production, maintenance, assimilation services in the landscape. Even more challenging is to attribute economic and cultural values to those services.

While all economies depend to an extent on their local natural assets, regions like the Sunshine Coast that have a mixture of agricultural pursuits, retirement living and tourism as their economic base, depend on their natural assets more than most. A combination of mild sub-tropical climate and attractive beaches, waterways and semi-rural landscape underpins the economy, traditionally agriculture and more recently and tourism, recreation and "sea-change" retirement lifestyles. The natural environment and its attractions are the major reasons for the Maroochy district being one of the fastest growing regions in Australia. The current population of about 150,000 is projected to increase to 240,000 by 2021.

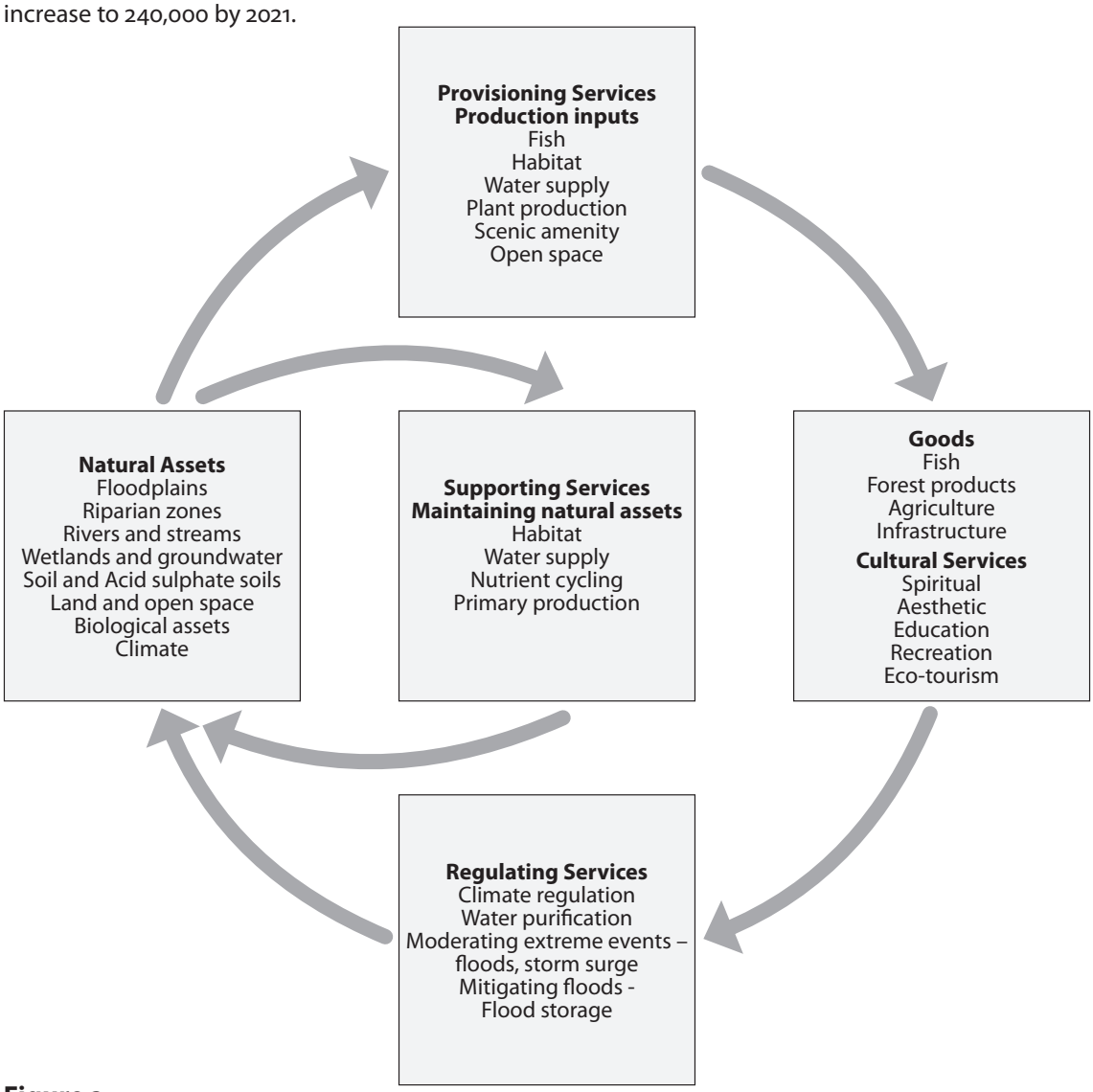
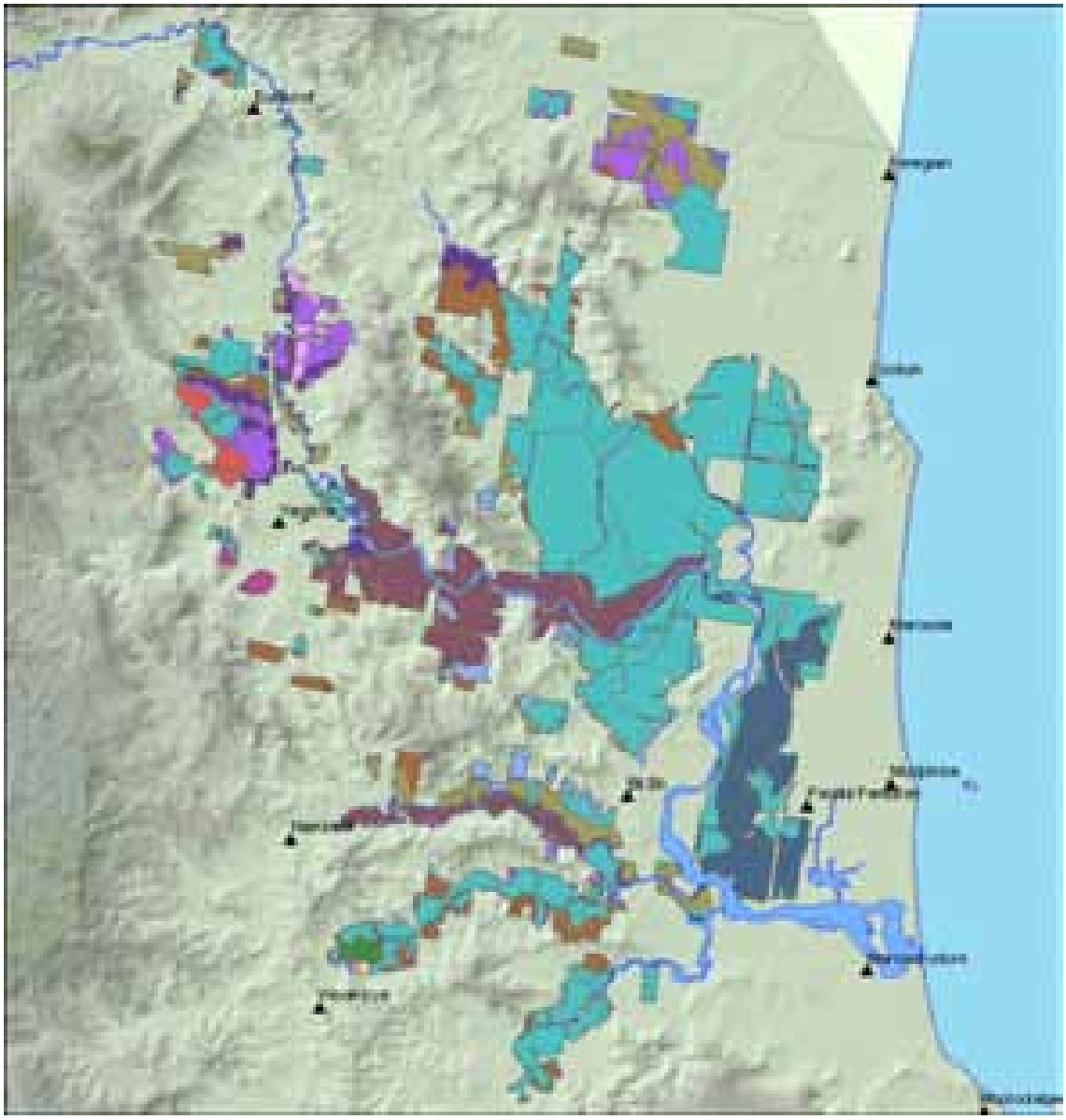


Figure 2
Natural assets and ecosystem goods and services in Sunshine Coast cane landscapes

The economic base for Maroochy Shire increasingly shows the features of a tourism and "sea change economy", the key employment activities being retail trade (18.3%), health and community services (11.0 %), construction (9.7 %), property and business services (9.5%) and manufacturing (8.5%), accommodation, cafes and restaurants (7.7%). Tourism directly provides 20% of the employment in the Sunshine Coast region and contributes over $733 million to the region's economy.

Assigned Cane Lands Soil Types

Figure 3 Soil types – major drivers of ecosystem services in cane landscapes



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In 2004, there were over 4 million domestic day trips and 16 million total visitor nights generating $39.8 in accommodation revenues. While the majority of tourism activity is domestic, 222,976 international visitors came to Maroochy in 2004.

The increasing numbers of people moving into retirement and relocating to the Sunshine Coast can be expected to have significant and specific impacts on the local economy and environment. Recreational activities and access to areas where these activities take place will need to accommodate the growing population and the retirement lifestyle.

Only a small number of studies have been specifically conducted to estimate the economic value of various ecosystem services in southeast Queensland but the interest is high and rising. The gross value of agricultural production in Maroochy Shire was $ 63.3 million in 2001, most depending on various ecosystem services. Fishing, both commercial and recreational, depends on fish and their habitats in the Maroochy estuary. In Maroochy estuary it is estimated that in 2005 there were 7305 boat fishing trips and 23376 shore trips. Research in nearby Pine River and Logan estuaries showed direct costs of $28.46 per boat trip by recreational fishers and $11.42 for shore fishers and annual willingness to pay by boat fishers of $223.85 and shore fishers of $146.25 (Reid and Campbell, 2002). There have been other studies of recreational fishing in which estimates of willingness to pay range from $19 - $43 /person per trip and annual non-use values of wetlands $19.22/year. Pearson and Lisle's study showed real estate prices approximately double for water views in Noosa other things being equal (Pearson and Lisle, 2002).

Mallawaarachchi and colleagues estimate community values for peri-urban land in production and conservation in the Sunshine Coast (Mallawaarachchi et al, 2005). They show total community willingness to pay of $1980/ha/year for protection of areas of unique or rare vegetation. Conversely, conversion of that land to urban land uses was a loss of -$1102 /ha/year. The Moreton mill was still operating at the time of the study and the cane area potentially expanding. The respondents loss for conversion to sugarcane was -$78 /ha/year

Soil types together with flooding are major ecological drivers in cane landscapes and along with acidity and salinity regimes define the main ecological domains. For this reason we use major soil types in floodplain reaches to summarise potential ecosystem services. The categories are:

- Humic podsols on the lower floodplain
- Humic gleys on the central floodplain
- Humic gleys along the creeks
- Alluvial soils in freshwater reaches
- Red podsols in the hinterland

These domains or landscape types are shown on **Figure 3**. These landscape units, together with the waterways they contain are critical for provisioning services including agriculture and forestry, regulating services including flood containment and water quality treatment as well as cultural services including open space, scenic amenity and recreation. Data sources are available for more detailed mapping of these services and the major sources are provided with the summary of each ecosystem service.

2.2 Floodplain

One of the services provided to the community by natural floodplains is to accommodate floodwater allowing the outflow of water from upstream catchments while minimizing flood heights in estuaries, river mouths and adjacent land thereby reducing damage to economic assets and reducing threats to human life. Recent severe flooding in New Orleans clearly illustrates the importance of this *regulating service,* the extent of which is proportional to the depth of water and the pathways provided for damaging flows. (See **Table 1**)

The importance of this service is likely to increase due to the inherent uncertainty about the flood potential of the Maroochy river system, climatic uncertainty, possible sea level rises, and probable increased flood peaks due to increased impervious surfaces from urban development. As urban development intensifies in coastal areas adjacent to the lower reaches of the River, the hazard will

also increase. Recently published climate change forecasts for south east Queensland predict more frequent extreme weather events, extreme daily rainfall intensity (1 in 20 year event) to increase by 30% and sea levels to rise by 17cm by 2030 (Hennessy, Macadam and Whetton, 2006).

Table 1 Regulation of flood waters in the Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
The lower floodplain contributes to the regulation of flood water although flood depth is lower than the central floodplain	The central floodplain contributes substantially to the regulation of flood waters as flood storage	Caneland in the lower reaches of the Eudlo, Paynter and Petrie Creeks all contribute moderately to the regulation of flood waters	Caneland in the vicinity of the lower stretch of Yandina Coolum Rd contribute moderately to the regulation of flood waters	Outside the flood area .

Key sources: DMR (2006); MSC (2000); D. McGarry MSC, pers comm.

No systematic assessment of flood hazard in the Maroochy River system has been conducted although recent work by MSC and the Queensland Department of Main Roads has improved our understanding of the risks (DMR, 2006). Approximately 70% of the previously assigned cane land is flood prone being flooded with a 2-10 yr interval and inundated between 1-3 metres in depth in a major flood. See **Figure 6** for a map showing the 1 in 100 year flood extent and the cane areas. Apart from low level roads and farm buildings, the developed areas most at risk of flooding include Marcoola, Pacific Paradise (where levees have been constructed), Picnic Point and Twin Waters.

Cane growing has minimal impact on flooding services since cane has similar roughness to natural systems and it involves few earthworks to impact on flood storage. New developments would need to be rigorously assessed for impacts on flood height, frequency, and recession.

2.3 Rivers and streams

A large number of aquatic species rely on free passage through rivers, estuaries, creeks, streams, wetlands and swamps at some stage in their life cycles. Salinity gradients and fresh water flushes are essential stimuli for ecological processes such as reproduction and growth.

The draft Mary Basin Water Resource Plan states that existing levels of water resource development have caused minor reductions in mean and median annual flows at the confluence of the North and South Branches of the Maroochy River, and significant reductions in low flows, especially in the drier months. Reductions at the mouth are minor due to large inflows to the estuary from local catchment areas that are relatively unaffected by water resource development. (DNRMW, 2005)

While the catchment receives relatively high rainfall, urban water supplies and rainfall for agriculture are limited on a seasonal basis. No significant groundwater aquifers exist in the North Maroochy catchment for irrigation use except in localised sub-catchments. Large off-stream dams exist throughout the North Maroochy to hold harvested surface water and more may be built. The draft Water Resource Plan recommends increased water harvesting in times of high flow to support agriculture.

Very little cane land is irrigated although there is a substantial supply of treated wastewater available for irrigation in the vicinity of trunk mains and treatment plants. As such cane land use does not have a major impact on the freshwater hydrology of the district. (See also sections on Riparian Zones and Wetlands). The need for supplementary irrigation water for other agricultural crops, especially horticulture, would require additional surface water storages on farms, with attendant environmental impacts.

2.4 Water quality

Clean water is essential for human health, the integrity of aquatic ecosystems and as an input into many economic activities. Altered water quality changes the structure and function of ecosystems within rivers and wetlands and affects the marine ecosystems of estuaries and near shore marine waters. Poor water quality is harmful to human health and is detrimental to the recreation and tourism values.

In relation to the water quality standards established by SEQRWQMS Ecological Health Monitoring Program, the Maroochy River received C, C, C, D, C in the report card for the years 2001-2005 respectively. Streams are generally in fair condition scoring a grade of C in both freshwater and estuarine sections. Improving water quality through a combination of enhanced sewage treatment, improved urban storm water management and rural catchment is a major program of Maroochy Shire Council. Since 2004 there has been a decrease in nutrient and turbidity levels, especially in the middle and upper reaches of the tidal section. (EHMP, 2006).

Since most of the cane is grown in areas of low slopes, with some exceptions in the western margin of the district, cane is not a major direct contributor to sediment and nutrient discharges in the estuary. There is scope for improved water quality outcomes from re-instating riparian corridors in many stream reaches. (**Table 2** and also page 27 Riparian zones).

Water quality modeling scenarios show that replacing cane with urban or rural residential uses would increase diffuse discharges above current levels.

Active maintenance of gates in historically created drains needed is to minimise salinisation and acidification of drainage water. This service is diminishing as land is not farmed risking intrusion of saline water and excessive drainage of acid sulfate soils. If more intensive cropping, horticultural or forestry pursuits replaced cane, this service would need to be maintained.

Table 2 Sediment loss from Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
The EMSS report indicates that there is negligible soil loss from the cane lands and sediment contributions from the lower floodplain itself are negligible. (See Riparian services.)	The EMSS report indicates that there is negligible soil loss from the cane lands apart from channel erosion along cleared reaches of the River.	The EMSS report indicates extensive channel bank erosion in the Eudlo, Paynter and Petrie creek areas contributes to approx 60% of sediment in the Maroochy River estuary.	The EMSS report indicates that there is negligible soil loss from the cane lands Extensive sediment loads are present in the Maroochy River around Yandina and Petrie Ck near Nambour.	The EMSS report indicates that there is negligible soil loss from the cane lands Extensive sediment loads are present in the Maroochy River around Yandina.

