Great Barrier Reef
Second Report Card 2010
Reef Water Quality Protection Plan
Detailed results

The Reef Water Quality Protection Plan (Reef Plan) Second Report Card measures progress from the 2009 baseline towards Reef Plan's goals and targets. It assesses the combined results of all Reef Plan actions up to June 2010.

The Second Report Card was produced as part of the Paddock to Reef program.

Information about how the key indicators were measured can be found in the Methods report.

Key findings

Overall progress towards Reef Plan targets has been encouraging; however it will take time for these achievements to translate into improved marine conditions.

Key results include:

- The condition of the marine environment remained moderate overall in 2009-2010. This ranking comprises moderate scores for water quality and coral and a poor score for seagrass, which has declined during the past four years.
- Overall, across the Great Barrier Reef region, there has been good progress by land managers towards Reef Plan targets. Twenty per cent of sugarcane growers, 11% of graziers, and 18% of horticulture producers have adopted improved land management practices.
- Estimated average annual pollutant loads entering the reef have reduced – nitrogen by four per cent, phosphorus by 2%, sediment by 2% and pesticides by 8%.
- Loss of wetlands and riparian areas has slowed in recent years.

Management practice results

By setting ambitious targets, Reef Plan aims to significantly improve land management practices and reduce pollution runoff to the Great Barrier Reef by 2013. Progress towards these output targets for grazing, horticulture and sugarcane up to June 2010 is shown below.

Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below. Progress for the grains industry is presented in the Fitzroy summary. Information for the cotton and dairy industries is not currently available.

Management practice systems

It is important to note that not all improved management practices result in a change in management practice system (rated from A to D for reporting purposes). This means that the number of landholders estimated to have improved management practices will typically be greater than the number estimated to have improved management systems. The status in terms of management practice systems for grazing, horticulture and sugarcane is shown.

The adoption of an improved management practice system for grazing is presented using the ABCD framework:

- 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.

The adoption of an improved management practice system for sugarcane and horticulture is presented using the ABCD framework:

- A—Cutting-edge practices
- B—Best practices
- C—Common or code of practices
- D—Practices considered unacceptable by industry or community standards.

The 2008–2009 baseline for management practice information in the First Report Card was based on limited data and, therefore, was of low confidence. As part of the Paddock to Reef program, new information has been collected through rigorous industry surveys, validated on ground. This has provided refined baseline data for 2008–2009 which is far more accurate and useful at the local scale. This Second Report Card uses the refined baseline and compares it against data collected in 2009–2010 using the same method.

Great Barrier Reef

Grazing

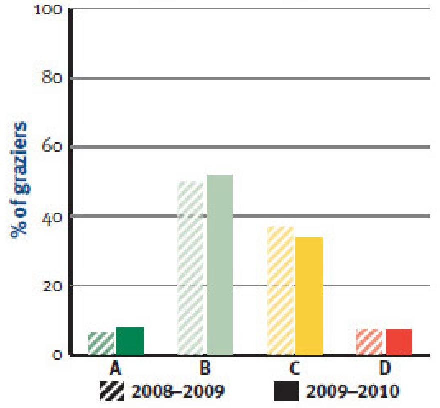
There are 8545 graziers managing 322,891 square kilometres of land across the Great Barrier Reef catchment.

Target: 50% of landholders in the grazing sector will have adopted improved pasture and riparian management practices by 2013.

Result: Good progress

By June 2010, 11% of graziers (908) had adopted improved land management practices. The greatest adoption of improved practices was in the Cape York region (23%).

Grazing practice systems



By June 2010, 59% of graziers were using (A or B) management practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

7% of graziers were using a high risk system, highly likely to degrade land to poor or very poor condition.

Major sources of adoption are outlined below.

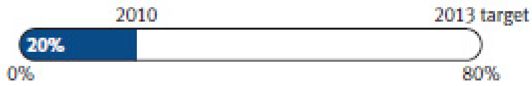
- Regional bodies, through the Reef Rescue program, facilitated management system improvements in 280 grazing businesses.
- Training and targeted extension through the Queensland Government is estimated to have influenced management practice improvements in 197 grazing businesses. In addition, training provided by AgForward is estimated to have contributed to management practice improvements in 173 grazing businesses.
- An estimated 487 graziers adopted improved practices through training directly relevant to Reef Plan objectives with the support of the Australian Government's FarmReady program.

Sugarcane

There are 3777 sugarcane growers managing 4032 square kilometres of land across the Great Barrier Reef catchment.

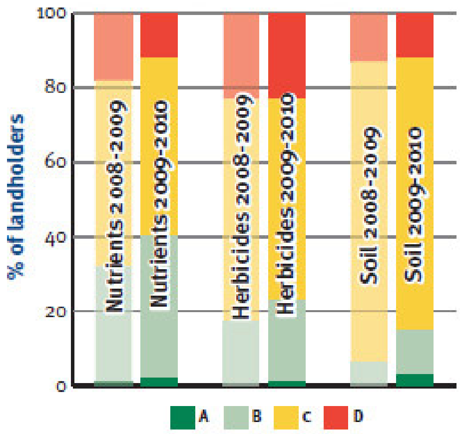
Target: 80% of landholders in agricultural enterprises will have adopted improved soil, nutrient and/or chemical management practices by 2013.

Result: Good progress



By June 2010, 20% of sugarcane growers (756) had adopted improved land management practices. The greatest adoption of improved practices was in the Burnett Mary region (25%).

Sugarcane practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 40% of sugarcane growers for nutrients, 23% for herbicides and 15% for soil.

Unacceptable (D) soil management systems were used by 12% of sugarcane growers.

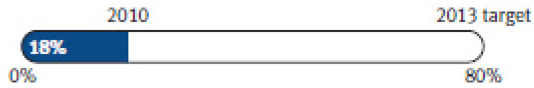
Regional Natural Resource Management bodies, through the Reef Rescue program, directly facilitated management system improvements in 756 sugarcane growing businesses. Training and targeted extension funded by the Reef Rescue program and driven by Terrain Natural Resource Management, BSES Ltd and local agronomy service providers, in combination with the introduction of the Reef Protection Package, is estimated to have influenced nutrient management system improvements in 212 businesses in the Wet Tropics.

Horticulture

There are 970 horticulture producers managing 697 square kilometres of land across the Great Barrier Reef catchment.

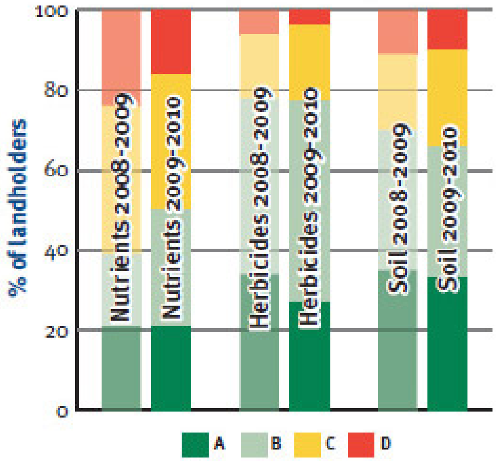
Target: 80% of landholders in agricultural enterprises will have adopted improved soil, nutrient and/or chemical management practices by 2013.

Result: Good progress



By June 2010, 18% of horticulture producers (174) had adopted improved land management practices. The adoption rate varied across regions and ranged from moderate to very good.

Horticulture practice systems

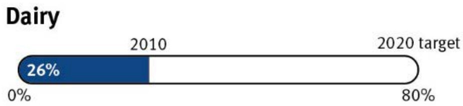


By June 2010, cutting-edge (A) or best management (B) practice systems were used by 50% of horticulture producers for nutrients, 77% for herbicides and 66% for soil.

Nutrient management was the area with the largest proportion of horticulture producers (52%) using C and D level systems.

All 174 horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by regional Natural Resource Management bodies and the Growcom Farm Management System program. Of these, 116 completed nutrient management projects, 34 completed herbicide management projects and 78 completed soil management projects.

Dairy



There are 306 dairy producers across the Great Barrier Reef catchment, with the majority in the Burnett Mary and Wet Tropics regions.

By June 2010, 26% of dairy producers (79) had adopted improved land management practices. Drivers of management practice change during 2008-2009 and 2009-2010 included:

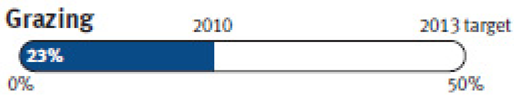
- The Australian Government's Reef Rescue program, facilitated by Terrain Natural Resource Management, Burnett Mary Regional Group and the DBnBR program.
- The Queensland Government's Rural Water Use Efficiency program, through the Dairy and Fodder Water for Profit program, assisted an additional 29 producers to implement improved irrigation and water recycling practices.

Cape York

Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

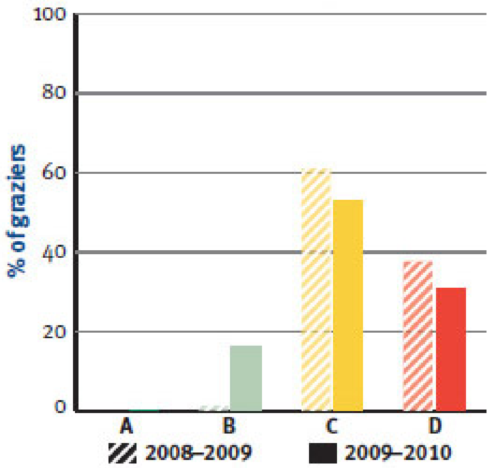
Grazing

There are 48 graziers managing 21,618 square kilometres of land in the Cape York region.



By June 2010, 11 graziers (23%) had adopted improved land management practices.

Grazing practice systems



By June 2010, 16% of graziers were using (A or B) practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

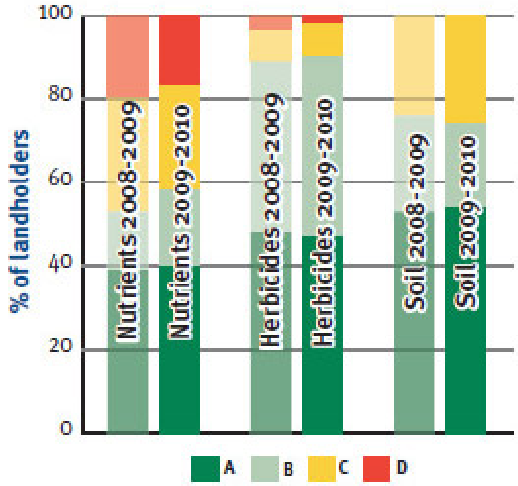
All of these graziers were supported by the Reef Rescue program, facilitated by Cape York Sustainable Futures. Five graziers completed Savannah Plan training (through the Queensland Government) and eight graziers implemented fencing and watering improvements to help manage riparian and frontage country.

Horticulture

There are 30 horticulture producers managing 30 square kilometres of land in the Cape York region.

By June 2010, eight horticulture producers (27%) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 58% of horticulture producers for nutrients, 90% for herbicides and 74% for soil.
Nutrient management had the largest proportion of horticulture producers (42%) using C and D level systems.

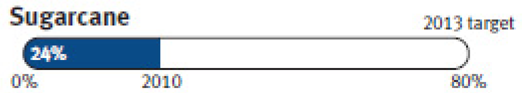
All eight horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by Cape York Sustainable Futures and the Growcom Farm Management System program.

Wet Tropics

Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

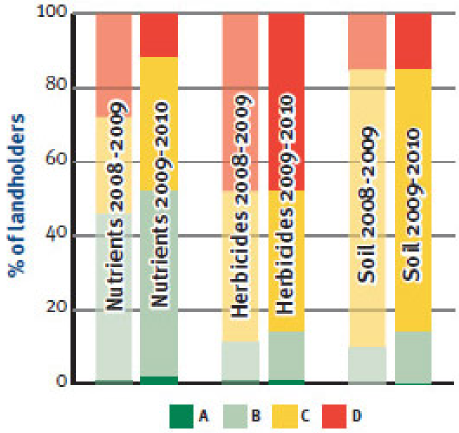
Sugarcane

There are 1343 growers managing 1364 square kilometres of land in the Wet Tropics region.



By June 2010, 24% of sugarcane growers (328) had adopted improved land management practices.

Sugarcane practice systems



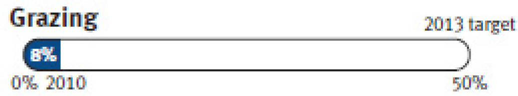
By June 2010, cutting-edge (A) or best management (B) practice systems were used by 52% of sugarcane growers for nutrients, 14% for herbicides and 14% for soil.

