

Mackay Whitsunday region

Chapter 9

"The region supports a diverse range of ecosystems from hard and soft coral communities and extensive mangrove, seagrass and fish habitats to the nationally recognised Goorganga wetland complex."

Photo by J Turner



9.1 Profile

The Mackay Whitsunday region covers an area of 9000 square kilometres and includes the catchments of the Pioneer, O'Connell and Proserpine River systems, which drain directly into the Great Barrier Reef lagoon. There are significant biodiversity assets throughout the region, mainly in national parks and state lands, including marine parks. The region includes 250 kilometres of coast with numerous beaches, coastal lagoons, reefs and 74 offshore islands.

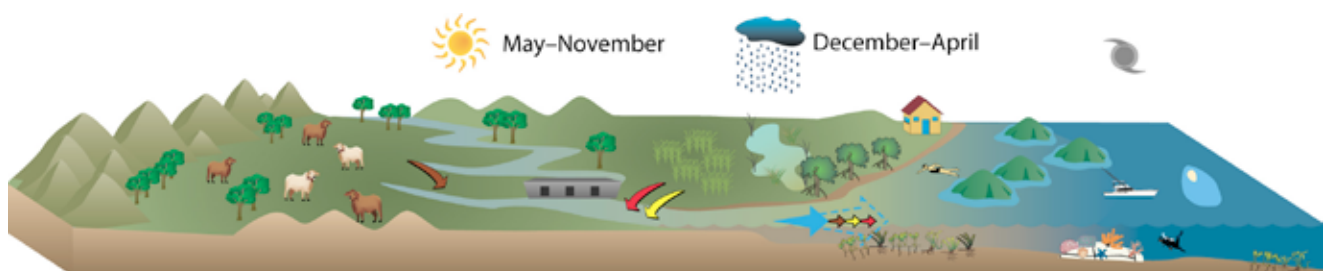
The dominant land use in the region is sugarcane production, with grazing, tourism and aquaculture also significant regional industries. The subtropical to tropical climate is characterised by a distinct wet season with 50 to 60 per cent of the average annual rainfall (1300 to 2000 millimetres) falling between January and March.

The region supports a diverse range of ecosystems from hard and soft coral communities and extensive mangrove, seagrass and fish habitats to the nationally recognised Goorganga wetland complex (Ball, 2008).

There is significant agriculture production in the region, including grazing, horticulture and the largest area of sugarcane production in Australia. Consequently, the sugarcane industry is the main diffuse source of nutrients and herbicide pollutants. In response, the region's agricultural industries are taking an active role in implementing improved farming practices in order to lower catchment loads and remove the associated threats to the Great Barrier Reef. The Mackay Whitsunday regional body, Reef Catchments, supports the region's agricultural industries in adopting improved farming practices.



Figure 9.1 – Map of the Mackay Whitsunday region and Great Barrier Reef Marine Park showing the paddock, catchment and marine monitoring sites.



The Mackay Whitsunday region has a number of small, steep catchments. The landscape is largely rural, has occasional cyclones and is dominated by summer monsoonal rains 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. Grazing is the largest single land use, followed by sugarcane and natural areas. Urban centres such as Mackay and Proserpine are located on the coastal strip. Habitats include wetlands, fringing and offshore reefs, intertidal, subtidal and deep water seagrass and mangroves. The continental islands (Whitsunday group) are important for tourism and the region also supports important commercial and recreational fisheries.

Figure 9.2 – Conceptual model showing the key processes influencing water quality and reef ecosystem health in the Mackay Whitsunday region.

9.2 Adoption of improved management practices

9.2.1 Results

- Overall, cutting-edge (A) or best management (B) practices for nutrients are used by 40 per cent of sugarcane growers, while 11 per cent of growers are using practices considered unacceptable by industry or community standards (D).
- In terms of herbicide management, the vast majority of sugarcane growers (97 per cent) are using common practice or equivalent to code of practice (C) management practices.
- In terms of soil management, best management (B) practices are used by 24 per cent of sugarcane growers, with 44 per cent using unacceptable (D) soil management practices.
- Cutting-edge (A) or best management (B) practices for nutrients are used by 22 per cent of horticulture producers. Code of practice or common (C) nutrient management practices are used by 50 per cent of growers.
- In terms of nutrient management, 28 per cent of horticulture producers are using practices considered unacceptable (D).
- Management practice adoption data for the grazing industry is not available at this time.

