Burdekin region

Chapter 8

"The Burdekin catchments drain a great diversity of tropical landscapes: semi-arid drylands, wooded grasslands, mountainous tropical rainforests, coastal plains and wetlands."

Photo courtesy of NQ Dry Tropics

8.1 Profile

The Burdekin region, which covers a land area of approximately 141,000 square kilometres, is largely drained by a single river system, the Burdekin. Regional land use is dominated by extensive grazing on natural pastures. The major threat from this land use is sediment and associated particulate nutrients from soil erosion, while some herbicide residues have also been detected in river runoff.

Other smaller coastal rivers drain around six per cent of the region. Intensive, irrigated agriculture along the coastal floodplain is dominated by sugar and horticulture. Runoff from these industries drains into the Great Barrier Reef through several smaller rivers, creeks and groundwater. Dissolved nutrients from fertiliser use and pesticides are the major threat to water quality entering the Great Barrier Reef from sugar and horticulture cropping areas.

The regional climate is characterised by strong seasonality, with pronounced wet and dry seasons, and high inter-annual variability. Discharge from rivers and creeks in the Burdekin region is characterised by high-magnitude pulses of water of short duration that are associated with wet season rains.

The Burdekin catchments drain a great diversity of tropical landscapes: semi-arid drylands, wooded grasslands, mountainous tropical rainforests, coastal plains and wetlands. The biodiversity assets of the Burdekin region are equally diverse and of both national and international significance. Many wetlands are listed in the National Directory of Important Wetlands in Australia.

The regional natural resource management body, NQ Dry Tropics, partners with industry groups to deliver training, extension support and financial incentives to landholders to accelerate best practice adoption of land management in the sugar, horticulture and grazing industries. Programs specifically target nutrient, pesticide and sediment reduction from these agricultural activities.

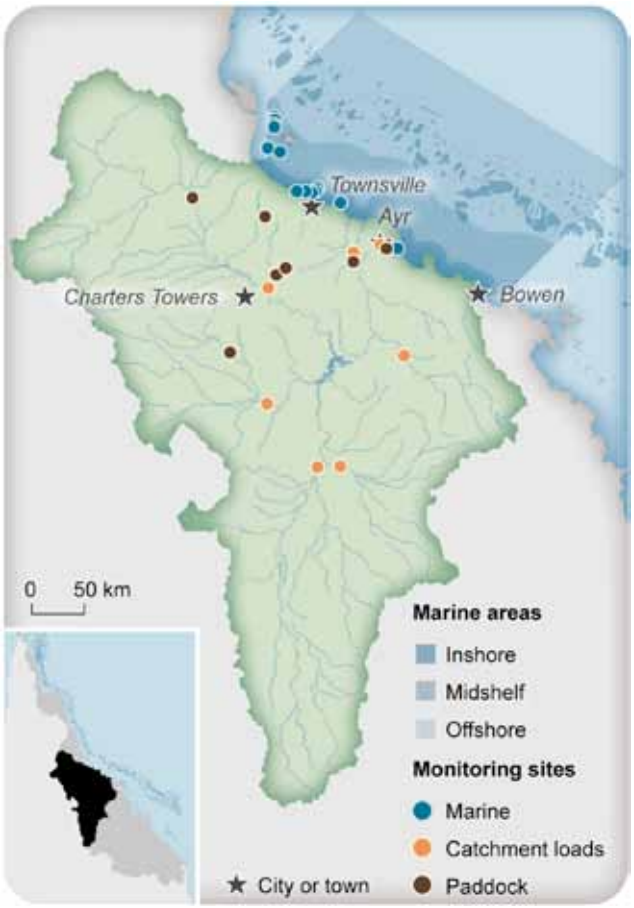
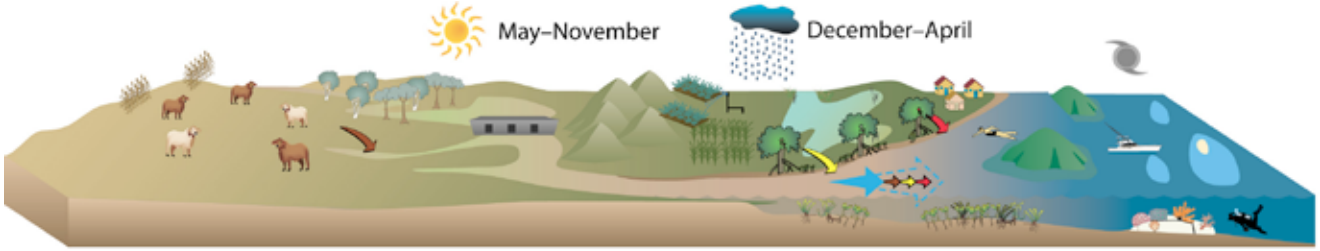


Figure 8.1 – Map of the Burdekin region and Great Barrier Reef Marine Park showing the paddock, catchment and marine monitoring sites.



