Fitzroy region

Chapter 10

"The Fitzroy is the largest of all catchments draining into the Great Barrier Reef lagoon… Much of the inland parts of the region contain open woodlands that include important areas of remnant Brigalow, as well as threatened native grasslands."

Photo courtesy of Fitzroy Basin Association Inc.

10.1 Profile

The Fitzroy region includes the Fitzroy, Boyne, Calliope, Waterpark, Shoalwater and Styx/Herbert catchments, and covers 156,000 square kilometres. The Fitzroy is the largest of all catchments draining into the Great Barrier Reef lagoon. The region experiences highly variable rainfall, high evaporation rates and prolonged dry periods, which are often followed by floods. Much of the inland parts of the region contain open woodlands that include important areas of remnant Brigalow, as well as threatened native grasslands.

Grazing is the predominant land use but there are also significant areas of cultivation including large expanses of irrigated and dryland cropping. Low groundcover is the main pressure resulting in excess sediments, nutrient and chemicals delivered to the Great Barrier Reef. Management focuses on activities to increase cover and reduce fertiliser and chemical application.

The Fitzroy Basin Association has been working with landholders in priority areas to reduce sediment and nutrients delivered to the reef by 1 per cent every year for the past five years. Landholders managing more than 22 per cent of the region have implemented projects to date. These activities support Reef Plan targets to reduce sediment loads delivered to the Great Barrier Reef.

Best available science helps prioritise investment in grazing land management. Through the Grains Best Management Practices program, growers benchmark their practices. A network of sub-regional groups, AgForce, Growcom and the Department of Employment, Economic Development and Innovation all work with the Fitzroy Basin Association to deliver best management practice knowledge and skills to landholders.

Figure 10.1 – Map of the Fitzroy region and Great Barrier Reef Marine Park showing the paddock, catchment and marine monitoring sites.

The Fitzroy region has has occasional cyclones and variable rainfall predominantly in summer delivering sediments, nutrients and pesticides to the inshore and sometimes offshore portions of the reef in pulsed flows, which can be affected by reservoirs and dams. The catchment is large and has high river flow variability. Grazing is the dominant land use, with dryland cropping and upland cotton. Mangroves are extensive and there is some mining. Urban centres such as Rockhampton and Gladstone are located on the coastal strip. Habitats include offshore reefs, seagrass and mangroves. Continental islands (such as the Keppels) are important for tourism and the region also supports important commercial and recreational fisheries.

Figure 10.2 – Conceptual model showing the key processes influencing water quality and reef ecosystem health in the Fitzroy region.

10.2 Adoption of improved management practices

10.2.1 Results

- **Fifty-three per cent of graziers are using (A or B) practices that are likely to maintain land in good to very good condition or improve land in lesser condition.**
- **Practices (D) likely to degrade land to poor condition are used by 12 per cent of graziers.**
- **Cutting-edge (A) or best management (B) practices for nutrients are used by 39 per cent of horticulture producers.**
- **Nutrient management practices considered unacceptable by industry and community standards (D) are used by 26 per cent of horticulture producers.**
- **In terms of herbicide management, cutting-edge or best management (A or B) practices are used by 64 per cent of producers, while 4 per cent of horticulture producers are using unacceptable (D) herbicide management practices.**
- **Cutting-edge (A) or best management (B) practices are used by 85 per cent of grain growers on 90 per cent of the land area. Code of practice (C) or practices considered unacceptable by industry and community standards (D) are used by 15 per cent of grain growers.**

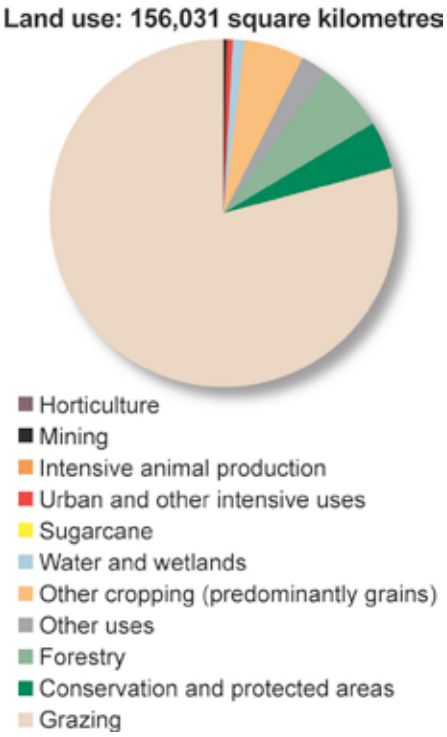

Figure 10.3 – Fitzroy region land use.