Unacceptable (D) soil management systems were used by 15% of growers.

Of the 328 growers who implemented improved practices, 116 completed Reef Rescue Water Quality Grants projects facilitated by Terrain Natural Resource Management. The remaining 212 growers are estimated to have progressed from D level nutrient management systems to C level nutrient management systems, through a combination of concerted Reef Rescue program extension efforts from a range of sources (Terrain Natural Resource Management, BSES Ltd and local agronomic services providers) and the introduction of the Queensland Government's Reef Protection Package.

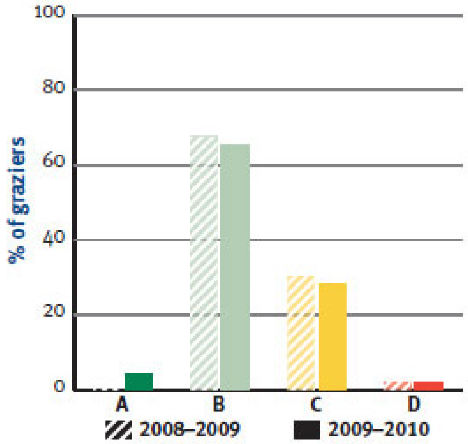
Grazing

There are 935 graziers managing 6983 square kilometres of land in the Wet Tropics region.



By June 2010, 8% (72) of graziers had adopted improved land management practices.

Grazing practice systems



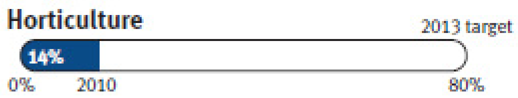
By June 2010, 70% of graziers were using (A or B) practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

2% of graziers were using high risk (D) management systems, highly likely to degrade land to poor or very poor condition.

14 graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by Terrain Natural Resource Management. The Reef Rescue program supported a further 39 graziers to complete relevant training through the Queensland Government and the remaining 19 graziers completed training in grazing management through private sector consultants with the support of the FarmReady program.

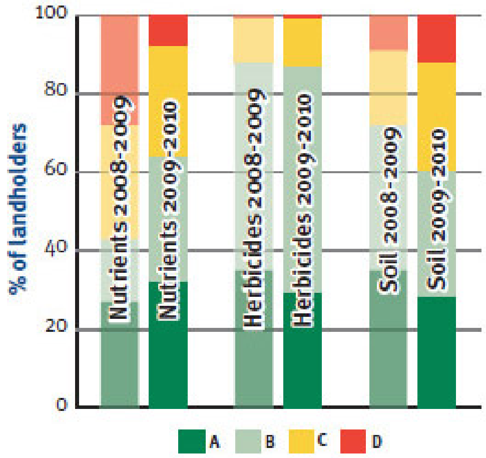
Horticulture

There are 330 horticulture producers managing 251 square kilometres of land in the Wet Tropics region. Bananas are the dominant sector, with 250 growers accounting for approximately 60% of this total area.



By June 2010, 14% of horticulture producers (45) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 64% of horticulture producers for nutrients, 87% for herbicides and 60% for soil.

All 45 horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by Terrain Natural Resource Management and the Growcom Farm Management System program. Of these, 32 completed nutrient management projects and 18 completed soil management projects.

Burdekin

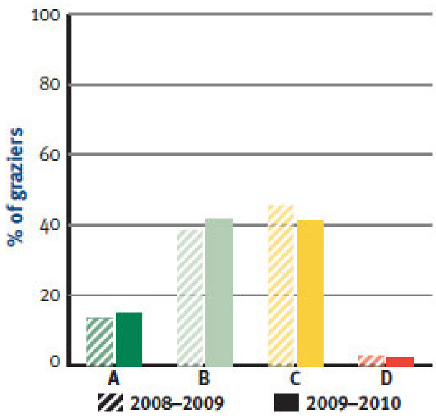
Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

Grazing

There are 983 graziers managing 135,753 square kilometres of land in the Burdekin region.

By June 2010, 13% of graziers (127) had adopted improved land management practices.

Grazing practice systems



By June 2010, 56% of graziers were using (A or B) practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

2% of graziers were using high risk (D) systems, highly likely to degrade land to poor or very poor condition.

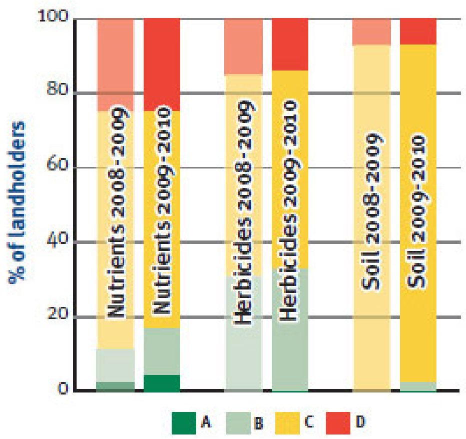
44 of the graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by NQ Dry Tropics. The remaining 83 completed relevant training through AgForward, private sector consultants (supported by the FarmReady program) and the Queensland Government.

Sugarcane

There are 556 growers managing 829 square kilometres of land in the Burdekin region.

By June 2010, 14% of sugarcane growers (75) had adopted improved land management practices.

Sugarcane practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 17% of sugarcane growers for nutrients, 33% for herbicides and 2% for soil.

Unacceptable (D) soil management systems were used by 7% of growers.

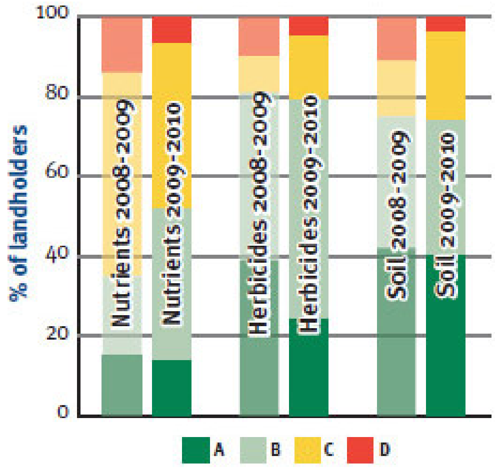
The 75 growers implemented improved practices through completing Reef Rescue Water Quality Grants projects facilitated by NQ Dry Tropics. Of these, 29 improved nutrient management, 25 improved pesticide management and 21 improved soil management.

Horticulture

There are 192 growers managing 155 square kilometres of land in the Burdekin region.

By June 2010, 26% of horticulture producers (49) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 52% of horticulture producers for nutrients, 79% for herbicides and 74% for soil.

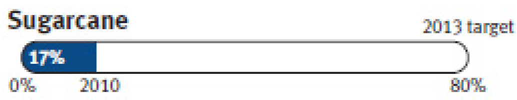
All 49 horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by NQ Dry Tropics and the Growcom Farm Management System program. Of these, 21 completed nutrient management projects, six completed herbicide management projects and 22 completed soil management projects.

Mackay Whitsunday

Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

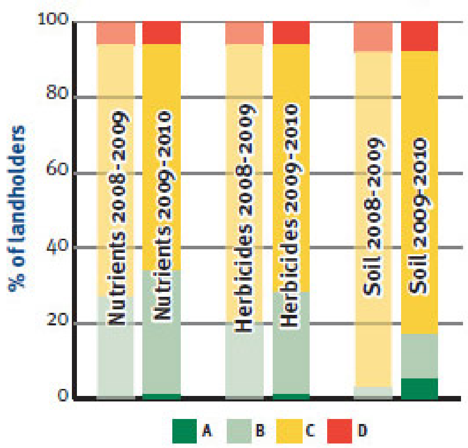
Sugarcane

There are 1380 growers managing 1362 square kilometres of land in the Mackay Whitsunday region.



By June 2010, 17% of sugarcane growers (228) had adopted improved land management practices.

Sugarcane practice systems



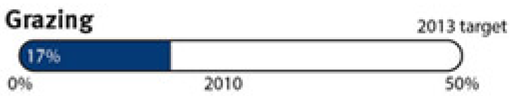
By June 2010, cutting-edge (A) or best management (B) practice systems were used by 34% of sugarcane growers for nutrients, 28% for herbicides and 17% for soil.

Unacceptable (D) soil management systems were used by 8% of growers.

All 228 growers implemented improved practices with the support of Reef Rescue Water Quality Grants facilitated by Reef Catchments. A total of 113 growers completed nutrient management projects, 115 completed herbicide management projects and 202 completed soil management projects.

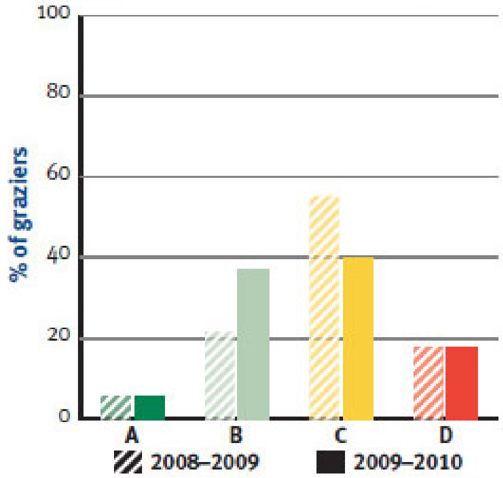
Grazing

There are 416 graziers managing 3038 square kilometres of land in the Mackay Whitsunday region.



By June 2010, 17% of graziers (72) had adopted improved land management practices.

Grazing practice systems



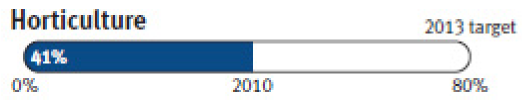
By June 2010, 43% of graziers were using (A or B) practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

17% of graziers were using high risk (D) management systems, highly likely to degrade land to poor or very poor condition.

49 of the graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by Reef Catchments. The other 23 completed relevant training through private sector consultants, supported by the FarmReady program.

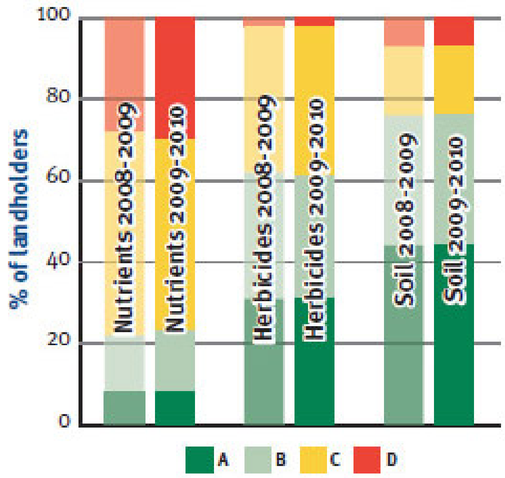
Horticulture

There are 33 horticulture producers managing 12 square kilometres of land in the Mackay Whitsunday region.



By June 2010, 41% of horticulture producers (13) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 23% of horticulture producers for nutrients, 61% for herbicides and 76% for soil.

Unacceptable (D) nutrient management systems were used by 30% of horticulture producers.

All 13 horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by Reef Catchments and the Growcom Farm Management System program. Of these, 5 completed nutrient management projects, 5 completed herbicide management projects and 9 completed soil management projects.

Fitzroy

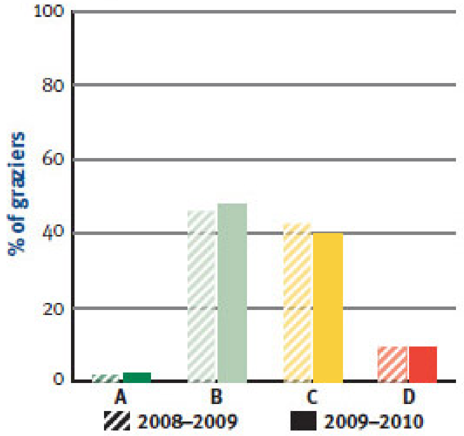
Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

Grazing

There are 3666 graziers managing 126,880 square kilometres of land in the Fitzroy region.

By June 2010, 10% of graziers (379) had adopted improved land management practices.

Grazing practice systems



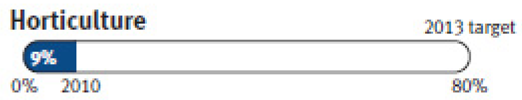
By June 2010, 51% of graziers were using (A or B) practices systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

9% of graziers were using high risk (D) systems, highly likely to degrade land to poor or very poor condition.

Of the 379 graziers who implemented improved practices, 80 completed Reef Rescue Water Quality Grants projects facilitated by the Fitzroy Basin Association. A further 254 graziers completed relevant training through AgForward, private sector consultants (supported by the FarmReady program), and the Queensland Government (supported by the Caring for our Country and Reef Rescue programs). Approximately 45 graziers adopted improved management practices through participation in targeted extension projects implemented by the Queensland Government and the Fitzroy Basin Association.

