The State of the Shire- Year 2000 Benchmark

Chapter 3 - Land Management Technical Paper

April 2001

Chapter 3 Land Management

CHAPTER 3 – NATURAL RESOURCES

3.1. Introduction

This paper aims to assess the current condition of natural resources in the Johnstone Shire. In this report the natural resources are defined as the existing resources that are used for the benefits of a type of production as opposed to the previous chapter which discussed the resources in their natural state. Sustainable land management is a key to the availability of our natural resources for future generations.

Assessment was undertaken on the three main catchments in the Shire, these being the Johnstone River Catchment, Moresby River Catchment and Liverpool Creek Catchment. The condition of the catchments was assessed in relation to presence and extent of wetlands, condition and extent of riparian vegetation, and the health of aquatic flora.

Many threats and disturbances to the maintenance of these systems were identified including, surrounding land use, introduction of exotic species, and unsustainable use of these resources, with these having an economically and environmentally detrimental impact on the resources within the catchments. As part of this assessment, recommendations are made on how to improve or maintain the condition of these resources.

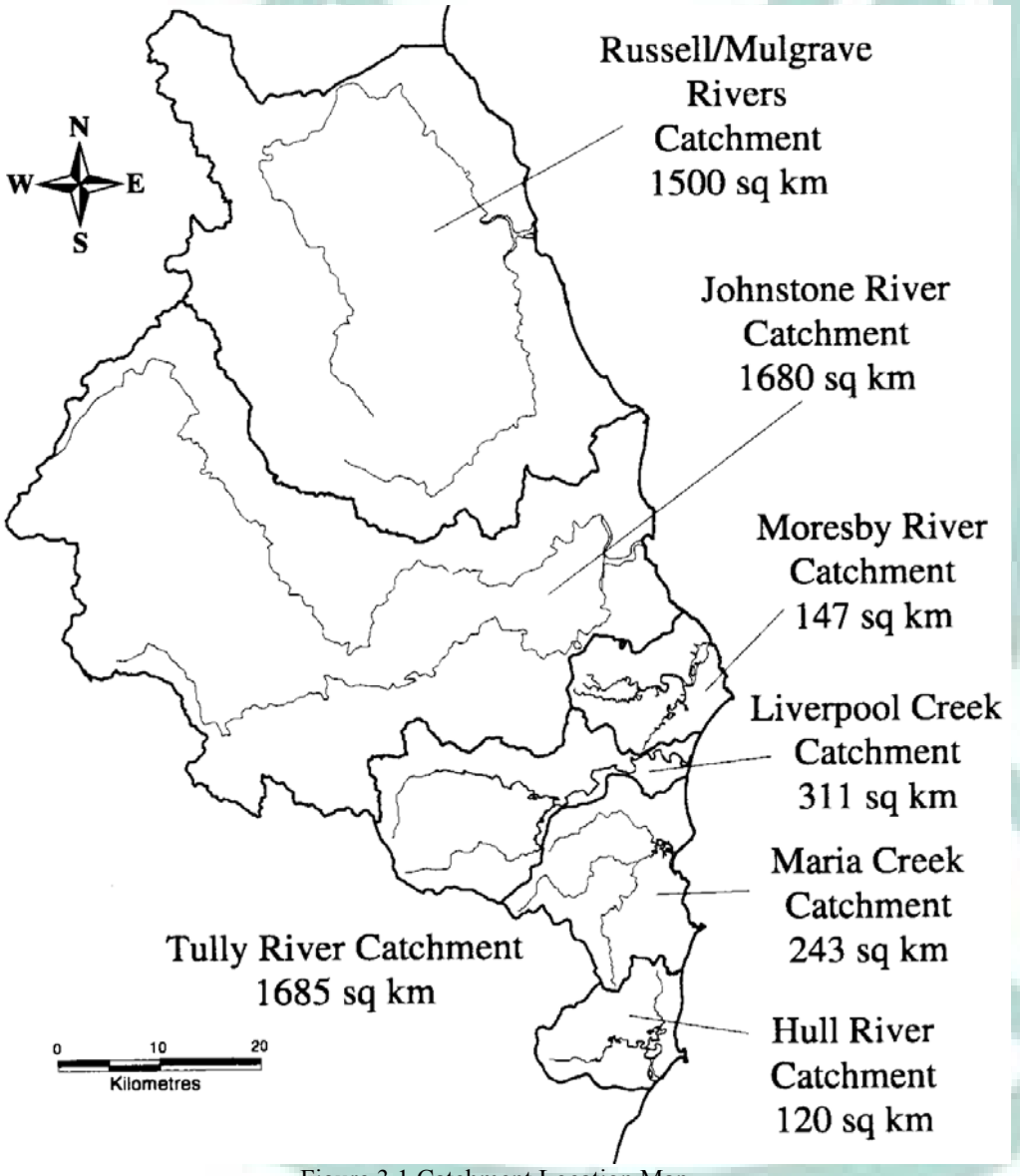

Figure 3.1 Catchment Location Map

3.2. Catchment Management

Integrated Catchment Management is an approach to managing natural resources which seeks to balance the range of uses of land, water and other natural resource in river catchments, to ensure the future preservation of the environment while maintaining sustainable production. In Queensland a strategy to achieve Integrated Catchment management was launched in 1991.

In river catchments, landholders, local authorities, government departments, conservation groups, Landcare Committees, and individuals use and manage land, water and other natural resources. Sometimes their actions are not in the best long-term interests of the catchment nor are they coordinated to achieve the best use of available resources. Integrated Catchment Management provides a mechanism, which can coordinate and integrate the activities of the catchment stakeholders. The sustainable and balanced use of our resources will result.

3.2.1. Johnstone River Catchment

Overview of the Catchment

'The Johnstone River Catchment flows into the Coral Sea near the mouth of the sugar town of Innisfail. The river branches about 5km from the mouth into the North and South Johnstone Rivers, both of which have their sources on the Atherton Tablelands. The highest part of the catchment is on the Atherton Tablelands and is 1385 m above sea level. The Atherton Tablelands and the coastal plain are separated by steep, heavily forested uplands where the rivers flow through deep gorges and are characterised by the presence of rapids and waterfalls'. The Johnstone catchment, which has an area of approximately 1680 km^2, and an average annual runoff of 2.7 million Megalitres. The report 'Stream Habitat and Fisheries Resources of the Johnstone River Catchment' (Russell & Hales, 1993) provides an account of the state of the catchment.

Wetlands in the Johnstone River Catchment

Over the period 1951-1992 significant portions of wetlands have been lost, mainly to agriculture. In this study the coastal wetlands were categorised into five major groups; mangroves, Melaleuca forests, mixed plant communities dominated by Melaleuca, palm/pandanus forests and freshwater swamp and reeds. Table 3.1 shows the total areas of these wetland communities in 1951 and 1992 and their net changes over that time.

Wetland	1951 (ha)	1992 (ha)	Net Change (ha)
Mangroves	176	202	26
Melaleuca forests	1277	282	-995
Mixed *Melaleuca* communities	462	258	-204
Palm/Pandanus	439	160	-279
Freshwater Swamps/Reeds	499	225	-274
Total Wetlands	2853	1127	-1726

Table 3.1 Change in Wetlands in the Johnstone River Catchment

The total area of wetlands decreased by about 60% over the 41-year period. All of the net losses were as a result of the reclamation of freshwater (non-mangrove) wetlands. The most significant losses were of *Melaleuca* forests (78%), particularly to the south of the estuary in the Ninds Creek Catchment. Mixed *Melaleuca* communities also declined by about 44%. The other major freshwater wetland categories, palm/pandanus and freshwater swamp/reeds, were reduced by 64% and 55% respectively. Freshwater wetlands to the north and west of the river confluence have almost completely disappeared. There was a slight increase in the total area of mangroves due mainly to colonisation on the southern foreshore and at the mouth on Ninds Creek.

One of the largest existing freshwater swamps was on the headwaters of Ninds Creek, and, as mentioned in an earlier section, drainage and reclamation works are threatening this and other wetlands.

Waterway Health in the Johnstone River Catchment

The riparian zone is the interface between terrestrial and aquatic ecosystems and it plays an important role in contributing to the physical and biological structure of a healthy stream. The study of 'Stream Habitat and Fisheries Resources of the Johnstone River Catchment' identified the following pressures on instream habitat:

- Channel morphology and habitat – ability to influence channel morphology and deposition of habitat material
- Modulating solar radiation – control of the productivity and temperature of the stream
- Deposition of organic and inorganic matter – for nutritional and habitat purposes
- Nutrient filtering – ability to intercept nutrients from runoff before polluting the stream
- Influence on aquatic vertebrates – contribution to habitat and food resources
- Influence on aquatic invertebrates – control of energy input into streams
- Other values of the riparian zone (wildlife corridors and dispersal of plants)
- Sedimentation and turbidity – control of water quality (covered in greater detail in the Water Management chapter)
- Agricultural chemicals – control of water quality and other effects (covered in greater detail in the water management chapter)

Adjacent land use also places pressure on the riparian zone. Land use in the Johnstone Catchment is summarised in table 3.2

Land Use	Area (hectares)
Forest	88,850
Pastures and Grazing	46,350
Canelands	19,700
Horticulture	3,350
Wetlands and Mangroves	1,400
Tea and Other Crops	1,250
Rural Residential Areas	1,250
Urban Areas	1,200

Table 3.2 Land Use in the Johnstone River Catchment in 1993

Disturbances

Major disturbances to the stream habitat were identified at 129 sites throughout the catchment. Seventy-three (57%) of these sites had associated with them more than one major disturbance. Table 3.3 shows the major disturbances in each zone. At a catchment level, siltation, damage through cattle access and bank erosion were the most frequently documented major disturbances.