10.2.2 Grazing

There are an 3591 landholders grazing cattle on 123,000 square kilometres of land in the Fitzroy region. Fifty-three per cent of graziers are using (A or B) practices that are likely to maintain land in good to very good condition, or improve land in lesser condition. Thirty-five per cent of graziers are using (C) management practices which may maintain land in fair condition or gradually improve land in poor condition. Practices (D) considered likely to degrade land to poor condition are used by 12 per cent of graziers.

This report presents data on ABCD management practices, as distinct from ABCD land condition. However, these are management practices that impact upon land condition:

A – Practices likely to maintain land in very good condition or improve land in lesser condition

B – Practices likely to maintain land in good condition or improve land in lesser condition

C – Practices that may maintain land in fair condition or gradually improve land in poor condition

D – Practices likely to degrade land to poor condition.

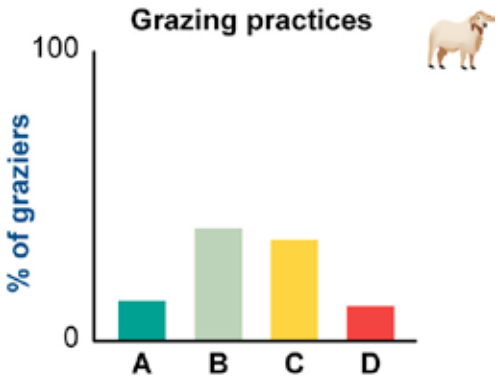

Figure 10.4 – Adoption of improved grazing management practices using the ABCD management framework for the Fitzroy region.

Table 10.1 – ABCD grazing management practices for the Fitzroy region.

Fitzroy	A practices	B practices	C practices	D practices
Number of graziers	496	1385	1266	444
% of graziers	14%	39%	35%	12%
Area (km^2)	16,986	47,441	43,358	15,215

10.2.3 Horticulture

The adoption of improved management practices for horticulture is presented using the ABCD management practice framework, a suite of management practices that are recommended to maintain and/or improve water quality:

A – Cutting-edge practice

B – Best practice

C – Common or code of practice

D – Practices that are considered unacceptable by industry or community standards.

As at 2008–2009, there are 106 landholders growing horticultural crops on 58 square kilometres of land within the Fitzroy region. The main horticultural crops include citrus and subtropical fruit trees.

The overall management practices (including nutrient, herbicide and soil) are shown in Table 10.2. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 54 per cent of producers. Code of practice or common practices (C) are being used by 33 per cent of producers. Practices considered unacceptable by industry or community standards (D) are used by 13 per cent of producers.

Cutting-edge (A) or best management (B) practices for nutrients are used by 39 per cent of producers. Code of practice or common (C) nutrient management practices are used by 35 per cent of producers. Nutrient management practices considered unacceptable (D) are used by 26 per cent of producers.

Cutting-edge (A) or best management (B) practices for herbicides are used by 64 per cent of producers, while 4 per cent of producers are using unacceptable (D) nutrient management practices.

Cutting-edge (A) or best management (B) practices for soil are used by 60 per cent of producers with 32 per cent using code of practice (C) soil management practices.

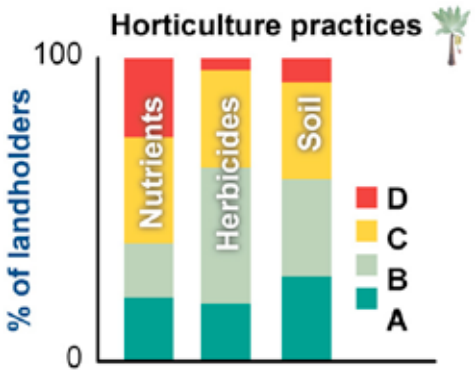

Figure 10.5 – Adoption of improved management practices for horticulture using the ABCD management framework for the Fitzroy region.

Table 10.2 – ABCD horticulture management practices for the Fitzroy region (Source: modified from Wallace S, 2010).