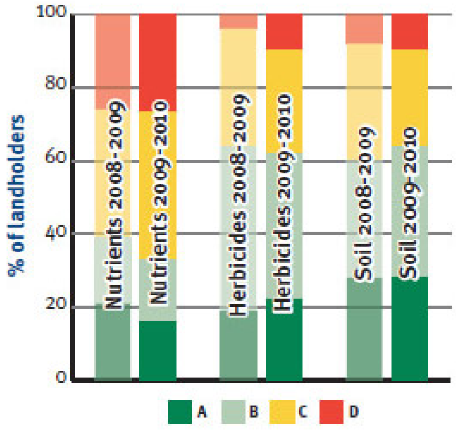
Horticulture

There are 106 horticulture producers managing 58 square kilometres of land in the Fitzroy region.



By June 2010, 9% of horticulture producers (10) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 33% of horticulture producers for nutrients, 62% for herbicides and 64% for soil.

Unacceptable (D) nutrient management systems were used by 27% of horticulture producers.

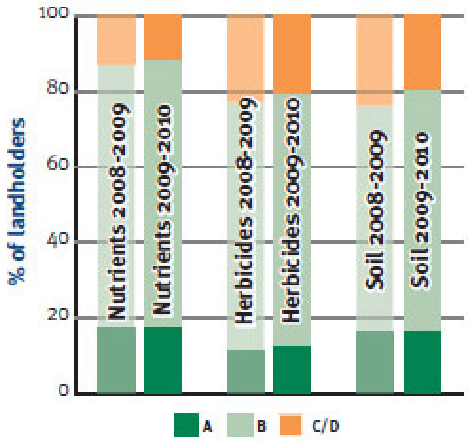
All 10 producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by the Fitzroy Basin Association and the Growcom Farm Management System program. 7 completed nutrient management projects, 5 completed herbicide management projects and 5 completed soil management projects.

Grains

There are 600 grain growers managing 9146 square kilometres of land in the Fitzroy region.

By June 2010, 14% of grain growers (78) had adopted improved land management practices.

Grains practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 88% of grains growers for nutrients, 79% for herbicides and 80% for soil.

Unacceptable or common (C/D) soil management systems were used by 18% of growers.

All 78 growers implemented improved practices with the support of the Reef Rescue program. This included 60 growers who improved herbicide management practices through training and purchasing fit-for-purpose equipment.

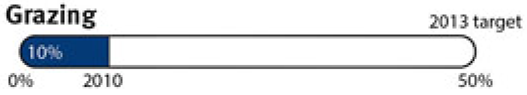
An absence of data sources and systems to collect data on improved practice adoption outside of the Grains Best Management Program and Reef Rescue program means this is likely to be a very conservative estimate of improved practices.

Burnett Mary

Land management practices have been improving over time. Progress since the 2008–2009 baseline is presented below.

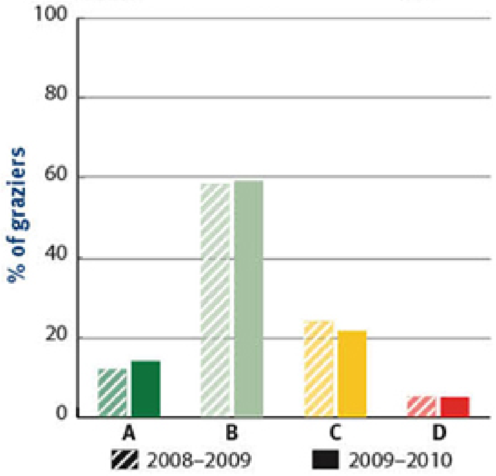
Grazing

There are 2495 graziers managing 28,618 square kilometres of land in the Burnett Mary region.



By June 2010, 10% of graziers (238) had adopted improved land management practices.

Grazing practice systems



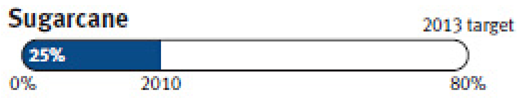
By June 2010, 73% of graziers were using (A or B) practice systems that are likely to maintain land in good to very good condition or improve land in lesser condition.

5% of graziers were using high risk (D) systems, highly likely to degrade land to poor or very poor condition.

Of the 238 graziers who implemented improved practices, 77 completed Reef Rescue Water Quality Grants projects facilitated by the Burnett Catchment Care Association and the Burnett Mary Regional Group. A further 133 graziers completed relevant training through AgForward, private sector consultants (supported by the FarmReady program) and the Queensland Government. Another 28 graziers adopted improved management practices through participation in targeted extension projects implemented by Burnett Catchment Care Association and the Queensland Government (supported by the Caring for our Country and Reef Rescue programs).

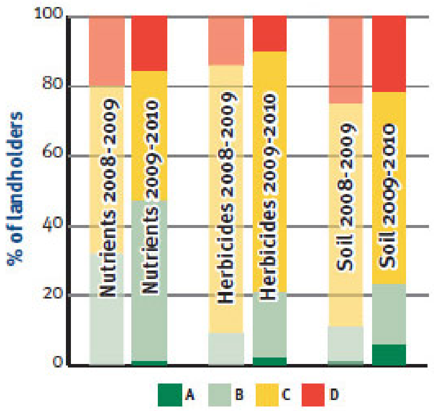
Sugarcane

There are 498 growers managing 476 square kilometres of land in the Burnett Mary region.



By June 2010, 25% of sugarcane growers (126) had adopted improved land management practices.

Sugarcane practice systems



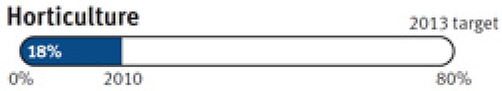
By June 2010, cutting-edge (A) or best management (B) practice systems were used by 47% of sugarcane growers for nutrients, 21% for herbicides and 23% for soil.

Unacceptable (D) soil management systems were used by 22% of growers.

All 126 growers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by the Burnett Mary Regional Group. Of these, 71 improved nutrient management practices, 61 improved pesticide management practices and 59 improved soil management practices.

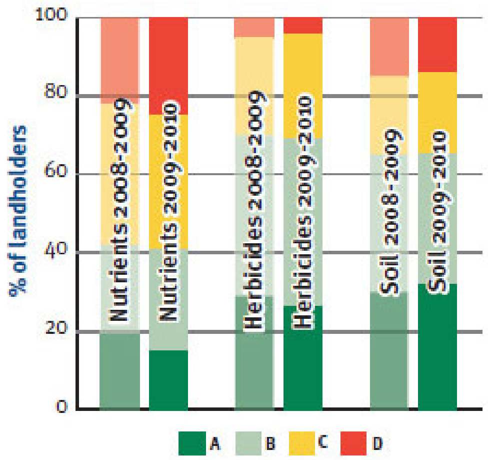
Horticulture

There are 280 horticulture producers managing 191 square kilometres of land in the Burnett Mary region.



By June 2010, 18% of horticulture producers (49) had adopted improved land management practices.

Horticulture practice systems



By June 2010, cutting-edge (A) or best management (B) practice systems were used by 41% of horticulture producers for nutrients, 69% for herbicides and 65% for soil.

Unacceptable (D) nutrient management systems were used by 25% of horticulture producers.

All 49 horticulture producers implemented improved practices with the support of Reef Rescue Water Quality Grants, facilitated by the Burnett Mary Regional Group and the Growcom Farm Management System program. Of these, 43 completed nutrient management projects, 20 completed soil management projects and 17 completed herbicide management projects.

Catchment indicator results

Since pre-European times, 18% of riparian forest and 17% of wetlands have been lost. Reef Plan aims to halt this loss. Some areas are less impacted with Cape York still having 100% of wetlands remaining.

The loss of wetlands and riparian forest was caused by a range of factors including modifications to hydrology and clearing of vegetation.

Wetland results

Wetland loss relates to agricultural and other land uses including urban.

Great Barrier Reef

Wetland loss

Target: There will have been no net loss or degradation of natural wetlands.
Result: Good progress

Loss of wetlands declined from 0.10% (742ha) between 2001 and 2005 to 0.03% (255ha) between 2005 and 2009. The Burnett Mary region had the highest proportional loss of wetlands for 2001–2005 (0.33%) and 2005–2009 (0.23%).

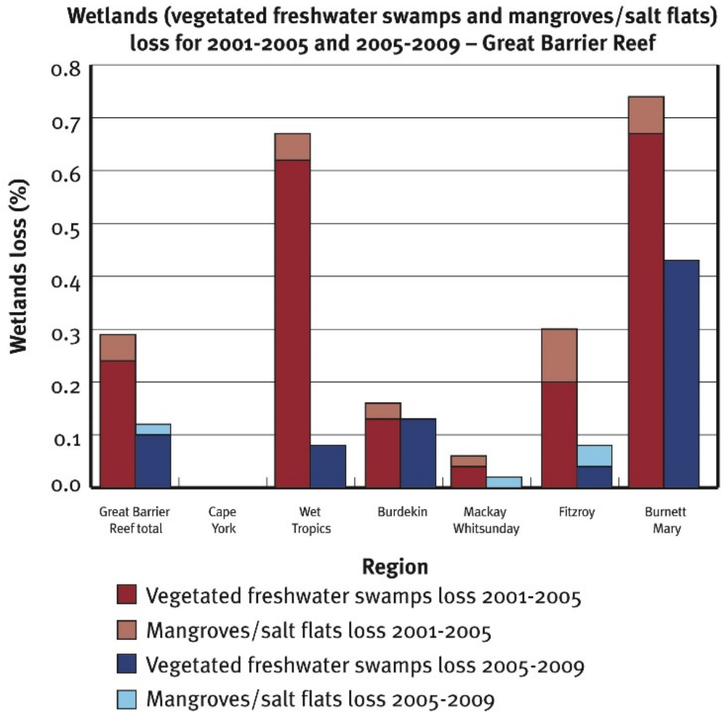
Wetland systems extent

Approximately 734,000ha of wetlands are mapped in the Great Barrier Reef catchment which is approximately 1.7% of the total area. Of these wetland areas:

- There are 262,000ha of vegetated freshwater swamps (palustrine wetlands). These areas occur with the greatest density in the small coastal catchments with extensive lowlands such as the Jacky Jacky Creek, Mulgrave-Russell, Murray, Water Park Creek and Shoalwater catchments.
- There are 21,000ha of lakes (lacustrine wetlands).
- There are 451,000ha of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in catchments such as the Jacky Jacky Creek, Murray, Haughton, Ross, Plane Creek, Shoalwater, Styx and Water Park Creek.

In addition to the above natural and modified wetlands, there were 150,000ha of artificial and highly modified wetlands (e.g. dams) mapped across the Great Barrier Reef catchment in 2009.

Recent change in extent



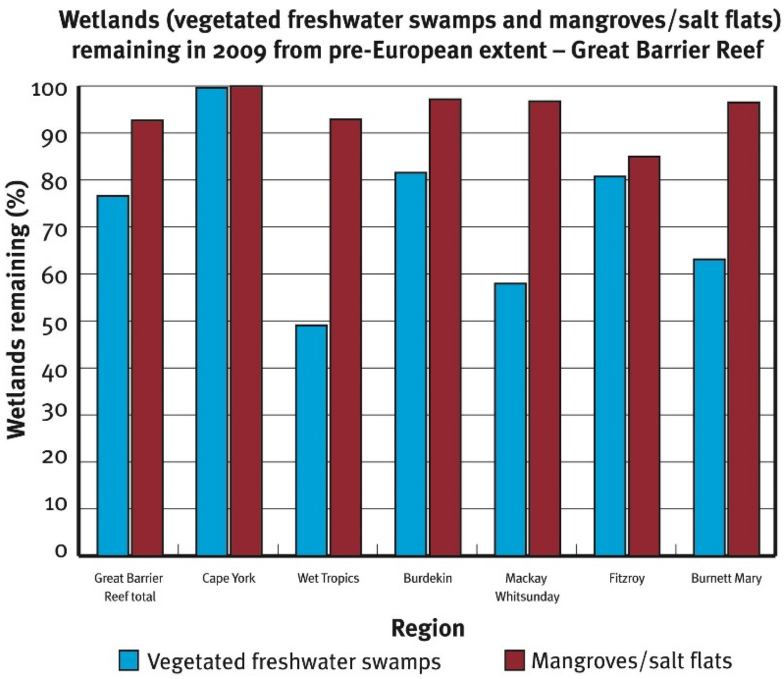
Wetland loss continued between 2005 and 2009 although the rate was substantially lower than between 2001 and 2005. The greatest reduction in the rate of loss of wetlands was in the Wet Tropics region, down from 0.30% (239ha) between 2001 and 2005 to 0.04% (30ha) between 2005 and 2009.