The Burdekin region has occasional cyclones and highly variable rainfall predominantly in summer that falls mostly along the coastal areas and delivers 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 large region is mostly drained by the Burdekin River. Grazing is the dominant land use and sugarcane , horticulture and other cropping are important irrigated land uses. The Burdekin dam and groundwater are important for irrigation. Urban centres such as Townsville and the smaller towns of Ayr and Bowen are located on the coastal strip. Habitats include fringing and offshore reefs , shallow-water seagrass , mangroves and freshwater swamp wetlands . There are continental islands (such as Magnetic Island) along the coast. Reef-based tourism , as well as commercial and recreational fisheries , are an important part of the regional economy.

Figure 8.2 – Conceptual model showing the key processes influencing water quality and reef ecosystem health in the Burdekin region.

8.2 Adoption of improved management practices

8.2.1 Results

- **Thirty-nine per cent of graziers are using (A or B) practices likely to maintain land in good to very good condition or improve land in lesser condition.**
- **Practices (D) considered likely to degrade land to poor condition are used by 12 per cent of graziers.**
- **Overall, cutting-edge (A) or best management (B) practices are used by 33 per cent of sugarcane growers.**
- **In terms of nutrient management, 45 per cent of sugarcane growers use best management (B) practices.**
- **In terms of herbicide and soil management, practices considered unacceptable by industry or community standards (D) are used by 25 per cent and 23 per cent of sugarcane growers respectively.**
- **Overall, cutting-edge (A) or best management (B) practices are used by 63 per cent of horticulture producers.**
- **In terms of nutrient management, cutting-edge (A) or best management (B) practices are used by 35 per cent of horticulture producers.**

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.

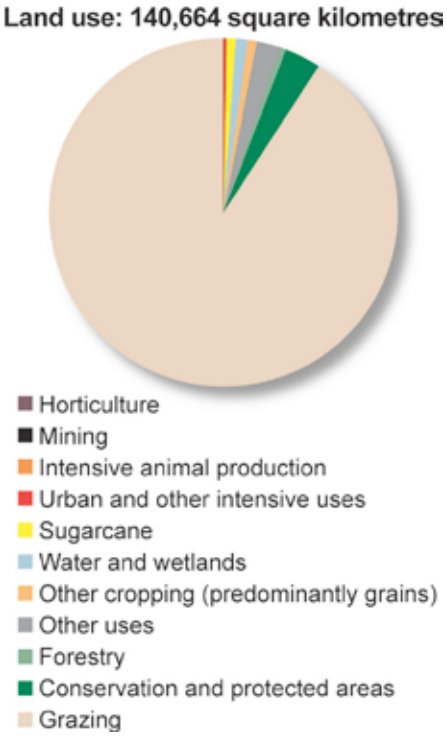


Figure 8.3 – Burdekin region land use.

8.2.2 Sugarcane

As at 2008–2009, there are 657 landholders growing sugarcane on 1061 square kilometres of land within the Burdekin region. The overall management practices (including nutrient, herbicide and soil) are shown in Table 8.1. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 33 per cent of sugarcane growers on 54 per cent of the land area. Code of practice or common (C) practices are used by 49 per cent of sugarcane growers. Practices considered unacceptable by industry and community standards (D) are used by 18 per cent of growers.

Best management (B) practices for nutrients are used by 45 per cent of sugarcane growers while six per cent of growers are using unacceptable (D) nutrient management practices.

Best management (B) practices for herbicides are used by 22 per cent of growers. Twenty-five per cent of growers are using herbicide practices considered unacceptable (D).

Cutting-edge (A) or best management (B) practices for soil are used by 32 per cent of growers with 23 per cent using unacceptable (D) soil management practices.