Disturbance	Tablelands	Range	Coastal Uplands	Coastal Lowlands	Estuary	Total
Siltation	50		45	6		101
Cattle Access	50		13	1		64
Bank Erosion	10		8	3		21
Channelization	4		1	1	1	7
Ford	2		2			4
Pump	1		3			4
Waste Outlets			2		2	4
Dam	2		2			4
Weeds	1		2	1		4
Bridges	1					1
Feral Pigs		1				1
Flood Gates					1	1
Dredging					1	1

n.b. Tablelands zone is not within the Johnstone Shire

Table 3.3 Disturbances to Johnstone River Catchment Zones

Riparian Zone Assessment

It was found that 116 (60%) of the sites assessed were in poor or very poor condition, 39 (20%) were in fair condition and 38 (20%) were in good, very good or excellent condition. Within each catchment zone the degree of disturbance of the riparian vegetation varied and was related to adjacent land use.

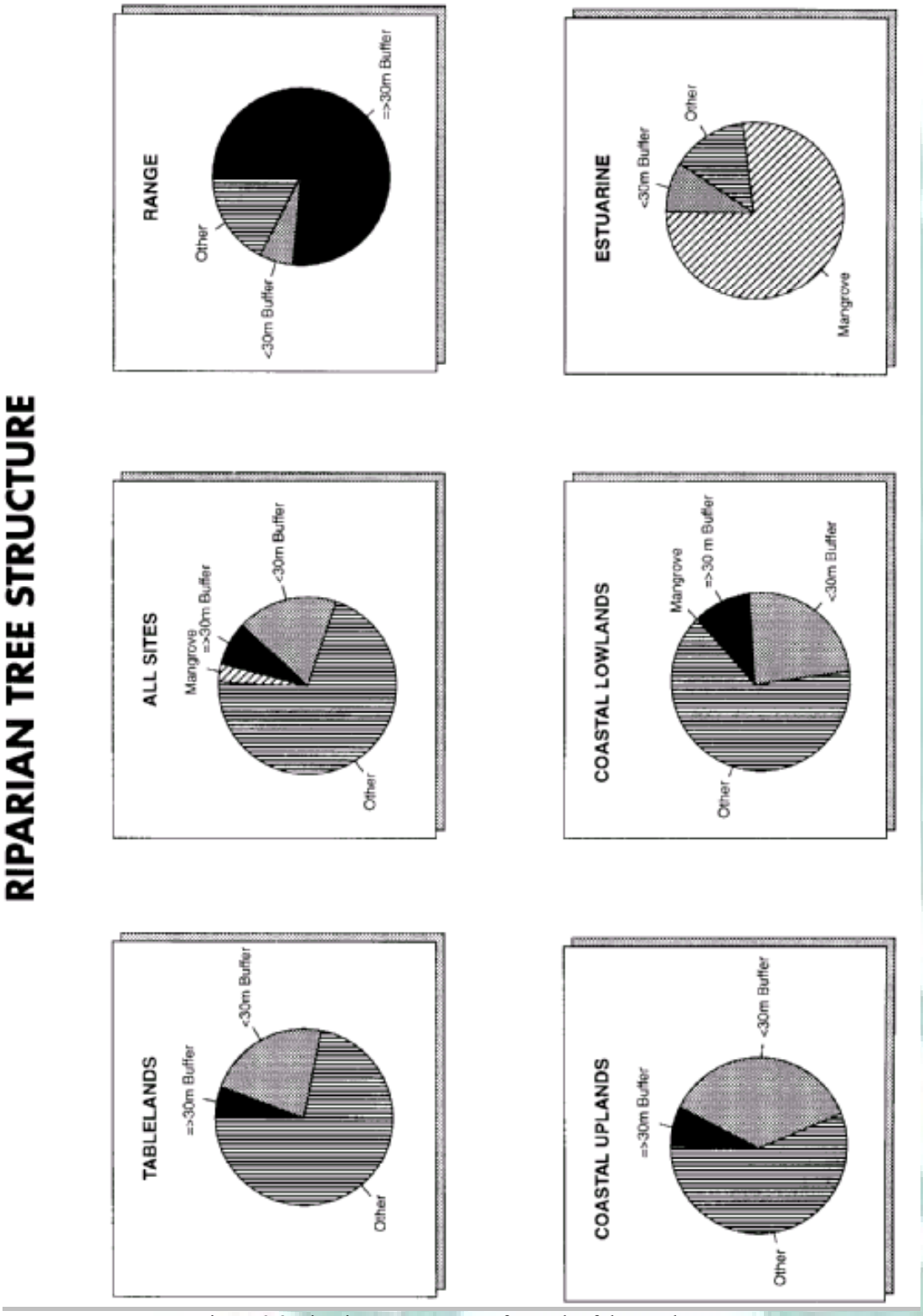

Figure 3.2 Riparian tree structure for each of the catchment zones

Riparian Tree Structure

Figure 3.2 shows the percentage of stream bank which was made up of trees, including mangroves at each site. Only 37 (19%) of sites had tree cover of between 80% and 100% of their lengths and most of these sites were located within the range zone. Whilst there is disagreement on the ideal width for a riparian zone, this study measured the treed riparian zone as being less than 30m wide or 30m wide or more.

Aquatic Vegetation

Most sites (88%) had between 0 and 3 species present at the time of survey. The most common species found was para grass (*Bracharia mutica*); it was recorded at over 43% of all sites. In the Johnstone catchment, about 9% of sites where para grass was found had a 90% to 100% cover and just under 50% had at least a 10% cover. Para grass was only found at few estuarine and ranges sites. The intolerance of the species to salt water and the relatively good riparian canopy cover at the range sites probably restricted its occurrence in these catchment zones. While naturally occurring filamentous benthic algae were recorded at some sites, there was no evidence of any blooms of toxic blue-green algae. Sea grass meadows of *Zostera capricornii* were found in the lower estuary.

The importance of the riparian zone in the maintenance of stream habitat cannot be overstated. At many sites where the predominant adjacent land use was agriculture, the riparian zone was significantly degraded. Vegetated stream side buffers were found to play an important role in protecting stream bank vegetation.

Riparian restoration through tree planting is required in the catchment to provide canopy, shade out para grass and control erosion. For this to be successful, a major community effort is required.

Control of domestic and feral animals is required. These animals can trample and cut young seedlings and destabilise stream banks and beds. Fencing off watering holes and other control measures will help ameliorate these problems.

Adequate buffer zones must be maintained around watercourses. A decision needs to be made on a realistic but flexible target buffer width for streams to be reviewed as more precise technical advice becomes available.

Discharges from point sources have the potential to negatively impact on stream habitat. Responsible agencies should be actively encouraged to ensure that any discharges are properly managed and to ensure all possible steps to prevent accidental, harmful spills.

Monitoring of introduced and exotic fish should be conducted and further introductions discouraged.

3.2.2. *Moresby River Catchment*

Overview of the Catchment

The Moresby River rises in the Basilisk Range west of the township of Moresby and flows into the Coral Sea through a gap in the Moresby Range near the Port of Mourilyan. The catchment size is 147 km^2 and its highest point is only 252 metres above sea level. The Moresby River is about 20km long. Considering the small catchment size, it would be expected that the mean annual discharge is relatively small compared to other wet tropics catchments but no actual data are available. Runoff from the catchment is estimated to be 1,380 mm/year.

Urban centres within the catchment include the small townships of Moresby and the Port of Mourilyan bordered by a buffer zone of mangrove wetlands and rainforest. Other land uses within the catchment include Marine Park reserves, Wet Tropics World Heritage Area, a defence area, State Forests and other Reserves, National Parks, and Fish Habitat Areas. The

report 'Fish Resources and Stream Habitat of the Moresby River Catchment' (Russell, Hales and Helmke 1996) provides an account of the natural resources of the catchment.

Wetlands in the Moresby River Catchment

Loss of non-tidal wetlands can be attributed to agricultural encroachment, although some of these wetland losses are due to the expansion of tidal wetlands. There has been an increase in tidal wetlands largely due to saltwater intrusion into areas that were previously described as non-tidal. Most (73%) of the remaining wetlands within the catchment are now protected under World Heritage listing and State Marine Parks.

The report 'Fish Resources and Stream Habitat of the Moresby River Catchment' found that a relatively large portion of the Moresby Catchment (27.5%) consists of wetlands. This is primarily because of its small size and location on the coastal belt. By comparison, in the nearby Johnstone Catchment, which is over ten times the size, less than 1% of the total area is wetlands.

Wetlands in the catchment are classified as either tidal wetlands (eg mangroves and salt pans) or non-tidal wetlands (eg Melaleuca communities, sedge/pandanus swamps and rainforest). Tidal and non-tidal wetlands account for 19.5% and 8% of the catchment area respectively. The areas of these wetlands and net changes occurring between 1951 and 1992 are given in table 3.4.

	Non-Tidal Area (ha)	**%**	**Tidal Area (ha)**	**%**	**Total Area (ha)**	%
1951	3,363	60	2,233	40	5,596	
1992	1,175	29	2,873	71	4,048	
Net Change	-2,188	-65	+640	+29	-1,548	-27

Table 3.4 Change in Wetlands in the Moresby River Catchment

The report on 'Fish Resources and Stream Habitat of the Moresby River Catchment' suggested:

- Investigate the extension of the Marine Park and/or establishment of a Fisheries Habitat Area to cover non-tidal wetlands and the remainder of the tidal wetlands not in the Marine Park or the Wet Tropics World Heritage Estate. The tidal wetlands would include areas in the vicinity of Walters Creek, major seagrass beds in the main estuary and tidal parts of the Moresby River upstream of the existing Marine Park. Non-tidal wetlands, including areas of *Melaleuca* forest, adjacent to but excluded from existing Marine Park, should also be considered for inclusion in a new fish Habitat Area.
- In addition, tidal wetland areas and rainforest vested in PCQ and designated as Environmental Buffer Zone, would be investigated for possible inclusion in the Marine Park, Wet Tropics World Heritage Area and/or a future Fish Habitat Area.
- Historical and existing land use practices should be reviewed with respect to their impacts on drainage and tidal patterns. Planning activities such as any possible future deepening of the harbour entrance and further expansion of agriculture should fully consider impacts on wetlands communities. While the cause of current increased tidal heights is unclear, they are impacting on wetlands and, in particular, non-tidal wetlands such as *Melaleuca* swamps. Historically, most of the wetland loss from along the wet tropic coast has been non-tidal wetlands, and what remains are worthy of protection.