Loss of vegetated freshwater swamps between 2001 and 2005 was 0.24% (over 624ha) across the Great Barrier Reef catchments. This reduced to 0.10% (257ha) between 2005 and 2009. Between 2001 and 2005, the loss of vegetated freshwater swamps was greater than 1% in the Herbert, Mossman, Murray, Kolan, and Mary catchments. Between 2005 and 2009, the loss of vegetated freshwater swamps was greater than 1% in the Black, Pioneer and Kolan catchments.

The loss of mangroves/salt flats between 2001 and 2005 was 0.05% (219ha) which reduced to 0.02% (72ha) between 2005 and 2009.

Lakes increased in overall extent between 2001 and 2005 (101ha) and 2005 and 2009 (73ha). These increases are due to modifying existing wetlands by levees and similar structures. Similar modifications in some catchments are associated with small increases in the extent of swamps (Don and Proserpine) and mangroves/salt flats (Burrum) between 2005 and 2009.

Historical change in extent



Historically, 17% of wetlands have been lost from pre-European extent. Some areas are less impacted with Cape York still having 100% of wetlands remaining. In terms of specific wetland systems, 23% of vegetated freshwater swamps have been lost across the Great Barrier Reef catchments from pre-European extent.

Loss of vegetated freshwater swamps from pre-European extent has been high in the Wet Tropics and Mackay Whitsunday regions with 51% and 42% lost respectively. Many smaller coastal catchments with extensive lowlands have undergone widespread loss of freshwater swamps with greater than 80% loss in the Kolan, Pioneer, Calliope and Barron catchments. This loss mainly relates to drainage, clearing and levelling of lowlands and parts of catchments associated with intensive agriculture or urban use.

Over 90% of pre-European extent of mangroves and salt flats remain in most catchments, except for Barron, Mulgrave, Russell, Pioneer, Boyne, Fitzroy, Shoalwater, Burnett and Kolan.

Generally, there has been no major reduction in lakes compared to their pre-European extent.

Cape York

Wetland loss

There was no historical loss of wetlands and no change in extent over the 2001–2005 or 2005–2009 periods.

Wetland systems extent

There are approximately 184,300ha of wetlands in the Cape York region. Of these wetland areas:

- There are 59,200ha of vegetated freshwater swamps (palustrine wetlands). The greatest density of vegetated freshwater swamps is in the Jacky Jacky catchment.
- There are 6200ha of lakes (lacustrine wetlands).
- There are 118,900ha of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in the Jacky Jacky, Jeannie and Lockhart catchments.

Historical and recent change in extent

The Cape York region recorded no historical loss of wetlands compared to pre-European extent and no changes in extent over the 2001 to 2005 or 2005 to 2009 periods.

Wet Tropics

Wetland loss

Loss of wetlands between 2005 and 2009 was 0.04% (30ha). This is 209ha less than 2001–2005.

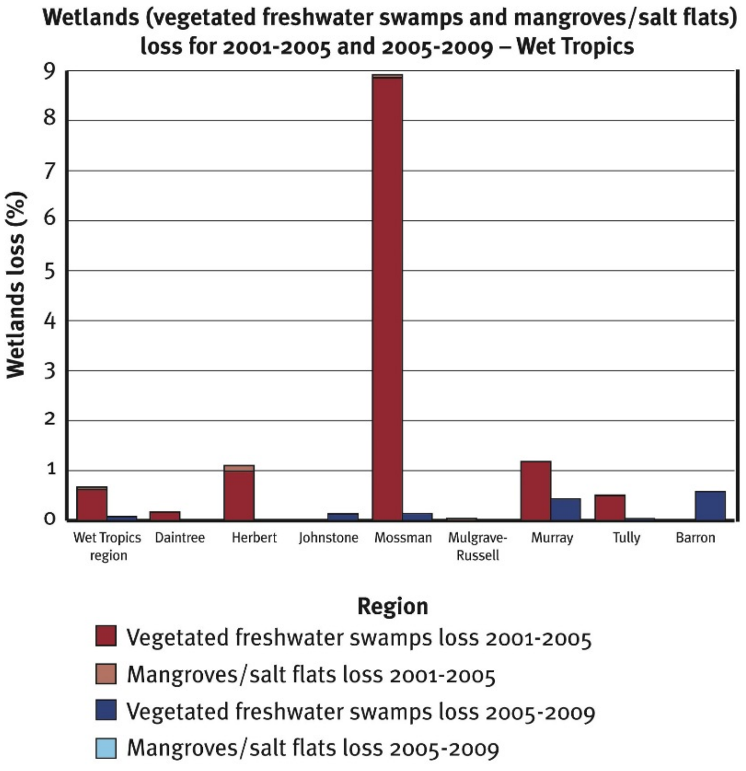
The rate of loss of vegetated freshwater swamps decreased from 0.62% (219ha) between 2001 and 2005 to 0.08% (29ha) between 2005 and 2009.

Wetland systems extent

There are approximately 79,000ha of wetlands in the Wet Tropics region. Of these wetland areas:

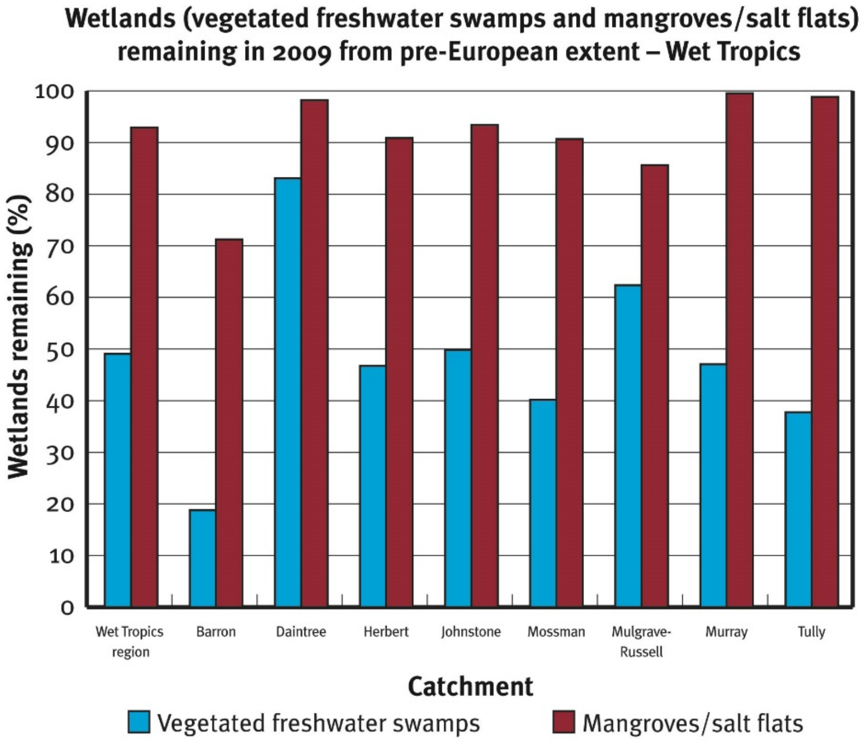
- There are 35,000ha of vegetated freshwater swamps (palustrine wetlands). The greatest density of vegetated freshwater swamps is in the Herbert and Russell-Mulgrave catchments.
- There are 700ha of lakes (lacustrine wetlands).
- There are 43,300ha of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in the Murray and Herbert catchments.

Recent change in extent



The greatest reduction in the rate of loss of wetlands was in the Mossman catchment, down from 0.96% (18ha) between 2001 and 2005 to 0.01% (0.3ha) between 2005 and 2009. The loss of vegetated freshwater swamps between 2001 and 2005 was 0.62% (219ha). Between 2005 and 2009 this reduced to 0.08% (29ha). There was a small loss of mangroves/salt flats between 2001 and 2005 of 0.05% (20ha) but no change in extent between 2005 and 2009.

Historical change in extent



The Wet Tropics region recorded the highest loss of vegetated freshwater swamps (51%) from pre-European extent compared to all other Great Barrier Reef regions. The Barron catchment had significant historical loss of vegetated freshwater swamps with only 19% remaining from pre-European extent. 93% of mangrove and salt flats remain from pre-European extent.

Burdekin

Wetland loss

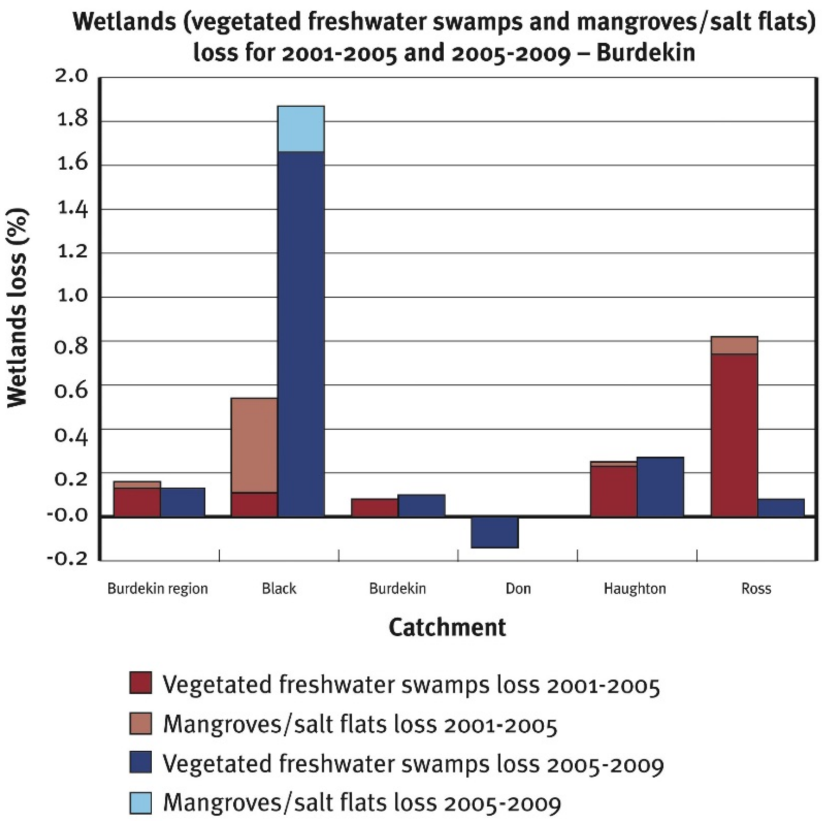
Loss of wetlands remained relatively constant at 0.03% when comparing 2001–2005 with 2005–2009 (35ha).

Wetland systems extent

There are approximately 138,000ha of wetlands in the Burdekin region. Of these wetland areas:

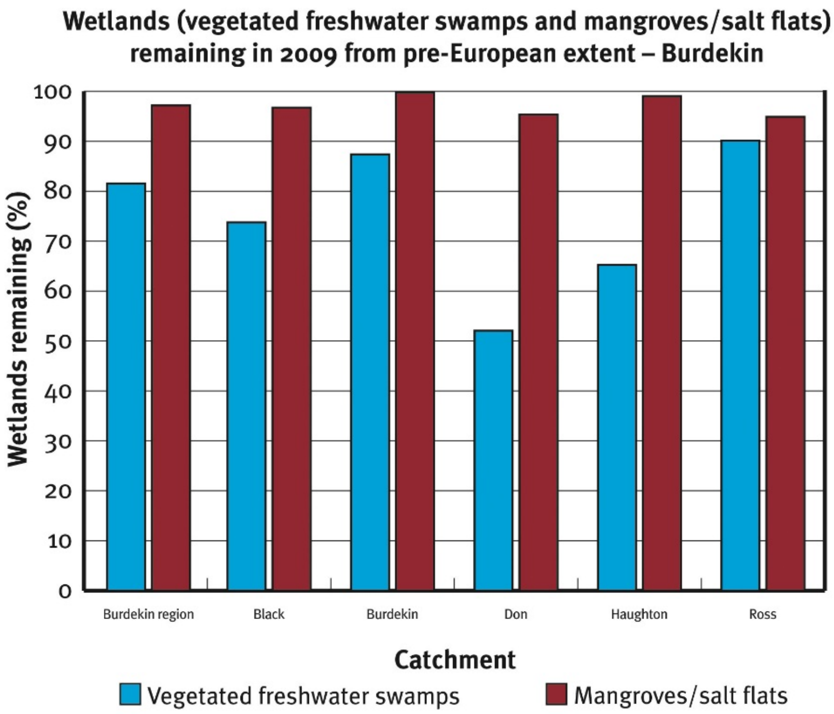
- There are 62,500ha of vegetated freshwater swamps (palustrine wetlands). The greatest density of vegetated freshwater swamps is in the Ross and Haughton catchments.
- There are 8300ha of lakes (lacustrine wetlands).
- There are 67,200ha of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in the Don, Haughton and Ross catchments.