Key sources: Chiew and Scanlon (2002); EHMP (2006); Caitcheon et al (2006)

2.5 Wetlands

Tidal estuaries are the most productive biomes providing habitat for aquatic and terrestrial organisms. Coastal wetlands are an essential part of natural biodiversity, supporting complex, species-rich ecosystems through the provision of both food and habitat for numerous species, including migratory birds, fish and crustaceans. Wetlands also provide important services within a floodplain system, such as regulating the watertable, regulating stream flow to help slow flooding, allow water filtration and nutrient recycling,

The cane fields are mostly in tidal reaches and encompass converted wetlands and other estuarine systems. Remnant wetlands areas are located adjacent to the Maroochy River and border existing cane lands. Maroochy River Conservation Park and the Maroochy Wetlands Sanctuary as well as adjacent national parks and conservation areas provide habitat for numerous fauna and flora species. Paper-barked tea tree occurs on poorly drained areas with pink bloodwood and brushbox on elevated areas of tall open forest. These communities are poorly conserved in the region. (Maroochy Shire Council, 2006).

Saltmarsh communities occur behind the littoral mangroves bordering the River providing important feeding and roosting sites for migratory waders and waterbirds. Mangroves, which form an integral part of estuarine habitats, provide a nursery habitat for many marine animals including commercial fish species (**Table 3**).

Maintaining or restoring wetlands is an important opportunity associated with any future land use change. Improved wetland management provides significant opportunities for increased ecosystem services from the cane landscapes. Apart from retaining or enhancing the essential regulatory services for water within the floodplains, provisioning through fish habitats, nature-based educational opportunities could be expanded and there is a promising potential for re-instating wetlands or creating artificial wetlands (compatible with local conservation and land use values) for waste water polishing.

Table 3 Wetlands in Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
There has been extensive clearing of vegetation in this area; however, mangroves, low closed forest and saltpan vegetation remain relatively undisturbed along the banks of the Maroochy River adjacent to the caneland. The northern bank of the Maroochy estuary is heavily populated with mangroves and saltpan vegetation, but the southern bank of the Maroochy estuary has been completely cleared. There are coastal wetlands of local, state and regional significance.	There has been extensive clearing of vegetation cleared for agricultural pursuits in this area; however, relatively undisturbed mangroves and low closed forest and saltpan vegetation remain along the banks of the Maroochy River and into Coolum Creek to the Yandina Creek junction. These are Coastal Wetlands of Local, State and Regional significance.	There has been extensive clearing of vegetation cleared for agricultural pursuits in this area; however, relatively undisturbed mangroves and low closed forest and saltpan vegetation remain along the lower reaches of Eudlo Creek. Coastal Wetlands of Regional Significance and Valuable Habitat	There are no wetlands or Coastal Wetlands of Local, State or Regional significance present in this area.	There are no wetlands or Coastal Wetlands of Local, State or Regional significance present in this area.

Key sources: EPA (2004), MSC (2006)

2.6 Riparian zones

Vegetated riparian zones, especially those with intact native tree canopies provide stream bank stability, support natural pollination and pest control, prevent erosion and improve water quality in streams. They prevent or minimise damage to both terrestrial and aquatic ecosystems, intercept and retain nutrients, decrease algal growth by reducing light and temperature and maintain natural river features such as shelter, and spawning areas. (Hunter, 2006)

A substantial proportion of the riparian zones in the cane land district have been cleared, in many reaches leaving minimal vegetative buffers (**Table 4**). Throughout the minor Maroochy tributaries, dense camphor laurel riparian growth has established over the last 50 years which depletes the in-stream dissolved oxygen levels and terrestrial and aquatic biodiversity. (Maroochy Shire Council, 2006)

The opportunity may arise during any land use change process for improvements in riparian zone conditions in new ventures in addition to community-supported efforts to increase vegetation in existing rural areas.

All streams and creeks within close proximity to caneland have a moderate to very high priority for rehabilitation of riparian vegetation to reduce sediment and channel erosion.

Table 4 Riparian vegetation on Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
There is extensive riparian vegetation along the Maroochy River from Bli Bli toward north toward Coolum and east of the caneland from Pacific Paradise to north of Marcoola.	Extensive riparian vegetation remains along Maroochy River and Coolum Creek to Coolum Yandina Rd. There is little riparian vegetation along the banks of the north and south Maroochy Rivers west of the Yandina Ck junction.	Negligible riparian vegetation remains along the lower reaches of Paynter, Petrie and Eudlo Creeks, except for the lower reaches of the Eudlo Creek.	There is very little remnant riparian vegetation along the Maroochy River from Dunethin Rock west to Yandina and along Petrie Creek west to Nambour	There is negligible and highly fragmented riparian vegetation north of Yandina.

Key sources: MSC (2006) and Rassam et al, (2006).

2.7 Acid Sulfate Soils (negative assets or liabilities)

When sulfidic sediments are artificially drained or excavated acid can be produced rapidly and in large quantities. The acid water becomes extremely toxic to fish and vegetation. The impacts of Acid Sulfate Soils (ASS) are widespread including agronomic impacts, engineering impacts and environmental impacts.

A large percentage of the eastern section of the cane land on the floodplain area occurs on mapped actual ASS or potential ASS. They have been partly disturbed by drainage for cane farming and by road construction (**Table 5**).

The presence of ASS is a major constraint to land development for urban pursuits and even for alternative agriculture as discussed in later sections of this report.

Table 5 Acid sulphate soils in Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
There is Potential ASS on caneland in lower south of Bli Bli. There are relatively low levels of AASS on caneland west of Pacific Paradise	Actual ASS are extensive in the central floodplain area	There are relatively low levels of actual ASS in the lower Eudlo and Paynter Creek areas	There are relatively low levels of actual ASS on caneland along the Maroochy River heading west towards Yandina	There are no ASS on caneland north of Yandina

Key sources: Malcolm et al (2002) and ARMCANZ (2000).

2.8 Biodiversity

Biodiversity is a landscape asset that generates a range of ecosystem services essential for ecosystem health. Healthy ecosystems in turn underpin an extensive variety of environmental goods and services, tangible provisioning services such as food, medicine and building materials; less obvious regulation services including water purification, waste removal, and pest control, as well as, aesthetic, cultural and heritage values. The biodiversity value of an area is assessed at a range of scales from species (even genetic) scale, to ecosystems that contain assemblages of plant and animal communities to the landscape scale where ecological functions and linkages are important.

The ecosystem services arising from biodiversity to ecosystem health are important, but there are also significant potentials for nature-based tourism and cultural services from environmental awareness raising and education through protecting and enhancing biodiversity resources.

For species conservation, the Maroochy Biodiversity Strategy (Maroochy Shire Council 2005) formulates locally significant species lists for management and protection of significant flora and fauna species. This comprehensive list includes threatened species listed under the Queensland *Nature Conservation Act 1992* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1997* which also covers migratory species. Within Maroochy Shire as a whole 249 significant species fall into this category including those that are endangered, vulnerable and rare and threatened. Caneland landscapes, especially riparian zones and other areas adjacent to cleared cane fields include the habitat for many of these species and the sites for legislatively protected, rare and threatened species.

National and State conservation programs focus on the conservation of Regional Ecosystems (RE) which are observable surrogates for a range of unknown biodiversity values and ecosystem processes. Maroochy Shire has a diverse range of ecosystems (65 REs) ranging from heath lands to rainforests and of these, six are classified as endangered having 10 per cent or less of the extent pre-European settlement remaining. Much of the remnant vegetation adjacent to cane growing areas is in this category (**Table 6**).

The cane landscape also helps maintain biodiversity through a connected system of habitats - habitat cores, mosaics and linkages (Maroochy Shire Biodiversity Strategy (2005, p. 14). These elements identify the larger 'core' habitat areas with good connectivity that provide habitat corridors or 'stepping stone' habitat patches that have the greatest prospect of retaining biodiversity especially in conditions of climate change and other perturbations.

The Maroochy Biodiversity Strategy identifies high priority areas for on-ground actions that include habitats of species and communities that have become rare, diverse areas of habitat in good condition (greater than 2 hectares); corridor networks; riparian zones.

Apart from protecting remnant species, ecosystems and landscape functions, the Maroochy Biodiversity Strategy recognises an opportunity for biodiversity enhancement as land previously used for sugarcane production could be used to improve biodiversity outcomes. The values to be enhanced include extending the area for conservation value of rare or threatened species and communities, creating wildlife buffers and nature corridors. This would be a public cost through incentives programs and selective land acquisitions.

Table 6 Biodiversity values in Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
Almost all of the caneland in the lower floodplain forms an important part of the biodiversity corridor There are a significant number of endangered, rare and vulnerable species in close proximity to the caneland	Approximately half of the central floodplain caneland forms an important part of the biodiversity corridor There is a significant cluster of endangered, rare and vulnerable species north of the central floodplain between Coolum and Peregian.	Almost none of the caneland in the Eudlo and Paynter Creeks forms part of the biodiversity corridor There are relatively few endangered, rare and vulnerable species and the landscape is somewhat fragmented.	The majority of the caneland falls outside the biodiversity corridor There are relatively few endangered, rare and vulnerable species and the landscape is somewhat fragmented.	Approximately half of the caneland in this area falls within the biodiversity corridor Rare species have been identified within the assigned caneland for this area. Higher levels of endangered, rare and vulnerable species are found north of this area towards Eumundi and west of Yandina

Key sources: MSC (2006)

2.9 Climate Regulation

Ecosystems, both natural and managed, exert a strong influence on climate and air quality as sources and sinks of pollutants, reactive gases, greenhouse gases, and aerosols and due to physical properties that affect heat fluxes and water fluxes (precipitation). Ecosystems can affect climate through warming (as sources of greenhouse gases), cooling (as sinks of greenhouse gas and aerosols); and by altering water redistribution and regional rainfall patterns through changes in evapotranspiration. Climate change while not always harmful for all regions will have a significant disruptive effect on ecosystems and current dependent economic activity. Warming can increase energy demands and when accompanied by sea-level rise damage urban developments and infrastructure in low lying coastal areas.

Neither the size of the carbon "pool" nor changes are known with precision in the SEQ. Emissions from the SEQ Region have not been specifically quantified. The majority of the region's electricity needs are met by fossil fuel generated electricity. The transport sector, and urban and tourism requirements no doubt contribute significantly to the stationary energy sector. Since the introduction of the state policy on tree clearing, emissions from land use change have been reduced, but agriculture would still contribute greenhouse gases from other sources including methane. Identifying and quantifying the sources of greenhouse gas emissions in the region is considered essential.

The choice of crop species and agronomic management practices can play a large part in determining the capacity of the agricultural sector to provide a sink for greenhouse gases. The most significant impact on greehouse gas emissions would come from the replacement of an annual cropping system with tree plantations. These would become carbon sinks at least in the medium term in both the soil and tree biomass.

The region may benefit from carbon trading that provides financial incentives for landholders to engage in forestry activities. For example, a fast growing eucalypt planted forest averaging a stem growth rate of 20 cubic metres of wood per hectare per year will sequester 5 tons of carbon. Australia has, as yet, made no decision about establishing a domestic emissions trading regime. Nonetheless, several state government and private forestry plantation companies have already supported the establishment of greenhouse sinks by farmers on private land.

2.10 Landscape and Open Space for Recreation

Land and water provide passive and active recreation opportunities that are important to the health

and well-being of residents and as attractions for day trippers and tourists. The environmental protection of components of the open space system at the same time provides protection for the 'aesthetic' aspects and values, prevents land degradation, preserves regional ecological integrity and preserves local biodiversity.

An increasing number of people are visiting natural areas over the past thirty years and this trend is expected to continue. The 2001 SEQ Outdoor Recreation Demand Study and the Sunshine Coast Hinterland Visitor Survey (2005), projected increasing demand for recreational services within the SEQ (OUM, 2006). A high proportion of domestic visitors took part in outdoor or nature-based activities (35%) or sports and active outdoor activities (13%).

Land being farmed for cane or other purposes does not directly contribute to recreational values, but does contribute to open space settings.

The Maroochy Shire Council Open Space Strategy highlights the importance of an interconnected physical system of open space to provide *"a framework for and backdrop to more intense land uses"*. Existing activities and potentials include providing public water access from river banks, fishing, boating, water and land trails, nature based visits and active sports. Given the increase in regional population, the demand for active and passive recreation will increased at least proportionately. Cane land may be converted to meet this need (**Table 7**).

These could also make up historical trail or areas for impressive walks. Walkers, runners and cyclists could use this for leisure and sporting activities. The viability of areas for recreational and tourism purposes should be viewed in terms of the potential ease of management, multi-use potential, operational effectiveness, service efficiency and equity of access (Maroochy Shire Council 1999).

Table 7 Open space and recreation values of Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
There are two major boat ramps along the Maroochy Estuary south of the caneland and two along the Maroochy River on the western side of the caneland Trails in the vicinity of the caneland consist of the regional coastal walk; canoeing; walking and bushwalking There is a open space corridor running adjacent to the caneland along Maroochy River and Coolum Creek heading north towards Weyba Downs	There are no major boat ramps in the vicinity of the central floodplains Trails in the vicinity of the central floodplain consist of horse riding; mountain bike riding; walking and bushwalking The central floodplain caneland forms part of the open space corridor which runs along Maroochy River and Coolum Creek heading north towards Weyba Downs	There is one major boat ramp situated along Eudlo Creek There is no access via Paynter Creek Trails in the vicinity of the caneland consist of canoeing and mountain bike riding A section of Eudlo Creek forms part of the open space corridor	There are no major boat ramps in the vicinity of the caneland Trails in the vicinity of the caneland consist of canoeing; mountain bike riding; walking and bushwalking	Trails in the vicinity of the caneland consist of walking and mountain bike riding

Key sources: Queensland Outdoor Recreation Federation (2006), Queensland Outdoor Recreation Federation (2002), MSC (1999)

2.11 Scenic amenity

Scenic amenity or the aesthetic value of landscape is a cultural ecosystems service contributing to people's feeling of security, and contributes to health, and good social relations. Other cultural services in landscapes include cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, social relations, sense of place, cultural heritage values, and recreation and eco-tourism. Scenic landscapes and their visual components provide amenity benefits to residents and generate wealth for commercial activities

The cane landscapes produce significant scenic values for residents and visitors, have substantial exposure to road travellers and residences on surrounding ridges and constitute an important community asset (Preston, 2005). While the sugarcane areas themselves provide only moderate direct benefits, the relatively low height and density of this crop affords views of inspiring mountains, bushland, rocky outcrops and waterways that have very high appeal (**Table 8**). As reflected in both scenic preference and visual exposure maps, the largest areas of very high scenic amenity are:

- The lower reaches of the Maroochy River between Bli Bli and Maroochydore.
- Natural Eucalypt forest and sparsely developed hillsides to the east of Yandina (Mt Ninderry)
- Elevated hills to the west of Coolum and Peregian (towards Yandina)
- Forests to the immediate north-east of Nambour,
- Hills to the west of Yandina
- Elevated forests and sparsely developed slopes to the east and south-east of Nambour and Woombye, north-west of Buderim.

Changes in land use will affect different components of scenic amenity. In particular, the visual exposure of distant landscapes and landscape foregrounds will be affected by different land uses due to changes in their height and density. Maintaining cane areas or replacing them with other low crops or pastures would allow people travelling through the areas to continue their enjoyment of these inspiring and tranquil landscapes.

Rural land uses such as industrial farming or establishment of exotic pine forests would however detract from these aesthetic values. In locations where substantial economic benefits would be derived from these types of land use, detailed planning of site design would be required to minimise impacts on important view corridors from important public viewing locations to key visual features in the study area such as rocky outcrops, forested hills, and waterways.