Waterway Health in the Moresby River Catchment

Adjacent land use contributes to pressure on the riparian zone, and indirectly on stream habitat. The land uses of the Moresby River Catchment are detailed in Table 3.5.

Category	Area (ha)	Area (%)
Undeveloped	7,826	55.3
Sugar	5,414	38.2
Grazing	471	3.3
Rural residential	155	1.1
Cleared/Degraded	127	0.9
Tropical Fruit Farms	113	0.8
Aquaculture	37	0.3
Industrial	11	0.1
Urban	10	0.1
Total	14,164* excluding the river and harbour	

Table 3.5 Land Use in the Moresby River Catchment (1992)

Disturbances

Disturbances in the catchment place pressure on the stream habitat and fisheries resources. These disturbances include:

- WasteWater Discharge – In 1996, 6 businesses have licences to discharge waste water to the Moresby River or tributary creeks.
- Water Extraction – As of February 1996, 20 licences were issued for extraction of water.
- Sand and Gravel Extraction – no current licences to extract sand and gravel
- Dredging – five incidences of harbour deepening have occurred since 1882. Minor maintenance dredging adjacent to the main wharf and in the swing basin occurs every 5 years.
- Port Development – approximately 6.5 hectares, including intertidal and mangrove areas have been reclaimed. An addition hectare was to be reclaimed in 1996/1997.
- Port Operations – actual and potential disturbances caused by shipping include discharge of ships' ballast water and potential accidents resulting in oil spills.

Riparian Disturbance

The majority (55%) of the sites sampled were assessed as either low disturbance or undisturbed and a further 37% classified as either high or extreme disturbance. This contrasts with the nearby Johnstone River Catchment in which 60% of sites were in poor or very poor condition.

Agricultural activities, which are concentrated in the non-tidal zone, have heavily impacted on the riparian vegetation. In the non-tidal zone, none of the sites were assessed as undisturbed, contrasting with the tidal zone where the majority (61%) of the sites were undisturbed. The large areas of wetlands in the tidal zone, much of which is protected as Marine Park, is the major reason for such a large percentage of undisturbed sites. Conversely, 50% of the sites in the non-tidal zone were extremely disturbed as opposed to only 11% of sites in the tidal zone. Figure 3.3 illustrates the number of sites within each riparian disturbance category for non-tidal and tidal zones.

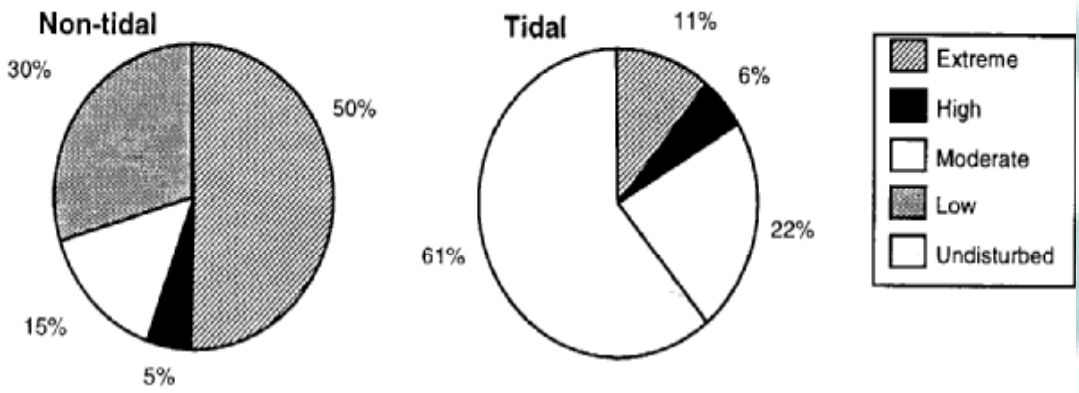

Figure 3.3 Number of sites within each riparian disturbance category for non-tidal and tidal zones

Riparian Vegetation Composition

Trees/shrubs (including mangroves) were the major components of the riparian zone. The impacts of agriculture on the riparian zone are also reflected in the riparian composition. In the tidal area, there is a high ratio of trees to grass suggesting mostly undisturbed conditions. By contrast, in the non-tidal zone, there is a higher proportion of grasses than trees. It has been suggested that the proliferation of grasses is primarily the result of diminished canopy cover, and therefore reduced shading, caused by the removal of riparian forest.

Riparian Width

At all but two sites, there was no difference between the riparian width of the left and right banks. The majority of sites (61%) had a riparian width of 10m or less while nearly 32% had a riparian width of more than 30m. As discussed previously, an unusually high proportion of the catchment is tidal wetlands. All but two of the sites where the riparian widths were >10m were in the tidal zone, while for most of the non-tidal sites the riparian corridor width was restricted to 10m or less.

In agricultural areas, stream size also appears to have a bearing on the width of the riparian buffer. Higher order streams (ie the largest rivers) tended to have wider buffers than the lower order streams. Most (72%) of first order stream sites had riparian buffers between 0 and 5 metres wide which contrasts with fifth order streams where 67% of streams had riparian buffers >30m.

Of the 167km of streams assessed, 60km (36%) were categorised as having a wide riparian tree coverage while 78km (47%) had a sparse tree coverage. In the non-tidal zone, only 41% by length of streams were classified as wide. Indeed, most of these streams were located in rugged sections of the Basilisk and Moresby Ranges with only about 12km (9% of total) actually on the flood plain. This suggests that adjacent agricultural activities have had substantial impacts on developed parts of the flood plain. This is probably also the case in the tidal zone, where most of the streams (63%) by length, were classified as sparse. Figure 3.4 illustrates the width and riparian trees in the tidal and non-tidal zones.

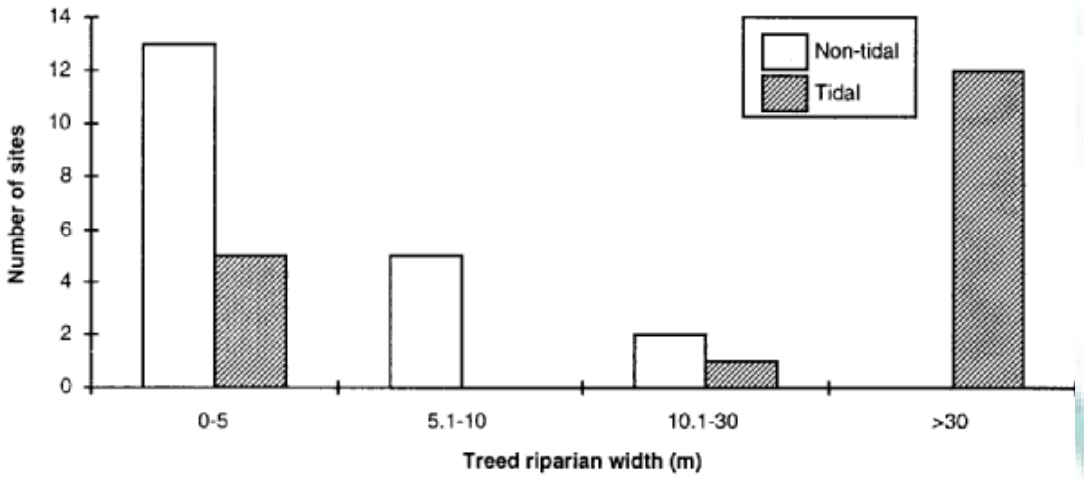

Figure 3.4 Width of riparian trees in tidal and non-tidal zones

Riparian Continuity

The riparian corridor along stream banks may not necessarily be continuous and can contain breaks of various lengths. Continuity is, however, correlated to the width of the riparian corridor, with a wide corridor more likely to have a thick, unbroken line of vegetation.

At 20 (53%) of sites, the treed riparian corridor was continuous along at least one bank. The remaining sites showed varying degrees of discontinuity; at 15 (39%) sites, on at least one bank, the length of cleared areas exceeds those of the remaining forested vegetation.

In the non-tidal zone, most sites had significant discontinuity in the treed riparian corridor and, as discussed earlier, this can probably be attributed to adjacent agricultural activities. Conversely, in the tidal zone, most sites had continuously treed riparian corridors and were less impacted by adjacent land uses.

Invasive Weeds and Grasses

Para Grass, an exotic species from Africa and Central and South America and northern cane grass (*Mnesithea rottboelliodies*) were found to have colonised watercourses. Para grass was recorded at 14 (37%) of sites while northern cane grass was found at only 2 (5%) locations. Dense stands of Panicum grass (*Panicum spp*.) on the banks also caused problems such as hampering the establishment of native tree species.

There are a number of factors likely to influence grass coverage, including degree of shading, salinity and width of stream. For example, species like para grass are relatively intolerant of high salinities and their occurrence at 18 sites in the tidal zone was limited. Stream banks, which are heavily shaded, are also likely to have limited occurrence of grasses.

At non-tidal sites, the median length of bank impacted by terrestrial plants was 42%, although at some sites they were present continuously. The median transverse coverage by weeds and grasses was 17%, with coverage of up to 50% at some non-tidal sites. The intolerance of species like para grass to salt water assisted in severely reducing their occurrence in tidal waters.