The adoption of improved management practices for sugarcane and 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 considered unacceptable by industry or community standards.

Land use: 9000 square kilometres

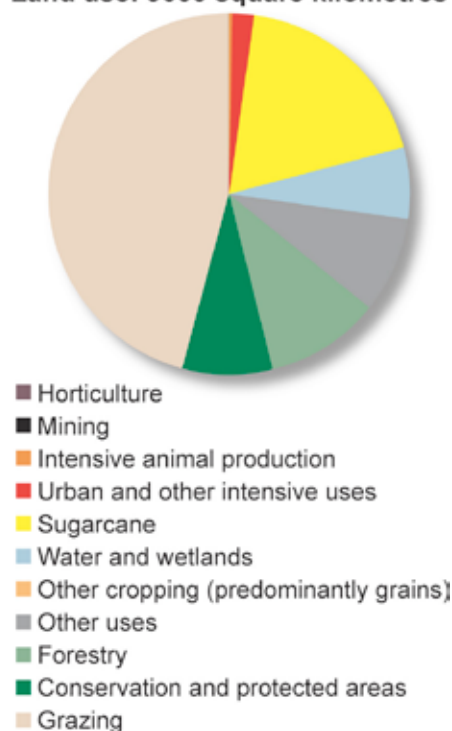


Figure 9.3 – Mackay Whitsunday region land use.

9.2.2 Sugarcane

As at 2008–2009, there are approximately 1320 landholders growing sugarcane on 1674 square kilometres of land within the Mackay Whitsunday region. The overall management practices (including nutrient, herbicide and soil) are shown in Table 9.1. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 23 per cent of sugarcane growers, while 59 per cent of sugarcane growers are using common or code of practice (C) management practices. Practices considered unacceptable by industry or community standards are used by 18 per cent of growers.

Cutting-edge (A) or best management (B) practices for nutrient are used by 40 per cent of sugarcane growers. Nutrient management practices considered unacceptable (D) are used by 11 per cent of growers.

Cutting-edge (A) or best management (B) practices for herbicides are used by only three per cent of growers. The rest of the growers (97 per cent) are using common practice or equivalent to code of practice (C) herbicide management practices. Results indicate that no growers are using herbicide management practices considered unacceptable (D).

Cutting-edge (A) or best management (B) practices for soil are used by 24 per cent of growers. Soil management practices considered unacceptable (D) are used by 44 per cent of growers.

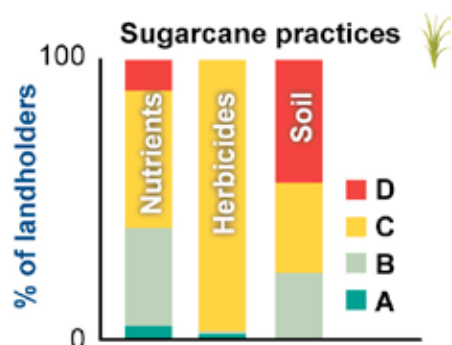


Figure 9.4 – Adoption of improved sugarcane management practices using the ABCD management framework for the Mackay Whitsunday region.

Table 9.1 – ABCD sugarcane management practices for the Mackay Whitsunday region (Source: modified from GHD, 2010d).

Combined management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of cane growers	31	264	783	242
% of cane growers	3%	20%	59%	18%
Area (km ²)	39	335	993	307
% of area	3%	20%	59%	18%
Nutrient management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of cane growers	66	462	647	145
% of cane growers	5%	35%	49%	11%
Area (km ²)	84	586	820	184
% of area	5%	35%	49%	11%
Herbicide management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of cane growers	26	13	1281	0
% of cane growers	2%	1%	97%	0%
Area (km ²)	33	17	1624	0
% of area	2%	1%	97%	0%
Soil management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of cane growers	0	317	422	581
% of cane growers	0%	24%	32%	44%
Area (km ²)	0	402	535	737
% of area	0%	24%	32%	44%

9.2.3 Horticulture

As at 2008–2009, there are 32 landholders growing horticultural crops on 12 square kilometres of land within the Mackay Whitsunday region. The main horticultural crops include lychees, mangoes and vegetables.

The overall management practices (including nutrient, herbicide and soil) are shown in Table 9.2. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 53 per cent of producers. Code of practice or common (C) practices are used by 34 per cent of producers. Practices considered unacceptable by industry and community standards (D) are used by 13 per cent of producers.