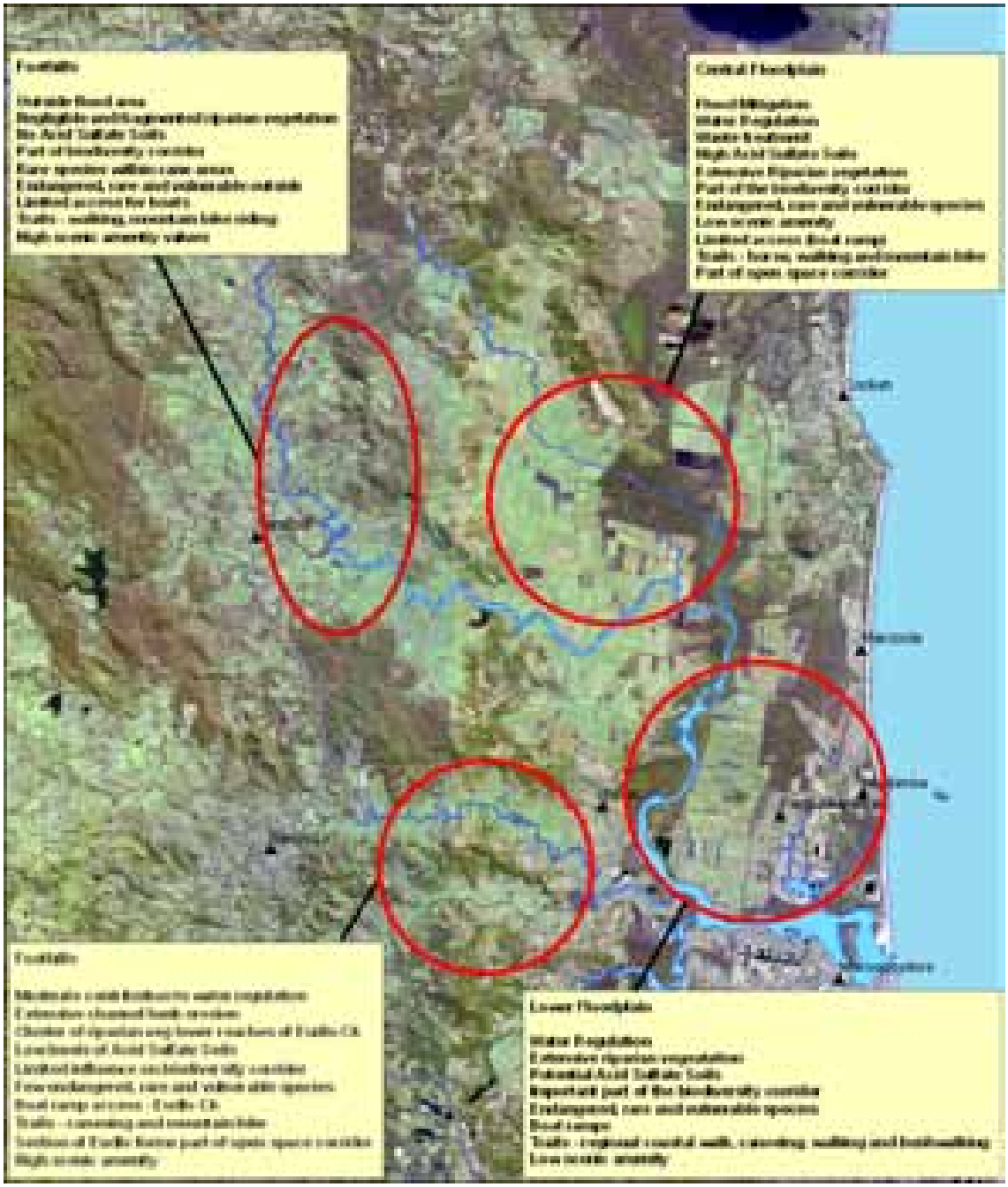
Table 8 Scenic amenity values of Sunshine Coast cane landscapes

Humic podsols on the lower floodplain	Humic gleys on the central floodplain	Humic gleys along the creeks	Alluvial soils in freshwater reaches	Red podsols in the hinterland
Cane areas themselves provide only moderate direct benefits, but its low height and density of this crop affords views of inspiring mountains, bushland, rocky outcrops and waterways that have very high appeal.	Cane areas themselves provide only moderate direct benefits, but its low height and density of this crop affords views of inspiring mountains, bushland, rocky outcrops and waterways that have very high appeal.	There are high scenic amenity values in this area	There are high scenic amenity values in this area	There are high scenic amenity values in this area

Key sources: Preston (2005), OUM (2005)

Summary of Assets and Potential Ecosystem Service

Figure 4 Summary of ecosystem services in cane landscapes



3 Alternative Crop Species

3.1 Physical production potential

The main biotic and abiotic issues influencing agricultural production on the Sunshine Coast canelands include climate, soil type, acid sulfate soils, flooding and waterlogging, irrigation, slope, pesticide residues, stoniness and wind.

3.1.1 Climate

The Maroochy region experiences a humid, warm temperate climate. Maximum temperatures range from around 30°C to 20°C throughout the year, with minimum temperatures averaging 20°C in the summer months to 8°C during winter. Severe frosts (<0°C) may occur, on average, approximately 15 times per year in the low-lying sheltered valleys, but only once or twice a year around the main floodplain areas of the Maroochy River. Rainfall is high, with an average of approximately 1650 mm annually. Approximately 70% of total rainfall occurs during the 6-month period from November to April. Rainfall intensity may frequently be high and result in short-term flooding in the coastal streams and rapid run-off from steep slopes. A minor flood, resulting in waterlogging for a period of 2 weeks, is experienced on average three times a year (generally between December and April) on the Maroochy and Mooloolah River floodplains. A major flooding event, resulting in waterlogging for a period of 4 weeks, is experienced approximately once every 7 years (pers. comm. Maroochy canegrower reference group[4]). Evaporation rates exceed rainfall from August to December, however stored soil moisture enables a potential 12 month growing season. On average, one tropical low pressure system is experienced every year, generally occurring between December and April.

4 Maroochy canegrower reference group: Tony Blatch, Tom Kennedy, Murray Oakes, Ron Clarkson.

3.1.2 Soil type

In general, the predominant soils of the coastal plain and valleys are a humic gley of high fertility, with disposition to seasonal wetness. These soils vary from medium to heavy clay in texture closer to the streams and have higher organic content in the former *Melaleuca* wetlands in the Yandina Creek, Valdora and Coolum districts. Areas of deep sandy humic podsol soils occur to the east between Bli Bli and the coast, while yellow podsolic soils and heavily weathered volcanic soils are found in the Yandina area. Soils in the Mary Valley are largely of alluvial origin (Kingston *et al*. 2004).

3.1.3 Acid sulfate soil

Many areas within the Sunshine Coast canelands contain actual acid sulfate soils (AASS) or potential acid sulfate soils (PASS). The associated farm enterprises have individual risk profiles which are largely dependent upon soil physical and chemical characteristics and management practices. A range of practices are used to manage AASS and PASS, including selective application and incorporation of lime or other neutralising materials, maintenance of broad and shallow drains to enable AASS and PASS layers to be kept wet and protected from oxidation, use of laser levelling to remove excess surface water, management of tillage depths to above the depth of oxidisable sulphur levels and lime slotting.

3.1.4 Flooding and waterlogging

Sugarcane crops grown on the floodplains of the Maroochy region regularly experience periods of flooding (above ground water flows), waterlogging (excess water in the root zone) and inundation (surface ponding). As noted above, minor flooding, resulting in waterlogging for a period of 2 weeks, is experienced on average three times a year and a major flooding event, resulting in waterlogging for a period of 4 weeks, is experienced approximately once every 7 years.

Rapid moving water-flows during flooding events result in the physical removal of, or damage to, the crop, and erosion and damage to in-field infrastructure, such as drainage systems and associated flood gates. Trash blanketing in sugarcane production (the beneficial retention of leaf matter on the ground following crop harvesting to aid moisture retention, nutrient recycling and organic matter build up) is consequently avoided in the flood-prone areas of the canelands.

The effects of waterlogging and inundation include yield reduction or plant death caused by anaerobic conditions and/or silt deposition inhibiting normal chemical and biological oxidative processes in the soil, and access for effective machinery operations. Waterlogged soils are susceptible to root-borne diseases and the associated leaching and denitrification reduces the amount of nitrogen available to the crop. Silt deposition is also a particularly significant management issue in the harvest of biomass for cattle feed. Waterlogged soils also delay effective machinery operations.

3.1.5 Irrigation

The concentration of rainfall in the summer months around the Sunshine Coast canelands restricts the range of crop species that can be grown under rainfed conditions. As sugarcane production is well suited to these rainfall patterns, few growers have installed irrigation infrastructure. A study conducted by the Maroochy Water Services (2004) suggests that sufficient recycled water is available to supply an agricultural industry in the Maroochy region. However, current demand for irrigation water is low and unable to provide sufficient regular demand from end users to justify investments in infrastructure.

3.1.6 Slope

Slope operates as a limiting factor to cropping by contributing to the soil erosion hazard and as a factor determining mechanised access to growing crops. In annual cultivated crops where erosion hazard is high, the critical slope is that beyond which soil erosion cannot be adequately controlled. However, in perennial, trellis and tree crops where ground cover is permanently maintained, soil

erosion hazard is low. The critical slope for these crops is that beyond which access throughout the year for management and harvesting operations is either impossible or unsafe. Areas used for annual vegetable and fruit crops and pineapples are most susceptible to soil erosion hazard due to the summer dominance of the Maroochy region's rainfall pattern. 78% of average annual erosive rainfall occurs from November to April. Areas used for growing annual winter crops are less susceptible since during the period of soil exposure (May to October) only approximately 22% of the average annual erosive rain is received. Crop management practices aimed at reducing erosion include the use of mulches and cover crops for surface protection and the use of row gradients to control surface run-off.

3.1.7 Pesticide residues

Organochlorine insecticides were used widely in the sugar industry for the 40 years prior to their general ban from Australian agriculture in 1987 and a subsequent ban from all uses in 1996 (Cavanagh et al. 2003). These insecticides persist in the environment for many years after applications and pose a risk to crops and animals subsequently produced on the land. Regulations are now in place regarding permitted levels of chemical residues found in agricultural products destined for human consumption. The most likely persistent organochlorides in sugarcane land are BHC (used for cane grub control), Dieldrin and DDT.

In the case of the Sunshine Coast canelands, three investigations into pesticide residues have been, or are presently being, undertaken. In 1996 the DPI/BSES Sugar Industry RD&E Program conducted a survey to estimate pesticide usage rates and frequency, and likely environmental fate for each mill area on a catchment scale. The report did not contain pesticide usage data for individual mills, but indicated that the southern region (containing Fairymead, Millaquin, Bingera, Isis, Maryborough, Moreton and Rocky Point Mills), used Diuron and Atrazine as the dominant herbicides, MEMC as the dominant fungicide and Chlorpyrifos as the dominant insecticide. Although the project recommended that no monitoring be conducted for persistent organochlorine insecticides as they no longer have approved uses in sugarcane, monitoring resources would be better directed towards pesticides in current use. Of those products most dominantly-used, Atrazine is noted due to it having previously been detected in ground water in the Burdekin Delta.

More recently, in 2001 Tony Blatch (BSES Extension Officer) undertook soil sampling for organochlorine residues in connection with supplies of drought fodder. Out of the 30 samples taken, 3 showed positive for the pesticide, with only one sample showing a significant level and the other two recording trace amounts. BioCane Limited have recently surveyed the soils of primary producers of Cow Candy to assess historic use of pesticides. It is intended that sub-samples of these soils will be analysed for pesticide residues in the future (pers. comm. D.Batstone[5]).

3.1.8 Stoniness

Stoniness is generally considered a minor limitation for crop production in the Maroochy region, however where stones do occur on the soil surface or within the soil profile they negatively impact cultivation through damage to implements, and crop growth through a reduction in the soil volume available for root growth. Stoniness can be limiting for cultivated crops, particularly root crops, but less so for perennial crops.

3.1.9 Wind

Damaging winds in the Sunshine Coast canelands may arise from three sources, namely, prevailing south-east winds between December and June, including infrequent cyclones; prevailing west to south-west winds which follow the passage of cold fronts between July and September; and storm winds which are unpredictable in direction but predominate from September to December (Capelin 1987). Many crops are susceptible to wind damage.

5 BioCane Limited

3.1.10 Sugarcane production potential

A modelling approach using the Agricultural Production Systems Simulator (APSIM) (McCown et al. 1996) has been used to estimate potential sugarcane yields in the Sunshine Coast canelands for the four main soil types found in the region (humic podsol, humic gley 'estuarine', humic gley 'upsteam', and alluvial). The model used historic climate data for the period 1960 to 2003 and simulated a fallow and plough-out replant system using Q124, a widely used sugarcane variety. Estimates of productivity have been compared with mean actual yield over a recent 5-year crop cycle to assess the difference and consider the potential for further increases in productivity.

The modelling exercise indicated that mean actual fresh cane yield for the Sunshine Coast canelands was within the expected range of variability (1 standard error) for the humic podsol and alluvial soil types. For humic gley 'estuarine' and humic gley 'upstream' soil types, mean actual yield was below the expected range of variability, however as the attainable yield predictions did not include a reduction in yield due to pests and diseases, it is likely that a more accurate estimate of attainable yields for the Sunshine Coast canelands are below those predicted in this exercise. As mean actual yield was only 6 to 7% below the minimum predicted attainable yield, this discrepancy could easily be accounted for by the absence of pests and diseases from the model predictions. It can therefore be considered that actual production levels in the Sunshine Coast canelands for the period 1994 to 1998 were close to predicted attainable yields and *ceteris paribus* further increases in productivity are unlikely to be achieved. Genetic development of new high-yielding varieties or yield benefits resulting from the adoption of best management practice has the potential to increase average actual yield in future years.

3.1.11 Threats to a regional agricultural industry – global change

An assessment was made of the direct and indirect effects of a change in atmospheric carbon dioxide (CO_2) concentration and individual climate variables (collectively termed global change) on agricultural production in the Sunshine Coast canelands. The capacity for adaptation in the sugar industry was assessed in consultation with the Sunshine Coast canelands growers reference group by considering the current methods used to manage inter-annual variability in temperature and rainfall in the region as a means of reducing risk and maintaining the biological and economic resilience of the industry.

In general, there is a trend for decreasing annual rainfall around the Sunshine Coast canelands over the coming decades (CSIRO, 2001). The projected change in annual rainfall from 1990 levels is between -13% and +7% by 2030, and -40% and +20% by 2070. The warmer conditions are likely to be accompanied by more extreme hot days and fewer cold days. It is considered that the drying associated with El Niño will be enhanced in future years. By 2030 the global average sea level is likely to have risen between 3 and 17 cm above 1990 levels, increasing to approximately 9 to 88 cm by 2100. Tropical cyclone intensity is projected to increase, but uncertainty remains regarding frequency and location.

APSIM was used to simulate sugarcane growth in the Sunshine Coast canelands and enabled the production of response surfaces for simulated percentage mean change in cane fresh weight and sugar yield for the year 2030 resulting from a change in temperature and rainfall for a range of soil and agronomic management scenarios. The results from the simulations suggest that soil type has a small influence on the relative change in fresh weight and sugar yield in response to projected changes in temperature and rainfall by the year 2030. The response surfaces provide a range of estimated changes and the greatest potential of an increase in productivity is predicted to occur on humic podsol soils, with up to 7.4% increase in sugar yield. Any reduction in crop and sugar yields are predicted to be minimal on all soil types.

3.2 Crop suitability

Following the closure of the Moreton Mill, there is a need to consider alternative crops that can be grown on farms formerly associated with sugarcane. This section of the report collates details from a number of studies that have been conducted over the past few years on potential alternative agricultural activities suitable for the Sunshine Coast canelands. It also contains details of alternative agricultural enterprises that have been practised by landowners in the Moreton region in recent years. The aim of this section is to synthesise the extensive amount of material available to interested parties to assist evaluation of future agricultural activities for the region. The information provided has been obtained from a wide range of sources and includes reports detailing the agronomic requirements of individual crops, local grower and 'expert' opinion and an assessment of the suitability of numerous crops given the biophysical conditions of the Sunshine Coast canelands. Independent evaluation, i.e. trials of individual crops, has not been conducted.

A number of studies have previously, or are currently, being conducted into the suitability of a range of crop species and other land use options for the Maroochy region. Past studies have generally been based on expert opinion, individually covered a limited range of crop species and based on a generic biophysical description of the canelands. In addition, the incorporation of canegrowers' opinions and experience has been limited in the majority of the studies.

The methodology adopted for this crop suitability study has sought to address some of the shortcomings of previous studies. We have done this by including 280 crop species in the initial stages of the crop suitability assessment by using a modelling approach, incorporating growers opinion and experience (in addition to expert opinion) throughout the research process, and assessing the suitability of alternative crop species in the context of the region's biophysical resources.

The information on crop suitability is to be treated as a general guide only. Site specific trials, market research and risk analysis were all outside the remit of this research and have not been performed by the authors. As with any new enterprise, growers need to undertake their own detailed research before making any commercial decisions to enter into the production of a particular crop.

Methodology

The suitability of 280 crops species was considered for the biophysical conditions on the Sunshine Coast caneland using the crop suitability model, PlantGro™ (Hackett, et al. 2004). PlantGro™ utilises empirical relations (produced by the Food and Agriculture Organization of the United Nations) to evaluate the suitability and limitations of individual plant species to a range of soil and climate variables. PlantGro™ provides a crop prediction framework based on semi-quantitative descriptions of plant and environment relationships. In making a prediction, the system compares the specific requirements of each plant species (as specified in the plant data files) with specific site conditions (as specified in the soil and climate data files specific to the Sunshine Coast canelands). A schematic of the framework is provided in **Figure 5.**

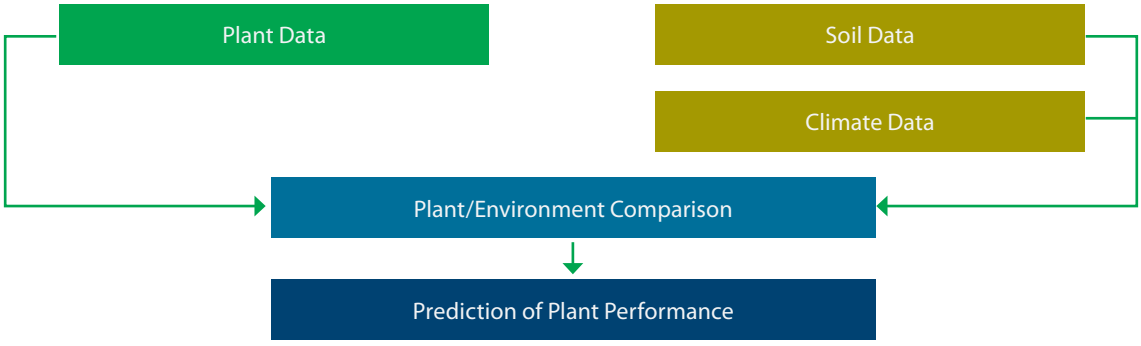


Figure 5 Structure of PlantGro™ (Hackett *et al.* undated).

The utility of PlantGro™ as a reconnaissance-level land evaluation tool has been evaluated over a wide range of studies, particularly in developing countries. It has also been used to determine suitable sites for the growth of broccoli (Deuter 1997) and a number of tree species for forestry production in Australia (CSIRO 1996, Hackett and Vanclay 1998). The most comprehensive description of PlantGro™ can be found in Williams *et al.* (2006) which documents a desktop study aimed at predicting suitable sites for Macadamia production across Australia.