The percentage of coverage of invasive grasses is more likely to be higher in narrower streams. This is primarily because of the inability of the more common species to successfully colonise deep water.

Aquatic Plants

Aquatic plants were recorded at 16 (89%) of the non-tidal sites sampled in the Moresby Catchment. Common plant genera included Blyxa (found at all 16 sites), Potamogeton, Nymphoides, Hydrilla and Salvinia as well as a number of emergent plants of the family Cyperaceae. Aquatic plants including Blyxa, Hydrilla and Potamogeton were also sampled from threes sites in the upper tidal zone. Seagrasses, mainly beds of *Zostera capricornii* were found at two sites in the lower estuary. Other less abundant species included *Halophila ovalis, H. decipiens, Halodule uniervis* and *Enhalis acoroides*. Seagrasses provide important habitat for several species of commercially important prawns and their distribution in Mourilyan Harbour is the subject of an ongoing independent investigation.

Riparian Restoration

The development of a coordinated catchment revegetation strategy should remain a priority with the Johnstone River Catchment Management Association (JRCMA) and information presented in this document should be considered when addressing issues including the restoration of riparian forests. In the development of the revegetation strategy, relevant conservation agencies and community groups should be consulted regarding the desirability of linking, through riparian restoration, remnant wetland and lowland forest communities to more substantial areas of natural vegetation in the Basilisk and Moresby Ranges. The revegetation strategy may also consider convening workshops of local community groups and landholders to strategically plan riparian regeneration including agreement on appropriate riparian widths. Community involvement and acceptance will increase its chances of success and allow for evolution of strategies.

Flood plain management

Encourage, where appropriate, the use of the Department of Primary Industries flood plain management guidelines. These guidelines recommend the inclusion of retention and detention basins in existing and future water management proposals as they have the potential to enhance fish and wildlife habitat and may assist in trapping sediments and polishing nutrients. Design of drainage channels needs to take into account fish movement and habitat requirements and include provision for cleaning and clearing.

3.2.3. Liverpool Creek Catchment

Overview of the Catchment

Liverpool Creek is contained in the third largest catchment in the Johnstone Shire, constituting 19% of the Shire and covering an area of 311km^2. Urban centres within the catchment include Japoonvale, Silkwood and the coastal township of Cowley Beach.

Liverpool Creek's headwaters are located in the Walter Hill Ranges to the west, draining a narrow coastal plain before discharging into the Coral Sea at Cowley Beach. Liverpool Creek itself is approximately 50km long, however the combined length of the tributaries is significantly greater. Major tributaries in the catchment include Kittabah, Meuribah, Jingu, Bombeeta, South Liverpool, Boundary and Cowley Creeks.

'Liverpool Creek can receive in excess of 5500mm annual rainfall. Water quantity is not usually a problem, however, during drier years when irrigation is required more frequently, extra pressure is placed on the stream.

There is a River Management Action Plan (JSRIT & JRCMA, 2000) for the Liverpool Creek Catchment. Whilst Liverpool Creek is the only catchment to have a river management plan prepared, plans are expected to be completed for the North and South Johnstone Rivers in the near future dependent on availability of resources.

Wetlands of the Catchment

'Coastal tidal and freshwater wetlands comprise 3.9km^2 of the catchment with 34% of these wetlands being tidal, and the remaining areas consisting of Melaleuca communities and freshwater swamps. The topology of the catchment has resulted in the formation of only a small estuary with limited associated tidal and freshwater wetlands'.

Land Use

'Sugar cane farming is the predominant agricultural activity in the catchment and accounts for around 19% of the total area'.

Fish Resources

'The estuaries support recreational and commercial fisheries for a wide range of fish species'.

The following provides a brief summary of typical problems identified in the Liverpool Creek system:

- Weed infested point bars and overflow channels are promoting further sedimentation, decreasing channel cross-sectional area, and subsequently increasing the pressure on the opposite bank and accelerating the rate of migration of the stream across the floodplain.
- High levels of erosion, particularly in areas with minimal or no riparian vegetation, are threatening agricultural land, infrastructure and habitat, and creating adverse downstream impacts.
- The release of ground water (seepage) is promoting mass bank failure in areas where minimal or inappropriate vegetation is present
- Invasion of weeds, particularly in riparian areas, is threatening both terrestrial and aquatic habitats.

- Infrastructure is under threat from the direct effects of erosion.
- Infrastructure is exacerbating erosion problems and creating adverse downstream impacts.
- A high percentage of existing rehabilitation works have been unsuccessful due mainly to the use of inappropriate techniques, resulting in ineffective use of funds, and loss of credibility amongst landholders.
- The position of select large woody debris (snags) is creating problems and directing erosion forces directly onto banks, and threatening infrastructure.

The following provides a brief description of the proposed rehabilitation works and management actions identified for the Liverpool Creek system to address some of the above problems;

- **Reinstate natural overflow channels** – establish sparse vegetation on weed (paragrass) infested areas adjacent to the main watercourse by carrying out selective weed control to assist natural regeneration, followed by supplementary seeding or enrichment planting where necessary. Extraction of material to reinstate overflow channel may be necessary.
- **Reduce pressure on outside bends** – establish sparse vegetation on weed (paragrass) infested point bars by carrying out selective weed control to assist natural regeneration, followed by supplementary seeding or enrichment planting where necessary. Future extraction of material may be required to prevent further build up of point bars.
- **Stabilise streambanks using 'soft' engineering approach** – stabilise toe of eroding bank by establishing dense vegetation on the toe, or by constructing a rock toe where necessary. Batter top of eroded bank where necessary and establish dense riparian vegetation using tree planting methods on top of bank.
- **Stabilise streambanks using 'hard' engineering approach** – stabilise banks using a combination of bank battering and rock/toe revetment. Establish dense riparian vegetation using tree-planting methods on top of bank and direct seeding methods amongst rock.
- **Manage aggregate extraction** – effectively manage aggregate extraction to remove non-natural aggregates where excessive sediments are having an adverse effect on the stream and adjacent riparian areas.
- **Upgrade infrastructure** – carry out upgrade works on existing infrastructure to minimise downstream impacts and future damage of adjacent and downstream areas.

3.3. Land Use

3.3.1. Agricultural Lands[1]

The agricultural lands of the Shire have been described as part of the project "Soils and Agricultural Suitability of the wet tropical coast of North Queensland". The soils reports are complete but the land suitability reports have not been published. Agricultural Land Suitability information is available on a series of three maps for the area south of the Johnstone River. This survey was conducted by Queensland Department of Primary Industries and CSIRO and the maps printed in 1992.

The attached map shows the land in the Shire categorised as follows: -

- Arable land 15% slope and less.
- Limited arable land dominantly between 15-20% slope mainly suitable for tree crops and pasture.
- Limited arable land subject to flooding.
- Pastoral land suitable for improved pasture mainly 20-30% slope.
- Non agricultural land
- unclassified (north of Johnstone River)

[1] Evans, pers. comm, 2000.

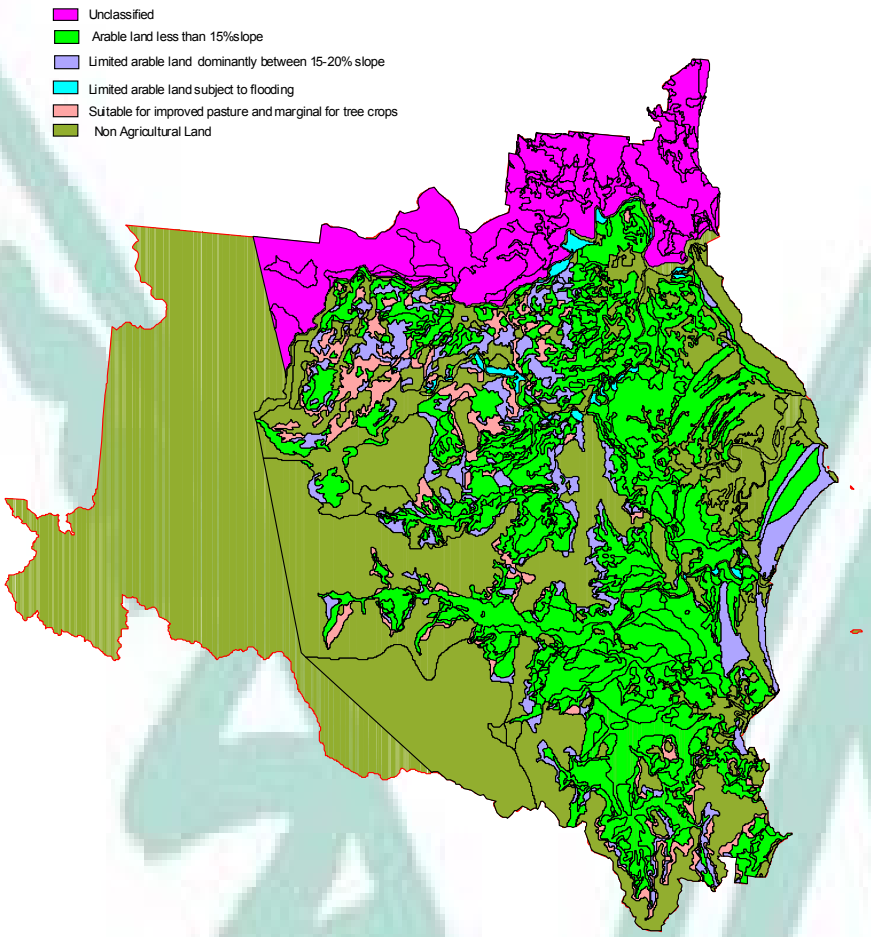

Figure 3.5 Agricultural Lands in the Johnstone Shire Area

The land resources were assessed to determine their suitability for growing 20 crops including sugar cane, bananas, pawpaw, some tree crops, *Pinus caribbaea* and improved pastures.