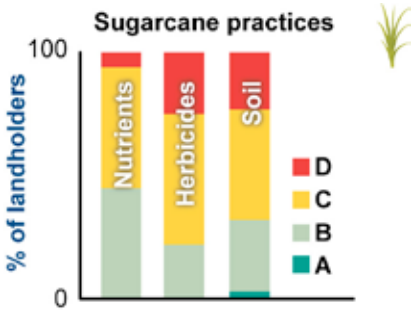


Figure 8.4 – Adoption of improved sugarcane management practices using the ABCD management framework for the Burdekin region.

Table 8.1 – ABCD sugarcane management practices for the Burdekin region (Source: modified from GHD, 2010c).

Combined management	A cutting-edge	B best practice	C code practice	D unacceptable practice
Number of cane growers	7	210	322	118
% of cane growers	1%	32%	49%	18%
Area (km²)	18	555	364	124
% of area	2%	52%	34%	12%
Nutrient management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of cane growers	0	296	322	39
% of cane growers	0%	45%	49%	6%
Area (km²)	0	668	371	21
% of area	0%	63%	35%	2%
Herbicide management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of cane growers	0	145	348	164
% of cane growers	0%	22%	53%	25%
Area (km²)	0	552	318	191
% of area	0%	52%	30%	18%
Soil management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of cane growers	20	191	296	150
% of cane growers	3%	29%	45%	23%
Area (km²)	53	446	403	159
% of area	5%	42%	38%	15%

8.2.3 Grazing

There are an estimated 827 landholders grazing cattle on 128,000 square kilometres of land in the Burdekin region. Thirty-nine 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. Forty-nine per cent of graziers are using (C) management practices that may maintain land in fair condition or gradually improve land in poor condition. Practices (D) considered likely to degrade land to poor condition are being 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.

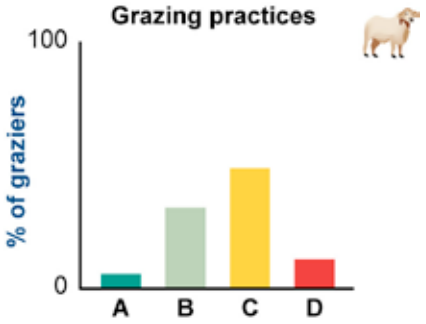


Figure 8.5 – Adoption of improved grazing management practices using the ABCD management framework for the Burdekin region.

Table 8.2 – ABCD grazing management practices for the Burdekin region.

Burdekin	A practices	B practices	C practices	D practices
Number of graziers	46	271	406	104
% of graziers	6%	33%	49%	12%
Area (km²)	7200	42,048	63,040	16,192

8.2.4 Horticulture

As at 2008–2009, there are 192 landholders growing horticultural crops on 156 square kilometres of land within the Burdekin region. The main horticultural crops include tomatoes, mangoes and vegetables.

The overall management practices (including nutrient, herbicide and soil) are shown in Table 8.3. Adoption of specific nutrient, herbicide and soil management practices are also reported.

Cutting-edge (A) or best management (B) practices are used by 63 per cent of producers. Code of practice or common (C) practices are used by 25 per cent of producers. Practices considered unacceptable by industry and community standards (D) are used by 12 per cent of producers.

Cutting-edge (A) or best management (B) practices for nutrients are used by 35 per cent of producers. Code of practice or common (C) nutrient management practices are used by 51 per cent of producers. Nutrient management practices considered unacceptable (D) are used by 14 per cent of producers.

Cutting-edge (A) or best management (B) practices for herbicides are used by 81 per cent of producers while 10 per cent of growers use unacceptable (D) nutrient management practices.

Cutting-edge (A) or best management (B) practices for soil are used by 75 per cent of producers, with 11 per cent using unacceptable (D) soil management practices.

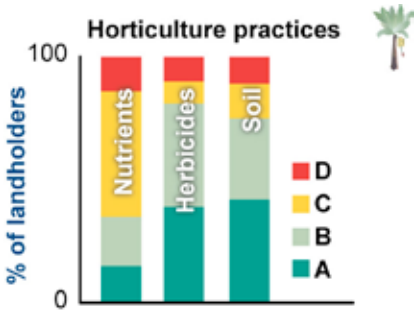


Figure 8.6 – Adoption of improved management practices for horticulture using the ABCD management framework for the Burdekin region.