Combined management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of horticulture growers	24	33	35	14
% of horticulture growers	23%	31%	33%	13%
Area (km^2)	16	17	18	7
% of area	27%	29%	32%	12%
Nutrient management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture growers	22	19	38	27
% of horticulture growers	21%	18%	35%	26%
Area (km^2)	15	12	18	13
% of area	26%	20%	32%	22%
Herbicide management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture growers	20	48	33	4
% of horticulture growers	19%	45%	32%	4%
Area (km^2)	17	23	17	1
% of area	30%	39%	30%	1%
Soil management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture growers	31	33	33	9
% of horticulture growers	28%	32%	32%	8%
Area (km^2)	15	16	20	7
% of area	26%	28%	34%	12%

10.2.4 Grains

The overall grain management practices (including nutrient, herbicide and soil) are shown in Table 10.3. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 85 per cent of growers. Code of practice (C) or practices considered unacceptable by industry or community standards (D) are used by 15 per cent of grain growers.

Cutting-edge (A) or best management (B) practices for nutrients are used by 87 per cent of growers. Code of practice (C) or unacceptable (D) nutrient management practices are used by 13 per cent of grain growers.

Cutting-edge (A) or best management (B) practices for herbicides are used by 83 per cent of growers. Code of practice (C) or unacceptable (D) nutrient management practices are used by 17 per cent of grain growers.

Cutting-edge (A) or best management (B) practices for soil management are used by 86 per cent of growers. Code of practice (C) or unacceptable (D) nutrient management practices are used by 14 per cent of grain growers.

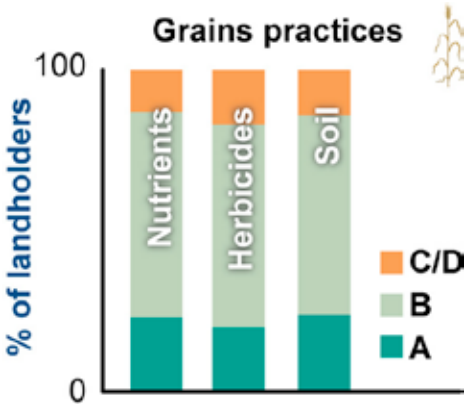

Figure 10.6 – Adoption of improved management practices for grains using the ABCD management framework for the Fitzroy region.

Table 10.3 – ABCD grain management practices for the Fitzroy region (Source: modified from Eames H. et al., 2010).

Combined management	A cutting-edge	B best practice	C code or D unacceptable practice
% grain growers	22	63	15
Area (km²)	2621	5302	913
% of area	30	60	10
Nutrient management	**A cutting-edge**	**B best practice**	**C code or D unacceptable practice**
% grain growers	23	64	13
Area (km²)	2651	5389	796
% of area	30	61	9
Herbicide management	**A cutting-edge**	**B best practice**	**C code or D unacceptable practice**
% grain growers	20	63	17
Area (km²)	2386	5301	1149
% of area	27	60	13
Soil management	**A cutting-edge**	**B best practice**	**C code or D unacceptable practice**
% grain growers	24	62	14
Area (km²)	2827	5213	796
% of area	32	59	9

10.3 Catchment indicators

10.3.1 Results

- **The total riparian area in the Fitzroy region is 1.9 million hectares, of which an estimated 38,000 hectares are likely to be susceptible to erosion (non-forested and low groundcover).**
- **The Fitzroy region has the lowest proportion of forested riparian areas compared to other regions with 1.3 million hectares (71 per cent).**
- **The loss of riparian vegetation between 2004 and 2008 was 12,702 hectares (0.68 per cent).**
- **The extent of wetlands (including vegetated freshwater swamps, lakes and mangroves/saltwater flats) across the Fitzroy region as at 2005 is 220,000 hectares. This represents 83 per cent of wetlands remaining from pre-European times.**
- **The Calliope, Fitzroy and Boyne catchments have had significant loss of vegetated freshwater swamps since pre-European times, with between 57 and 90 per cent lost.**
- **The 2009 mean dry season groundcover for the grazing lands of the Fitzroy region is 83 per cent, which is above the Reef Plan target of 50 per cent.**
- **As at 2009, four per cent of the grazing land area is below the 50 per cent groundcover target, with 1.4 per cent of the area below 30 per cent.**

10.3.2 Riparian vegetation

The Fitzroy region had the lowest proportion of forested riparian areas within the Great Barrier Reef region, with 1.3 million hectares (71 per cent). There were 500,000 hectares (26 per cent) of non-forested areas with high groundcover. 38,000 hectares (2.03 per cent) were non-forested with low groundcover, making these areas likely to be susceptible to erosion and, therefore, sediment loss to streams. From 2004 to 2008, 12,702 hectares (0.68 per cent) of forested riparian areas were cleared. The Waterpark and Styx catchments had the highest proportion of clearing between 2004 and 2008, with 564 hectares (1.7 per cent) and 725 hectares (1.6 per cent) respectively.