Recent change in extent



The loss of vegetated freshwater swamps between 2001 and 2005 was 0.1% (83ha), with a similar loss between 2005 and 2009. The loss of mangroves and salt flats reduced from 0.03% (20ha) between 2001 and 2005 to 0% (3ha) between 2005 and 2009. There were slight increases (100ha) in the extent of lakes between 2001 and 2005 and 2005 and 2009 associated with local hydrological modifications.

Historical change in extent



Historically, 10% of wetlands have been lost from pre-European extent. The loss of vegetated freshwater swamps from pre-European extent across the region was 18%, with 48% and 35% loss in the Don and Haughton catchments respectively. Only 3% of mangroves and salt flats have been lost from pre-European extent.

Mackay Whitsunday

Wetland loss

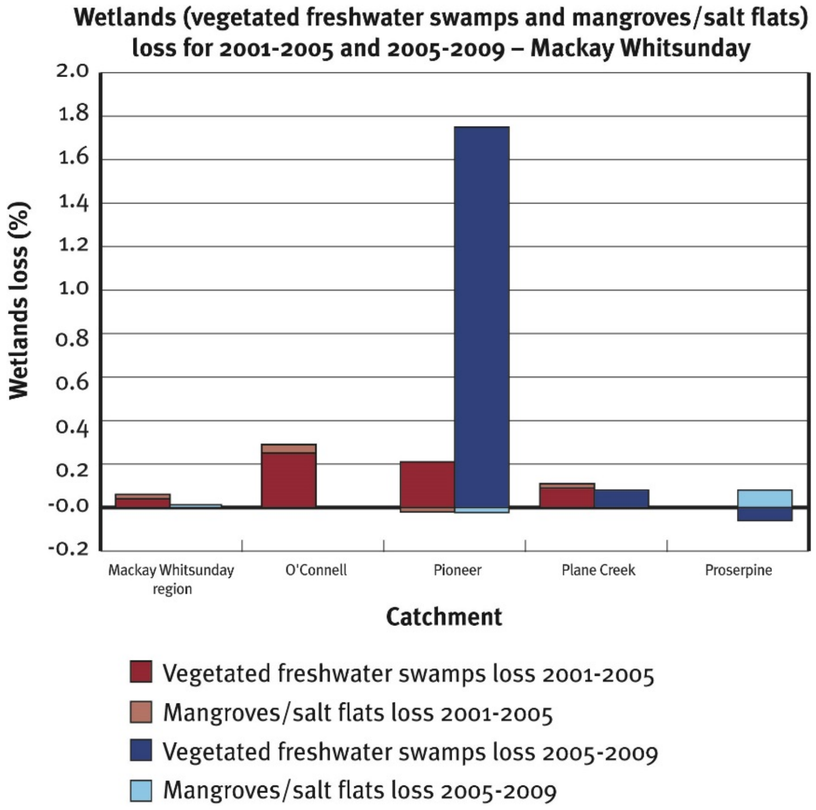
Loss of wetlands remained relatively constant when comparing 2001–2005 (0.02% - 14 ha) with 2005–2009 (0.01% - 5ha).

Wetland systems extent

There are approximately 58,000ha of wetlands in the Mackay Whitsunday region. Of these wetland areas:

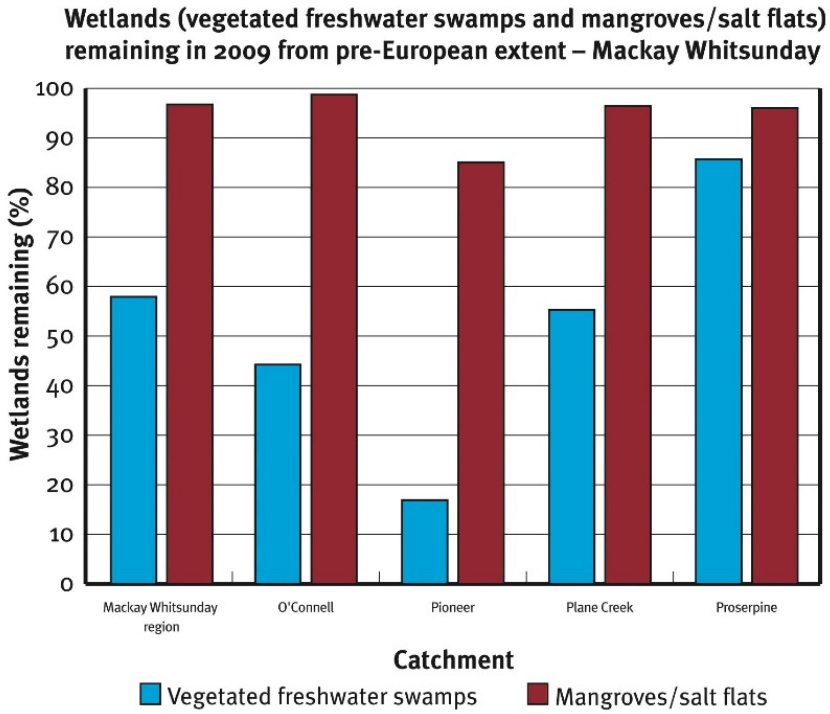
- There are 10,100ha of freshwater swamps (palustrine wetlands). The Plane Creek catchment has the greatest density of vegetated freshwater swamps.
- There are 200ha of lakes (lacustrine wetlands). The Proserpine catchment has the greatest area of lake wetlands.
- There are 47,700ha of mangroves/salt flats (estuarine wetlands).

Recent change in extent



The loss of vegetated freshwater swamps between 2001 and 2005 and 2005 and 2009 was 0.04% (less than 5ha). Approximately 10ha of mangroves/salt flats were lost between 2001 and 2005 and 2005 and 2009.

Historical change in extent



89% of all wetlands remain from pre-European extent. The loss of vegetated freshwater swamps from pre-European extent was 42%. The Pioneer and O'Connell catchments had significant loss of vegetated freshwater swamps from pre-European extent with 83% and 56% loss respectively. 97% of mangrove and salt flats remain across the region.

Fitzroy

Wetland loss

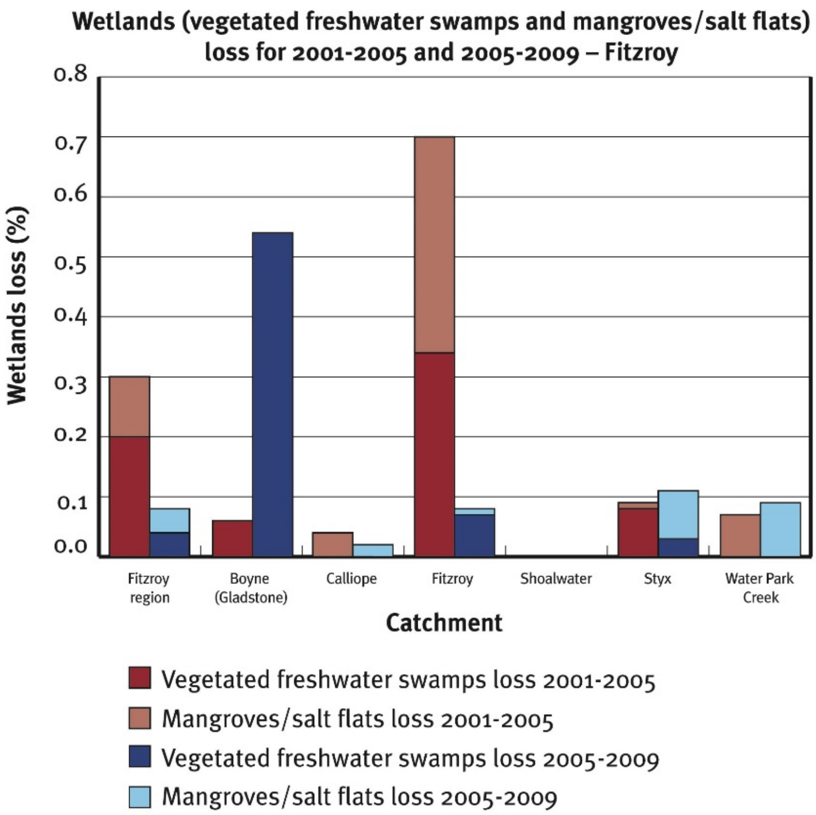
Loss of wetlands between 2005 and 2009 was 0.03% (68ha). This was 203ha less than 2001–2005.

Wetland systems extent

There are approximately 222,600ha of wetlands in the Fitzroy region. Of these wetland areas:

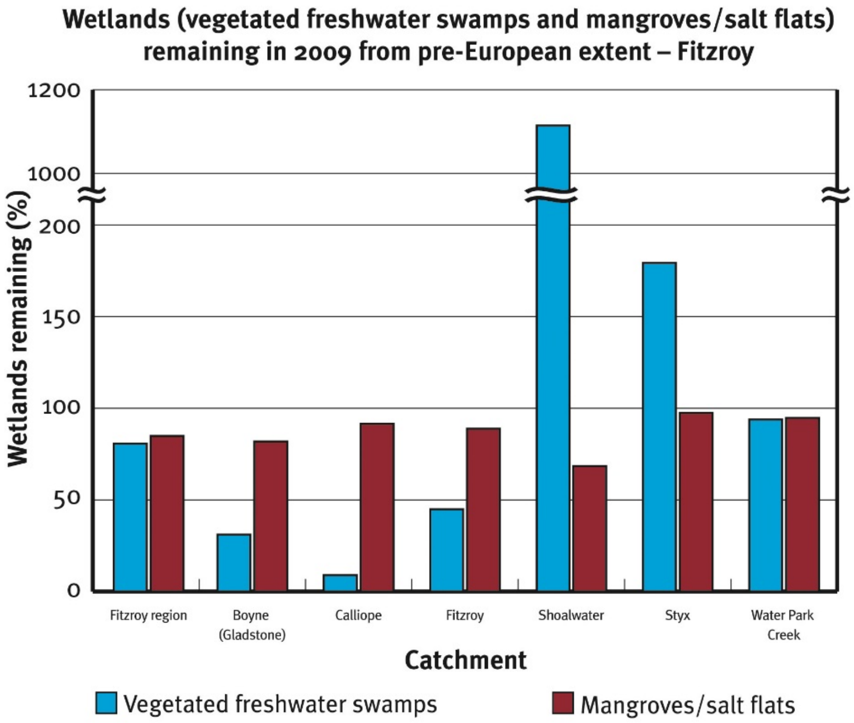
- There are 67,000ha of vegetated freshwater swamps (palustrine wetlands). The greatest density of vegetated freshwater swamps is in the Shoalwater and Water Park catchments.
- There are 5300ha of lakes (lacustrine wetlands).
- There are 150,300ha of mangroves/salt flats (estuarine wetlands).

Recent change in extent



The loss of vegetated freshwater swamps between 2001 and 2005 was 0.20% (132ha), with this loss derived entirely from the Fitzroy and Styx catchments. The loss of vegetated freshwater swamps reduced to 0.04% (29ha) between 2005 and 2009. The loss of mangroves and saltflats decreased to 0.04% (58ha) between 2005 and 2009.

Historical change in extent



Historically, 22% of wetlands have been lost from pre-European extent. The loss of vegetated freshwater swamps from pre-European extent was 19%. However, this figure is influenced by the increase in vegetated freshwater swamps in the Styx and Shoalwater catchments. This is due to converting estuarine plains to freshwater wetlands by damming, which is a common practice in many coastal catchments.

The Calliope catchment has undergone the greatest loss of vegetated freshwater swamps across all Great Barrier Reef catchments with 89% loss from pre-European extent. The Fitzroy and Boyne catchments also had significant loss of vegetated freshwater swamps from pre-European extent, with only 45% and 31% remaining respectively. 85% of mangroves and salt flats remain across the region, associated with converting to freshwater swamps mainly in the Shoalwater catchment.