Cutting-edge (A) or best management (B) practices for nutrients are used by 22 per cent of producers. Code of practice or common (C) nutrient management practices are used by 50 per cent of producers. Nutrient management practices considered unacceptable (D) are used by 28 per cent of producers.

Cutting-edge (A) or best management (B) practices for herbicides are used by 62 per cent of producers, while 2 per cent of producers are using unacceptable (D) nutrient management practices.

Cutting-edge (A) or best management (B) practices for soil are used by 76 per cent of producers, with 7 per cent using unacceptable (D) soil management practices.

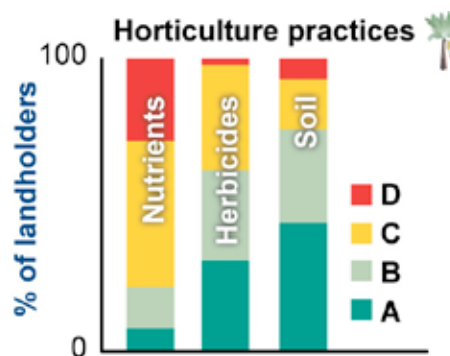


Figure 9.5 – Adoption of improved management practices for horticulture using the ABCD management framework for the Mackay Whitsunday region.

Table 9.2 – ABCD horticulture management practices for the Mackay Whitsunday region (Source: modified from Wallace S, 2010).

Combined management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of horticulture producers	9	8	11	4
% of horticulture producers	28%	25%	34%	13%
Area (km ²)	2.8	2.9	5.1	1.3
% of area	23%	24%	43%	10%
Nutrient management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of horticulture producers	2	4	16	10
% of horticulture producers	8%	14%	50%	28%
Area (km ²)	0.3	1.8	7.6	2.4
% of area	3%	15%	62%	20%
Herbicide management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of horticulture producers	10	10	11	1
% of horticulture producers	31%	31%	36%	2%
Area (km ²)	4.4	3.2	4.2	0.1
% of area	37%	27%	35%	1%
Soil management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of horticulture producers	15	10	5	2
% of horticulture producers	44%	32%	17%	7%
Area (km ²)	3.5	3.8	3.4	1.3
% of area	29%	31%	29%	11%

9.3 Catchment indicators

9.3.1 Results

- The total riparian area in the Mackay Whitsunday region is 130,000 hectares, of which 650 hectares are likely to be susceptible to erosion (non-forested and low groundcover).
- The O'Connell catchment had the highest riparian clearing rate between 2004 and 2008, with 389 hectares (1.16 per cent) cleared.
- The extent of wetlands (including vegetated freshwater swamps, lakes and mangroves/salt flats) across the Mackay Whitsunday region as at 2005 is 58,000 hectares. This represents 88 per cent of wetlands remaining from pre-European times.
- Forty-seven per cent of vegetated freshwater swamps have been lost since pre-European times.
- The Pioneer and O'Connell catchments have had significant loss of wetlands since pre-European times with 84 per cent and 62 per cent of vegetated freshwater swamps lost respectively.
- The 2009 mean dry season groundcover for the grazing lands of the Mackay Whitsunday region is 93 per cent, which is above the Reef Plan target of 50 per cent.

9.3.2 Riparian vegetation

The Mackay Whitsunday region had a total of 100,000 hectares (76 per cent) of riparian areas forested, and 27,000 hectares (20 per cent) of non-forested riparian areas with high groundcover areas. Only 650 hectares (0.48 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, 825 hectares (0.62 per cent) of forested riparian areas were cleared. Within the region, the O'Connell catchment had the highest clearing rate between 2004 and 2008, with 389 hectares (1.16 per cent) cleared.

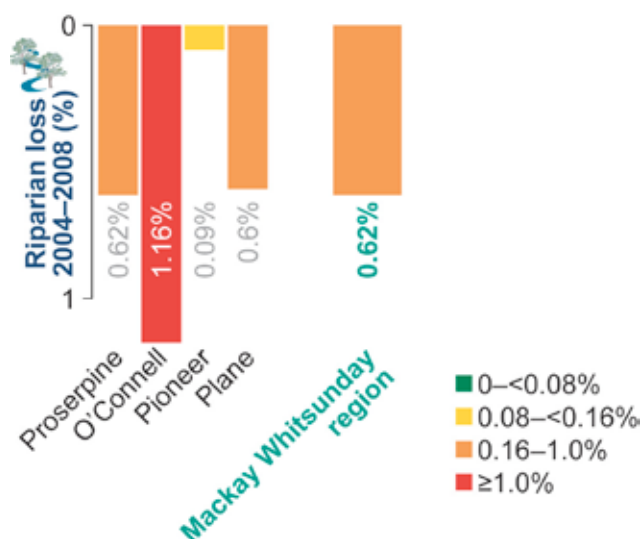


Figure 9.6 – Loss of riparian vegetation between 2004 and 2008 in the Mackay Whitsunday region.