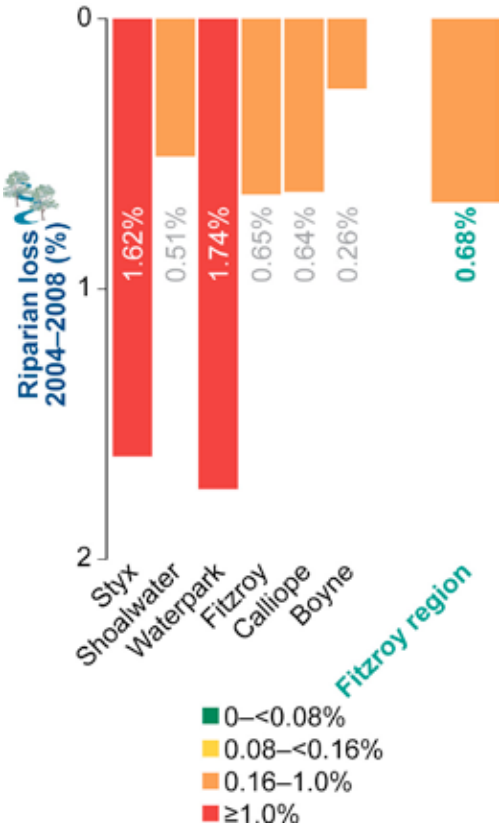

Figure 10.7 – Loss of riparian vegetation between 2004 and 2008 in the Fitzroy region.

Table 10.4 – Areas forested within the riparian buffer, non-forested with high groundcover (above or equal to 50 per cent), non-forested with low groundcover (less than 50 per cent) for 2008 and the area cleared from 2004 to 2008.

Catchment	Total riparian buffer area	Forested		Non-forested high groundcover		Non-forested low groundcover		Missing data*	2004–2008 riparian clearing	
	(ha)	Area (ha)	%	Area (ha)	%	Area (ha)	%	%	Area (ha)	%
Fitzroy	1,660,113	1,149,092	69.22	459,014	27.65	37,092	2.23	0.90	10,744	0.65
Styx	44,759	31,946	71.37	12,095	27.02	560	1.25	0.35	725	1.62
Shoalwater	68,923	58,257	84.52	10,242	14.86	248	0.36	0.25	349	0.51
Waterpark	32,513	31,335	96.38	911	2.80	55	0.17	0.65	564	1.74
Calliope	32,164	22,585	70.22	9105	28.31	195	0.61	0.87	206	0.64
Boyne	43,141	38,055	88.21	4758	11.03	87	0.20	0.56	114	0.26
Fitzroy region	**1,881,613**	**1,331,270**	**70.75**	**496,125**	**26.37**	**38,237**	**2.03**	**0.85**	**12,702**	**0.68**

*Missing data refers to areas affected by cloud, cloud shadow, topographic shadow or areas of water within the riparian buffer.

10.3.3 Wetlands

Wetland types

As at 2005, there are approximately 218,000 hectares of wetlands in the Fitzroy region. Of these wetland areas there are:

- 57,000 hectares of vegetated freshwater swamps (palustrine wetlands). The greatest area of vegetated freshwater swamps is in the Fitzroy catchment.
- 6900 hectares of lakes (lacustrine wetlands).
- 150,000 hectares of mangroves/salt flats (estuarine wetlands).

Of the region's total wetlands, 83 per cent remains from pre-European times, while 78 per cent of vegetated freshwater swamps remain. The Calliope, Fitzroy and Boyne catchments have had significant loss of wetlands since pre-European times, with between 57 and 90 per cent lost. The extent of vegetated freshwater swamps in the Styx and Shoalwater catchments has increased. This is due to the conversion of estuarine plains to freshwater wetlands by damming of ponded pastures, which is a common practice in many coastal catchments. Of the mangroves and salt flats, 85 per cent remains for the region.

The overall loss of wetlands in the Fitzroy region between 2001 and 2005 was 278 hectares (0.13 per cent). The loss of vegetated freshwater swamps over the 2001–2005 period was 146 hectares (0.25 per cent), with this loss derived entirely from the Fitzroy and the Styx catchments. There was a moderate loss of mangroves/salt flats over the 2001–2005 period, ranging from nil to 0.36 per cent.