As used in this study, the prediction system within PlantGro™ determines the dynamic effects of 13 environmental variables on plant performance (and hence a species' suitability to a particular location). These variables include temperature, moisture availability, solar radiation, phosphorus, potassium and nitrogen. The framework synthesises the variation in a species' response to the full range of environmental factors using Liebig's *Law of the Minimum* to determine the most limiting factor or factors related to overall growth.

If a limitation is determined as fatal by PlantGro™ this does not mean that the crop cannot be cultivated. It may simply mean that a management regime must be instigated to overcome the limitation. In the case of soil limitations, such as soil pH, these may be ameliorated by appropriate management actions, however climate limitations are less easily managed and may ultimately affect the yield, quality and economic viability of the crop. For those limitations that could not be practically managed and represented an ultimate no-grow constraint, the crop was eliminated from further consideration. Assessing the limitation mitigation options for each crop species resulted in a subset of 134 crop species being deemed potentially suitable for growth on the Sunshine Coast caneland and worthy of further investigation into their agronomic and economic viability.

In order to incorporate the knowledge and future intentions of the Sunshine Coast cane growers into the crop suitability study, a questionnaire was sent out to all cane growers formally associated with the Moreton Mill. The growers were asked to rate each of the 134 potentially suitable crop species in terms of their likeliness to grow them as a means of achieving a viable financial income. The aim of the questionnaire was to reduce the number of crop species subjected to further analyses to only those that growers themselves considered were potentially (a) agronomical suitable, and (b) viable alternatives or additional crops to sugarcane.

After evaluation of the questionnaire results and reference to expert opinion, the following 29 crop species/enterprises were identified for further agronomic and economic analyses:

- Broadacre - hemp, maize, oats, sorghum, soybean, sugarcane, sweetpotato, cassava, taro.
- Tree/shrub/vine crops - avocado, banana, coffee, lychee, macadamia, mango, Australian native foods.
- Horticulture - cucumber, melon, potato, pumpkin, watermelon, ginger, strawberry.
- Other – Turf, sown pastures, bamboo, cabinet timbers, hardwoods, softwoods.

Twenty-six of the above agricultural crop species/enterprises were assessed for their suitability for growth on the canelands. For an assessment of cabinet timbers, hardwoods and softwoods, see Forestry and silvicultural possibilities below. The aim of the assessment of agricultural crops was to value-add to current generic information already available on each of the crop species/enterprises through sources such as PrimeNotes (DPI&F, 2005). The focus of the assessment was predominantly on the agronomic suitability of the selected crop species, although some social, marketing and economic information has been included in the report where it was readily obtained during interviews with local growers and crop 'experts'. Land suitability maps produced by Burgess and Ellis (2006) are also included in the crop suitability assessment. The maps provide a spatial assessment of the suitability of each crop species to a range of climate and soil attributes. Full information on the crop suitability assessment is included in the Technical report (Section 6).

Table 9 provides a summary of the main agronomic and production points for consideration of suitability for each of the 26 crop/enterprises. Gross margin budgets have been completed for a selection of crop species. The availability of gross margin analysis is also contained in **Table 9**.

Table 9 Summary of the main agronomic and production characteristics of selected crop species for the Sunshine Coast canelands.

Broadacre

Crop Species	Summary of Suitability (main limitations)	Suitability Map (Burgess and Ellis, 2006)	Gross Margin Analysis
Hemp	Not recommended on floodplains due to waterlogging. Experts consider hemp to be highly suitable for the low slopes around the Maroochy region and likely to achieve comparable yields to other hemp growing areas in Queensland. However there is presently no processing plant in the region and with only 845 ha of the cane assignment lands considered suitable for hemp production (Burgess and Ellis, 2006), it is unlikely to attract sufficient funds to support the construction of processing facilities in the near future.	Yes	Yes
Maize (corn) (fodder)	Generally not recommend on floodplains due to waterlogging. Suitable for well drained soils. Considered a low risk crop. Low pH and lack of irrigation may reduce yields in some areas.		
Oats (forage)	Agronomically suitable (irrigation required on alluvial soils). Care must be taken to manage pests and diseases. Winter crops not vulnerable to summer flooding. With a root depth of 400 mm the crop is unlikely to reach PASS and ASS layers. Unlikely to be economically viable if fodder is to be transported long distances.		
Sorghum (fodder)	Climatically suited to the region, although warm humid conditions are favourable for the development of fungal diseases. Successfully grown around Bli Bli area. The areas of suitability estimated by Burgess and Ellis (2006) are likely to be reduced substantially by seasonal flooding. Reported to be a present and projected domestic shortfall in animal feed supplies.	Yes	
Soybean (manure and grain)	Rainfall in April would jeopardise the grain reaching optimum moisture content and harvest operations. Raised beds enable better drainage during the wet summer months on the flood-prone soils, however this is not always sufficient to eliminate waterlogging. Warm, humid conditions favour a number of pests and diseases.		
Sugarcane	Agronomically suited to the region. Not economically viable for producing sugar, but potentially profitable for a proportion of current growers planning to move into ruminant feed production (Cow Candy).	Yes	Yes
Sweet potato (fodder and human consumption)	Periods of inundation are likely to reduce the quality of the yield (price is highly dependent upon tuber quality) and summer crops are considered risky for the floodplain areas. Winter crops of sweet potato may be possible on some of the floodplain areas, but in general they are unsuitable to the central and lower floodplains. The gentle slopes are likely to be more suitable for production, but care must be taken to reduce erosion.	Yes	
Cassava	Agronomic and marketing information is very limited at present. Cassava will not tolerate waterlogged conditions and is fairly drought tolerant.		
Taro	Agronomic and marketing information on Taro is limited at present. Taro can tolerate waterlogged conditions. Temperatures around Maroochy are likely to constrain growth. Taro is considered to be a very small niche market; an increase in the production area of around 10 ha would likely saturate the present market. Present costs of production would need to reduce in order for Australia to compete in export markets.		

Tree/Shrub/Vine Crops

Crop Species	Summary of Suitability (main limitations)	Suitability Map (Burgess and Ellis, 2006)	Gross Margin Analysis
Avocado	The daily temperature regime in Maroochy is suitable to avocado production, but frost-free sites should be selected (valley bottoms should be avoided). However, as a sufficiently well-drained root depth of at least 1.5 m is essential to reduce the risk of infection by root-rot fungus, this will limit suitability to only a limited number of sites around the canelands. The crop will likely be prone to pests and diseases. Full production is not achieved until the third year. Irrigation is essential.	Yes	
Banana	Requires a well drained soil profile (poor drainage is a major cause of reduced yield and quality). Alluvial soils should be avoided. Bananas are particularly sensitive to frost. The provision of irrigation enables only a slightly wider production area for bananas on the Sunshine Coast canelands. An insufficient supply of good quality water and flooding will affect the quality of the crop and ability to achieve premium price in a highly competitive market. Production areas in north Queensland are climatically better suited to the production of banana. Two serious diseases are present in southern Queensland.	Yes	
Coffee	The temperature regime around Maroochy is well suited to the production of coffee, however other factors, such as terrain (access for mechanical harvesting) and effective control of flowering (to limit the number of harvest operations required per year), pose limitations to commercial production. Highly susceptible to wind and frost. Irrigation is essential for commercial production. Coffee does not tolerate waterlogging and soils need to be well-drained and aerated. Inundation for >4 days is likely to result in crop death.		
Lychee	The crop is climatically well suited to the Sunshine Coast caneland conditions providing frost-free sites and suitable varieties are selected, however irrigation is essential for commercial production. Lychee may be suitable for a number of small sites around the region if flood events do not result in water remaining above the trunk for more than a couple of days. Mounding may be used to produce sufficient depths of well-drained soil. Netting is essential during the fruiting season. Trees take between 4 to 5 years to come into commercial production. The Maroochy area produces fruit late in the season that is ideally timed for the Chinese New Year. There are a number of pests of economic importance.	Yes	
Macadamia	Macadamia is native to the coastal rainforests of southern Queensland and northern New South Wales so is climatically well suited to the Sunshine Coast canelands. Trees should be planted in a frost-free site as even light frosts can damage a young tree. Trees can tolerate flooding events of around 4 or 5 days duration without significant effects, but the crop is not suitable for poorly drained areas of the floodplains. The necessity for irrigation depends on soil depth.	Yes	
Mango	Mangos are already produced around the Maroochy region. Maroochy is generally considered a marginal growing region due to the predominantly summer rainfall pattern. Research has shown that mango trees will tolerate a flooding event of up to 1 month's duration once in their lifecycle. The Sunshine Coast canelands are likely to experience high levels of disease due to humid wet conditions occurring during fruiting.	Yes	

Australian native foods Australian native foods

Crop Species	Summary of Suitability (main limitations)	Suitability Map (Burgess and Ellis, 2006)	Gross Margin Analysis
	Many native food species are indigenous to South East Queensland and therefore are highly suitable to the climatic conditions in Maroochy. Irrigation is required for many species at the time of establishment only. Valley slopes would appear to offer suitable conditions for a large number of species. A number of tree species occur naturally in creek or river courses and therefore have potential to be grown on the floodplains. Harvesting is generally labour intensive. Estimates of the current and future market potential for native foods is debatable. Whilst a short supply of generally all native food species in the catering and processing industries at present and established export markets, suggest domestic demand is set to increase in future years, other commercial producers consider that in general most native food species have little actual commercial market at present or in the immediate future.		
	Wattleseed (Acacia)		
	Davidson's plum		
	Native tamarind		
	Native fruits of the vine (Millaa Millaa and native raspberries)		
	Lemon, Aniseed, Cinnamon, Curry and Honey myrtle (Backhousia & Anetholea species)		
	Lilly pilly		Yes
	Native lime		
	Lemon aspen		
	Plum pine		
	Bunya pine		
	Native fig		

Horticulture

Crop Species	Summary of Suitability (main limitations)	Suitability Map (Burgess and Ellis, 2006)	Gross Margin Analysis
Cucumber	Irrigation is essential for even and rapid growth and the production of good quality fruit (water stress will reduce yields and quality). Cucumber will not tolerate flooding and irrigation is essential during winter months. The domestic market for cucumber is in general, over supplied and it is unlikely that the Sunshine Coast canelands would be able to exploit any specific advantage.	Yes	
Melon	The summer months in Maroochy are likely to be too wet for melon production. Winter months do not provide a sufficiently reliable dry period to produce a regular crop.	Yes	
Potato	Summer storms and hot temperatures around October are likely to impact harvesting operations in many years. Summer storms and hot temperatures around October are likely to impact harvesting operations in many years. The floodplains around Maroochy are unlikely to provide potatoes that are sufficiently competitive in terms of quality and price.		
Pumpkin	Although the temperature regime for Maroochy is favourable, the wet conditions during the summer months can increase the risk of disease. The crop can withstand only a couple of days of inundation at the most. Both spring and summer crops are likely to experience impedance of field operations due to the wet conditions. Whilst rainfed production is possible in the Maroochy region, the unpredictability of rainfall makes commercial production precarious.	Yes	
Watermelon	Watermelon can be grown in all districts of Queensland during the warm months, and are presently grown around the Maroochy region. The crop will not tolerate any flooding and requires good drainage – the floodplains are therefore unsuitable. Foliage and fruit diseases can be a major problem in high rainfall areas such as the Sunshine Coast canelands.		
Ginger	Ginger has no tolerance to waterlogging and is highly unsuitable for the floodplain areas of the Maroochy region. Irrigation is essential for commercial production. The present number of growers supplying the local ginger factory produce sufficient yield to satisfy current demands. Any new growers would need to sell their fresh produce on the domestic market, but it is considered unlikely that there is sufficient demand for fresh ginger to withstand many new producers.	Yes	
Strawberry	Strawberry is presently grown around the Eumundi and Valdora areas and is well suited to the foothills provided severe frosts can be avoided. The floodplains are generally impractical for sustained production of strawberry due to seasonal waterlogging. Strawberry is very frost-and wind-sensitive. A reliable supply of good quality water for irrigation is essential. A very high level of management skill is required to produce high quality fruit. The availability of reliable seasonal labour is seen as a major barrier to increases in strawberry production.	Yes	

Other Crops/Enterprises

Crop Species	Summary of Suitability (main limitations)	Suitability Map (Burgess and Ellis, 2006)	Gross Margin Analysis
Turf	Turf is presently produced on the canelands and will tolerate short-term flooding, but the main floodplain areas of the Sunshine Coast canelands are unlikely to be suitable for sustainable turf production. Meticulous attention to weed control, pest and disease control, irrigation and nutrition is essential to grow the crop successfully and careful management of environmental impacts must be practiced. Irrigation is essential. Erosion is a potential problem after the crop has been striped back (harvested).	Yes	
Sown pasture	The Sunshine Coast canelands are not generally considered economically viable for sown pasture and beef operations due to the small size of farm units, high infrastructure costs and climate and soil constraints. However some cattle rearing is evident on the foothills in the region and the low labour and management requirements of this enterprise favours it as a "semi-retirement" agricultural activity.	Yes	
Bamboo	Research into agronomy, post-harvest practices and marketing is limited. The crop performs best in well drained soils. The floodplain areas would require drainage ditches or mounds to be maintained to ensure good growth, but the undulating and sloping valley sides would be well suited to bamboo. The crop would benefit from irrigation in the early years of establishment. Bamboo cultivation is suitable for recycling treated effluent if the harvestable product is not destined for human consumption.	Yes	Yes

3.3 Conclusion on alternative crops

The Sunshine Coast canelands can be broadly characterised as those sites located on the floodplains and those located on the sloping foothills of the Blackall Ranges. By far the greatest area of cane assignment land (approximately 70%) is located on what is generally referred to as floodplains. The predominant soil type on these areas is humic gley, with high fertility and a disposition to seasonal wetness, low pH and underlying potential and/or actual acid sulfate soil layers. Soils on the foothills are generally outside of the extent of flooding, well drained, and vary in their level of fertility and hence potential productivity. Of importance to all cane assignment areas is the predominantly summer rainfall pattern and lack of irrigation infrastructure available for cropping during the dry winter months.

This section of the report documented an evaluation of the potential suitability of a number of crop and enterprise options for the Sunshine Coast canelands given the biophysical constraints of the region. The crops and enterprises selected for assessment were those identified by the greatest proportion of canegrowers responding to a questionnaire, as being likely to be undertaken as a means of achieving a viable financial income. This method of selecting the crop species for assessment inevitably excluded a number of potentially suitably options, however the limited interest shown in these by cane growers was used as a guide to deciding where best to effectively invest limited research resources. The questionnaire responses showed sugarcane to be the most likely crop species to be grown by land owners in future years. The crop is well suited to the climatic and agronomic conditions in the Maroochy region, and is tolerant to seasonal flooding, highly acidic soils, predominantly summer rainfall and the lack of irrigation infrastructure characteristic of the farms in the area.

The focus of the assessment has been predominantly on the agronomic suitability of the selected crop species, although some social and economic information has been included in the report where it was readily obtained during interviews with local growers and crop 'experts'. In the assessments, consideration has been given to the estimated frequency of obtaining adequate yield quality and quantity in a sufficient number of years to enable the enterprise to be viable over the long term. Gross margin budgets have been produced for a limited number of crop species.

Suitability has been assessed using a combination of model output, published literature (e.g. PrimeNotes (DPI&F, 2005)), anecdotal information from growers trialling alternative crop species in the region and expert opinion. Information gained from local growers indicated that a large number of crop species have previously been trialled in the region using informal unreplicated experimental procedures. Accounts of individual successes with particular crop species highlighted the importance of micro-climates and grower knowledge and skill on levels of crop success. Rather than focussing on isolated incidences in this report, anecdotal information and crop suitability have been considered at a wider district scale.

Table 9 provides a summary of the main considerations for production for each of the crops/enterprises. Whilst it is noted that most cultivated crops on the Sunshine Coast require supplementary irrigation for economic production, there is presently little irrigation infrastructure in the region.

The range of foothill areas of the Sunshine Coast canelands have varying levels of suitability for the majority of the 26 agricultural crops/enterprises considered in this study providing sufficient irrigation water, frost sensitivity, pests and pathogens, aspect, mechanisation and erosion can be managed effectively. Nearly all of the broadacre crops (hemp, maize, oats, sorghum, soybean, sugarcane, sweet potato and cassava) have potential to be grown successfully, or have previously been or are presently being grown on the gently sloping areas of the Sunshine Coast canelands. Taro is the only broadacre crop considered marginal for production on the foothill areas due to temperature constraints on crop growth. However, as with all broadacre crops, potential suitability may be limited by production quantity, distance to specialty markets and infrastructure requirements. It is unlikely that the minimum economic size of a hemp production unit of around 2000 ha, can be achieved on the Sunshine Coast canelands.

Avocado, banana, lychee, macadamia and mango are all considered to be agronomically suitable for the range of foothill areas, providing sufficient irrigation water is supplied as required. Coffee is not considered suitable due to the inability to effectively control flowering. The perennial nature of tree crops and the ability to maintain a permanent understory would assist the management of erosion on the foothills. However, as with all perennial crops, there is the necessity to tie up the use of high quality land for a number of years, endure a long lag phase from planting to first harvest, source and withstand the cost of planting material, and undertake the cost of trellising or nets for pest control.

A number of Australian native foods have been assessed for potential suitability and whilst all of the species considered, with the exception of wattleseed, show only moderate, minor or negligible agronomic limitations for the range of foothill areas of the Sunshine Coast canelands, agronomic information is generally limited, the commercial potential for these crops is uncertain and the prospects for current and future markets is largely unknown. Nonetheless, a number of the species considered in this study are currently being produced commercially around the Maroochy area and suppliers report a shortage of generally all Australian native food species in the catering and processing industries at present. The lack of ongoing irrigation needs beyond establishment for generally all native species is a positive consideration to be borne in mind when considering this group of crops.