Table 9.3 – 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)	%
Proserpine	32,094	26,466	82.46	5153	16.06	134	0.42	1.06	200	0.62
O'Connell	33,553	26,271	78.30	6605	19.69	149	0.44	1.57	389	1.16
Pioneer	32,684	24,158	73.91	6656	20.36	296	0.91	4.82	29	0.09
Plane	34,377	23,957	69.69	8590	24.99	68	0.20	5.12	207	0.60
Mackay Whitsunday region	132,708	100,852	76.00	27,004	20.35	647	0.49	3.17	825	0.62

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

9.3.3 Wetlands

Wetland types

As at 2005, there are approximately 58,000 hectares of wetlands in the Mackay Whitsunday region. Of these wetland areas, there are:

- 9700 hectares of vegetated freshwater swamps (palustrine wetlands). The Proserpine catchment has the greatest areas of vegetated freshwater swamps.
- 200 hectares of lakes (lacustrine wetlands).
- 48,000 hectares of mangroves/salt flats (estuarine wetlands).

Compared with pre-European times, 88 per cent of the total extent of wetlands remain. Forty-seven per cent of vegetated freshwater swamps in the region have been lost since pre-European times. The Pioneer and O'Connell catchments have had significant loss of wetlands since pre-European times, with 84 per cent and 62 per cent of vegetated freshwater swamps lost respectively. Of mangroves and salt flats, 96 per cent remains for the region.

Wetland loss in the Mackay Whitsunday region between 2001 and 2005 was 15 hectares (0.03 per cent). The loss of vegetated freshwater swamps over the 2001–2005 period was four hectares (0.05 per cent), with the greatest loss in the O'Connell catchment (0.28 per cent). There was minimal loss of mangroves/salt flats over the 2001–2005 period, ranging from nil to 0.04 per cent.

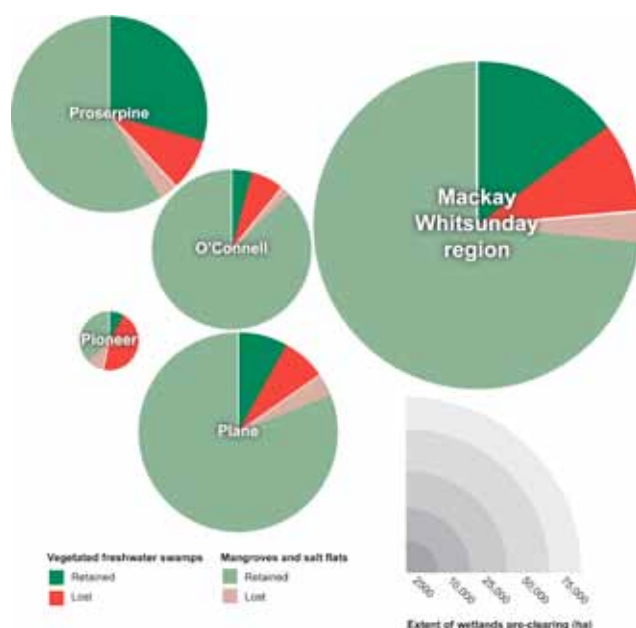


Figure 9.7 – Extent (hectares) and proportion of vegetated freshwater swamps and mangroves/salt flats remaining from pre-European extent in the Mackay Whitsunday region.