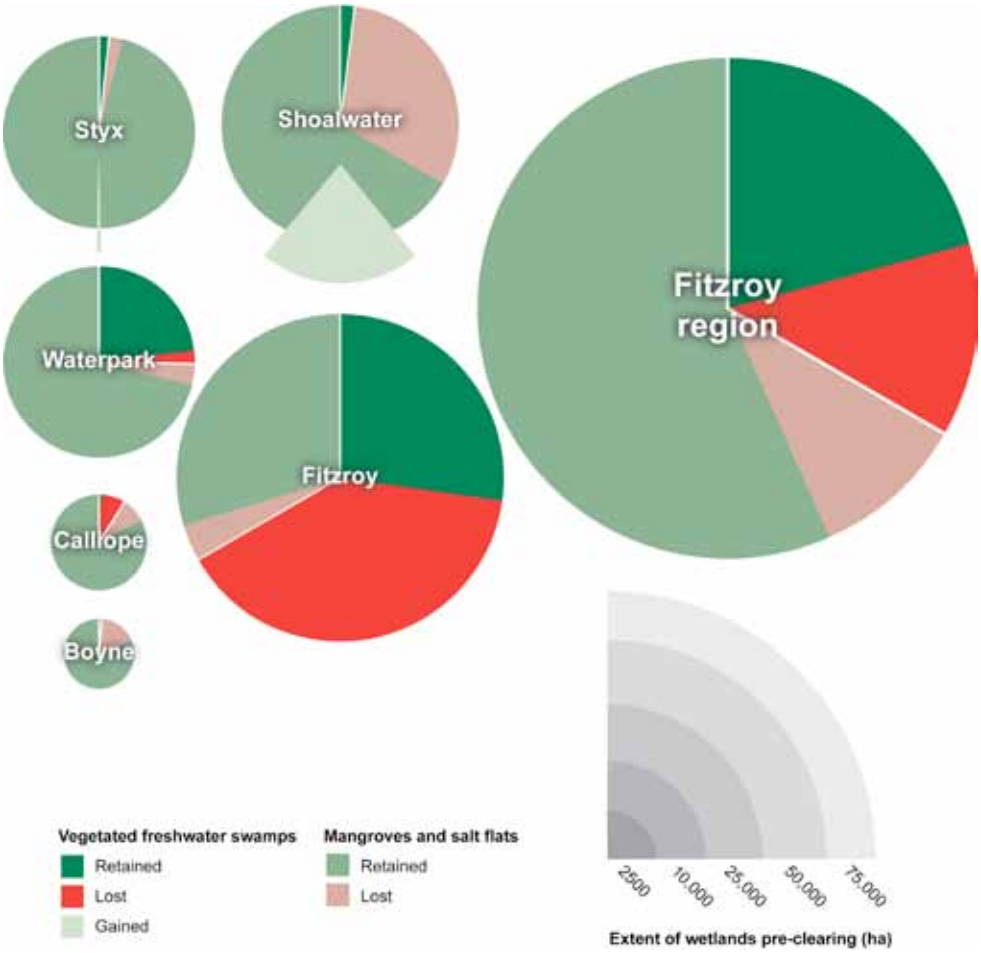

Figure 10.8 – Extent (hectares) and proportion of vegetated freshwater swamps and mangroves/salt flats remaining from pre-European extent in the Fitzroy region.

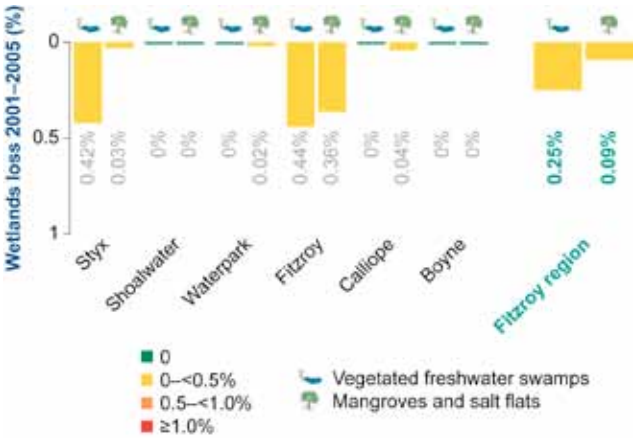

Figure 10.9 – Loss of vegetated freshwater swamps and mangroves/salt flats (between 2001 and 2005) for the Fitzroy region.