Table 8.3 – ABCD horticulture management practices for the Burdekin 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	60	61	48	23
% of horticulture producers	31%	32%	25%	12%
Area (km²)	54	53	37	12
% of area	34%	34%	24%	8%
Nutrient management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture producers	29	38	98	27
% of horticulture producers	15%	20%	51%	14%
Area (km²)	21	47	78	10
% of area	13%	30%	50%	7%
Herbicide management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture producers	73	81	18	20
% of horticulture producers	39%	42%	9%	10%
Area (km²)	78	58	10	10
% of area	50%	38%	6%	6%
Soil management	**A cutting-edge**	**B best practice**	**C code practice**	**D unacceptable practice**
Number of horticulture producers	79	64	27	22
% of horticulture producers	42%	33%	14%	11%
Area (km²)	63	53	23	17
% of area	40%	34%	15%	11%

8.3 Catchment indicators

8.3.1 Results

- **The total riparian area in the Burdekin region is 2.1 million hectares, of which an estimated 58,000 hectares are likely to be susceptible to erosion (non-forested and low groundcover) and, therefore, sediment loss to streams.**
- **The loss of riparian vegetation between 2004 and 2008 was 5834 hectares (0.28 per cent).**
- **The extent of wetlands (including vegetated freshwater swamps, lakes and mangroves/salt flats) across the Burdekin region as at 2005 is 137,000 hectares.**
- **As at 2005, the loss of vegetated freshwater swamps since pre-European times was 20 per cent; however, 49 per cent and 37 per cent were lost in the Don and Haughton catchments respectively.**
- **The loss of vegetated freshwater swamps over the 2001–2005 period was 124 hectares (0.2 per cent) across the Burdekin region, with almost three per cent loss in the Ross catchment.**
- **The 2009 mean dry season groundcover for the grazing lands of the Burdekin region is 83 per cent, which is above the Reef Plan target of 50 per cent.**
- **Despite the generally higher cover, areas with low cover (under 30 per cent) have increased in 2009.**

8.3.2 Riparian vegetation

The Burdekin region has 1.6 million hectares (77 per cent) of riparian areas forested and 400,000 hectares (19 per cent) of non-forested riparian areas with high groundcover. Fifty-eight thousand hectares (2.8 per cent) of riparian areas were non-forested areas with low groundcover. The Burdekin and Don catchments have the highest percentage of area with low riparian forest and groundcover, with 2.9 per cent and 2.6 per cent respectively. These areas are likely to be susceptible to erosion and, therefore, sediment loss to streams.

The Ross catchment had the highest proportion of clearing between 2004 and 2008, with 415 hectares (one per cent).

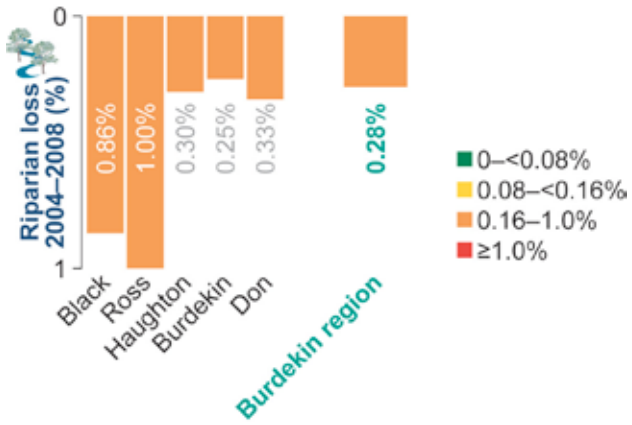


Figure 8.7 – Loss of riparian vegetation between 2004 and 2008 in the Burdekin region.

Table 8.4 – 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)	%
Burdekin	1,832,515	1,415,482	77.24	353,586	19.30	53,921	2.94	0.52	4652	0.25
Black	32,604	30,303	92.94	1786	5.48	235	0.72	0.86	280	0.86
Ross	41,391	32,222	77.85	7926	19.15	667	1.61	1.39	415	1.00
Haughton	91,974	65,164	70.85	23,469	25.52	1297	1.41	2.22	272	0.30
Don	65,264	49,192	75.37	13,246	20.30	1694	2.60	1.73	215	0.33
Burdekin region	2,063,748	1,592,363	77.16	400,013	19.38	57,814	2.80	0.66	5834	0.28

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

8.3.3 Wetlands

As at 2005, there are approximately 137,000 hectares of wetlands in the Burdekin region. Of these wetland areas there are:

- 62,000 hectares of vegetated freshwater swamps (palustrine wetlands). The greatest area of vegetated freshwater swamps is in the Burdekin catchment.
- 8200 hectares of lakes (lacustrine wetlands).
- 67,000 hectares of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in the Don, Haughton and Ross catchments.