Burnett Mary

Wetland loss

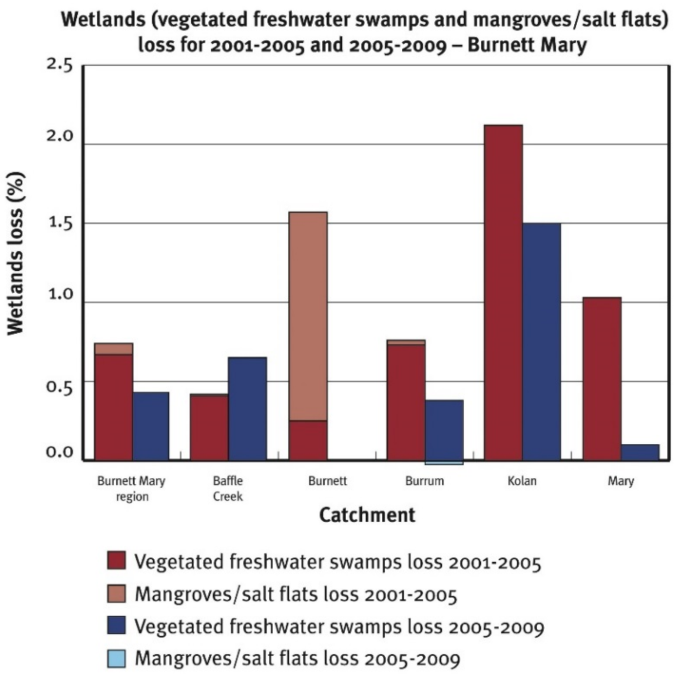
The Burnett Mary region had the greatest loss of wetlands of all the regions between 2005 and 2009, losing 0.23% (118ha). This was a decrease from 0.33% (173ha) between 2001 and 2005.

Wetland systems extent

There are approximately 52,000ha of wetlands in the Burnett Mary region. Of these wetland areas:

- There are 27,800ha of vegetated freshwater swamps (palustrine wetlands). The greatest density of vegetated freshwater swamps is in the Baffle catchment.
- There are 400ha of lakes (lacustrine wetlands).
- There are 23,800ha of mangroves/salt flats (estuarine wetlands). These wetlands occur in the greatest density in the Baffle catchment.

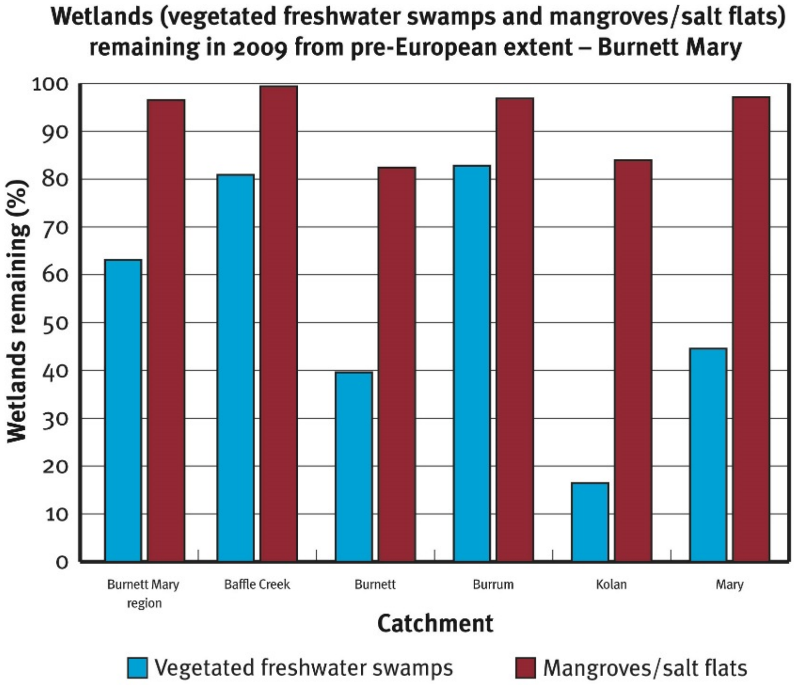
Recent change in extent



Losses were mainly from vegetated freshwater swamps which decreased by 0.67% (186ha) between 2001 and 2005 and by 0.43% (119ha) between 2005 and 2009. This was the highest proportional loss of vegetated freshwater swamps of all the Great Barrier Reef regions. The rate of loss of vegetated freshwater swamps increased in the Baffle Creek catchment from 0.41% (44ha) to 0.65% (70ha). Although reduced from 2001 to 2005, the loss of vegetated freshwater swamps in the Kolan catchment was one of the highest of all the Great Barrier Reef catchments between 2005 and 2009 (1.50%).

The extent of lakes increased between 2001 and 2005 by 8.27% (30ha) associated with modifications due to earth works. No change in lake extent was recorded between 2005 and 2009. There was no loss of mangroves/salt flats between 2005 and 2009.

Historical change in extent



Historically, 30% of wetlands have been lost from pre-European extent. 37% of vegetated freshwater swamps have been lost from pre-European extent. The Kolan, Burnett and Mary catchments recorded substantial loss of wetlands with only 16%, 40% and 45% of vegetated freshwater swamps remaining respectively. This loss is particularly prevalent in the lowlands of these catchments. 97% of mangroves and salt flats remain for the region.

Riparian results

Riparian forest is the vegetation beside waterways which can help reduce pollutant losses to waterways.

Great Barrier Reef

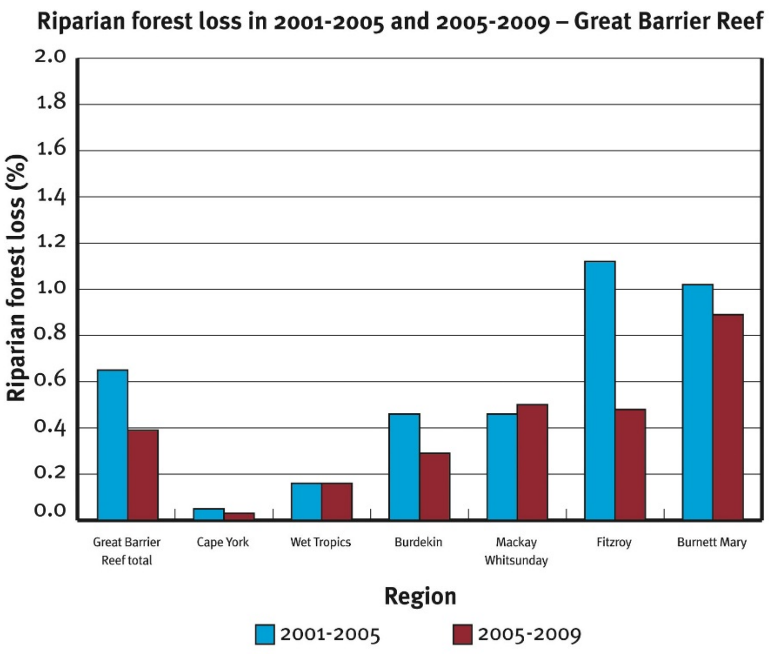
Since pre-European times, 18% of riparian forest has been lost. Reef Plan aims to halt this loss. The loss of riparian forest was caused by a range of factors including modifications to hydrology and clearing of vegetation.

Riparian loss

Target: Improved condition and extent of riparian areas.
Result: Moderate progress

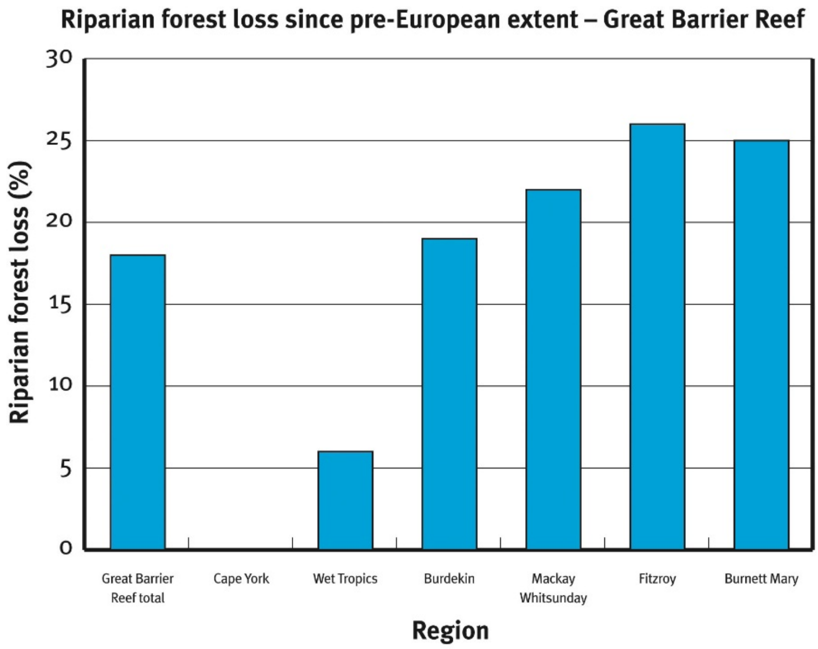
Loss of riparian forest decreased from 0.65% (41,490ha) between 2001 and 2005 to 0.39% (24,636ha) between 2005 and 2009. The greatest reduction in the rate of loss of riparian forest was in the Fitzroy region, down from 1.12% (21,153ha) between 2001 and 2005 to 0.48% (9069ha) between 2005 and 2009.

Riparian forest is the vegetation beside waterways which can help reduce pollutant losses to waterways.



From 2005 to 2009, the Burnett Mary region had the highest proportion of riparian forest loss with 0.89% (7889ha), followed by the Mackay Whitsunday region with 0.50% (672ha. Between 2001 and 2005 the highest proportion of vegetation loss occurred in the Fitzroy region, with a loss of 1.12% (21,153ha), followed by the Burnett Mary region which experienced a loss of 1.02% (9037ha).

The loss of riparian forest has decreased across all regions except Mackay Whitsunday and the Wet Tropics where little or no change was reported.



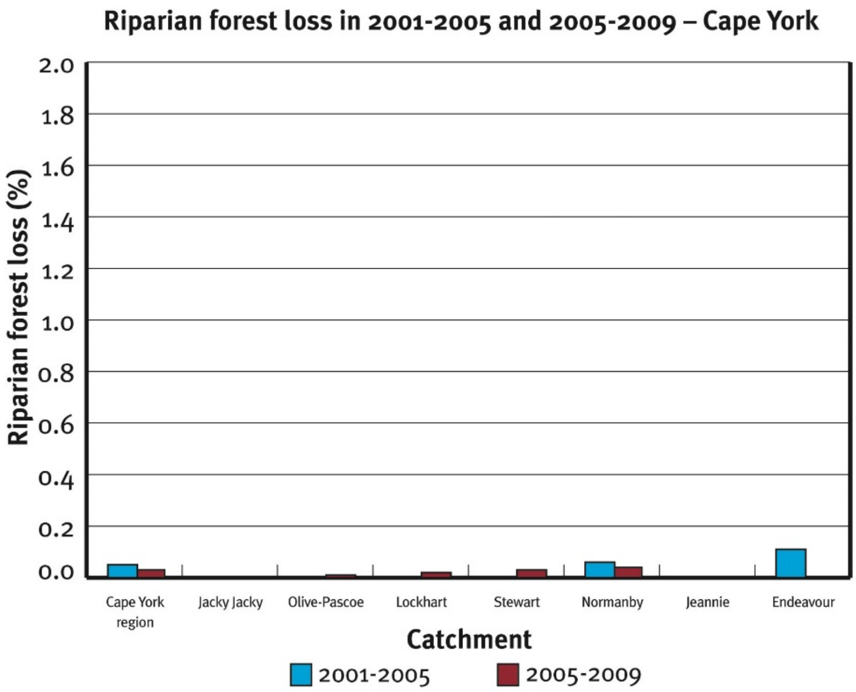
Approximately 6.39m ha of riparian areas were mapped in the Great Barrier Reef region. In 2009, the forested area was approximately 79% (5.03m ha). The loss of riparian forest since pre-European extent was an estimated 18% (1.2m ha).

In 2009, 1.63% (103,854ha) of the Great Barrier Reef region was classed as non-forested and low groundcover within riparian areas. This included degraded areas such as gullies which have a higher risk of erosion, but also some areas of sandbars and rocky streams where erosion is unlikely to be a concern.

Cape York

Riparian loss

The Cape York region lost the lowest proportion of riparian forest out of all the Great Barrier Reef regions with only 0.03% (265ha) of clearing between 2005 and 2009. This compares to 424ha (0.05%) from 2001 to 2005.