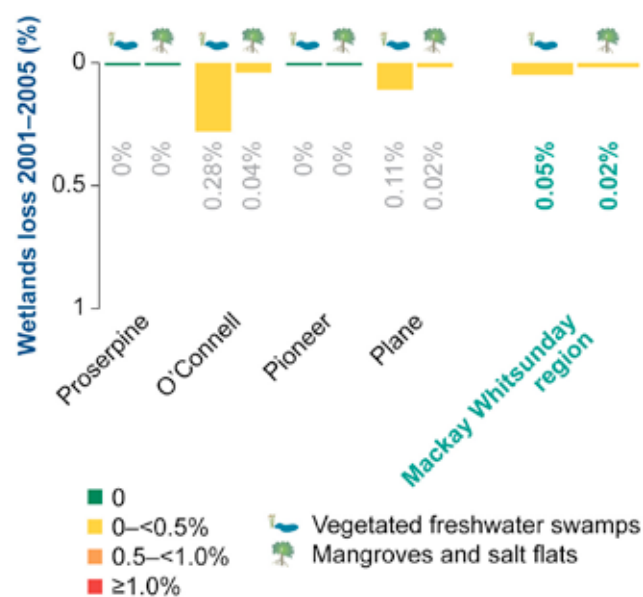


Figure 9.8 – Loss of vegetated freshwater swamps and mangroves/salt flats (between 2001 and 2005) for the Mackay Whitsunday region.

Table 9.4 – The extent of wetlands in 2005 and change between 2001 and 2005 across the Mackay Whitsunday region for vegetated freshwater swamps, lakes and mangrove/salt flat wetlands.

Catchment	Vegetated freshwater swamps			Lakes			Mangroves and salt flats			All wetlands		
	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)
O'Connell	650	38	0.28	15	100	0	13,555	98	0.04	14,220	91	0.05
Pioneer	180	16	0	NP	NP	NP	780	80	0	960	40	0.03
Plane	1955	52	0.11	NP	NP	NP	19,685	96	0.02	21,640	89	0.03
Proserpine	6910	77	0	190	100	0	13,760	95	0	20,860	92	0
Mackay Whitsunday region	9695	53	0.05	205	100	0	47,780	96	0.02	57,680	88	0.03

NP – wetland type was not present.

9.3.4 Groundcover in grazing lands

Groundcover is influenced by a combination of factors including the land type, climate and management practices. The majority of the Mackay Whitsunday region's grazing lands are in the upper lands of the region's catchments. The long term mean dry season groundcover for the grazing lands of the Mackay Whitsunday region (Table 5.6) over the 1986–2009 period is 90 per cent, 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 93 per cent. The proportion of the grazing area with groundcover of 50 per cent or greater in 2009 is high (97.9 per cent). Only 2.1 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.

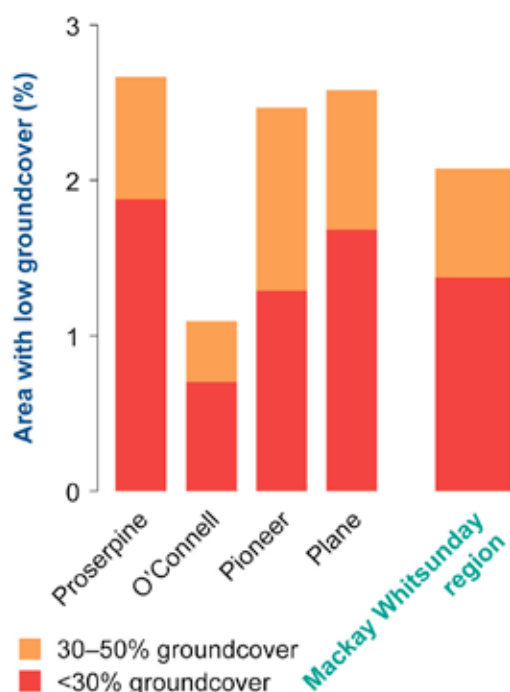


Figure 9.9 – Area with low groundcover (area under 30 per cent and between 30 per cent and 50 per cent) as at 2009 for the Mackay Whitsunday region.

9.4 Catchment loads

The total suspended solids load leaving the catchments of the Mackay Whitsunday region is an estimated 1.5 million tonnes per year. Of this, 1.3 million tonnes are from human activity (Kroon et al., 2010).

The total nitrogen load leaving the catchments of the Mackay Whitsunday region is 8100 tonnes per year, of which 7200 tonnes are from human activity.

The total phosphorus load leaving the catchments of the Mackay Whitsunday region is 2200 tonnes per year, of which 2000 tonnes are from human activity.

The dissolved nitrogen load is 3300 tonnes per year, of which 2500 tonnes are from human activity. The dissolved phosphorus load is 370 tonnes per year, of which 310 tonnes are from human activity.