Strawberry are agronomically well suited to the foothill areas of the Sunshine Coast canelands providing a frost-free site is used and sufficient quantities of irrigation water are provided. However, the availability of sufficient quantities of reliable seasonal labour is seen by some landowners as a major hindrance to the growth of strawberry production in the region. Cucumber, watermelon and ginger all show only moderate limitations to agronomic production in the foothill areas of the Sunshine Coast canelands providing irrigation is adequately supplied. However melon, potato and pumpkin are considered marginal due to the rainfall and temperature regimes experienced in the region. Careful selection of site is essential for horticultural production as almost all horticultural crops are susceptible to wind damage. North to north-east aspects offer the least susceptible sites in the region. Whilst the foothills may offer agronomically suitable sites for the production of some horticultural crops, it must be remembered that many of the markets for these crops are finely balanced and new producers face high competition.

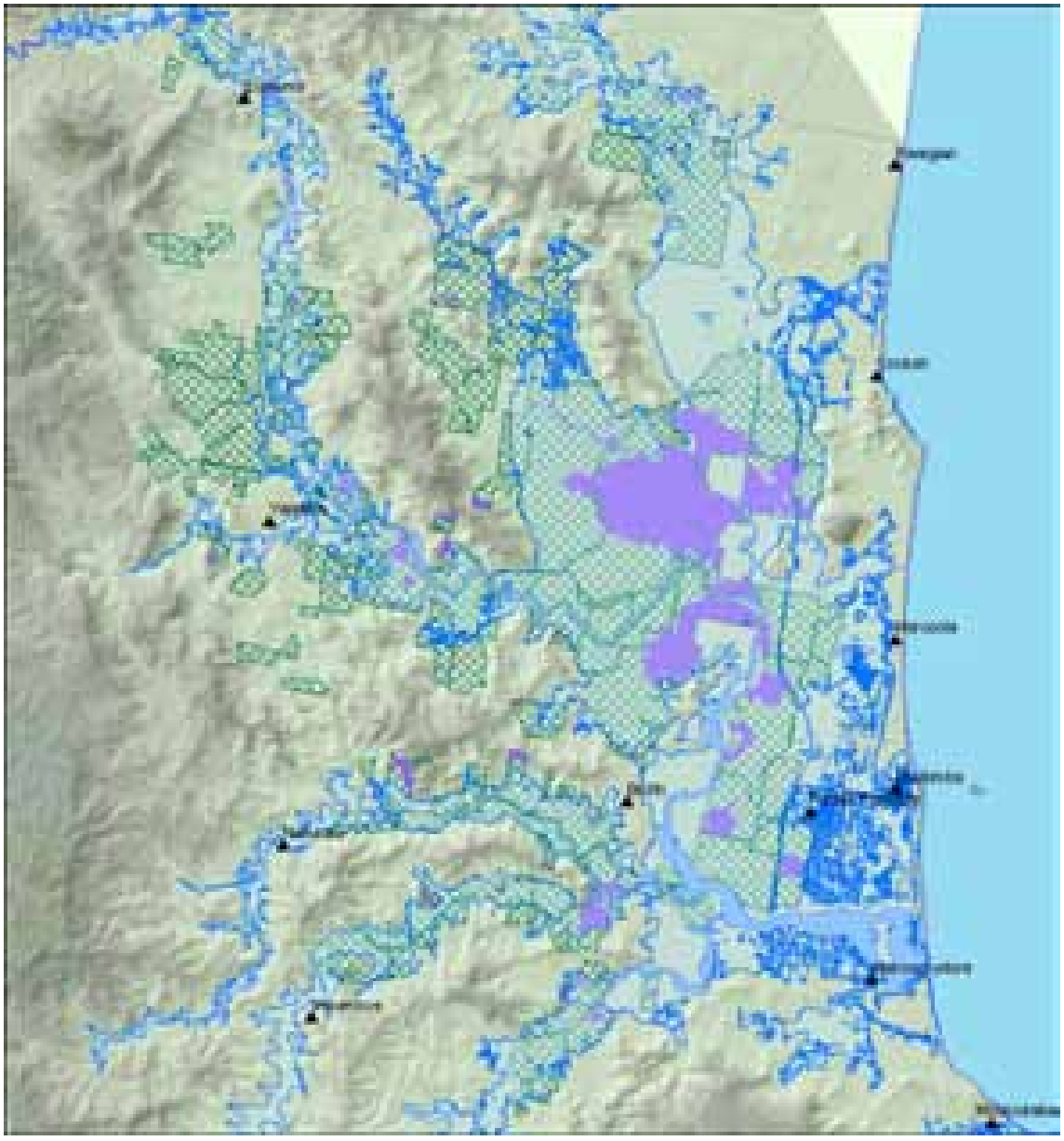
Turf, sown pastures and bamboo are all considered agronomically suitable for the foothill areas of the Sunshine Coast canelands, however particular aspects of all three enterprises must be borne in mind when considering them as a potential alternative to sugarcane. In the case of turf, exacting crop husbandry is essential and concerns about environmental impact must be addressed. However, large areas of turf production presently found around the Petrie Creek area show that these issues may be managed. Sown pastures must be seen as part of a larger livestock enterprise and the generally small size of cane farms in the Sunshine Coast region are not considered sufficient to support an economically viable grazing enterprise. In contrast, bamboo is both agronomically suited to the region and estimated to achieve a positive gross margin after 3 years and reach its maximum of approximately $25,000/ha in year 10 of production. However, domestic markets are presently small for both edible shoots and poles and future demand will rely upon sourcing overseas markets and the development of new composite products containing bamboo.

Many crop options exist for the foothill areas of the Sunshine Coast canelands which lie outside the extent of frequent flooding events and competition for space will likely be decided on the economics of production for each species. In stark contrast, the main floodplain areas around the Maroochy River are suitable to few crop species. With the exception of sugarcane, only native tamarind, lilly pilly, bunya pine, native fig and possibly bamboo species are considered potentially tolerant to the seasonal flooding, highly acidic soils, predominantly summer rainfall and lack of irrigation infrastructure characteristic of the farms in this area. As no trials of these species have been conducted on the floodplain areas, their suitability is only considered potential at this stage and further research would be required before the suitability of these crop species could be stated with any level of certainty. In particular, tolerance to acid sulfate soils is presently unknown. Lilly pilly (native riberry) are considered to have the greatest potential of the native tree crop species and whilst present calculations of internal rates of return are favourable and suggest 50% to be a very conservative estimate of enterprise-level return, this has potential to decrease as the number of suppliers in the riberry market increases. As stated above, agronomic information on native crop species and bamboo is generally limited, the commercial potential for these crops is uncertain and the prospects for current and future markets is largely unknown.

Figure 6 shows areas of the Sunshine Coast canelands that are considered unsuitable for crop growth within the range of species assessed by Burgess and Ellis (2006) and reproduced in this study. As the number of crops contained within this figure is limited, further analysis would be required before these areas could be considered 'no-grow' zones for crop species other than sugarcane.

It is therefore concluded from this assessment of 26 agricultural crop species that there are a number of crop options available to landowners on the foothill areas of the Sunshine Coast canelands. In contrast, only sugarcane has a known agronomic suitability to the floodplain areas, although a number of native food tree species (native tamarind, lilly pilly, bunya pine and native fig) and bamboo may offer potential suitability. However as no known trials of these species have been conducted on the floodplain areas, their agronomic suitability is only considered potential at present and further research would be required before the suitability of these crop species could be stated with any level of certainty. It must be remembered also that agronomic suitability does not ensure the viability of production in these regions, and further assessments must undertake rigorous assessments of economic, social and marketing issues.

Figure 6 Areas of the Sunshine Coast canelands considered unsuitable for crop production within the range of crops assessed by Burgess and Ellis (2006) and reproduced in this study.



CSIRO

Cartography: Ben Harman
August 2006

Produced by the CSIRO Sustainable Ecosystems, Brisbane, Queensland.

Data source: All data integrated into this product has been provided by the Maroochy Shire Council unless otherwise acknowledged.

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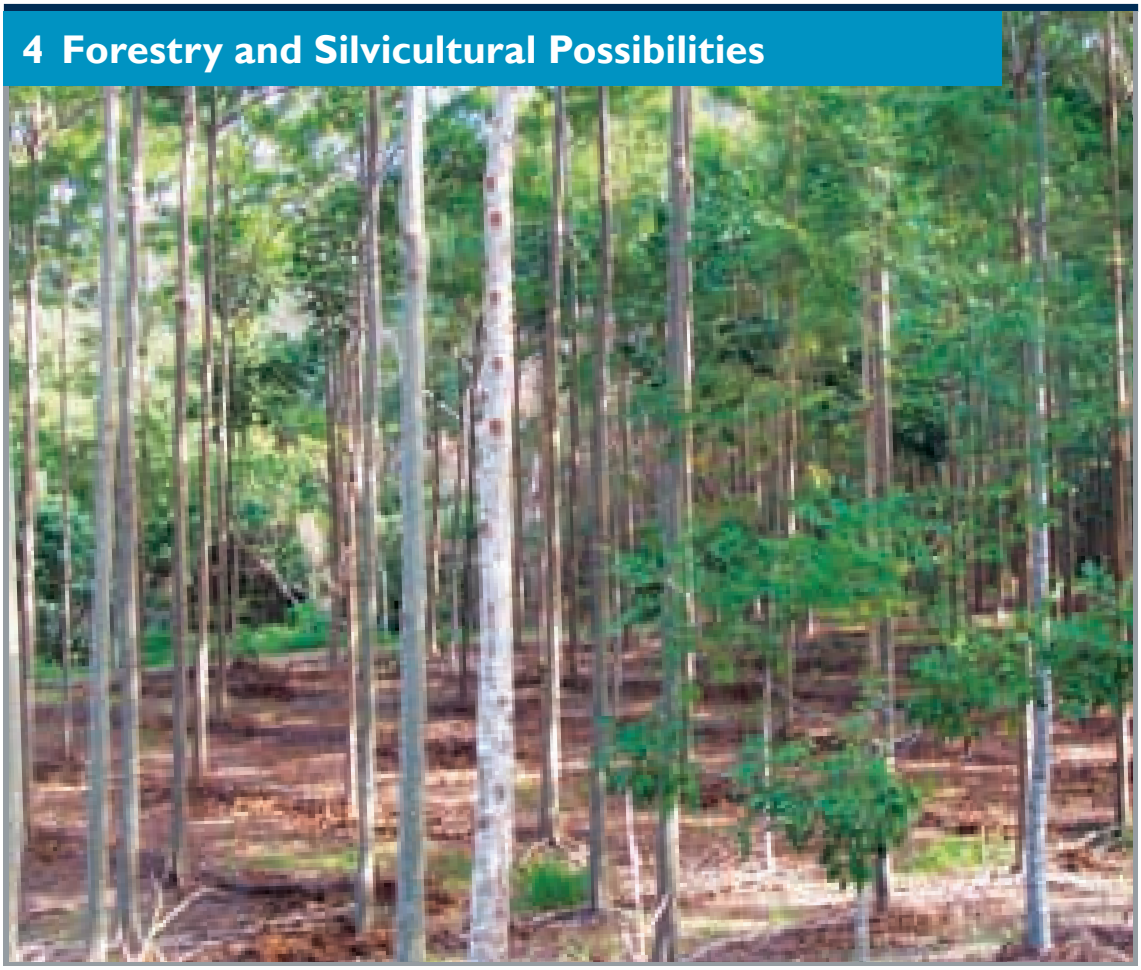
4 Forestry and Silvicultural Possibilities



4.1 Situation

The use of cane land in SEQ for timber plantations is a relatively new enterprise. While information about forestry practices across SEQ generally is available, most reports focus on lands that are not classed as 'good quality agricultural land'. This is changing as the work recently undertaken in the Sunshine Coast area by DNRMW exemplifies. Previous research identified a set of commonly grown commercial tree species in SEQ, which fall into two broad groups: hardwoods (*Eucalyptus* and *Corymbia* species), and softwoods (the *Pinus* species). Research focused on these better-known species because these have established products and markets, no major pests and disease problems, and proven performance in coastal soils.

The DPI-F recognised the pending short supply of hardwoods due to increasing demands and loss of supply from public native forests leading to a potential market for these timbers. The challenge is to produce a quality, high value product. DPI-F has initiated a plantation establishment scheme in the form of joint venture agreements with private landholders to help address the limited supplies. The markets for timber products have a critical bearing on the commercial success of a farm forestry enterprise. The selection of the targeted markets for the timber from a plantation also has an important influence on the management regime for the plantation, the timing of harvests and cash flow, and affects the certainty of the revenue streams and management practices. A general distinction can be made between 'commodity' markets and 'niche' markets that broadly correspond with markets for well-known and lesser-known timbers respectively.

The primary means of data collection and analysis used to gather information on forestry options for the Sunshine Coast canelands included a review of previous studies, the use of the crop suitability model, PlantGro™ (Hackett et al. 2004) and a workshop attended by local experts in forestry production.

4.2 Forestry suitability

Private landholders who wish to develop farm forestry thus face a choice of whether they will grow species with established markets and known silvicultural requirements or use lesser-known species. Forest growers that operate independently from industrial-scale operations may receive higher per unit prices for their products if they are manage to meet the specifications of the market, however they face additional difficulties in establishing and maintaining markets for their products due to the small and fragmented nature of supplies of these timbers (Sewell 2003a, Smorfitt et al. 2003). Different tree species have varying tolerance for flooding, poor drainage, acidity and frosts, all of which can be an issue on the coastal floodplains. Details about which species were recommended for various soil types are presented in **Table 10** and **11**. In the following section, the general suitability of the broad groupings of tree species (hardwoods, softwoods and rainforest species) are discussed in terms of their suitability for the canelands.

Hardwood species

The DPI – F (2004) report stated that: 'Hardwood plantation species need well-drained soils. They suit ridge/midslope locations. Many species are frost sensitive. Blackbutt, Gympie messmate and spotted gum grow well on the coast and are good for sawlog production.' In the floodplain areas where there are existing drainage channels the forestry experts generally believe that a number of hardwood species can be grown in plantations if drainage channels are maintained and attention is paid to the variations in soil and frost conditions across a site. This has not been widely tested in the field.

Softwood species

Much of the public research and development investment for forestry that has been undertaken in Australia has been applied to a small number of softwood species whose silvicultural requirements are well understood. The DPI & F (2004) study reported that: "The exotic pine species planted in the coastal areas of Queensland are tolerant of a range of soil types. In general, exotic pine species require light well-drained soils with a soil depth of at least 600 mm.

Soil is a critical factor for growing these trees. Exotic pines grow best on sandy soil with at least 35 cm depth above any heavier clay subsoil. Exotic pines will grow in low-lying, poorly drained soil as long as they are not permanently wet from high water tables or tidal activity.

The Moreton Mill area is also close to existing exotic pine plantations and processing facilities, which should make it easier to market timber".

Rainforest species

Growing trees that naturally occurred in rainforests in the region is increasing in practice and a number of private consultants and practitioners specialise in these types of plantations (see Sewell 2003d). According to DPI & F (2004): "Land that previously supported rainforest is the most suitable for growing rainforest timber species. These sites have rich clay loam/alluvial soils with good drainage… Hoop pine grows best on deep loam soils."

Local Assessment

A survey of 160 cane growers identified cabinet timbers, hardwoods and softwoods as enterprises likely to be considered by landowners in the Sunshine Coast canelands as viable alternatives or additional crops to sugarcane.

A survey of forestry experts based in South East Queensland was conducted in October 2005[6]. Regional foresters identified potential tree species suitable to the four main soil types found on the Sunshine Coast canelands for timber production, agro forestry systems, and revegetation.

6 SEQ Coastal Floodplains Forestry Options Workshop, Maroochy Council Function rooms, Nambour 7th October. Maroochy Shire Council, CSIRO and NRMSEQ.

Table 10 Summary of site suitability characteristics of species recommended for timber plantations on the Sunshine Coast canelands

Common name	Species	Frost tolerance	Flooding tolerance.	Position in the landscape	Geology
River oak	Casuarina cunninghamiana	H	3	LF, LS	G, S, A
Red bloodwood	Corymbia intermedia	L	2	LS, MS, US	G, NAV, S, B, A
Pink bloodwood	C. gummifera	L	2	LF, LS	S, A
Dunn's white gum	C. dunnii	H	2	LF, LS	G, NAV, B ,S, A
Rose gum	C. grandis	H	2	LF, LS	G, NAV, B, S, A
Red mahogany	C. resinifera	L	2	LF, LS	S, A
Broad leafed tea tree	Melaleuca quinquenerva	H	3	LF, LS	G, S, A
Turpentine	Syncarpia glomulifera	L	2	LF, LS	NAV, S, A
Silver quandong	Elaeocarpus grandis	N	2	LF, LS	B, A
Eumundi quandong	El. Eumundi	N	2	LF, LS	B, A
White beech	Gmelina leichardtii	N	2	LF, LS, MS	B, S, A
Silky oak	Grevillea robusta	H	3	LF, LS, MS	B, S, A
F1 Hybrid-Slash pine	Pinus car. v. hon x P.ell.+	L	2	LF, LS, MS	B, S, A

Source: Ashley Sewell (DNRMW).