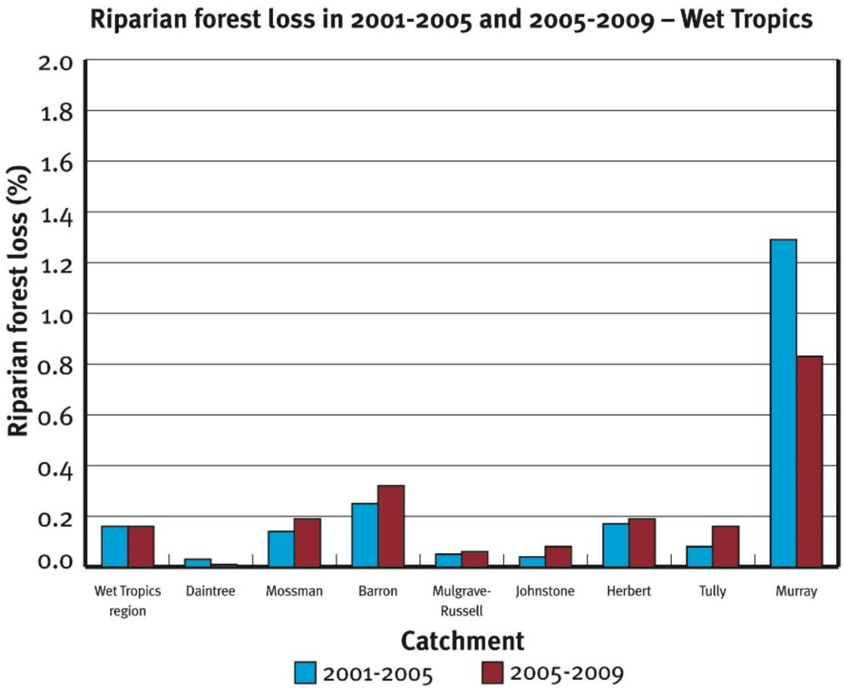
Approximately 939,669ha of riparian areas were mapped within the Cape York region. Historically, there has been limited change in riparian forest in this region.

In the Cape York region, 0.16% (1541ha) of riparian areas were non-forested with low groundcover. The low groundcover areas were mainly associated with coastal sand dunes in the Jacky Jacky and Jeannie catchments.

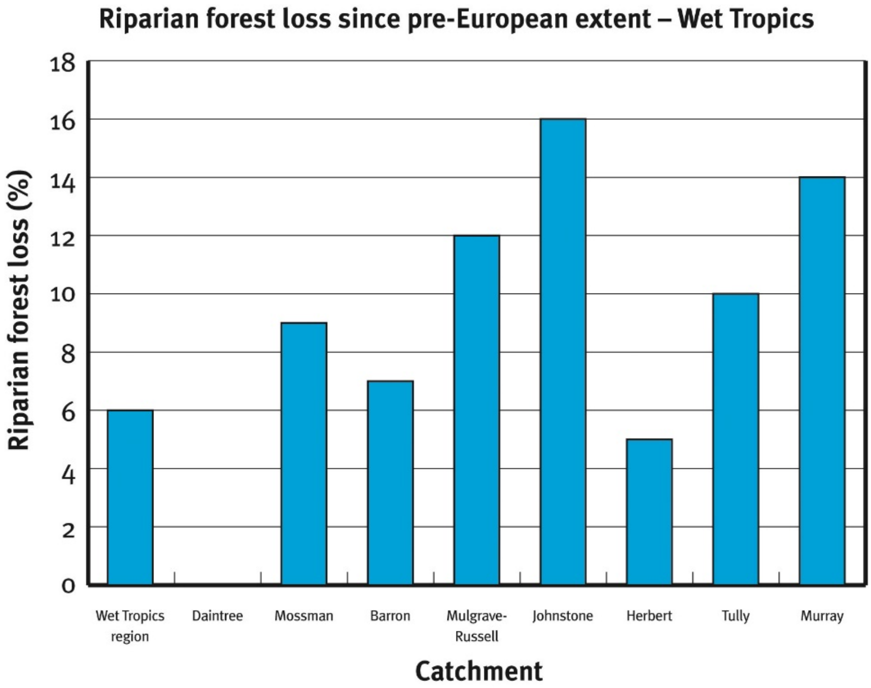
Wet Tropics

Riparian loss

Loss of riparian forest remained constant at 0.16% when comparing 2001–2005 (734ha) with 2005–2009 (753ha). The Murray catchment had the highest riparian forest loss with 0.83% (135ha) between 2005 and 2009. However, this was 0.46% lower compared to 2001 to 2005.



Most catchments had a very minor increase in riparian loss between 2001 to 2005 and 2005 to 2009. The Mossman, Barron, Herbert and Tully catchments had riparian forest losses of 0.19% (31ha), 0.32% (144ha), 0.19% (340ha) and 0.16% (45ha), respectively. The Daintree, Mulgrave-Russell and Johnstone catchments had riparian forest losses of 0.01% (10ha), 0.06% (19ha) and 0.08% (29ha), respectively.



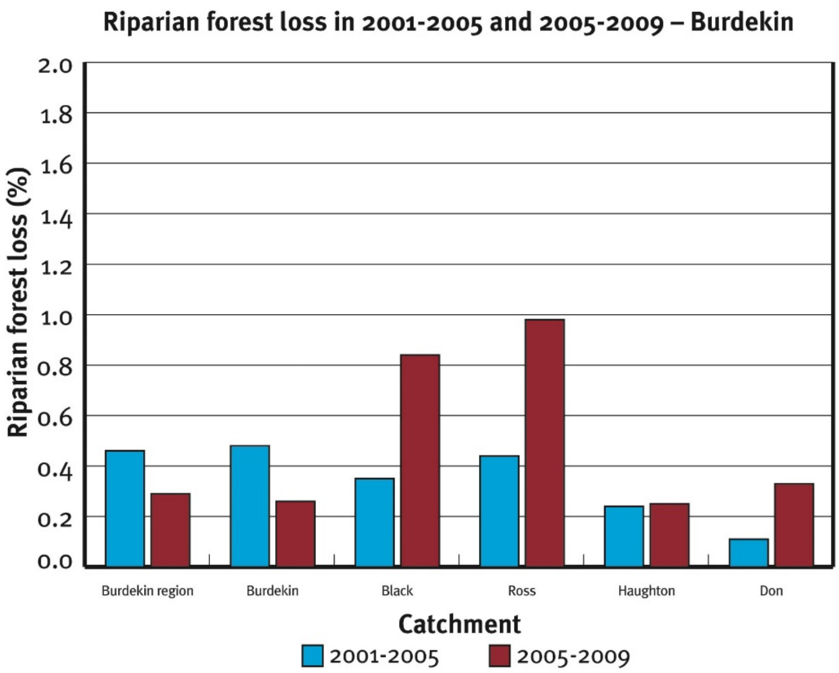
Approximately 472,889ha of riparian areas were mapped in the Wet Tropics region. In 2009, the forested riparian area was approximately 91% (429,677ha) of the riparian area. Historically, approximately 6% (28,000ha) of riparian forest has been lost from pre-European extent.

In the Wet Tropics region, 0.41% (1948ha) of riparian areas were non-forested and had low groundcover, potentially leading to lower bank stability and an increased risk of erosion. The highest proportion was in the Herbert catchment with 0.63% (1132ha).

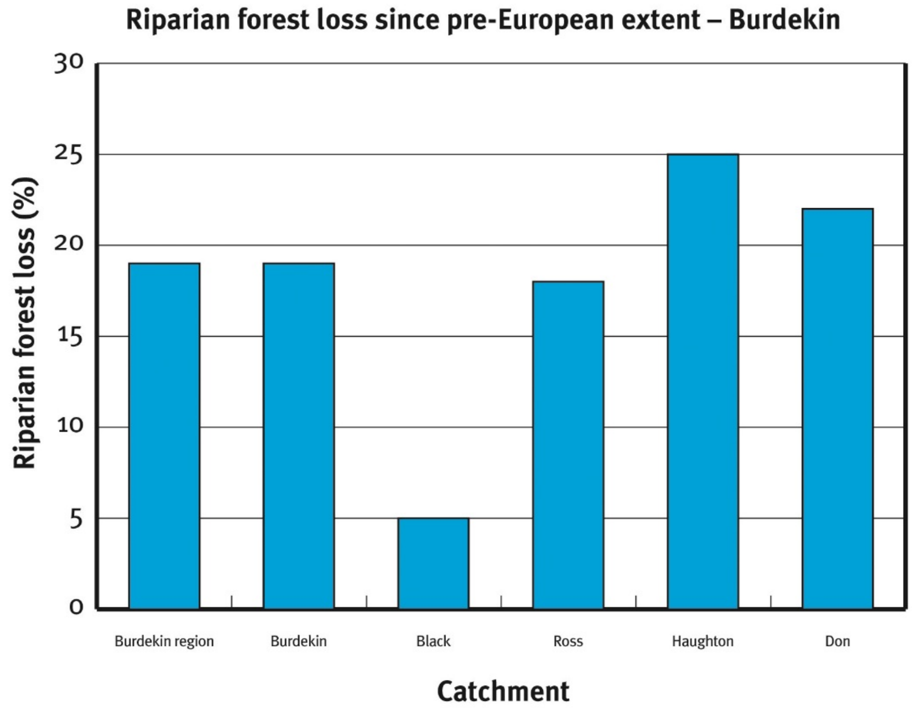
Burdekin

Riparian loss

Loss of riparian forest between 2005 and 2009 was 0.29% (5988ha). This was 0.17% (3537ha) less than 2001 to 2005. However, in the Black, Ross and Don catchments there was an increase in riparian forest loss from 2005 to 2009 compared with 2001 to 2005.



The loss of riparian forest in the Black and Ross catchments was 0.84% (277ha) and 0.98% (408ha), respectively. The loss of riparian forest in the Burdekin, Haughton and Don catchments was 0.26% (4848ha), 0.25% (237ha) and 0.33% (218ha) respectively.

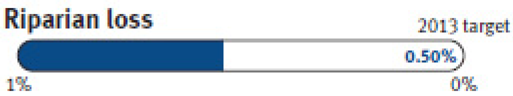


Approximately 2.08m ha of riparian areas were mapped in the Burdekin region. In 2009, the forested riparian area was approximately 77% (1.6m ha). Historically approximately 19% (400,000ha) of riparian forest has been lost from pre-European extent.

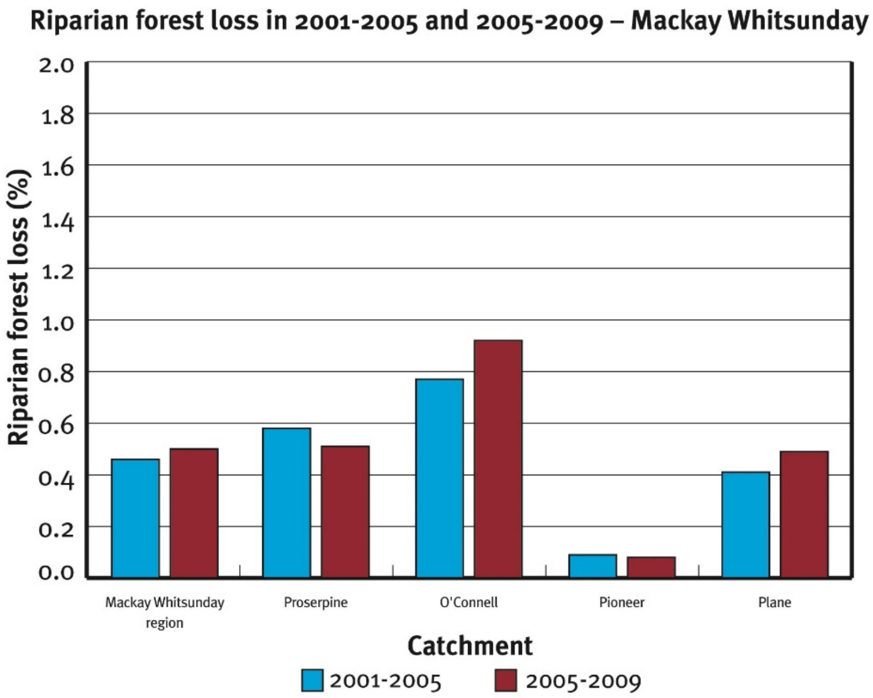
In the Burdekin region, 2.78% (57,764ha) of riparian areas were non-forested with low groundcover. This region had the highest proportion of low groundcover potentially leading to lower bank stability and an increased risk of erosion.