Ninety-one percent of wetlands remain from pre-European times. There has been a 20 per cent loss of vegetated freshwater swamps since pre-European times across the region; however, 49 per cent and 37 per cent have been lost in the Don and Haughton catchments respectively. More than 98 per cent of mangroves and salt flats remain in all catchments.

The overall loss of wetlands in the Burdekin region between 2001 and 2005 was 144 hectares (0.11 per cent). The loss of vegetated freshwater swamps over the 2001–2005 period was 124 hectares (0.2 per cent) across the Burdekin region, with almost three per cent loss in the Ross catchment. There was little reduction in the extent of mangroves/salt flats over the 2001–2005 period, ranging from nil to 0.43 per cent.

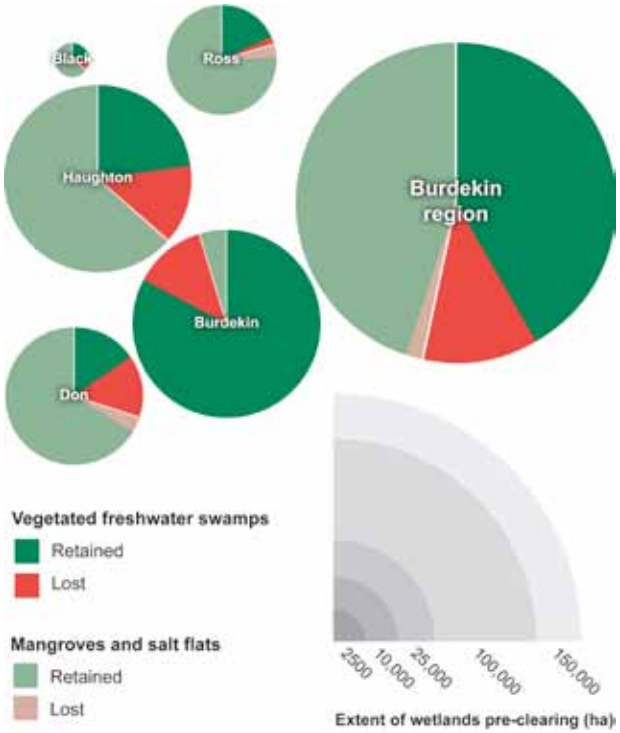


Figure 8.8 – Extent (hectares) and proportion of vegetated freshwater swamps and mangroves/salt flats remaining from pre-European extent in the Burdekin region.

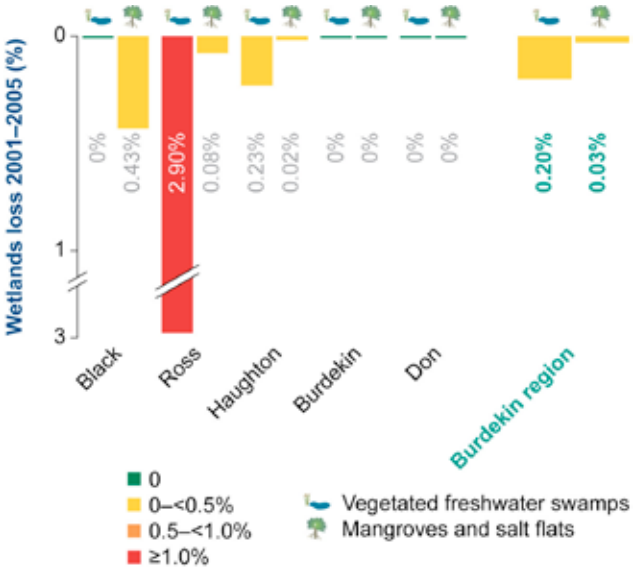


Figure 8.9 – Loss of vegetated freshwater swamps and mangroves/salt flats (between 2001 and 2005) for the Burdekin region.

Table 8.5 – The extent of wetlands in 2005 and change between 2001 and 2005 across the Burdekin 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)
Black	430	75	0	NP	NP	NP	1080	97	0.43	1510	91	0.31
Burdekin	42,390	87	0	8015	100	0	2425	100	0	52,830	93	0
Don	4225	51	0	10	100	0	18,205	95	0	22,440	85	0
Haughton	11,650	63	0.23	155	80	0	31,955	99	0.02	43,760	88	0.07
Ross	3180	90	2.9	0	100	0	13,190	95	0.08	16,370	94	0.22
Burdekin region	61,875	80	0.20	8180	99	0	66,855	98	0.03	136,910	91	0.11

NP – wetland type was not present.