Each of the unique map areas identified during the study was individually assessed for their suitability for each crop using a land suitability classification scheme developed for Queensland by DPI/DNR as set out in Key to the soils and land suitability of the wet tropical coast Cardwell – Cape Tribulation.

The limitations examined were climate, water availability, soil nutrient supply, salinity, wetness, flooding, landscape complexity, soil physical condition, topography, rockiness and water erosion.

An extensive study of Acid Sulfate Soils has, to date, only been conducted in the Moresby Catchment.

3.3.1.1. Cane Production[2]

Background

Sugar cane production is a major activity in the Johnstone Shire, with 549 cane farmers cultivating 26,200 hectares of cane. This activity is a major contributor to the economy, with a total of 1,641,437 tonnes of cane crushed in the Innisfail District in the year 2000, of which 1,451,356 were harvested green, representing 88% of total tonnage.

In 1995 the Queensland cane growing industry commissioned an extensive environmental audit. An industry-wide environment management strategy was subsequently developed to

[2] Hopkins, Garratt, Telford, pers. comm, 2001.

address the 156 audit recommendations. This strategy, endorsed in September 1997, has provided a policy framework for initiatives aimed at improving agricultural practices and achieving a balance between cane growing and the protection of natural systems.

There are many research and development activities that have been undertaken to provide the information and techniques to assist growers in improving the productivity, profitability and sustainability of their farm. Institutions providing the sugar industry with RD&E into managing impacts on the natural environment are:

- Cooperative Research Centre for Sustainable Sugar Production
- CANEGROWERS organisation
- Bureau of Sugar Experiment Stations
- CSIRO
- State Government Agencies such as Departs of Primary Industries, Department of Natural Resources and Great Barrier Reef Marine Park Authority
- Various Universities
- Cane Pest and Productivity Boards

Issues

The following major environmental issues affect cane growers in the Innisfail area:

- Water quality
- Soil quality
- Noxious weeds
- Streambank and Riparian zones & Remnant vegetation

Additional environmental and natural resource issues in the Johnstone Shire include:

- Acid Sulfate Soils
- Chemical and Dangerous Goods Use and Storage
- Pest Control
- Long term productivity/ farm sustainability

The current state of these issue, including existing and potential pressures and responses for the Johnstone Shire are outlined in the following section.

Pressure, State & Response of Identified Issues for the Cane Growing Industry

Water Quality

Applications of fertilisers to cane fields and field and stream bank erosion place pressure on water quality.

The first six monthly surface quality report for cane catchments (DNR 2000) provides information on 10 parameters for 2 sites on the Johnstone River. This report indicates that levels of conductivity, total dissolved solids and pH were consistently within or below all recommended ANZECC guidelines both currently and historically. Turbidity and phosphorus levels are variable and have exceeded ANZECC guidelines during high flow conditions. There is no data in this report on nitrate and nitrogen levels at these sites.

In response:

- Approximately 88% of cane crops in the Innisfail area are harvested green and trash blanketed. As a consequence the sediment contribution from the sugar industry has decreased markedly from approximately 400 to 5 tonnes per hectare per annum.
- Along with trash blanketing, minimum or zero tillage of ratoon crops is also practiced. This farming system has been practiced for over 20 years and soil erosion has been reduced substantially. Growers in the Innisfail area are adopting minimum tillage planting operations.
- Attention to the type, amount, timing and placement of fertiliser is now a priority for cane farmers. Fertilising Best Management Practice relies on representative soil samples to determine the needs of the crop and working within BSES

recommendations. Growers apply fertiliser at a time to minimise losses from the farm by storm rains.

- Adoption of Green Cane Trash Blanketing would be expected to also reduce nutrient loss. A CSIRO study (Johnston, Walker and Wood 1998) indicated that under the burnt cane system nutrient output was typically in the order of 3.8 kg/ha while under a green cane system no cell in the area produced greater than 0.8 kg/ha of soluble nitrogen.

Soil Quality

Mechanical farming practices that affect soil structure, soil biota and field erosion have implications for soil quality. Presently, the majority of cane growers in the Innisfail District practice reduced tillage, which has resulted in improved soil quality.

In response:

- BSES facilitation of an SRDC funded grower workshop on "Maintaining Soil Fertility" is to be run in 2001. The aim of the course is to encourage responsible nutrient management within the sugar industry. The package will enable growers to develop crop management strategies by understanding and addressing nutrient loss, soil properties and crop nutrition while at the same time reduce offsite impacts to the environment.
- The practice of trash blanketing ratoon crops returns most of the leaf material and nutrients back to the soil at harvest, resulting in higher organic matter in the soil and hence, greater microbial activity improving the quality of soils in the area. Minimum tillage planting operations are being adopted by growers in the Innisfail area, which will help to improve the quality of soils.

Noxious Weeds

Noxious weeds have the potential to place pressure on agricultural lands. Movement of machinery from farm to farm can also increase the distribution of some noxious weeds.

The following noxious weeds have limited impact, due to Johnstone Shire Council's Pest Management Plan and the activities of advisory staff on agricultural land in the Johnstone Shire. Noxious weeds present include Hymenachne, Giant Sensitive Plant, Milkweed, Pond Apple, Siam Weed.

In response:

- Productivity Boards monitor and report the presence of noxious weeds. Where noxious weeds are present on individual farms, growers implement the advised control measures to assist in eradicating the problem.
- Farm contractors follow best management practices on machinery cleaning and movement to reduce the spread of noxious weeds.

Pest Control

Pests damage/effect to farm productivity and profitability. Pests have a significant impact on the Australian sugar industry costing more the $20 million each year in lost production and control programs. Pesticides are widely used as the main means of cheap and effective control of target species.

Most of the significant pests attack the roots of the sugar cane plant (canegrubs are by far the most important). Rodents are by far the most important vertebrate pests of cane in far north Queensland. Approximately 950 hectares in the Johnstone Shire were effected by Greyback canegrub and 15,000 tonnes of cane were lost to rats in 1999.

In response:

- The sugar industry is developing integrated pest management (IPM) systems for major pests. Implicit in the development of IPM is the recognition of an economic threshold

for each pest, and the regular monitoring of cane blocks to determine when pest populations exceed that level.

- Combining the pesticide with a range of other management strategies is effective in keeping pest populations below levels likely to cause economic damage. This Integrated Pest management (IPM) depends on a good understanding of the ecology of the pest and then using these concepts to develop strategies including the use of the pesticides, appropriate biological controls and cultural control methods.
- The sugar industry is coming to grips with IPM in terms of rats and canegrubs, both of which are native species that have benefited from the intensive agriculture of the sugar industry. Permits to control rats have to be granted to districts by the Environmental Protection Agency. These come with conditions to ensure the control is humane and unlikely to threaten the species.

Streambank, Riparian Zones and Remnant Vegetation

Desire for reduced streambank erosion and reduced harbourage for rats can have detrimental consequences for streambanks, riparian zones and remnant vegetation. Many riparian zones in the Johnstone Shire are no longer continuous but still do provide some corridor function.

In response:

- Best management practices now advocate leaving a wider headland between the cane and the stream bank to allow for protection and revegetation of vegetation. Revegetation of degraded areas is occurring in Innisfail by individuals and through programs such as the Community Rainforest Reforestation Program, the Wet Tropics Tree Planting Scheme and initiatives under the Johnstone River Catchment Revegetation Strategy (1996) and the Johnstone Shire Council. Burning occurs far less often and has seen the return of tree seedlings where previously there was only grass. Revegetation is promoted as a part of an integrated rat management strategy.

Acid Sulphate Soils

Cane production can create potential off and on-site effects if Potential Acid Sulfate Soils (PASS) are oxidised. Indicative mapping of Potential Acid Sulphate Soils in the Johnstone Shire has been completed by DNR. Potential Acid Sulphate Soil is harmless when it remains below the water table. It is when these soils are drained or disturbed that they are oxidised producing sulphuric acid which may leach into waterways.

In response:

- Testing is carried out prior to drainage works being undertaken in any potential acid sulphate soil areas.

Under the Fish Habitat Code of Practice, cane growers needing to maintain drainage systems within marine ecosystems can be accredited to operate under a Tidal Drainage Maintenance Permit held by CANEGROWERS.

Chemical and Dangerous Goods Use and Storage

Workplace Health and Safety, and duty of care issues associated with handling and storage and disposal of agricultural chemicals and dangerous goods place pressure responsibility on growers to implement proper procedure.

It is generally accepted within the industry that Integrated Pest Management Strategies that combine "soft" chemicals with cultural and other techniques, once perfected, will be effective under normal conditions. However, there is increasing frustration that, under exceptional circumstance, the industry cannot access more effective chemicals.

A number of chemicals used by the Queensland cane growing industry have been included in the National Registration Authority's "Existing Chemical Review Program". This has resulted in changed label conditions for atrazine and reviews, with results pending, for ametryn, chlorpyrifos and paraquat. Chemical review is extensive, rigorous and scientific.

It must be highlighted that further constraints, particularly in the absence of supporting data, are totally unnecessary.

In response:

- If not all, then the vast majority of farmers have completed chemical accreditation courses that highlight the legal obligation to follow directions on the label, applying the chemical appropriately, avoid conditions that may cause off-site damage, appropriate storage and disposal of chemical containers and promoting the use of dry-flowable formulations that use much less packaging.
- The National Farmers Federation, Farm Chemicals Taskforce released a discussion paper in October 2000 outlining proposed requirements for special accreditation for users of certain chemicals. It was proposed that special accreditation be required for chemicals referred to as National Prescribed Chemicals (NPC). The chemicals that fall under the NPC bracket are yet to be classified. The proposed requirements under the scheme include chemical re-accreditation (by the completion of a Chemcert Re-accreditation Course) every 5 years. The scheme allows that only accredited growers, carrying the required identification, be able to purchase and use the NPC's.
- The Code Of Practice For Sustainable Cane Growing in Queensland advises all growers to adhere to the Code of Practice for Storage and Use of Chemicals at Rural Workplaces and to keep comprehensive records of usage of agricultural chemicals.
- Cane growers now pay a levy of 4 cents per litre on chemical containers to support the reuse and recycling of chemical containers. This drumMUSTER program is a rural industries' initiative.