Notes: Frost tolerance: N = not tolerant, L = withstands light frosts, H = withstands heavy frosts;

Position in the landscape: LF- Lower flat, LS- Lower slope, MS- Mid slope, UP- Crest/Upper slope

Geology: Species located on the following sites - G (Granites), NAV (North Arm Volcanics), S (Sandstone), B (Basalt) and A (Alluvial)

Flooding tolerance: weeks that species can withstand inundation before losses occur and the larger they are the more tolerant

Note: Only Broad leafed tea tree and River oak tolerate salinity

Table 11 Summary of potential growth rates, harvest ages and products from species recommended for timber plantations on the Sunshine Coast canelands

Common name	Scientific name	Potential Products	Harvest age range (Min-max)	Stumpage prices ($/m3 on site)	Sawn timber prices ($/m3 seasoned)
River oak	Casuarina cunninghamiana	F,C,T	35- 50	80-120	1800-2000
Red bloodwood	Corymbia intermedia	S,FM,P&R	15-40	60-80	
Pink bloodwood	C. gummifera	FM,P&R	15-40	60-80	
Dunn's white gum	C. dunnii	S,W	20-40	50-60	1000-1200
Rose gum	C. grandis	F,C,BB,S,W	20-40	60-80	1100-1400
Red mahogany	C. resinifera	F,C, S	20-45	60-80	1100-1400
Broad leafed tea tree	Melaleuca quinquenerva	S	25-45	45-50	800-1200
Turpentine	Syncarpia glomulifera	F,S,FM,P&R	20-60	60-80	1100-1400
Silver quandong	Elaeocarpus grandis	C,P,BB,T	15-35	130-180	1200-2500
Eumundi quandong	El. eumundi	C,P,BB,T	15-35	130-180	1200-2500
White beech	Gmelina leichardtii	C,BB,T	25-65	140-210	2300-3000
Silky oak	Grevillea robusta	C,P,T	25-45	120-180	2000-2500
F1 Hybrid	Pinus car. v. hon x P.ell.+	F,C,P,T,S, FM,P&R	25-30	60-70	800-1200

Source: provided by Ashley Sewell (DNR&M).

Notes: Potential products: F (Flooring), C (Cabinet furniture), P (Plywood), BB (Boat building), T (Turnery), S (Scantling), FM (Fencing material),P&R (Poles and Rails), W (Woodchips)

Table 12 documents those species considered suitable for revegetation programs to aid biodiversity conservation on Sunshine Coast canelands. Some additional species and further details about them can be found in the technical report accompanying this document.

Table 12 Possible species to use for revegetation programs on floodplain areas of the Sunshine Coast canelands

Common name	Scientific name	Soil type	Primary biodiversity conservation values	Commercial products
Eucalypts	Eucalyptus seeana, E. bancroftii, E. signata, E. curtsii, E. conglomerata	Humic gley 'upstream'	Nectar, habitat	None
Tea tree	Melaleuca quinquenervia, M. linariifolia, Leptospermum liversidgei, L. pertersonii	Humic gley 'upstream'	Nectar, habitat	Essential oils from leaves
Banksia	Banksia robur	Humic gley 'upstream'	Nectar, habitat	Flowers/ foliage
Wattles	Acacia spp	Humic gley 'upstream'	N - fixation, pollen, habitat	
Hoop pine	Araucaria cunninghamii	Alluvial	Overstorey for development of understorey (alluvial soils only)	Yes, veneer and saw logs
Figs	Ficus spp	Alluvial	Fruit (birds, fruit eating bats etc)	No
Silver quandong	Elaeocarpus grandis	Alluvial	Fruit (birds, fruit eating bats etc)	Yes, veneer and saw logs
Flooded gum	Eucalyptus grandis	Alluvial	Habitat	No (not in SEQ)
She-oak, swamp oak	Casurina cunninghamiana, C. glauca	Humic gley 'estuarine'	Stream bank protection	None

* Source: species suggestions provided by Paul Ryan (DPI&F).

4.3 Financial analysis of forestry options

Forestry experts provided estimates of input costs to enable financial modelling of plantation scenarios. Gross margin assessments which are typically used to investigate financial returns to agricultural enterprises are not applicable to forestry enterprises because of the time taken for the enterprise to develop to maturity. Discounted cash flow analysis is required to assess the financial returns of projects that take place over a number of years by discounting the value of future costs and benefits back to present day values.(See Herbohn and Harrison (2000)

These calculations are intended to provide a general guide only. Costs for establishing plantations will vary according to the site conditions. Important factors influencing the costs of land preparation and planting include the stoniness of the soil, the state of the drainage systems, the planting density used, the species used and cost of seedlings, whether weed mats are used and other factors. In general terms the establishment and management of plantations using one to five species of hardwoods is cheaper than mixed species plantations using rainforest species. Revegetation plantings for biodiversity conservation are typically the most expensive type of reforestation planting.

A guide to the prices currently being paid 'at the stump' (i.e. to the landholder by timber harvest contractors is shown in **Table 13**. (see also Sewell (2003a)). It is important to note that up to 16 different timber products could be produced from plantations, and that landholders need to consider which markets they would aim for during the planning of the plantation to ensure the right species and management regimes were applied.

Table 13 Results of financial analyses of possible species for plantation development in the Sunshine Coast canelands

Common name	Scientific name	Soil type	Growth rate MAI/ ha/yr	Harvest age yrs	Stumpage price ($/m3)	Internal rate of return (%)	Net present value/ha
F1 hybrid	Pinus car. v. hon x P.ell.+	Alluvial	25	28	65	8.7	2267
F1 hybrid	Pinus car. v. hon x P.ell.+	Humic podsol or Humic gley 'upstream'	20	28	65	7.8	898
F1 hybrid	Pinus car. v. hon x P.ell.+	Humic gley 'estuarine'	15	28	65	6.5	-471
Rose gum	Eucalyptus grandis	Humic gley 'upstream' or Alluvial	12	40	70	5.2	-2303
Blackbutt	Eucalyptus pilularis	Humic gley 'upstream'	11	40	70	-	-3517
Spotted gum	Corymbia citriodora var variegata	Humic gley 'upstream'	15	36	70	5.9	-1299
Hoop pine	Araucaria unninghamii	Alluvial	15	45	70	5.1	-2387
Gympie messmate	Eucalyptus cloeziana	Alluvial	20	35	70	6.9	-178
Spotted gum	Corymbia citriodora var variegata	Alluvial	20	35	70	6.9	-178

MAI –Mean annual incremental of merchantable timber cubic metres

NPV using a 7% discount rate

The most financially profitable forestry systems included local species of quandong (Elaeocarpus grandis and El. Eumundi), Southern Silky Oak (Grevillea robusta) and the exotic F1 Hybrid pine tree (Pinus car. v. hon x P.ell.+). All of these species, with the exception of the F1 hybrid, were recommended for alluvial soils.

Other species that showed reasonable financial viability in the analyses included the Red and pink bloodwoods (Corymbia intermedia and C. gummifera), Gympie Messmate (Eucalyptus cloeziana) and, when grown on alluvial soils, Spotted gum (Corymbia citriodora var variegate). River oak (Casuarina cunninghamiana), White beech (Gmelina leichardtii), Rose gum (Eucalyptus grandis), Red mahogany (Corymbia resinifera), and Hoop pine (Araucaria cunninghamii) had slightly lower internal rates of return (IRR) of approximately 5%.

Of the species examined, only the F1 hybrid pine recorded a positive NPV on soils other than alluvial when a discount rate of 7% was applied. Species identified as unviable included Broad leaved tea tree (Melaleuca quinquenerva), Turpentine (Syncarpia glomulifera) and Blackbutt (Euc. pilularis). These later species performed badly in the financial analyses due to their slow growth rates and long rotation times which were not balanced by high timber prices.

4.4 Conclusions on forestry options

For humic gley (estuarine) soils which constitute a majority of cane lands, discussions with forestry experts revealed a majority view that the 'F1' *Pinus* hybrid species was the only well-known timber tree species that could be established for financially viable timber production at this point. One respondent also suggested that broad-leafed tea trees (*Melaleuca quinquenerva*) could be used to produce timber on these soils although recent market performance has been poor[7].. In terms of tree species that could be used to develop revegetation plantings, only She oaks, Swamp oaks (*Casuarina spp*) and *Melaleuca spp* were thought suitable for these soils. Other soil types, particularly the alluvial soils found higher in the catchments, can potentially be used to grow a wider range of species for conservation purposes.

A consistent message from researchers and practitioners involved in the farm forestry industry in Australia is that landholders that wish to establish plantations for commercial reasons need to pay close attention to the markets for their plantation products. A variety of products can be produced from timber plantations, including a number of timber products as well as non-timber products such as foliage, flowers and essential oils. Mixed species plantings with native timbers can provide significant ecosystem services once they are well established and the local fauna brings in seeds from surrounding areas to add to the diversity of plants and the 'naturalness' of the stand (Erskine and Caterall 2004, Kanowski et al. 2005). This may provide opportunities for landholders to earn money by establishing recreation activities like walking or cycling tracks as well as tourist accommodation in conjunction with the timber production.

The financial analyses undertaken for this project revealed a greater number of forestry systems could be potentially viable on the alluvial soils of the region, with fewer options for the other soil types. Local quandong species (Elaeocarpus grandis and El. Eumundi) have an added advantage of being potentially lucrative in terms of their financial performance plus useful for biodiversity conservation. The locally found Southern Silky Oak (Grevillea robusta) is another species that has shown strong financial viability and is likely to have biodiversity conservation benefits. As these species are less commonly grown than the softwoods landholders who wish to grow these species would need to ensure they understand the marketable products and the silvicultural regimes needed to meet the requirements of these markets before they begin planting.

The other species found to be financial viable across a range of soils was the F1 hybrid pine (Pinus car. v. hon x P.ell.+). While the silvicultural regime for this species is well understood by industrial foresters a potential difficulty for landholders could be getting access to markets. Contracts between processors and the large scale timbers growers, primarily DPI Forestry have in the past effectively excluded small scale growers from selling Pinus species timbers to processors. It is recommended that landholders secure a contract for selling their timber before they plant this species.

It is recommended that landholders considering forestry enterprise development ensure that they know which market or markets they are targeting with their operations. Landholders on the Sunshine Coast canelands are fortunate in terms of their access to a large established market for timber products. Those landholders with property sizes greater than 30 ha have an opportunity to negotiate agreements with existing growers, processors or exporters. These agreements can be flexible according to the level of involvement and risk that the landholder chooses to adopt. The options range from the potential for landholders to lease land to plantation companies with no involvement in the plantation management, harvesting or marketing in return for an annual lease fee, to joint-venture agreements that may include lease payments and or shares in harvest revenues determined according to the level of inputs provided by the partners. Landholders that wish to operate independent of marketing agreements are also well-served in the SEQ region as they have access to a number of experienced private consultants offering plantation design, establishment, maintenance, harvesting and marketing services.

7 It is important to note that there remains uncertainty about which tree species can be successfully grown on the coastal floodplains. Informants from the Noosa District Landcare Farm Forestry Program had successfully established Swamp mahogany (E. robusta), Large fruited red mahogany (E. pellita) and Tallowwood (E. microcorys) on sites with humic gley 'upstream' and alluvial soils.

5 Farm-Household Economics and Capacity to Change

5.1 Cane farming

This section provides an overview of the characteristics of farms and farmers that had sugar cane assignments in 2003 who are now considering alternative uses of their land. The information is based on a written questionnaire distributed to all cane growers who had assignments at that time and 70% responded. Growers who were members of the Sunshine Coast Reference Panel also assisted by defining the parameters of the cane farming system for the financial modelling reported below.

The broad picture is that of relatively small farms still with a large amount but declining amount of sugarcane despite the collapse of the regional sugar industry two years previously. The hardship caused by the collapse is evident from the very low level of farm contribution to household income that is in contrast to the majority of the household's labour being used on the farm. Farmers' age is similar to that in Australian agriculture generally which was 59 at the time of the survey.

Table 13 shows the summary characteristics of Moreton cane farms on the basis of the farm-household survey carried out in 2005 as part of the project.

Crop options identified previously have been evaluated for their potential financial performance. Sugarcane (for various uses), hemp, bamboo and native riberry *(Syzygium luminii)* were selected for the most detailed analysis (**Table 14**), since there is much information available on conventional cropping alternatives (**Tables 12** to **14**).

Table 14 Situation summary of Sunshine-Coast canegrowing farm-households

Attribute	Measure	Sample farms
Farm size	ha average median	 98 66
Titles on farm	number average median	 4.4 3.0
Cane area in 2005	ha average median	 59 32
Good quality cane in cane area	% average median	 53 55
Medium quality cane in cane area	% average median	 15 0
Poor quality cane in cane area	% average median	 23 0
Cane yield in 2004, where harvested	t/ha average	 73

Attribute	Measure	Sample farms
Workers, paid in 2005	persons average median	 1.1 1.0
Workers, unpaid in 2005	persons average median	 0.6 0.0
Farmer's year of birth	year average median	 1947 1947
Household members working on farm	persons average median	 1.4 1.3
Household members working off farm	persons average median	 0.8 0.3
Household member dependent	persons average median	 1.1 0.3
Farm share in household income in 2005	% average median	 26 10

Table 15 Comparative returns of the modelled crop options

Crop	Yield t/ha	Price $/t	Gross Margin excl. labour $/ha	Gross Margin incl. labour $/ha	Labour use hrs/yr/ha
Cane for sugar (Moreton Mill)1	95 (plant cane)	25.0	571 (crop cycle)	376	10
Cane for sugar (Maryborough)	95 (plant cane)	12.42	-356 (crop cycle)	-550 (crop cycle)	10 (crop cycle)
Cane for Cow Candy3	109 (plant cane)	30.0	1,248	1,054	10
Hemp	10	245	956	832	6
Bamboo (7 yr old)	6 (shoots) 61.5 (poles)	3,500-5,500 (shoots) 20 (poles	21,796	12,936	473
Riberry (7 yr old)	14 (raw fruit)	14 (fruit syrup)	108,858	81,1963	1,356

[1] A notional scenario for comparison

[2] $25/t less $10/t road haulage and $2.6/t transport cost to the B-double loading pad

[3] Figures represent steady state. Impact of startup costs of up to $5/t of cane for the first three years, depending on the extent of farmer's involvement in BioCane Limited, is not shown.

There is a possibility that the recent increase in sugar price may push cane prices to $35/t in the short-to-medium term, well up on the $25 long-term expectation used in this study.[8] **Figure 7** and **Figure 8** show the sensitivity of sugar and CowCandy returns to prices ranging from $20-$35 per ton of cane and transport costs of from $0-$20 per ton. Note that cane for Cow Candy has a permanent cost advantage over hauling cane to sugar mills outside the region. The additional haulage cost of $12.60 (to Maryborough, higher still to Rocky Point) is unavoidable, and a larger portion of the cane plant is used for Cow Candy. Overall, for the same level of profitability, prices obtained from sugar mills has to exceed those from BioCane Limited by at least $15/t of cane.

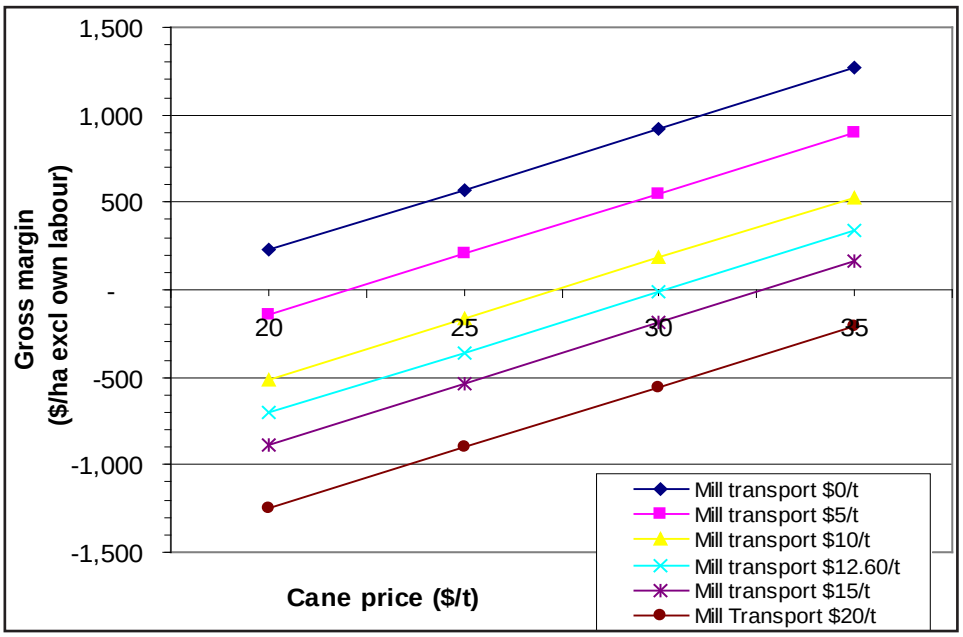


Figure 7 Cane for sugar: sensitivity of returns to cane price and transport cost

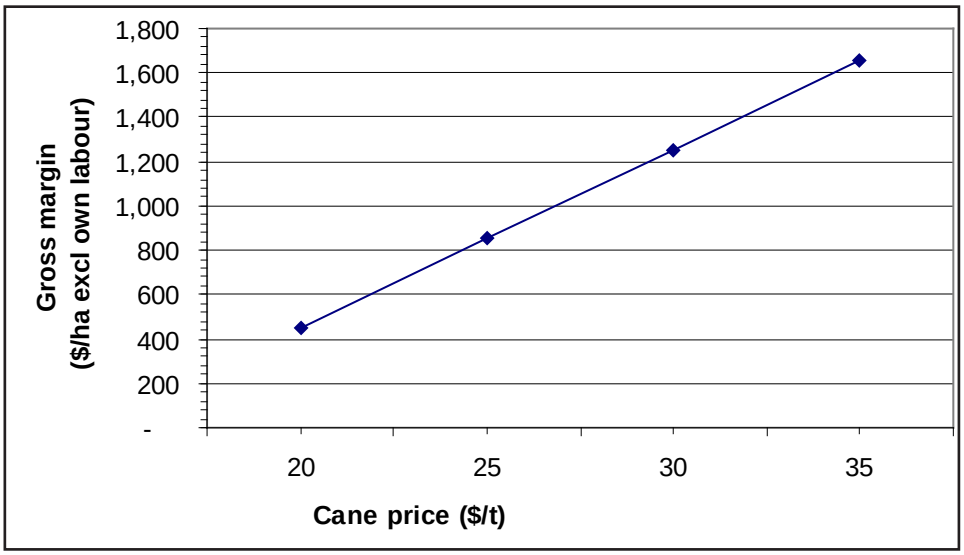


Figure 8 Cow Candy: sensitivity of returns to cane price

8 QSL discounts the likelihood of protracted high international prices (Warren Males, pers. comm.)

5.2 Other crops

No consistent data are available on the Sunshine Coast for broad acre crop returns other than for sugar cane. However information from Southern Queensland and Northern NSW offer a broad guide (see **Tables 16**, **17** and **18)**. Overall, the income-earning capacity of broadacre crops is around or below that for cane production for a local sugar industry (the notional Moreton Mill scenario). Apart from the financial and psychological transaction costs, Moreton canegrowers with farms on the slopes may turn to other broadacre crops that would leave them financially no worse off than if Moreton mill had not closed. Farmers on the floodplains have much more limited choice, and for them the only option not involving radical change is continued cane production for BioCane Limited.