The total photosystem inhibiting (PSII) pesticide load leaving the catchments of the Mackay Whitsunday region is an estimated 10,000 kilograms per year. Along with the Wet Tropics region, this was significantly higher than other regions. The pesticide residues most commonly found in surface waters from areas of sugarcane cultivation are diuron, atrazine, ametryn and hexazinone (Lewis et al., 2009). 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.

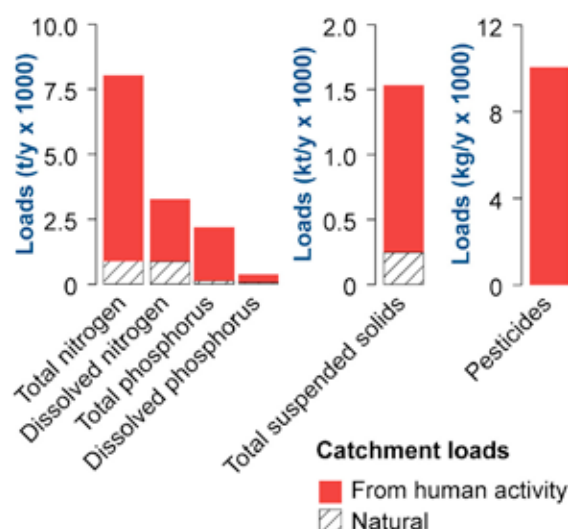


Figure 9.10 – Total and anthropogenic (caused by human activity) pollutant load estimates for total suspended solids, total nitrogen, total phosphorus, dissolved nitrogen, dissolved phosphorus and pesticides.

9.5 Great Barrier Reef water quality and ecosystem health

9.5.1 Results

- **Inshore waters in the Mackay Whitsunday region have concentrations of suspended solids above Great Barrier Reef Marine Park Water Quality Guidelines. A range of pesticides including diuron, atrazine and tebuthiuron are detectable in inshore waters of the region.**
- **Seagrass abundance is moderate but is declining at many sites. Seagrass reproductive capacity is declining raising concerns about resilience to disturbance.**
- **Inshore reefs in the Mackay Whitsunday region are in moderate condition. Coral cover is stable but has not increased in recent years despite the lack of disturbances, leading to a poor rating overall. The cover of macroalgae is low and the number of juvenile colonies is good, but has declined in recent years.**

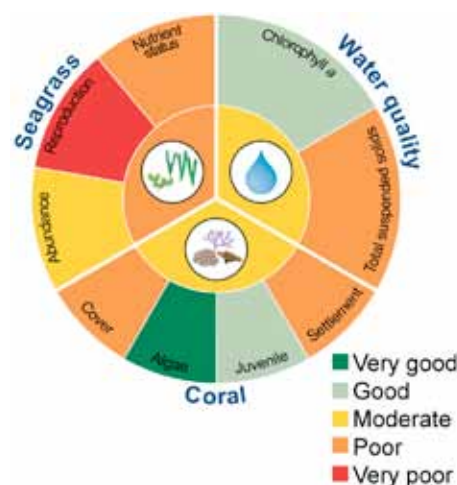


Figure 9.11 – Great Barrier Reef water quality and ecosystem health of the Mackay Whitsunday region showing the status of water quality, seagrass and corals.

9.5.2 Water quality

Over the period 2008–2009, freshwater discharges from the Proserpine, O’Connell and Pioneer Rivers and Plane Creek were above median flows, with the Proserpine River and Plane Creek having flows 1.8 and 1.7 times greater than the median flow respectively. Great Barrier Reef 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 9.5). The mean values of suspended solids concentrations in the region exceeded the Great Barrier Reef Marine Park Water Quality Guideline values for the inshore, midshelf and offshore areas.

Table 9.5 – Summary of the exceedance of mean annual chlorophyll *a* and non-algal particulate matter (as a measure of suspended solids) for the Mackay Whitsunday region (1 May 2008–30 April 2009).

Chlorophyll <i>a</i> : 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
24	3	0	74	42	50

A range of pesticides were detected in passive samplers deployed in inshore marine environments in the Mackay Whitsunday region over the monitoring period (Figure 5.13). Detected pesticides included diuron, atrazine, and tebuthiuron. In contrast to other regions, atrazine was the pesticide detected in highest concentrations. Concentrations of detected pesticides were typically (but not always) higher during the wet season. The maximum water concentrations of individual pesticides ranged from 0.15 to 4.1 nanograms per litre.