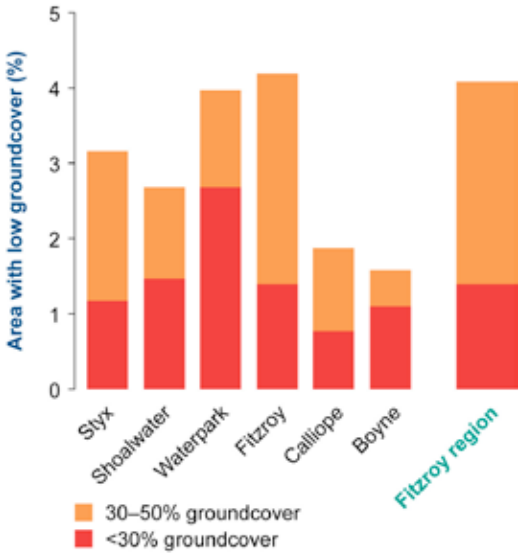

Figure 10.10 – Area with low groundcover (area under 30 per cent and between 30 per cent and 50 per cent) as at 2009 for the Fitzroy region.

Table 10.5 – The extent of wetlands in 2005 and change between 2001 and 2005 across the Fitzroy region for vegetated freshwater swamps, lakes and mangrove/salt flat wetlands.

	Vegetated freshwater swamps			Lakes			Mangroves and salt flats			All wetlands		
Catchment	Extent 2005 (ha)	Extent (% pre-European)	Loss 2001–2005 (% of 2001)	Extent 2005 (ha)	Extent (% pre-European)	Loss 2001–2005 (% of 2001)	Extent 2005 (ha)	Extent (% pre-European)	Loss 2001–2005 (% of 2001)	Extent 2005 (ha)	Extent (% pre-European)	Loss 2001–2005 (% of 2001)
Boyne	35	43	0	10	100	0	4305	82	0	4350	80	0.00
Calliope	90	10	0	20	100	0	8210	91	0.04	8320	90	0.04
Fitzroy	31,775	41	0.44	6870	88	-0.17	34,405	89	0.36	73,050	65	0.34
Shoalwater	14,820	1114	0	40	100	0	40,630	68	0	55,490	81	0
Styx	1310	169	0.42	20	100	0	38,335	98	0.03	39,665	99	0.04
Waterpark Creek	9250	92	0	5	100	0	28,125	95	0.02	37,380	94	0.02
Fitzroy region	**57,280**	**78**	**0.25**	**6965**	**88**	**-0.17**	**154,010**	**85**	**0.09**	**218,255**	**83**	**0.13**

10.3.4 Groundcover in grazing lands

Groundcover is influenced by a combination of factors including the land type, climate and management practices. The majority of the region's grazing lands are in the largest catchment, the Fitzroy. The long term mean dry season groundcover for the grazing lands of the Fitzroy region over the 1986–2009 period is 79 per cent (Table 5.7), which is above the Reef Plan target of 50 per cent. Similar to other regions, the average groundcover in 2009 is higher than the historical average, increasing to 83 per cent. The proportion of the grazing area with groundcover of 50 per cent or greater in 2009 is high (96 per cent). Only 4.1 per cent of the area was below the 50 per cent groundcover target, with 1.4 per cent of the area below 30 per cent.

10.4 Catchment loads

The total suspended solids load leaving the catchments of the Fitzroy region is an estimated 4.1 million tonnes per year. Of this, 2.9 million tonnes are from human activity. This is the second highest of the Great Barrier Reef regions (second only to the Burdekin region). These high suspended sediment loads in streams are associated with extensive grazing areas (Packett et al., 2009).

The total nitrogen load leaving the catchments of the Fitzroy region is 15,000 tonnes per year, of which 13,000 tonnes are from human activity. A large proportion of this is in the form of particulate nitrogen, with a total load of 12,000 tonnes per year, which is almost entirely due to human activity.

The total phosphorus load leaving the catchments of the Fitzroy region is 4100 tonnes per year, of which 3900 tonnes are from human activity.

The dissolved nitrogen load is 2700 tonnes per year of which 1100 tonnes per year are from human activity. The dissolved phosphorus load is 245 tonnes per year, of which 154 tonnes are from human activity.

The total photosystem inhibiting (PSII) pesticide load leaving the catchments of the Fitzroy region is an estimated 2300 kilograms per year. It is important to note that this estimate does not include several land uses known to leak PSII pesticides (e.g. grazing, forestry, cotton, urban) and non-PSII pesticides, indicating that the total pesticide pollutant load to the Great Barrier Reef is likely to be higher.