Table 16 Dryland crops for the Darling Downs, 2002/03

Crop	Yield t/ha	Price $/t	Gross Margins $/ha
Barley	2.80	198	382
Chickpea	1.50	457	427
Double-crop mungbean	0.95	386	171
Fallow mungbean	1.40	386	331
Maize	3.50	209	439
Millet	1.40	287	254
Navy beans	0.80	711	269
Peanuts	1.60	625	301
Sorghum	3.50	188	381
Soybeans	1.00	385	167
Sunflower	1.60	347	324
Wheat	2.50	277	522

Source: Queensland Department of Primary Industries Prime Notes

Table 17 Dryland crops for north-east New South Wales 2005/06

Crop		Yield t/ha	Price $/t	Gross Margins $/ha
Grain sorghum		5.00	125	250
Macadamia	7 yr old 15 yr old	1.2 3.5	2,500 2,500	141 4,275
Maize		5.00	150	336
Mungbean	- clean seed - gradings	0.88 0.12	500 120	83
Soybeans		1.50	300	167
Sunflower		1.85	410	429

Source: New South Wales Department of Primary Industries

Table 18 Irrigated vegetable crops for north-east New South Wales 2001

Crop	Yield t/ha	Price $/t	Gross Margins $/ha
Broccoli	6.4	1,750	2,250
Butternut pumpkin	1200 cartons	7.50/carton	1,760
Sweet corn Fresh consumption Processing	 16 18	 530 125	 1,035 826
Watermelon	30	250	1,860

The Moreton farm model was used to assess the potential returns to the enterprise options for a farm of 66 hectares, the median farm size in the region. It is assumed that the whole farm is used for the given enterprise, except for bamboo and riberry that would have an area of 2 ha and 1 ha, respectively.

Table 19 Estimated returns to a 66 ha Moreton farm under exclusive enterprise options

Crop	Area ha	Farm cash income3 $	Farm business profit4 $	Profit at full equity excl. capital appreciation5 $	Labour use on farm hours/year
Cane for sugar (Moreton Mill)	66	-2,348	-52,643	-47,643	645
Cane for sugar (Maryborough)	66	-63,748	-114,043	-109,043	645
Cane for Cow Candy	66	42,534	-7,762	-2,762	645
Hemp	66	22,914	-23,297	-18.297	441
Bamboo (7 yr old) 1	2	3,410	-51,710 1	-46,710 1	1,086
Riberry (7 yr old) 2	1	66,767	2,523 2	7,523 2	2,258

[1, 2] A 2-ha bamboo farm or a 1-ha riberry farm would not carry the same farm overheads as a 66-ha cropping farm, hence profit measures are substantially under-estimated

[3] The sum of gross margins less repair/maintenance costs and general farm overheads for cane sold at $25 / ton.

[4] Farm cash income less depreciation and operator's labour costs

[5] Farm business profit less interest payments

None of the broadacre cropping enterprises analysed have the capacity to provide a profit at full equity on their own, while cane for Cow Candy comes closest to approaching the Australian long-term average farm cash income of over $70,000. Given their gross margins of $200-500/ha, the likely performance of the other dryland cropping options quoted above is generally between the hemp and the notional Moreton sugar option. Irrigated vegetables shown above may do better with gross margins approaching $2000/ha, but only a limited number of Moreton farms have irrigation or have the potential to install it.

The small size of farms in the region is a major cause of low farm income from broadacre crops. **Figure 7** shows the sensitivity of fam cash income from cane hauled to Maryborough for various farm sizes and cane prices[9].

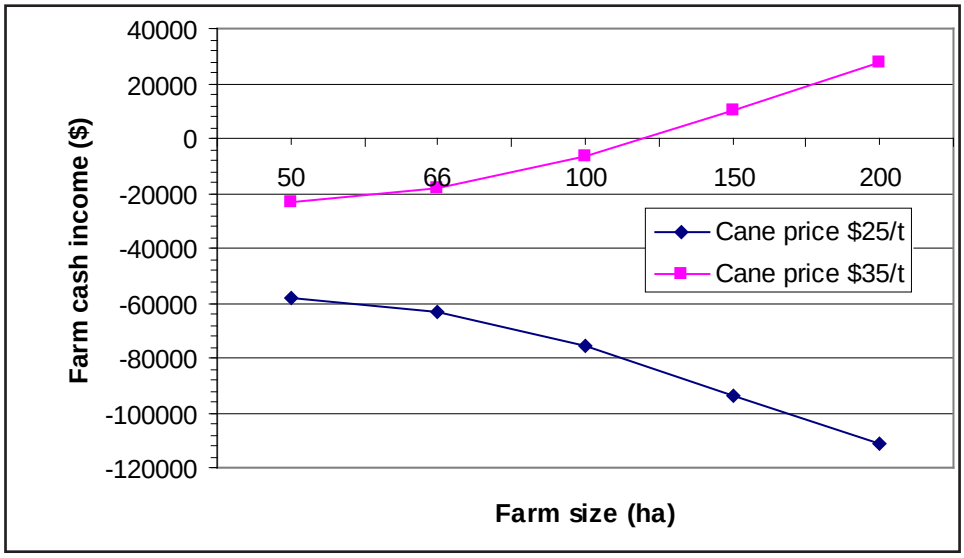


Figure 9 Sensitivity of farm cash income from cane hauled to Maryborough

Only the few large farms in the region are likely to turn a profit with conventional enterprise options. With such enterprises, the region's typically smaller farms would have to be run on a part-time basis, supplemented by (and effectively subsidised from) off-farm income. If the household wanted the farm to be the primary source of income, a mix of low-risk/low-income and high-risk/high-income enterprises may be considered. **Table 20** and **Table 21** show examples of such a mixed-enterprise farm that is still mainly growing sugarcane, for Cow Candy (more uncertain, higher return) or for processing in Rocky Point or Maryborough (less uncertain, lower return).

Table 20 Returns to a possible mixed-enterprise farm in Moreton – version 1

Crop	Area ha	Farm cash income $	Farm business profit $	Profit at full equity excl. capital appreciation $	Labour use on farm hours/year
Cane for Cow Candy	48	162,266	86,020	91,020	2,862
Hemp	17				
Riberry (7 yr old)	1				

While it indicates the potential for profitable farming enterprises in the Moreton region, this simplistic analysis clearly ignores such issues as:

- Farmers would need to re-equip, obtain working capital and extension services to undertake some of these options
- the need to establish processing infrastructure for hemp,
- financing the development of the riberry orchard till maturity,
- seasonal labour availability,

9 All farms have the same overheads: a simplistic but not unreasonable assumption.

- general production and price risk associated with any of the enterprises, and
- the psychological capacity of the farmers in the region to take such a radical departure from their traditional operations.

Table 21 Returns to a possible mixed-enterprise farm in Moreton – version 2

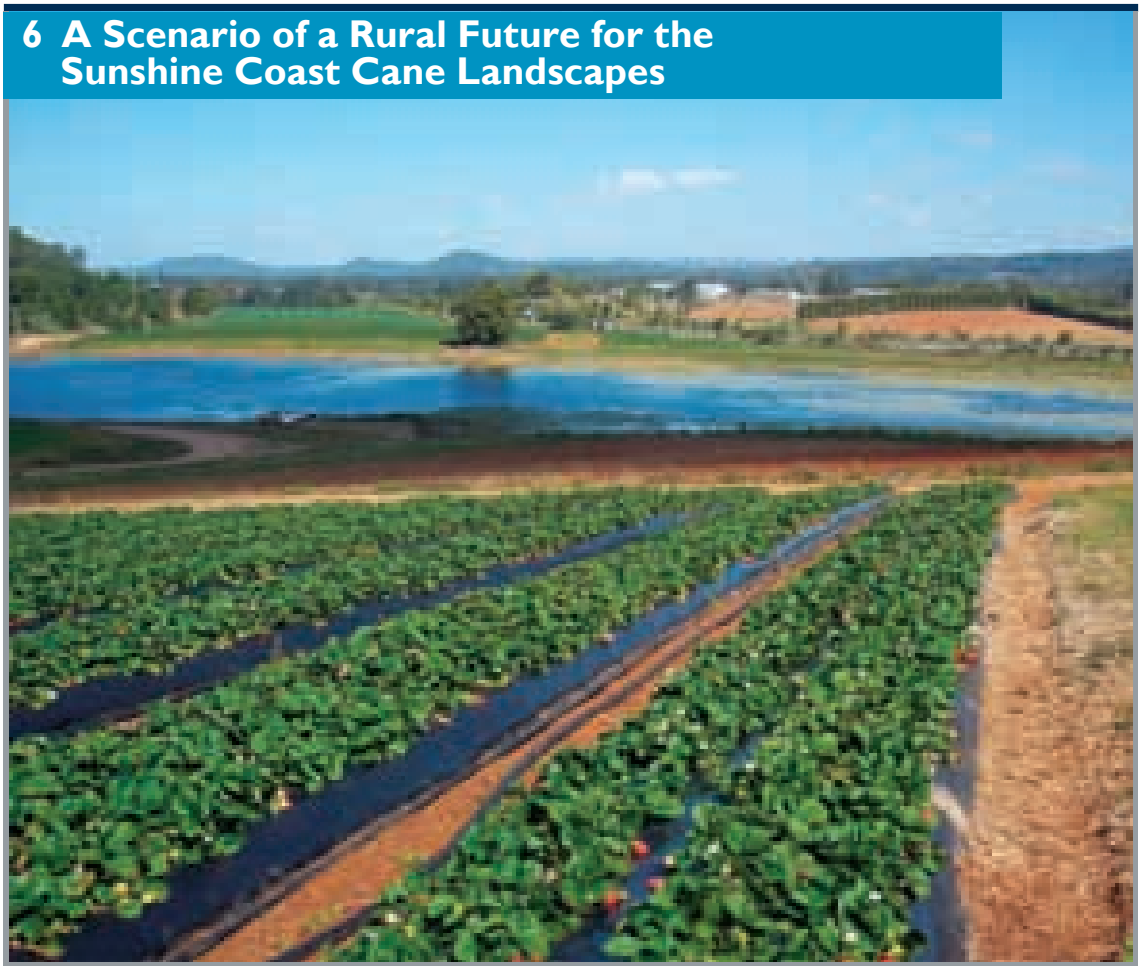
Crop	Area ha	Farm cash income $	Farm business profit $	Profit at full equity excl. capital appreciation $	Labour use on farm hours/year
Cane for sugar (Maryborough)	48	65,789	-10,458	-5,458	2,862
Hemp	17				
Riberry (7 yr old)	1				

Forestry options involve substantial long-term uncertainty about biophysical performance and prices. Although before-tax expected returns of forestry tend to be lower than in broadacre agriculture, a major part of the incentives is 'tax-efficient' investment driven by differences in personal and corporate tax rates. As the current tax-rate differences are unlikely to continue indefinetely, long-term incentives from this source are in doubt. Hence, forestry options are difficult to fit into a farm plan without knowing the specifics of the investment scheme and its conditions vis-a-vis the land owner.

The farm-household survey indicated that, despite the economic and political pressures, a substantial majority of surveyed farmers (58%) want to continue growing sugarcane. A sizeable minority (27%) would prefer growing nothing but cane. Around one-third of farmers had a preference for other agriculture than cane and development on their own farms, respectively. The answers seem to be no different for farms grouped either by size or debt level. However, one-fifth of farmers gave no answer to the questions about future land use. In addition, 38% and 10% of respondents have put, respectively, part or the whole of the farm on the market.

All this would suggest that there is a limited financial and psychological capacity in the region to radically change farming enterprise mixes. For the majority, the preferred option would be a centrally organised and marketed crop that would only require agronomic attention from farmers. Under the current options, this is only satisfied by BioCane Limited and, potentially if a local champion should emerge, hemp. These two crops have a potential to be profitable under favourable market conditions. The other crop options are either unprofitable or constitute too radical a departure in terms of labour intensity and perceived risk. However, there is a strong possibility of a number of farms in the region changing hands and, likely, ceasing to be used in large-scale agriculture. However, the availability of paid employment in the region makes it well suited for part-time farming where a substantial part of the farm-household's income is from off-farm sources.

6 A Scenario of a Rural Future for the Sunshine Coast Cane Landscapes



6.1 Scenario Premises and Major Drivers

This scenario outlines a possible **rural** future for Sunshine Coast cane landscapes. It is not a prediction of what will happen nor a proposed optimal or best future for the area, rather it is a broad picture of how a rural future might come about and what its main attributes could be. A scenario was constructed for each of the four major land uses to show how the future may evolve on the basis of

- What is observable now and likely to continue,
- The preferences and motivations of stakeholders as we have observed and discussed, and
- The scope of bio-physical and economic potential that we have identified.

A range of scenarios arose during Maroochy Shire Council's previous major community consultation activities - the *Cane Futures Project* and *Maroochy 2025 Visioning* - both of which involved substantial community wide consultation about future development of the cane landscapes. The final scenario built on those through an interactive and iterative process with the *Sunshine Coast Reference Panel* and *Sunshine Coast Cane Subcommittee* (see 1.3.2 below).

The notional scenario period envisaged is 5-10 years. Within that period it is reasonable to speculate on socio-economic trends and relationships and to establish interactions between key driving forces. Beyond 10 years, trends and relationships become hazier but it is important to note that the land use created through the next 10 years underpins the future after that time. Some of those land uses may limit future options, for example urban or rural residential development, whereas other states might be reversible, for example maintenance of natural landscapes and current production areas. What happens in the next 10 years is therefore critical for the long term.

The scenario concentrates on future land use and takes account of the suitability of land for agricultural pursuits and of the current or potential future ecosystems services the land might provide. The defining features of the target land area are:

- Much of the land, approximately 7000 ha is flood prone, poorly drained and land owners face a limited set of farming or forestry opportunities
- The balance of the land approximately 3000ha has a wide range of suitable crops but most of the farms are small, making economic returns from broad acre cropping difficult to achieve
- All of the cane land provides ecosystem services to the region including flood storage and protection, fisheries habitats, scenic amenity, water quality improvement and recreation opportunities.

New urban development is not part of the rural future, but urban related land uses including rural living and a wide variety of decentralised non-farm activities on existing allotments can not be ignored. The scenario shows the extent and character of each of the main land uses that could occupy the cane landscape in the future including cane growing for sugar production or for other products, other commercial agriculture and forestry and other types of green rural land use such as conservation, recreation and managed low density residential development.

These land uses in turn have economic correlates in terms of production, employment and profitability, environmental consequences in terms of contribution to the provision of ecosystem services and social consequences for land holder families, dependent entities and community cohesion and character. Each scenario is evaluated in terms of economic, social and environmental sustainability. (See Technical Report)

The specific scenarios presented in the Technical Report explore the effects of specific driving forces and their consequences including what happens if current trends continue, if the cane industry is successfully promoted, other large scale commercial agriculture and forestry prosper or if other 'forms of green" such as recreation, conservation and water recycling expand.

Economic drivers

- Oil prices remain at least at current levels (c$US75) which although affecting rural production costs, will continue to cause diversion of farm products including cane to energy production such as ethanol
- Cane prices remain at or above A$35 in the immediate future in the Australian sugar industry but the current much higher prices do not persist.
- Population growth in the Sunshine Coast continues as projected to increase from 300,000 in 2006 to 485,000 in 2026, an increase of over 60% in 20 years.

Government actions

Institutional factors and especially the decisions by government affecting the land use rights and development conditions are critical. These factors are every bit as dynamic as the economic drivers. For example the recent decision to provide some start up capital to BioCane Limited significantly improved the prospects of that enterprise. A key driver, the SEQ Regional Plan is a dynamic document and changes will occur to it with changes in attitude from the State Government over the next 10 years.