8.3.4 Groundcover in grazing lands

The majority of the region's grazing lands are in the Burdekin catchment. The long term mean dry season groundcover for the grazing lands of the Burdekin region over the 1986–2009 period is 75 per cent, which is above the Reef Plan target of 50 per cent (Table 5.6). The average groundcover in 2009 is higher than the historical average, increasing to 83 per cent. Despite the generally higher cover, it appears areas with low cover (under 30 per cent) have increased in 2009, with 2.3 per cent coverage compared to the long term mean of 1.7 per cent. This is accompanied by a reduction in areas with groundcover (greater than or equal to 30 per cent up to 50 per cent) in 2009 with four per cent compared to the long term mean of 5.4 per cent.

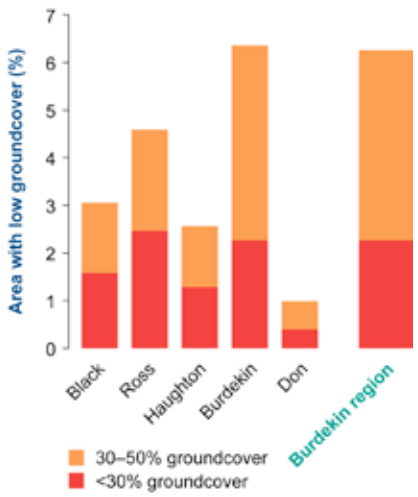


Figure 8.10 – Area with low groundcover (area under 30 per cent and between 30 per cent and 50 per cent) as at 2009 for the Burdekin region.

8.4 Catchment loads

The total suspended solids load leaving the catchments of the Burdekin region is an estimated 4.7 million tonnes per year, of which 4.1 million tonnes are from human activity. These high suspended sediment concentrations in streams are associated with rangeland grazing and locally specific catchment characteristics.

The total nitrogen load leaving the catchments of the Burdekin region is 14,000 tonnes per year, of which 11,000 tonnes are from human activity.

The total phosphorus load leaving the catchment of the Burdekin region is 2600 tonnes per year, of which 2200 tonnes are from human activity.

The dissolved nitrogen load is 5700 tonnes per year, of which 3500 tonnes are from human activity. It is estimated that the main source of this load is fertiliser loss from sugarcane areas (Brodie et al., 2009). The dissolved phosphorus load is 430 tonnes per year, of which 300 tonnes are from human activity.

The total photosystem inhibiting (PSII) pesticide load leaving the catchments of the Burdekin region is estimated at 4900 kilograms per year. 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 herbicides (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.

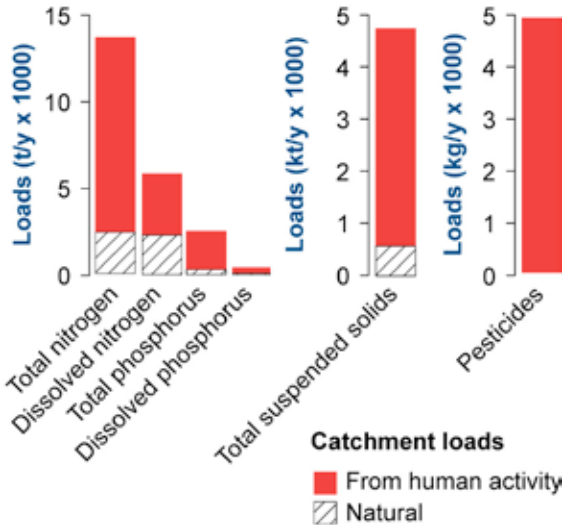


Figure 8.11 – Total and anthropogenic (caused by human activity) pollutant load estimates for total suspended solids, total nitrogen, total phosphorus, dissolved nitrogen, dissolved phosphorus and pesticides.