Long term productivity/farm sustainability

The industry is under pressure to maintain/increase profitability and sustainability.

The Innisfail district has suffered heavy cane and sugar losses from adverse weather conditions in 1998, 1999 and 2000 and also suffered from the detrimental effects of declining CCS for over 5 seasons. Grower incomes have fallen and production costs have continued to increase, resulting in severe economic hardship for the industry. This severe reduction in both growers' and millers' incomes results in a devastating economic decline for the Johnstone Shire Community. Using the economic "rule of thumb" growers' disposable income circulates the Shire economy three times in total. Hence losses for the Sugar Industry are detrimental to the entire Shire.

Sugar Industry Assistance Package

CANEGROWERS prepared a submission to the Federal Government seeking a comprehensive Industry Assistance Package in March/April 2000.

Following constant lobbying of and meeting with Government Representatives by Sugar Industry Leaders, the Federal Government announced the details of the Sugar Industry Assistance Package in September 2000. Under the Assistance Package the following forms of assistance are available:

- Interest subsidies on loans up to $50,000 used to plant cane this season and next season
- Interest subsidies on loans up to $100,000 associated with the business of producing cane
- Family Relief Payments to assist cane farmers and their families
- Farmbiz Programs to target the cane industry, offering assistance with farm skills and business management training
- Vouchers up to $1,000 per farmer to access financial counselling services, where these services are not already available.

A Centrelink Officer has been operating out of the CANEGROWERS Innisfail Office to assist growers with applications for assistance.

Overall industry response

Innisfail-Babinda Sugar Industry Strategic Planning

CANEGROWERS Innisfail, CANEGROWERS Babinda and Bundaberg Sugar are working on a project which aims to identify, modify and implement those elements of whole of system sugar production that can be improved to ensure the sugar industry in the region is world competitive and profitable on a sustainable basis. The objective of the plan is to maximise the long term wealth of the industry through an on-going strategic planning and management process, implemented in a co-operative way in partnership between the mill owner and CANEGROWERS.

Strategies being considered to improve industry competitiveness include;

- Evaluating the benefits and costs of alternative forms and degrees of industry structure and regulation
- Improving the interaction between researchers, extension staff, growers, millers, marketers and sugar users
- Analysing the adverse effects of urban encroachment and other competing resources uses on sugar production
- Improving extension methodologies and techniques for the industry as a whole
- Benchmarking industry performance against sugar industries in other countries.

CP2002 Accelerated Enhancement of Productivity and Profitability for the Australian Sugar Industry

CP2002 is one multi level program activity outlined in the Sugar Research and Development Corporations R and D Plan, which was established to manage the special allocation of $13.45 million for North Queensland in August 1998. These funds were allocated to address problems of declining sugar content, pest control and associated productivity issues.

The desired outcomes of the plan, which runs for four years from 1998 to 2002, are;

- Identifying, implementing and monitoring R and D to increase the profitability of the sugar industry
- Increased levels of collaboration among research providers and industry participants
- Enhanced adoption of Best Management Practice by industry to improve the viability of the sugar industry, with emphasis on improving sugar content and pest control
- Identification of means to increase sugar mill throughput without significant capital investment.

BSES Far North Queensland Improving CCS Program

- This program aims to improve CCS across all districts without compromising yield of cane.
- Changes to the BSES plant-breeding program have been made to ensure future varieties maximise productivity and industry profitability.
- Varieties released now will have higher CCS, be more erect and have less suckers.
- R, D and E Organisations place a higher priority on profitability of research outcomes rather than just productivity.

3.3.1.2. Banana Production[3]

Location and Area

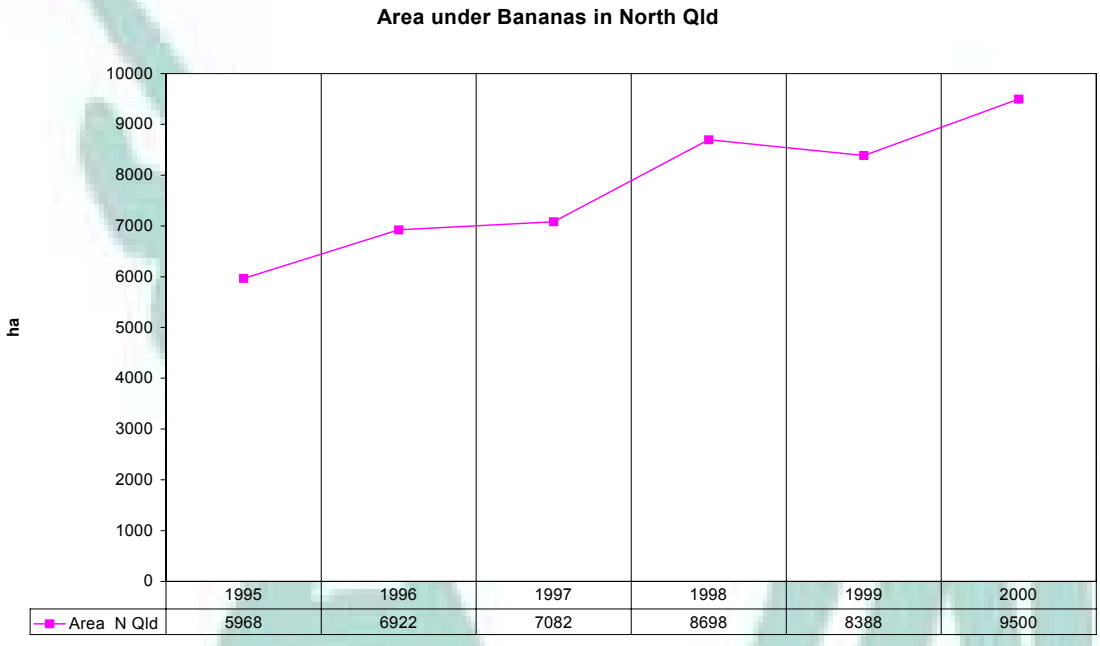

Figure 3.6 Area under banana production in the Johnstone Shire

The banana industry currently uses about 4500ha of land in the Shire (BIPB Census 2000), as illustrated in Figure 3.6. This has been consistently expanding over a number of years. The farms are distributed widely, often forming part of an overall enterprise, which includes cane. Plantations range in size up to 350 hectares. There are several plantations of significant size in the Shire, however the smaller family farms predominate. Bananas will not tolerate the waterlogging which cane will. For this reason there has been more interest in recent years in the Palmerston district and similar slightly elevated areas.

Environmental Management

The Banana Committee of Queensland Fruit and Vegetable Growers (QFVG) has been involved with important developments, which mitigate the impact of banana production in the Wet Tropics. In the late 1980s, the industry approached DPI to develop an Integrated Pest Management (IPM) system for banana production. This led to the training of professional pest scouts, all of whom are currently consultants to the industry. More importantly, the industry reduced its use of insecticides and fungicides by more than 19% over the last decade. Growers are reminded of the critical importance of IPM strategies through monthly newsletters.

In the early 1990s QFVG also supported the work done on nutrient transport and water quality in the Johnstone Catchment. This led to a National Heritage Trust (NHT) project "Best Bet Management Practices for Bananas" to assist in reducing nutrient loss to rivers and the reef lagoon. The late 1990s saw the preparation of the Farmcare manual, an Environmental Protection Agency (EPA) accredited code of practice which dealt in all aspects of a producers duty of care to the environment. Copies were distributed to all growers.

Currently, the Banana Committee of QFVG is participating in the development of a generic Environmental Management System (EMS). Several banana enterprises are implementing environmental management systems as individuals.

[3] Hine, pers. comm, 2001

3.3.1.3. Soil Erosion

A paper written by Prove, Doogan and Truong titled "Nature and magnitude of soil erosion in sugarcane land on the wet tropical coast of north-eastern Queensland" found that there was a significant difference in soil erosion between cane crops conventionally cultivated and those where no-tillage practices were applied. Soil erosion from conventionally cultivated ratoon canelands was measured in the range 47-505 t/ha.year, with an average annual loss of 148t/ha.year. No tillage practices reduced this erosion to <15t/ha.year. The paper also found that ground cover didn't significantly reduce soil erosion, and consolidation of the soil surface at harvest is the dominant factor reducing soil erosion. Further, the study also proposed that sediment from the no-tillage practice may be transported further from the erosion site and carry a more mobile fraction of nutrients.