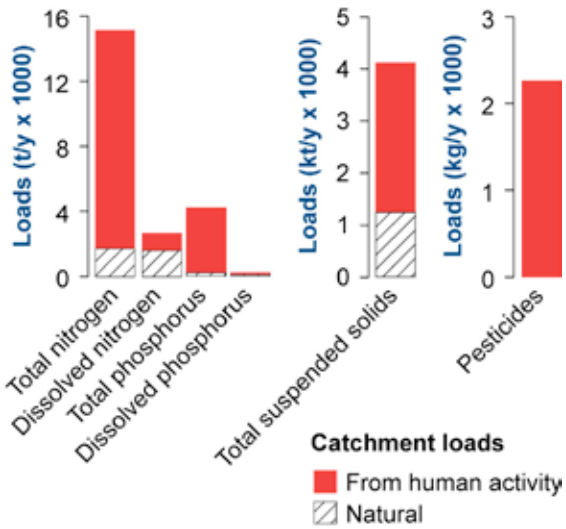

Figure 10.11 – Total and anthropogenic (caused by human activity) pollutant load estimates for total suspended solids, total nitrogen, total phosphorus, dissolved nitrogen, dissolved phosphorus and pesticides.

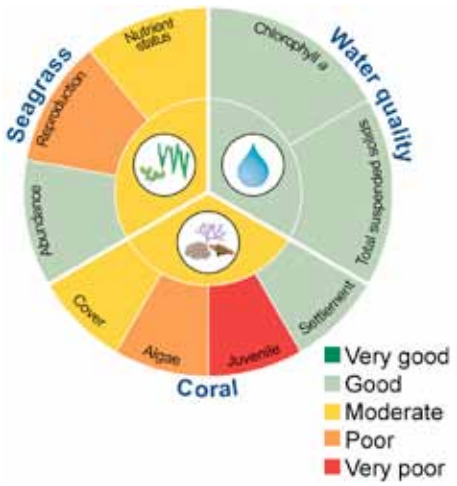

Figure 10.12 – Great Barrier Reef water quality and ecosystem health of the Fitzroy region showing the status of water quality, seagrass and corals.

10.5 Great Barrier Reef water quality and ecosystem health

10.5.1 Results

- **Water quality in the Fitzroy region is good overall, but concentrations of chlorophyll *a* and suspended solids are above Great Barrier Reef Marine Park Water Quality Guidelines in the inshore area. The pesticides diuron and tebuthiuron are detectable in inshore waters of the region.**
- **Seagrass abundance in the region has increased or is variable at coastal and estuarine locations, but has declined in reef locations. There are low numbers of reproductive structures, indicating reduced resilience to disturbance. The Shoalwater Bay site contains the most healthy and least impacted coastal seagrass meadows along the urban coast of the Great Barrier Reef.**
- **Reefs in the Fitzroy region are in moderate condition overall, with moderate coral cover and good settlement of juvenile corals, but very poor juvenile diversity and high cover of macroalgae. The reefs have been subject to significant disturbances over the past 10 years and have recovered, but mainly by re-growth from fragments and not recruitment. As a result, their long term resilience to future disturbance is uncertain.**

10.5.2 Water quality

Freshwater discharge from the Fitzroy River during 2008–2009 was less than the river's long term median. Great Barrier Reef Marine Park Water Quality Guideline (GBRMPA, 2009) exceedances for chlorophyll *a* and suspended solids concentrations were calculated for the May 2008–April 2009 period from satellite imagery (Table 10.6). The mean chlorophyll *a* and suspended sediment concentrations exceeded the Great Barrier Reef Marine Park Water Quality Guideline value for the region's inshore area.

Table 10.6 – Summary of the exceedance of mean annual chlorophyll *a* and non-algal particulate matter (as a measure of suspended solids) for the Fitzroy region (1 May 2008–30 April 2009).

Chlorophyll *a*: Relative area (%) of the waterbody where the annual mean value exceeds the water quality guideline value			**Suspended solids:** Relative area (%) of the waterbody where annual mean value exceeds the water quality guideline value		
Inshore	Midshelf	Offshore	Inshore	Midshelf	Offshore
35	2	0	35	2	0

Diuron and tebuthiuron were the two pesticides detected in passive samplers deployed in the Fitzroy region at North Keppel Island (Figure 5.13). Diuron was found at the highest concentration and maximum water concentrations of individual pesticides ranged from 0.18 to 1.1 nanograms per litre over the sampling period.