8.5 Great Barrier Reef water quality and ecosystem health

8.5.1 Results

- **Inshore waters in the Burdekin region have concentrations of chlorophyll *a* and total suspended solids above Great Barrier Reef Marine Park Water Quality Guidelines. A range of pesticides including diuron, atrazine, hexazinone, simazine, ametryn and tebuthiuron are detectable in inshore waters of the region.**
- **Seagrass abundance in the region is good, but has declined at coastal locations and is variable at reef locations. There are low numbers of reproductive structures indicating reduced resilience to disturbance.**
- **Inshore reefs in the Burdekin region are in poor condition. The lack of recovery of these reefs is of concern as there have been no obvious natural disturbances since they were impacted by coral bleaching in 2002. Settlement of coral larvae is very poor and numbers of juvenile corals are poor, which may be due to low coral cover limiting the availability of coral larvae.**

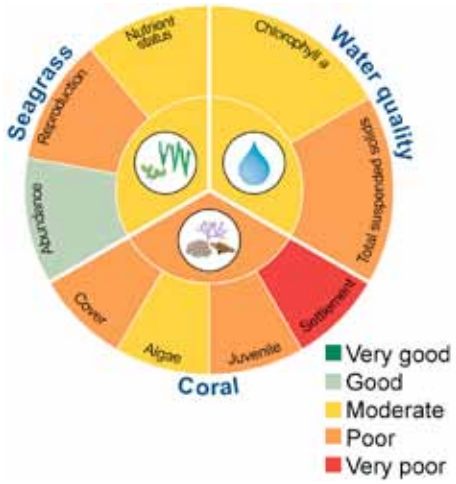


Figure 8.12 – Great Barrier Reef water quality and ecosystem health of the Burdekin region showing the status of water quality, seagrass and corals.

8.5.2 Water quality

Fresh water discharged from the Burdekin River in 2008–2009 was more than five times the annual median regional flow. Great Barrier Reef Marine Park Water Quality Guideline exceedances for chlorophyll *a* and suspended solids concentrations were calculated for the May 2008–April 2009 period from satellite imagery (Table 8.6). The mean chlorophyll *a* and suspended sediment concentrations exceeded the Great Barrier Reef Marine Park Water Quality Guideline values (GBRMPA, 2009) for the inshore area of the Burdekin region.

Table 8.6 – Summary of the exceedance of mean annual chlorophyll *a* and non-algal particulate matter (as a measure of suspended solids) for the Burdekin 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
54	1	0	65	5	3

A range of pesticides were detected in passive samplers deployed in inshore marine environments in the Burdekin region over the monitoring period (Figure 5.13). Detected pesticides included diuron, atrazine, hexazinone, simazine, ametryn and tebuthiuron. Concentrations of pesticides were typically (but not always) higher during the wet season. The maximum water concentrations of individual pesticides in the region ranged from 0.25 to 10 nanograms per litre.

Pesticides detected in high river discharge conditions had concentrations exceeding Great Barrier Reef Marine Park Water Quality Guidelines for diuron at several inshore sites (Lewis et al., 2009).

8.5.3 Seagrass status

Seagrass meadows are monitored at reef and coastal sites at four locations in the Burdekin region. In 2008–2009 seagrass abundance declined at coastal locations and was variable at reef locations (Figure 8.13). Seagrass tissue nutrient concentrations indicate that all sites are light limited and nutrient rich. In coastal locations in Townsville, nitrogen levels are elevated and increasing. Monitoring has shown that regional meadow light regimes are influenced primarily by climatic factors such as day length, rainfall, wind speed and tidal height.