Site	Locality	Lat. (s) and long (E)	Elevation (m)	Slope (%)	Great Soil Group	Soil Type US Soil Taxonomy	Local Series Name	Parent Material
A	Garradunga	145 59', 17 26'	30	12	Krasnozem	Oxisol	Garradunga	Basaltic
1	Corrumba	144 55', 17 34'	90	16	Krasnozem	Oxisol	Pin gin	Basaltic
2	Mundoo	144 59', 17 34'	30	18	Krasnozem	Oxisol	Pin Gin	Basaltic
3	Nerada	145 53', 17 33'	100	8	Krasnozem	Oxisol	Pin gin	Basaltic
4	Liverpool Ck	146 03', 17 40'	40	15	Red earth	Oxisol	Mission	Metamorphic
5	Cowley	146 02', 17 40'	20	5	Podsolic	Oxisol	Gialmara	Metamorphic
6	Babinda	145 55', 17 18'	30	16	Red earth	Oxisol	Tyson	Granitic

Table 3.6 Description and location of erosion-monitoring sites

	NTRR	NTBC	NTGC	CCBC	s.d
Basaltic					
Site A, 1980-81	n.d.	n.d.	n.d.	380	-
Site 1, 1982-83	n.d.	10a	n.d.	135 b	52.5
Site 2					
1984-85	88a	58a	54a	136b	63.5
1985-86	55a	33a	19a	505b	142.3
Site 3					
1982-83	6a	4a	-17a	75b	60.3
1983-84	-9a	-21b	21a	91c	16.9
Metamorphic					
Site 4					
1982-83	5a	-10a	-50a	72b	47.5
1983-84	m.d.	42a	21a	161a	175.0
Site 5					
1982-83	-11a	-17a	4a	82b	25.7
1983-84	5a	-2a	11a	92b	52.2
1984-85	-1a	-8a	2a	47a	66.4
1985-96	3a	-9a	-29ab	87b	64.2
Granitic					
Site 6					
1982-83	16a	22a	2a	135b	38.3
1983-84	3a	21ab	21ab	61b	59.9
Average	15	10	5	148	
n.d., no done; m.d., missing data.					

Within a row means followed by a common letter do not differ significantly at P=0.05
Negative values indicate an estimation of a net soil gain

Table 3.7 Soil erosion measurements (t/ha. year) for cultivated (CCBC) and no-tillage (NTR, residues removed; NTBC, residues retained after a burnt harvest; NTGC, residues retained after a green cane harvest) practices on ratoon cane land sited grouped by parent material

Similar studies have also been conducted on land containing natural rainforest and other primary production, however the methodology of those investigations is somewhat different and should not be directly compared to this study.

3.3.1.4. Pest Management

Council adopted a 3 year Integrated Pest Management Strategy in 1998. Since this time a full time Pest Management Officer has been employed and resourced to inspect all lands in the Shire and conduct control on Council land and under special projects.

A Pest Management working group has been established with representation of stakeholder groups. The group meets every second month and discusses pest management issues relevant to the Shire and makes recommendations to the Council. Every year in May the group meets to review the plan and ensure it adequately addresses the issues in the Shire

The working group are heavily involved in promoting weed awareness in the Shire and the majority of awareness education is focused on Weedbuster Week in October of each year.

The group have now ceased the Annual Singapore Daisy spraying program in favour of more urgent weed control. In 99/00 there was a focus on the Thunbergia Assistance Program and in 00/01 on the Hymenachne Incentive Program.

Under this program landholders are required to supply half the chemical and a labourer, whilst Council provides the other half of the chemical, the Pest Management Officer and all spray equipment. A property management plan is signed off by the landholder outlining future commitment to control of the plant. Currently 11 properties are signed up under the program treating and estimated 34.5 hectares of Hymenachne. Council also assists the Department of Natural Resources with control of Siam Weed in the Shire under the Strategic Weed Eradication and Education Program.

The Shire has evolved a long way in the 3 years under the program from originally spraying only Giant Sensitive Plant on all lands to a full pest management program looking for existing and potential weeds in the Shire. Importantly the landholders have now taken responsibility for control of the weeds on their own property

Name (scientific and common)	Problem	Control Priority
Cabomba spp. (Cabomba)	An anchored water weed which has the ability to clog up waterways and lakes which leads to fouling of irrigation systems, displacement of native flora and fauna and a severe reduction in water quality. EXTENT OF INFESTATION Localised to several creek systems eg. Canal Ck, Fitzgerald Ck, Sweeny Ck, South Maria Ck.	Found generally in the Johnstone Shire and information on identification and treatment by owners is promoted.
Rubus alceifolius (Giant Bramble)	A vigorous, scrambling, thorny, perennial, which invades cleared area such as pastures, road reserves and access tracks. EXTENT OF INFESTATION Common throughout the Shire on roadsides and creek systems.	Found generally in Johnstone Shire and are to be controlled by the owners
Mimosa invisa (Giant Sensitive Plant)	An extremely aggressive plant which takes over arable land and can destroy native vegetation. It is a serious threat to primary producing land and is extremely difficult to eradicate because of the seed longevity (exceeds 40 years). Is also a contaminant of seed and fodder products. EXTENT OF INFESTATION Johnstone Shire is known to have Giant Sensitive Plant throughout the Shire – heavy infestations in Palmerston, Mena Creek, and El Arish areas.	Found in the Johnstone Shire which are to be destroyed by owners where found

Mikana species (Mikania Vine)	Mikania has only recently been found in the Shire and is an introduced ornamental which outcompetes native vegetation EXTENT OF INFESTATION Mission Beach – localised infestation	Generally not found in the Johnstone Shire, but have the potential to readily establish
Euphorbia heterophylla (Milkweed)	Milkweed is a very competitive weed in cropping situations. It competes vigorously with sugarcane and other crops in early growth stages. (Only known to occur in isolated areas.) EXTENT OF INFESTATION Scattered infestations – particularly Goondi refuse facility and Fishers Creek.	Found generally in the Johnstone Shire and it is the intent to eradicate the plant over time, from the Shire
Opuntia sp. (Prickly Pears)	Rare, isolated infestations occur in the Shire	Found generally in Johnstone Shire and are to be controlled by owners
Salvinia molesta (Salvinia)	Rare, isolated infestations occur in the Shire	Found generally in Johnstone Shire and are to be controlled by owners
Chromolaena odorata (Siam Weed)	Known as one of world's worst weeds. Rapid growth and prolific seeding. Has the potential to seriously degrade land used for agriculture, forestry and conservation purposes throughout coastal Queensland agricultural industries. At risk are the grazing, horticulture, sugar and timber industries. EXTENT OF INFESTATION Infestations occur at Bingil Bay, El Arish, and Mission Beach. Isolated areas occur at Japoonvale and Granadilla. At present Siam Weed does not occur north of Liverpool Creek.	Found generally in the Johnstone Shire and it is the intent to eradicate the plant over time, from the Shire
Senna obtusifolia (Sicklepod)	Sicklepod can invade and completely dominate pastures, or become a weed of many crops. It is not eaten by animals, except for the seedpods which assists in the spread of seeds. Develops large seed reserves in the soil, which may germinate at any time of the year under favourable conditions. EXTENT OF INFESTATION Common throughout Shire – pastures, unmanaged land.	Found generally in Johnstone Shire and are to be controlled by owners
Thunbergia grandiflora (Thunbergia)	Thunbergia species are garden plants that have escaped into native forest areas. This plant destroys the rainforest leading to loss of all vegetation in affected areas. Difficult plant to control due to large tubers, its ability to vegetatively reproduce and limited chemical control measures. EXTENT OF INFESTATION North and South Johnstone Rivers, Fishers Creek, small infestations throughout the Shire.	Found generally in the Johnstone Shire and it is the intent to eradicate the plant over time, from the Shire
Elephantopus mollis (Tobacco Weed)	Tobacco weed is a major threat to pastures in the area as it is not eaten by cattle and its broad leaves smother native species. EXTENT OF INFESTATION Localised infestations in North Johnstone River, Moresby, Mena Creek, Silkwood and Palmerston.	Found generally in the Johnstone Shire and it is the intent to eradicate the plant over time, from the Shire
Eichhornia crassipes (Water Hyacinth)	Rare, isolated infestations occur in the Shire	Found generally in Johnstone Shire and are to be controlled by owners
Pistia stratiotes (Water lettuce)	Rare, isolated infestations occur in the Shire	Found generally in Johnstone Shire and are to be controlled by owners

Table 3.8 Declared Weeds in the Johnstone Shire

Name (common and scientific)	Problem	Priority
Hymenachne amplexicaulis – Hymenachne	Ponded pasture grass which can grow and thrive in water up to 1.5 metres in depth and acts as an efficient silt and nutrient trap when it colonises rivers, drains, wetlands and will exacerbate flooding problems through reduction in flood flows. Heavy growth in waterways has the potential to reduce aquatic life. Once widely established it will become an ongoing operation to maintain waterways. EXTENT OF INFESTATION Localised infestations where deliberately planted or escaped. South Maria Creek System, Mena Creek area, small infestations at Palmerston.	1
Annona glabra – Pond Apple	Pond Apple is the only weed known that will invade undisturbed estuarine and wet areas. It will out compete all other vegetation and is a serious environmental pest. EXTENT OF INFESTATION Heavy infestations in Warrina Lakes. Common in creek systems in Garradunga area.	1
Wedelia triolobata – Singapore Daisy	A difficult weed to control with underground runners providing rapid regrowth. Spreads rapidly in most sites excluding other ground vegetation and smothering low growing shrubs, ferns etc. EXTENT OF INFESTATION Commonly used garden ornamental invading areas throughout the Shire.	2
Harungana madagascariensis – Harungana	An introduced rainforest species from Central Africa, which colonises disturbed rainforest margins, particularly associated with past logging activities. Where established, it may form pure stands and effectively exclude normal rainforest regrowth. A serious threat to the long-term integrity of rainforest communities, it is able to penetrate into unlogged rainforest, germinating in disturbed areas created by cyclone damage and stream flooding. EXTENT OF INFESTATION Current distribution is mainly confined to the Cairns City area with very limited areas in Johnstone Shire, mainly South Johnstone and Garradunga.	2
Bambusa spp. – Bamboo (spreading variety)	Bamboo is fairly widespread in the Shire with different landholders having different views of its status as a weed. Bamboo grows on the surface, holding banks of riparian areas, but is causing severe undercutting. No chemical control has yet been proven effective. EXTENT OF INFESTATION Liverpool Creek, Mission Beach/Bingil Bay, South and North Johnstone Rivers are heavily infested along with scattered infestations throughout the Shire	3
Spathodea campanulata – African Tulip	African Tulip is a prolific seeder which readily suckers from the roots. It competes vigorously with other trees and is a serious problem in creek systems. Soft timbered, easily blown down in cyclones. EXTENT OF INFESTATION Common throughout the Shire.	3
Alamanda cathartica – Yellow Alamanda	Isolated infestations throughout the Shire	3

Table 3.9 Environmental Weeds in the Johnstone Shire

Animal	Responsibility
Wild Dogs/Dingos	Council will only handle wild dog problems if the Pest Management Officer has a 1080 Licence. In the event that the Pest Management Officer does not have a 1080 Licence they shall be referred to the Department of Natural Resources in Innisfail. This service may be refused where the landholder has previously failed to carry out their responsibilities in accordance with established guidelines.
Rabbit/Hare	The responsibility of rabbits and hares shall fall mostly on the land occupier. Council shall endeavour to assist in the control rabbits or hares that are causing a problem within the Shire to the best of their ability.