10.5.3 Seagrass status

Seagrass meadows are monitored at reef, estuarine and coastal sites at three locations in the Fitzroy region. Seagrass meadow cover has increased over the past seven years at coastal and estuarine sites in the region. Average seagrass cover at the coastal location has been consistently higher than the long term Great Barrier Reef average (Figure 10.13). In contrast, seagrass cover at the reef location is much lower than the long term Great Barrier Reef average. Biomonitoring suggests that more southern meadows at Great Keppel Island and Gladstone receive low light levels and are subject to nutrient rich conditions. In contrast, the more remote northern Shoalwater Bay site had lower nutrient conditions and was less turbid. Monitoring sites at Shoalwater Bay contain the most healthy and least impacted coastal seagrass meadows along the urban coast of the Great Barrier Reef.

10.5.4 Coral status

Six coral reefs are monitored in the Fitzroy region. These reefs have been exposed to several disturbances over the past 10 years including floods and coral bleaching events. However, the reefs in the region have high average coral cover and high settlement of larval spat. They also often have low coral diversity, low numbers of coral recruits and high densities of macroalgae. This combination of factors is of concern as coral reef recovery in the past has been a consequence of coral regrowth from surviving fragments rather than recruitment. As a result, the reefs are likely to be vulnerable to a major disturbance event in the future that could cause extensive mortality of whole coral colonies, which in turn would preclude recovery through regrowth of surviving fragments.

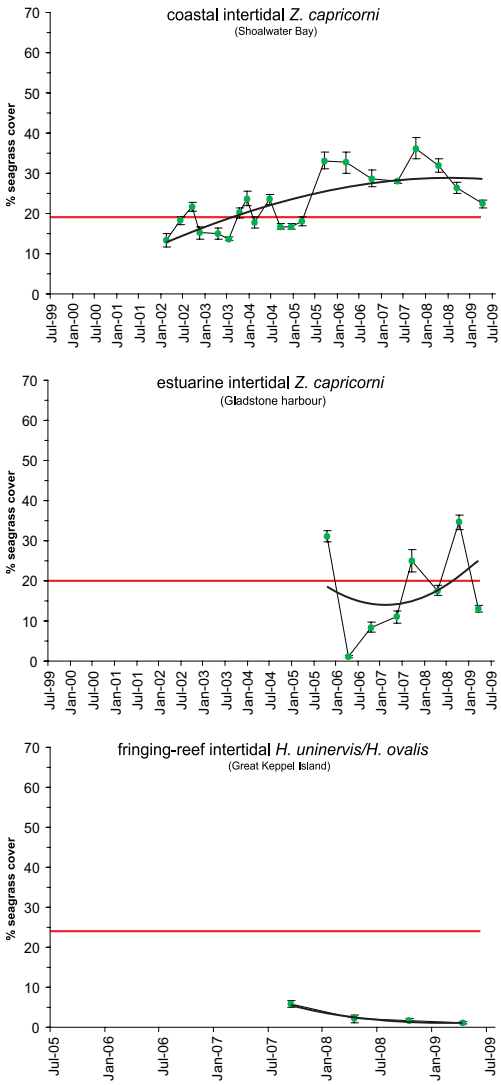

Figure 10.13 – Long term seagrass cover, Shoalwater Bay (coastal), Gladstone Harbour (estuarine) and Great Keppel Island (reef), Fitzroy region, compared with long term Great Barrier Reef average (red line) (Source: DEEDI).

Table 10.7 – Summary of coral community status of monitored reefs in the Fitzroy region, 2008–2009.

Reef	Depth (m)	Overall status	Coral cover	Change in hard coral cover	Macroalgae cover	Juvenile density	Settlement
Barren Island	2	-	neutral	neutral	+	-	-
	5	+	+	+	neutral	neutral	-
North Keppel Island	2	- - - -	-	-	-	-	N/A
	5	- - - -	-	-	-	-	N/A
Humpy Island and Halfway Island	2	+	+	neutral	neutral	-	+
	5	- -	neutral	-	-	-	+
Middle Island	2	- -	neutral	N/A	-	-	N/A
	5	+	+	N/A	neutral	neutral	N/A
Pelican Island	2	+++	+	+	neutral	neutral	+
	5	+	neutral	+	neutral	-	+
Peak Island	2	- -	-	+	-	-	N/A
	5	- - -	neutral	-	-	-	N/A

Explanatory note: + status and resilience is good; neutral denotes status and resilience is moderate; - status and resilience is poor. Overall status is estimated by summing the individual status scores.