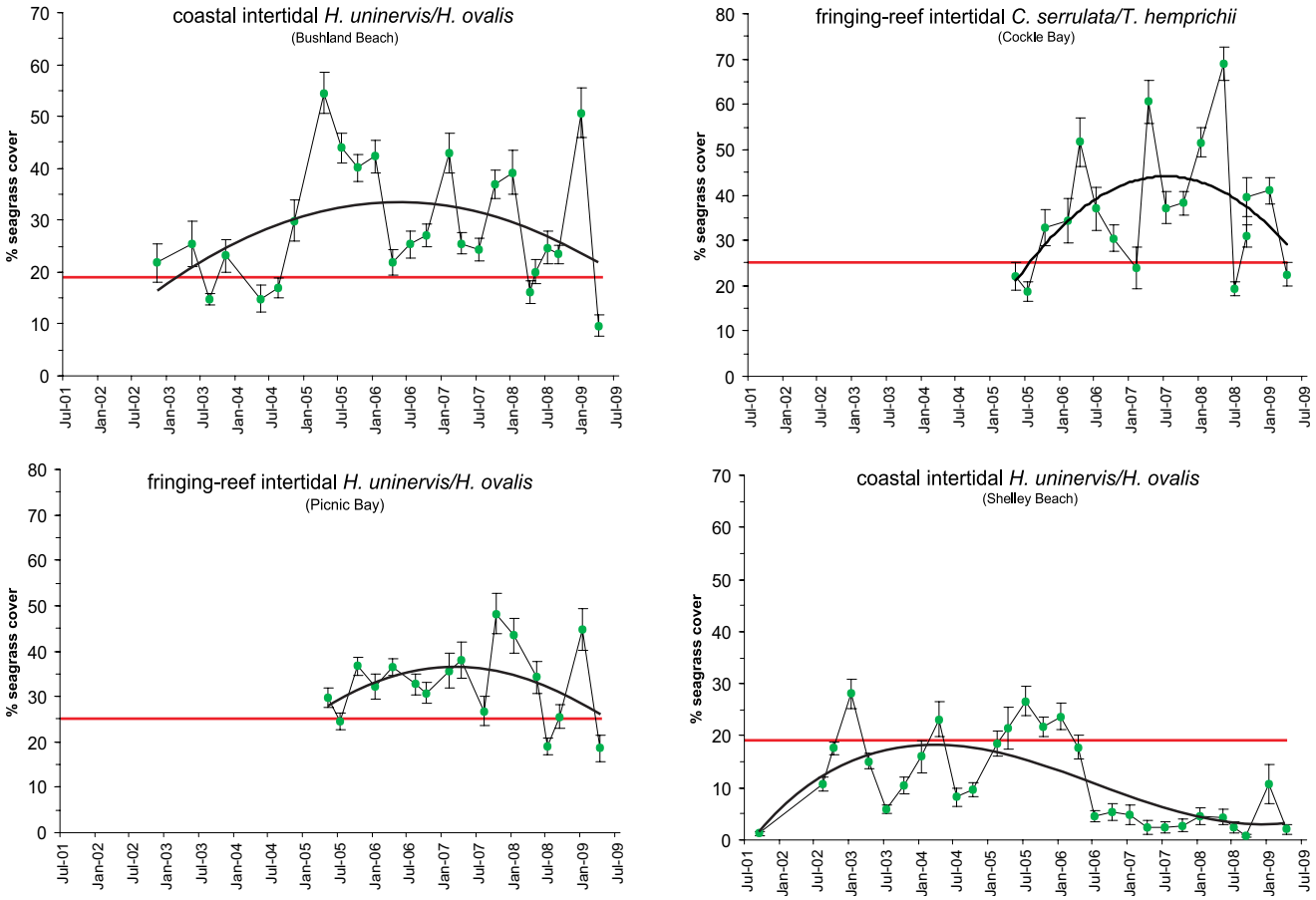


Figure 8.13 – Long term seagrass cover, Bushland Beach (coastal), Shelley Beach (coastal), Cockle Bay (reef) and Picnic Bay (reef), Burdekin region, compared with long term Great Barrier Reef average (red line) (Source: DEEDI).

8.5.4 Coral status

Seven inshore reefs are monitored in the Burdekin region. These reefs have all been exposed to severe disturbances from elevated seawater temperatures, cyclones or both, with crown-of-thorns starfish outbreaks also impacting some reefs. Most of the Burdekin region reefs have failed to recover from these disturbances over the past five years of monitoring, and remain in a poor state with low coral cover and high macroalgal cover. Critically for reef resilience and recovery, levels of coral recruitment in the region have remained consistently low over the five year monitoring period. The regionally low coral cover may be limiting the availability of coral larvae, which may explain the regionally low density of juvenile colonies.

Table 8.7 – Summary of coral community status of monitored reefs in the Burdekin region, 2008–2009.

Reef	Depth (m)	Overall status	Coral cover	Change in hard coral cover	Macroalgae cover	Juvenile density	Settlement
Orpheus Island East	2	neutral	neutral	neutral	+	-	N/A
	5	+	neutral	+	+	-	N/A
Pelorus Island and Orpheus Island West	2	++	neutral	neutral	+	+	N/A
	5	-	neutral	-	+	neutral	-
Havannah Island	2	-	-	neutral	+	-	N/A
	5	- - - -	-	-	-	-	N/A
Pandora Reef	2	- -	-	+	-	-	N/A
	5	- - -	-	+	-	-	-
Lady Elliot Reef	2	neutral	neutral	neutral	-	+	N/A
	5	+	neutral	N/A	neutral	+	N/A
Middle Reef		++	neutral	neutral	+	+	N/A
Geoffrey Bay	2	- - -	-	neutral	-	-	N/A
	5	- - - -	-	-	-	neutral	-

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.