- The Office of Urban Management (OUM) and Maroochy Shire Council (MSC) remain committed to the rural future of the cane landscapes by retaining the current land use and subdivision controls. A Rural Precinct Plan for part (especially the floodplains) or all of the cane landscapes will provide greater detail to land use change – see outline below
- Local governments use a range of incentives for compatible land use developments, boundary re-alignments and bonuses in conjunction with regulation to support a rural future,
- Governments create the conditions under that supports rural enterprise, co-ordinating where possible private initiatives and continuing to provide extension and business advice for farm diversification. Each level of government can assist in this.

- Local government develops recreation opportunities, especially riparian access and nature-based activities and trails
- Local government implements innovative water recycling and rehabilitation schemes to maximise the use value of treated water while avoiding waste water being disposed in waterways

Industry actions

- BioCane Limited prospers and expands to provide a market for cane from 3,000ha of canelands, especially from land with limited alternative uses on the floodplain.
- Other value-adding rural industries expand based on rural products, lifestyles and landscapes.

Land owners actions

Land owner values, attitudes and motivations are critical. In purely agricultural areas the pursuit of a livelihood is the primary driver and for commercial enterprises land uses must be financially viable in their own right. In high amenity rural landscapes such as the Sunshine Coast, land owners have important motives other than financial ones. For many landowners, including farmers, residential amenity and quality of life issues are extremely important. There is also a greater scope for earning supplementary off-farm income. Consequently we can expect a spectrum of activities from purely commercial enterprises, to sub-commercial (hobby-farms) to purely life style land uses to exist. Whatever their motivations might be, land owners need to believe that on balance their returns, financial and otherwise, are sufficient to use land in a particular way.

In considering possible futures, the rights and responsibilities of land owners (as opposed to their expectations) are significant constraints. Land owners have the right to sell land (titles), and to use land as they wish within the constraints of the development regulations of state and local governments. It can not be assumed that landowners will actually farm their land.

The right to occupy land by constructing a dwelling is widely (although not universally) acknowledged. Land owners also have a duty of care and responsibilities not to damage or create nuisance to others and to pay land related taxes as set out in law.

6.2 A Scenario of a Rural Future

Cane growing for sugar production

Cane growing for sugar production can occur if farmers receive over c$35 per ton of cane after paying transport to a mill. Given that it costs approximately $12/t to transport cane to Maryborough sugar mill and more to Rocky Point, mill prices need to be above $47 per ton. This is unlikely but not impossible.

Alternatively, payments to farmers could be tied to the provision of environmental services equivalent to the price discrepancy to help to retain land in cane for sugar production. For a current price of $35/t the total service payment on 200,000t (a likely upper limit on the capacity of the Maryborough and Rocky Point mills to accept) would be $1.4 million per annum. Such a revenue stream would allow approximately 2,500ha to continue in sugarcane production.

Cane growing for sugar production may not disappear at the end of the current viable ratoon crops. It may be grown in conjunction with cane intended for BioCane Limited or other products including mulch as prices determine. Mulch is an additional attractive by-product from cane production for the manufacture of sugar as it is attracting approximately $8/tonne of cane equivalent. This provides a value of approximately $4 per tonne of cane that should be added to the gross margin in any analysis for cane production for sugar. A few growers will continue to grow cane for mulch for existing markets.

Cane growing for other products

The success of the BioCane Limited ("Cow Candy") venture is a critical element in this scenario. Its Stage II processing plant will process approximately 6000 tons per annum (tpa) from about 600ha of cane. When the BioCane Limited enterprise expands to Stage III, its projected design capacity, and processes 300,000tpa of cane, substantial areas of land could continue to grow cane for processed stock feed. The given indicative supply price is $35/t.

The BioCane Limited enterprise will be particularly effective at ensuring the survival of cane growing in approximately 3,000ha of the floodplain areas where there are few farming alternatives to cane.

Present uncertainties about BioCane Limited include the company's need to attract additional venture capital and to demonstrate the reliability of international marketing contracts.

It also needs to be noted that in a substantial proportion of the cane in the originally assigned area is beyond ratoonable age, has no salvage value and will need to be replanted. The cost to farmers of replanting cane constitutes a significant barrier following the recent period of negligible cash flows and will be a constraint on grower ability to expand cane supply to BioCane Limited in the short term.

With a more secure future for cane, there would be a reduced incentive for farmers to change into other farming enterprises.

Other agriculture

Agricultural land resource suitability is a major factor controlling the diversification of cane farming. While cane can be grown successfully on much of the previously assigned land, on large areas of flood affected and poorly drained caneland (approximately 70%) commercial alternatives to cane are limited. Environmental constraints, especially poor drainage, acid sulphate soils and flooding will further limit agricultural developments that require significant reclamation works.

The median farm in the region is 66 ha. Units of this size can not make a profit from other broad acre crops (or cane) and will only support high valued specialty crops or force owners into off-farm employment and part-time farming. Substantial land amalgamations to form larger units are unlikely.

There are potential significant new agro-industries that could have substantial area-wide benefits such as hemp, plantation forests or bamboo for timber. Obstacles for these industries to overcome include industry establishment costs, the necessity of coordinated industry development (possibly supported in some way), and the need for supply guarantees for sufficient throughput. Small-scale forestry and some hardy niche crops will not be so limited.

Approximately 30% of the caneland supports a wide choice of field and horticultural crops and on these areas agriculture diversify. Some enterprising farmers will switch into other farming enterprises. These will be scattered throughout the district but especially on the better alluvial and red podsolic soils in the western areas. Some significant commercial horticultural enterprises including greenhouse and hydroponic farming will develop.

Rural and farm-based recreation and tourism activities will be part of the future – emphasising high quality farm products through farm gate and market sales, farm stays and B&Bs. This should expand the region's high tourism profile and include for example on-farm accommodation, cooking schools, agricultural education, farm gate enterprises and outdoor recreation. Value-adding on-farm and farm tourism aspects in the possible scenarios would require research and extension in the areas of food (and wine) tourism experiences, bringing the agricultural components of the region more into the consciousness of tourists, and tourism marketers to "value adding to agriculture".

Research, extension and freeing-up planning restrictions to include on-farm value adding, including the promotion off outdoor recreation, combined with food experiences being marketed and sold on-farm, could also help to take the pressure of protected, natural areas (ie, National Parks) from environmental and social impacts associated with increasing visitation.

A serious commitment to a range of policies that provide incentives and remove perverse incentives is essential. These would include a combination of extension information services, stewardship payments for environmental services provided by farms, incentives for land management practices,

investment in supply chain infrastructure, reduction in local government rates and charges and facilitation of farm diversification in the development approval system.

A number of stakeholders have proposed the application of a more complex program of transferable development rights fund permanent farm land conservation. Such a proposal would allow some strategically placed urban development on former caneland and fund individuals or area wide agricultural initiatives that would lift farm size, farm investment and farm incomes.

Residential

Many farmers see the need to sell their land for retirement as one of their only options and will continue to sell blocks within the existing subdivision pattern[10]. Most farms consist of smaller blocks and are already effectively subdivided into an average of 4.4 titles per farm. There are approximately 650 titles in the caneland of which only 150 have houses, meaning a further 500 houses are possible. A disproportionate number of these will occur in the upstream well drained allotments in the Yandina, Eumundi and upper creeks with superior site amenity, rather than on the floodplain.

Some of the new residents will engage in hobby agricultural pursuits and revegetate former cultivated land with native and exotic tree species.

Continued encroachment of semi-urban activities including residential uses with land used for equipment storage, home occupations and public acquisitions for road and other infrastructure will erode the integrity of the land base.

- As a consequence, farming lands will gradually become more fragmented and alienated by the sale and development of some parcels of land. Minimising these trends and consolidating farming areas, can be partially achieved by encouraging boundary re-alignment that is at present costly, slow and conditions are onerous. In the short term this situation can be improved by easing conditions and minimising costs of boundary realignments by reducing fees for applications and contributing to consultants studies and survey costs required by Council.

In some cases the right to build a house on a parcel of land could be a right which can be traded to achieve strategic boundary realignments. For example the right to build a house on a parcel of land could be bought out by government, if the land owner was willing to sell it.

Permanent protection of the district's agricultural land and ecosystems in the medium term (beyond 10 yrs) would be achieved by a program of transferable developments rights or levies to create a "Farm Future Fund". This fund will help sustain agricultural pursuits and land stewardship payments on land with limited economic viability.

Owners of floodplain farms would be seriously disadvantaged because there are fewer allotments and their residential desirability is lower than other districts financially for lack of options.

Other types of green rural land use

In a rapidly expanding urban area, demand for recreation space and access to water will increase more than proportionately given existing crowding and limited access. MSC acquires additional recreation space especially in water front locations for public use.

Some land will be converted to wetlands for the purpose of waste water polishing while at the same time achieving biodiversity outcomes.

MSC continues to make strategic land purchases for the purpose of adding to the protection of endangered species habitat and of ecosystems.

Outdoor recreation activities including land and aquatic trails, riparian access, themed recreation parks that use a bush setting (eg, horse or bike riding), will be development by private enterprise.

10 Most local government planning schemes permit a house to be built on an individual land title subject to building and other development codes. While this is not universal, prohibiting houses on land titles would have significant social and political ramifications and would be likely compensatable.

6.3 Evaluation of a Rural Future Scenario

Economic impacts

A rural future will have the following benefits:

- Create sustainable employment in agro-industry.
- Enhance tourism and value adding opportunities and increase value of agricultural produce
- Provide an agro-processing hub to retain the district's capacity to expand into other crops such as hemp or bamboo through bulk handling facilities and skilled workforce in the area.
- Produce ecosystem services supporting recreation and tourism including quality water, fishery habitat, open space and scenic amenity
- Avoiding costs of flood regulation, flood damages and coastal erosion prevention
- Reduce cost of waste water treatment
- Reduced servicing costs for roads, water and waste
- Provide real estate gains to surrounding developments.
- Continuing haphazard sale of farm blocks will fragment farms, irreversibly undermining a rural future for the area, frustrate orderly land use planning including urban development and increase servicing costs for roads, water and waste.

There are significant costs involved in creating the rural future including:

- Cost of government intervention in markets for land and for any land acquisitions
- Cost of infrastructure and services provided.
- Cost of working capital for farmers

Environmental impacts

The maintenance of active sustainable farming on rural land will:

- Reduce the incidence of pest plant and animals
- Maintain drains and headwork's which will sustain water quality
- Protect open space and scenic amenity for future populations.
- Minimise flood problems
- Protect water quality through maintaining wetland filters and limiting catchment pollutant and hydrological impacts
- Allow creation of artificial wetlands

Expanded public recreation access would have environmental impacts on riparian neighbours and possible losses of land value and lifestyle. Some land use changes, such as the creation of artificial wetlands, or the expansion of public recreation access would have environmental impacts on riparian neighbours and possible losses of land value and lifestyle

Social and political impacts

At present time cane growers are trapped with few options especially in floodplain locations. Without concerted action, there will be on-going income and welfare problems for some cane farmers and increase in welfare differences between haves and have nots. There is urgency to progress the rural future to prevent further welfare problems and to reduce uncertainties for farmers.

A rural future can provide stability for many cane farming families and maintain a farming community.

For some farmers the emerging constraints of the rural future will reduce the value of real estate sales and certainly will damage expectations of some landowners.

A coordinated rural future can maintain a rural spirit and rural character in a rapidly urbanising landscape. On the other hand, gradual land fragmentation will create social conflicts in unplanned low density settlements and increased conflict between farmers and residents. Increase in nuisance complaints in agricultural areas and general community dissatisfaction at lost opportunities.

The rural future will provide increased recreational opportunities which have important social as well as economic benefits to the community.

6.4 A Rural Precinct Plan?

A Rural Precinct Plan would be a good organising framework for achieving a coordinated approach to the rural future of the cane landscape. It could include:

- Detailed land use layouts in the rural zones including conservation, production and urban footprint refinement.
- Streamlining the boundary re-alignment process
- Incorporating high resolution information on environmental values including biodiversity, scenic amenity, ecosystem services
- Application of new tools such as transferable development rights, cluster zoning, planning bonuses and easements.
- Potentials for providing new ecosystems services such as waste water treatment, passive and active recreation
- Strategic use of rural residential areas to maintain rural amenity and buffer rural production areas

Development control and performance standards: providing efficient development assessment processes at the local scale that gives positive guidance and encouragement to innovative rural production and "new forms of green".

- Providing guidance for new rural activities including agriculture, extractive industries, intensive livestock, intensive horticulture, and aquaculture.
- More detailed definitions of prohibited and allowable uses
- Use codes for rural activities currently exempt including forestry and farming.
- Local details on environmental values and impact assessment requirements
- Consideration of nuisance issues such as noise, smells, dust, visual pollution (requiring tree screening), water flows, land use buffers and rights-to-farm issues for key sectors.
- Locally specific subdivision rules.
- Development assessment processes improved for rural production activities that may be a change of use (eg turf farms). Large poly or glass houses may need to be considered as light industry as it does not provide the desired rural amenity.
- Rules to allow large-scale recreation parks on private land conditional on specific vegetation cover and the provision of environmental services.
- Rural industries maintain performance standards relevant to industry codes of practice, QA codes and local refinements

Land and water management

- Responsibilities for land management for fire and the harbouring of pest plants, animals and disease.
- Management of public land and reserves including site management, waste management, recreation services and amenities. (Government responsibility)
- Responsibilities for water management flooding, drainage, surface water control, levies and drains soil erosion.

Finance for implementation: equitable and adequate finance to support the maintenance of rural production and ecosystem services

- Economic incentives for rural conservation and maintenance of rural landscape activities including rates, charges, levies, stewardship payments and payments for environmental services.
- Finance to support enterprise development for "new forms of green", new farming enterprises
- Investment in transport and processing infrastructure to underpin new industries (eg BioCane Limited)
- Transitional funding support for some rural industries.

List of Acronyms

AASS	Actual Acid Sulfate Soils
APSIM	Agricultural Production Systems Simulator
ARI	Annual Return Interval for flooding
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soils (AASS)
BSES	Bureau of Sugar Experiment Stations
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DMR	Department of Main Roads, Queensland
NRM&W	(Queensland) Department of Natural Resources Mines and Water
DPI&F	(Queensland) Department of Primary Industries and Fisheries
EHMP	Ecological Health Monitoring Program of the Moreton Bay Waterways & Catchments Partnership (Healthy Waterways)
EMSS	Environmental Management Support System
MEA	Millennium Ecosystem Assessment (See Reid, 2005)
MSC	Maroochy Shire Council
NRMSEQ	Natural Resource Management SEQ now SEQ Catchments
OUM	Office of Urban Management of the Queensland Premier's Department
PASS	Potential Acid Sulfate Soils
RAG	Regional Advisory Group of SIRP
RE	Regional Ecosystem
SCCA	Sunshine Coast Canegrowers Association
SCEC	Sunshine Coast Environment Council
SDI	(Queensland) State Development and Innovation
SEQ	South East Queensland
SEQRP	SEQ Regional Plan 2005-2026 which came into force in July 2005
SIRP	Sugar Industry Reform Program of Agriculture Forestry and Fisheries Australia
UDIA	Urban Development Institute of Australia

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8 Appendix 1 Consultation Activities

The consultation and steering group activities for this project were focussed on the cane industry, caneland owners and local, state and Australian Government agencies.

The project built on the previous major community consultation activities associated with the Maroochy Shire Council's *Cane Futures Project* and *Maroochy 2025 Visioning* which involved substantial community wide consultation about future development of the cane landscapes.

Specific Consultation Activities are outlined below:

Sustainable Cane Catchments Project Reference Panel

Members throughout duration

Adrian Volders (NRM SEQ),
Amy Russell (NRM SEQ),
Tim Wrigley (Qld Canegrowers Assoc),
Tony Blatch (Sunshine Coast Canegrowers Assoc)
David Huth (Grower – Rocky Point),
Chris Crowley (Maroochy Shire Council),
Paul Cridland (NRM&E),
Craig Matheson (DPI&F)
Steve Macdonald (OUM)
Anthony Mathieson (OUM)
Brian Stockwell (DPI&F)
Ed Gainer (Sunshine Coast Area Consultative Committee & RAG South)
Chris Rinehart (DAFF),
Susie Chapman (NRMSEQ & RAG South)
Tanya Plant (UDIA),
Brian Stockwell (DPI&F)
Adi Jeuda, (NRM&E),
Evan Thomas (Gold Coast City Council)
Harvey Walsh (Gold Coast City Council)

Meetings

20 August 2004
24 September 2004
23 February 2005
18May 2005
12 October 2005

Sunshine Coast Reference Group

Members throughout duration

Ross Boyle
Howard Prentis
David Braddock (RAG south)
Bruce Duncan (SDI)
Keith Weier (SCEC)
Chris Crowley (MSC)
Tony Blatch (SCCA)
Peter Wilson (DNRMW)
Edward Gainer (SCACC)
Liz Garson (MSC)
Ken Campbell (Centrelink)
Susie Chapman (SEQ Catchments, RAG South)
Murray Oakes
Ron Clarkson
Scott Grimley (BioCane Limited)
Tony Kennedy
Troy Apps
Laurel Sommerfeld
Jay Chandler

Meeting:

29 November 2005
31January 2006
9 May 2006

Information Exchanges Yandina

Public meetings to which all cane growers and other local landholders were invited.

Meetings

27 May 2005
22 July 2005
13 October 2005

Many other meetings with stakeholders especially MSC, Canegrowers, DNRMW.

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