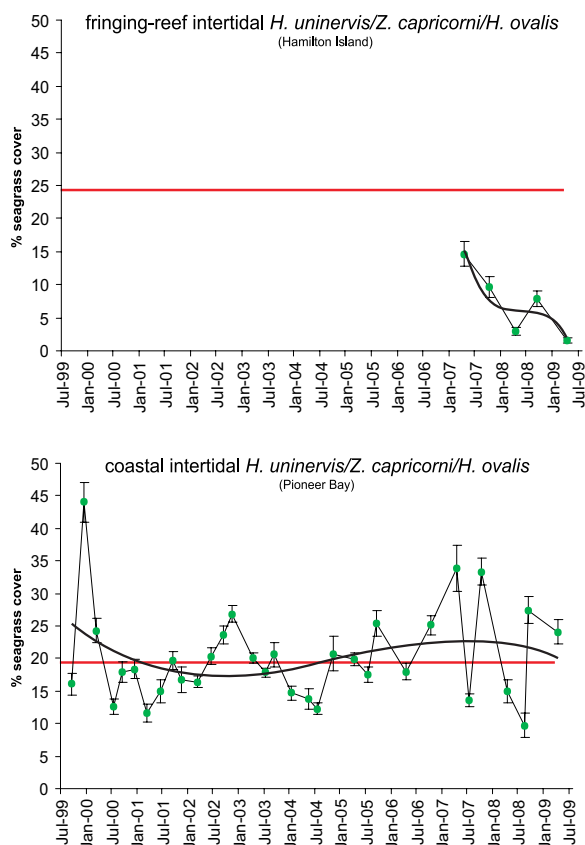
In high river flow conditions, diuron was detected at concentrations above Great Barrier Reef Marine Park Water Quality Guidelines off the Pioneer River in 2007, and tebuthiuron was detected above Great Barrier Reef Marine Park Water Quality Guidelines off the O’Connell River in 2005 and 2007 (Lewis et al., 2009). Refer to the case study: Pesticides in flood plumes in the Mackay Whitsunday region (Section 5.5.2).

9.5.3 Seagrass status

Seagrass meadows are monitored at reef, coastal and estuarine sites at three locations in the Mackay Whitsunday region. Similar to other regions, seagrass cover is variable between habitat types. Cover at the coastal site is currently higher than the long term Great Barrier Reef average, whereas cover at the estuarine and reef sites is lower (Figure 9.12). Seagrass cover at the reef site has declined since 2007.

Seagrass reproductive capacity in the region is in decline, raising concerns about the ability of regional meadows to recover from significant future disturbance events such as cyclones and floods. Seagrass meadows in the region are also subjected to reduced light availability.

Figure 9.12 below – Long term seagrass cover, Pioneer Bay (coastal), Sarina Inlet (estuarine) and Hamilton Island (reef), Mackay Whitsunday region, compared with long term Great Barrier Reef average (red line) (Source: DEEDI).



9.5.4 Coral status

Seven coral reefs are monitored in the Mackay Whitsunday region. Coral status in the region is moderate overall, with monitored reefs having high coral cover and low cover of macroalgae. Despite the lack of disturbances such as cyclones and bleaching events in the region over the past four years, coral cover is stable and has not increased. However, this is generally expected from resilient reefs. The density of juvenile corals has declined over the past four years to low levels, despite high densities of coral larvae settling on reefs in the region. The sediment at these reefs has a high proportion of fine (silt and clay) particles, which increased after repeated flood events in recent years.

Table 9.6 – Summary of coral community status of monitored reefs in the Mackay Whitsunday region, 2008–2009.

Reef	Depth (m)	Overall status	Coral cover	Change in hard coral cover	Macroalgae cover	Juvenile density	Settlement
Double Cone Island	2	neutral	+	-	+	neutral	-
	5	+	+	-	+	neutral	neutral
Daydream Island	2	-	neutral	-	+	neutral	-
	5	+	neutral	-	+	+	neutral
Hook Island	2	++	+	neutral	+	neutral	N/A
	5	+	+	-	+	neutral	N/A
Dent Island	2	++	+	-	+	+	N/A
	5	neutral	neutral	-	+	neutral	N/A
Shute Island and Tancred Island	2	+++	+	neutral	+	+	N/A
	5	+	neutral	-	+	+	N/A
Pine Island	2	--	neutral	-	neutral	neutral	-
	5	+	neutral	-	+	+	neutral
Seaforth Island	2	neutral	neutral	-	neutral	+	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.