Feral Goats, Buffalo, Cats, Brumbies, Deer and Foxes	The responsibility of these animals shall fall mostly on the land occupier. Council shall endeavour to assist in the control of these species to the best of their ability when they are causing a problem within the Shire. Trapping shall be the main source of control of the smaller species, however some of the larger species may require to be destroyed by other methods.
Feral Pigs	Council will endeavour to support the Community Pig Trapping Program. Council will assist in the control of pigs with the landholders and trappers where appropriate. The main control programs for pigs shall be through trapping, poisoning, hunting and fencing. Particular attention will be paid to the type of attractant used in the traps so to avoid attracting cassowaries. All traps must be of a Department of Natural Resources approved type and must also be checked at least daily.
Locusts	The responsibility of locusts shall be on the land occupier, however Council will only assist in the control of locusts that are declared to be in plague proportions in the Shire to the best of their ability. Council shall also endeavour to support the plague locust fund.

Table 3.10 Declared Animals in the Johnstone Shire

3.3.2. Urban Lands

Background

Urban land use has the potential to impact significantly on the natural environment, both through development on the land and expansion of urban development onto good quality agricultural land or land with environmental significance.

The Johnstone Shire Planning Scheme (1997) recognises the need to protect environmental and agricultural values of the land resource in our Shire. Objectives stated in the planning scheme include:

- Protection of habitat
- Protection of good quality agricultural land by avoidance of fragmentation, controlling urban encroachment and establishment of buffer areas between agricultural and other uses which would compromise agricultural activity
- Ensure a steady supply of land development for urban use and encouragement of commercial activities within the urban centres.

Innisfail is recognised as the main urban centre in the Shire and is expected to continue to be the focus of business and service activity. Mission Beach is the second main centre for urban development. Other settlements are Kurrimine Beach, Silkwood, El Arish, Mourilyan, South Johnstone, Flying Fish Point and Wangan. The 1996 census population figures were 8987 for Innisfail and 19780 for the Shire. Innisfail is the only sewered urban area in the Shire.

Pressure

Significant environmental pressures which result from urban development include greenhouse emissions, discharges to surface and ground water, waste disposal (both solid and liquid) and acid sulphate soils.

Atmosphere: There are no measures of the state of our atmosphere available from Council or State sources.

Surface Waters: A 1997 report on land use impacts on water quality in the Johnstone River catchment by H Hunter and R Walton of the Department of Natural Resources indicates that the rate of sediment runoff from urban areas is similar to that from rainforest. Nutrient runoff in the form of nitrates is significant from unsewered urban areas with 15% of the total loading coming from 0.5% of the catchment represented by these areas. Council should develop a stormwater management plant to deal with runoff from urban areas to waterways

Stormwater runoff from urban areas results in solid rubbish as well as sediments and nutrients entering waterways and the ocean. There is no specific scientifically gathered and analysed

information about the effects of urban runoff in the Shire or from Innisfail's sewerage effluent which discharges to Ninds Creek and then to the Johnstone River.

Ground Waters: The only area where detailed investigation of ground water quality has been undertaken is in the Mission Beach area as part of investigations for possible construction of a sewerage system. These investigations show significant adverse impact on groundwater from domestic septic systems.

Floodplain Management: Much of Innisfail is constructed on floodprone areas adjacent to the Johnstone Rivers. The need to provide land with at least 50-year flood immunity restricts the locations for future urban development and increases the cost of development. The possibility of exposure of acid sulphate soils is an issue which has to be addressed when considering areas suitable for future urban expansion.

Waste Management: The combination of high rainfall and generally high water tables throughout the Shire results in area specific problems for disposal of solid waste. Former landfill sites which were closed 10 and more years ago were not remediated and may be causing environmental harm.

Responses

Atmosphere: It has been suggested that Council join the Federal Government sponsored program 'Cities for Climate Protection'. Local assessment of this program is that the possible benefits in this region for our rural based Shire do not warrant the effort and costs required to implement the program.

Surface waters: Council has adopted a trade waste policy, which, in conjunction with environmental licence conditions, will reduce the quantum of environmentally harmful liquid discharges from industry and commercial activities. Council's total management plan for its water and sewerage assets provides a strategy for upgrading the sewerage and water treatment plants to improve effluent quality.

Ground Waters: Council is investigating options for the installation of a sewerage scheme in Mission Beach. In non sewered areas with known high water tables eg beach areas, and any other area with problem soils, applications for effluent disposal have to be carried out in accordance with the DNR Interim Code of Practice for On –Site Sewerage Facilities.

Floodplain Management: Council is updating its 1985 flood management study on the Johnstone Rivers. Council also has in place a planning policy, which requires various categories of development to provide minimum levels of flood immunity with residential buildings having to provide Q100 immunity.

Waste Management: Council established new waste disposal facilities in 1999 in conjunction with development of a waste management strategy which emphasises waste reduction and separation into wet and dry streams. A landfill remediation assessment investigation was undertaken during 2000. Preliminary results (first round testing) do not indicate significant environmental problems to be corrected at the smaller sites but environmental licence conditions require significant expenditure in the short-term future to close down the Bell's Creek and Goondi Bend facilities and monitor their effects.

3.4. Natural Resource Management Groups

Multiple Natural Resource Management Groups were operating in the Shire in the year 2000. Once such group is the Johnstone Region Landcare.

3.4.1. Johnstone Region Landcare Group Inc

The Johnstone Region Landcare Group was established in 1989. It is a community movement involving landholder and others who are concerned with sustainable land, water and resource usage.

In 2000, Landcare was involved with:

- Tree plantings at Flying Fish Point Dump, Palmerston Rocks, Bulguru Swamp, Liverpool Creek, Bamboo Creek, Upper Liverpool Creek, and Daru Creek
- Information workshops – hymenachne, Innisfail Show and World Environment Day
- Bird counts for Bird Atlas – Flying Fish Point Dump and McCutcheons Park

Future plans include workshops on environmental sustainability, agro-foresty, support for the River Trust and the Community Revegetation Unit.

The barramundi Action Group formed in Innisfail in January 2000 in response to a decision not to terminate gill netting in the Johnstone River. It is their aim to remove as many licensed net operators from the Johnstone River as is consistent with restoring a return to reasonable recreational catch rates.

3.5. Deficiencies in Data

Maria Creek catchment details should be collated in a similar format to that of the other catchment reports for the Shire streams. An assessment of agricultural lands in the Shire (eg papaya, exotic fruit, vegetables, etc.) should be conducted in a manner similar to that for cane and banana production. Similarly, the threats to these lands should also be further investigated and reported. Specific information to be collected includes:

- Information on nitrate and nitrogen levels in surface waters of cane catchments.
- An assessment of potential acid sulphate soils across the Shire.
- Greater information about introduced fish species.

3.6. Recommendations – Natural Resources Chapter

Catchment Management

General

- That ecologically and economically viable land-use through the development (engaging all stakeholders) and implementation of best management practices be promoted
- That preservation and restoration of riverine habitat on a catchment-wide basis, but in particular wetlands and minor streams be promoted
- That development and implementation of pro-active river management plans be enacted
- That regular monitoring be undertaken in the catchments of the Shire for the parameters of suspended sediments, dissolved nutrients, and contaminates from herbicides, pesticides and urban runoff.

Johnstone River Catchment

- That strategic riparian restoration continue throughout the Shire's Catchments
- Domestic and Feral animals be controlled to prevent destabilisation of creek banks
- Research be carried out to establish a realistic and flexible vegetation buffer width for the major streams in the Shire.
- Monitoring be conducted of introduced fish species and education programs be conducted to prevent further introductions.

Moresby River Catchment

- Investigations be carried out into protection of wetlands as Fishing Habitats or Marine Park.
- Investigation into Historical and existing land use practices and the impacts on drainage and tidal patterns.
- That the Johnstone River Catchment Management Association maintain a co-ordinated approach to revegetation through the Revegetation Strategy.

Liverpool Creek Catchment

- That rehabilitation works for the Liverpool Creek be undertaken as stated in the River Management Action Plan – Liverpool Creek.

Land Management

- General Agricultural Land - that DNR publish the land suitability report occur by June 2002.

General Agricultural Land

- That publication of the land suitability report occur by June 2002.

Cane Production Land

- That research continues to improving and enhancing farming practices, cane varieties and off farm impacts.
- That growers continue to utilise industry codes of practice and continue to develop best management practices
- That industry continues to actively pursue the partnership between growers, BSES, Canegrowers, Cane Protection and Productivity Boards and other agencies to further develop and enhance sustainable practices

Banana Production

- That Queensland Fruit and Vegetable Growers continue to support the production of Environmental Management System in banana enterprises.

Pest Management

- That Council undertake control of all the weeds of national significance in the Shire and that the weed infestations be reduced by 2004 in the order of 50 percent

Urban Lands

- That Council develop a stormwater management plan
- That Council upgrade the Innisfail sewage treatment plant to improve effluent quality
- That Council install a sewage collection and treatment system at Mission Beach

3.7. Bibliography and Further Reading

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