Mackay Whitsunday

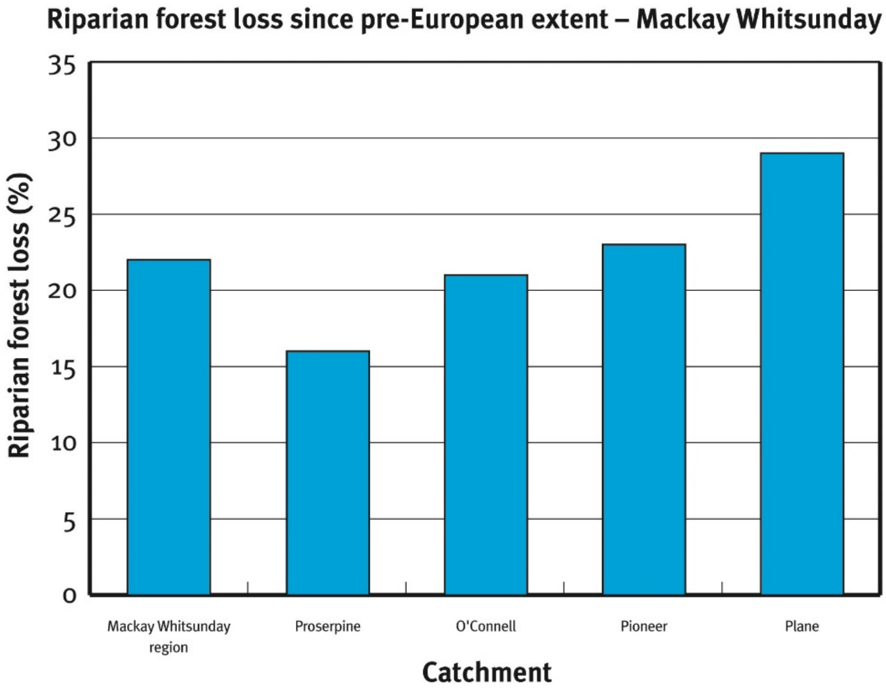
Riparian loss



Loss of riparian forest increased from 0.46% (617ha) between 2001 and 2005 to 0.5% (672ha) between 2005 and 2009. The O'Connell catchment had the highest loss of riparian forest with 0.92% (312ha).



In the O'Connell and Plane catchments, loss of riparian forest increased when comparing 2001 to 2005 with 2005 to 2009. The loss of riparian forest in the Pioneer, Proserpine and Plane catchments was 0.08% (28ha), 0.51% (163ha) and 0.49% (169ha), respectively.

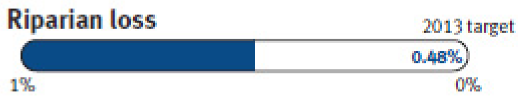


Approximately 133,876ha of riparian areas were mapped in the Mackay Whitsunday region. In 2009, the forested riparian area was approximately 76% (101,873ha). Historically approximately 22% (30,000ha) of riparian forest has been lost from pre-European extent.

In the Mackay Whitsunday region, 0.47% (635ha) of riparian areas were non-forested with low groundcover, potentially leading to lower bank stability and an increased risk of erosion.

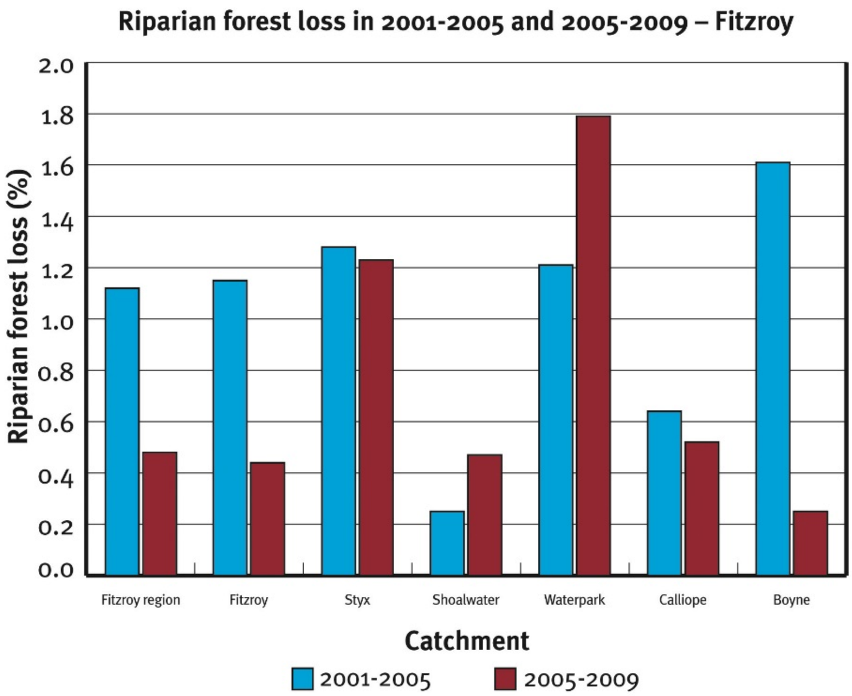
Fitzroy

Riparian loss

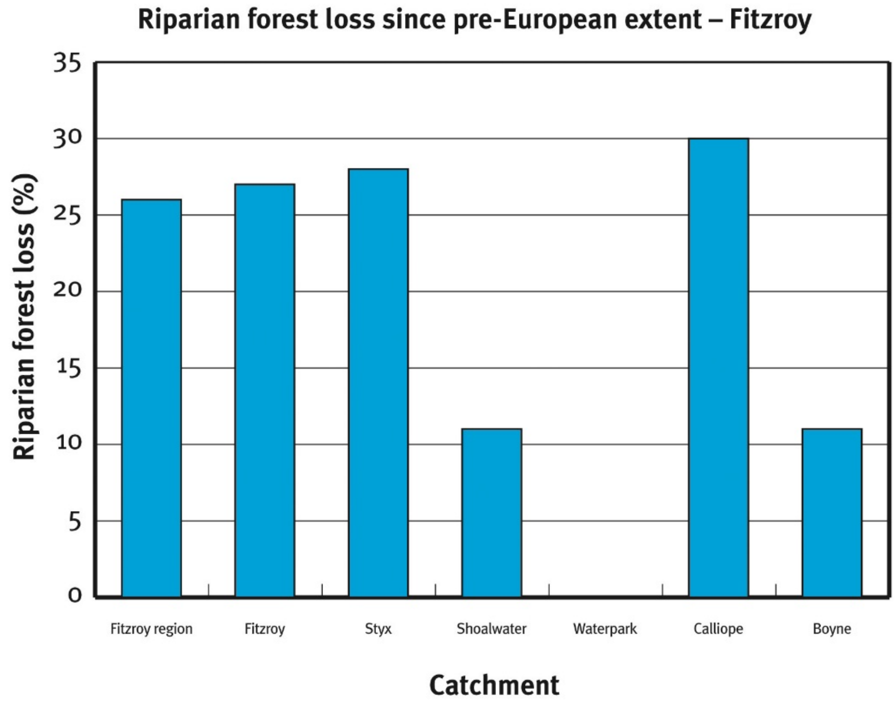


Loss of riparian forest decreased considerably from 1.12% (21,153ha) between 2001 and 2005 to 0.48% (9069ha) between 2005 and 2009.

There was significant riparian forest loss in the Styx catchment with 1.23% (552ha) and Waterpark catchment with 1.79% (555ha) between 2005 and 2009. The loss of riparian forest in the Shoalwater and Waterpark catchments increased from 2001 to 2005 and 2005 to 2009.



Riparian forest loss in the Fitzroy, Shoalwater, Calliope and Boyne catchments was 0.44% (7359ha), 0.47% (325ha), 0.52% (169ha) and 0.25% (109ha), respectively.

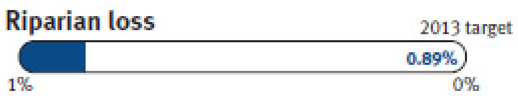


Approximately 1.88m ha of riparian areas were mapped in the Fitzroy region. In 2009, the forested riparian area was approximately 71% (1.3m ha). Historically approximately 26% (490,000ha) of riparian forest has been lost from pre-European extent.

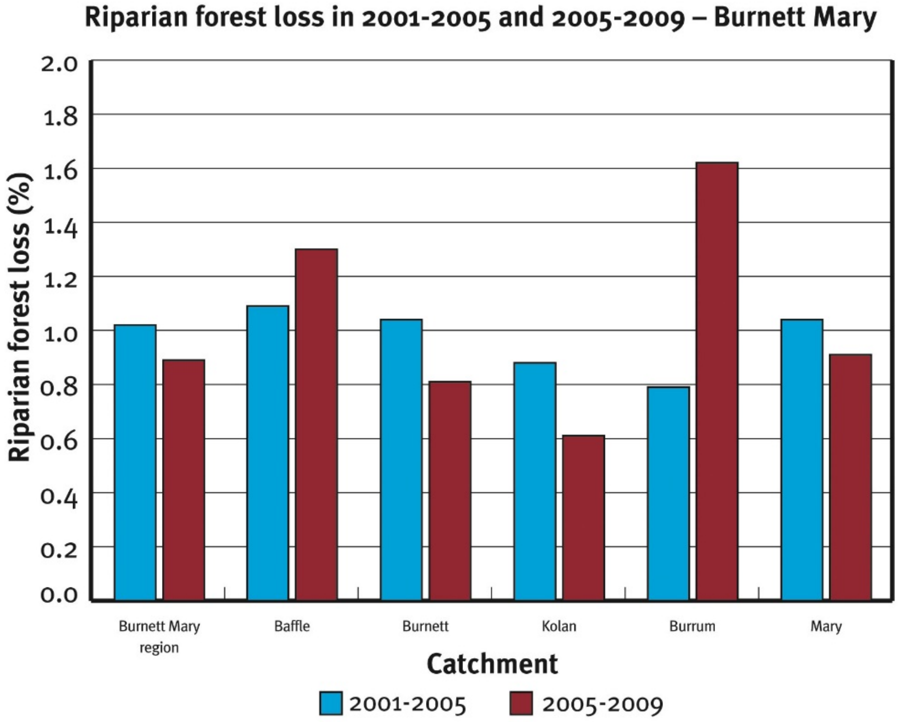
In the Fitzroy region, 2.03% (38,169ha) of riparian areas were non-forested with low groundcover potentially leading to lower bank stability and an increased risk of erosion. This is the second highest proportion of all Great Barrier Reef regions.

Burnett Mary

Riparian loss

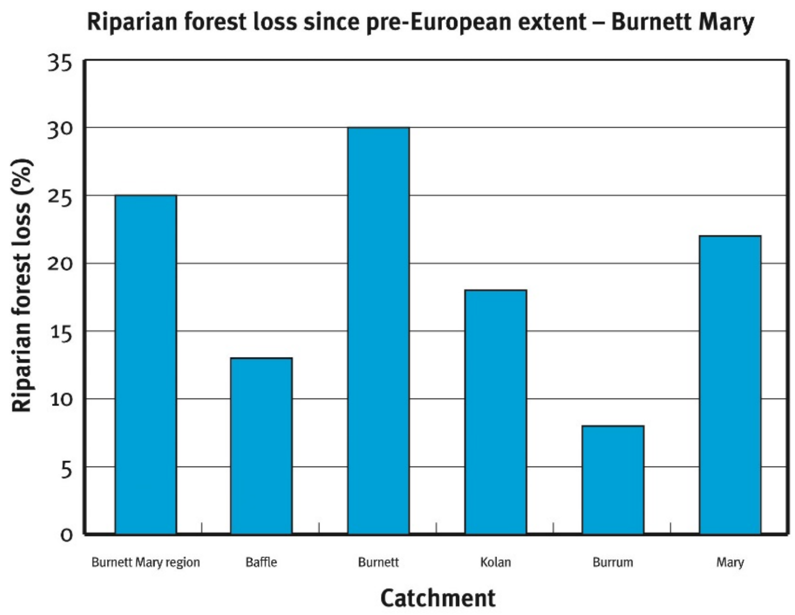


The Burnett Mary region had the greatest loss of riparian forest between 2005 and 2009 of all the regions with 0.89% (7889ha). However this was a reduction from 9037ha (1.02%) between 2001 and 2005.



Most catchments had a decrease in loss of riparian forest, except for the Baffle and Burrum catchments. Loss in the Burrum catchment increased from 0.79% (341ha) between 2001 and 2005 to 1.62% (700ha) between 2005 and 2009. Loss in the Baffle catchment increased from 1.09% (605ha) between 2001 and 2005 to 1.3% (722ha) between 2005 and 2009.

Riparian forest loss in the Burnett, Kolan and Mary catchments was 0.81% (4080ha), 0.61% (285ha) and 0.91% (2102ha), respectively.



Approximately 881,837ha of riparian areas were mapped in the Burnett Mary region. In 2009, the forested riparian area was approximately 74% (653,215ha). Historically, approximately 25% (220,000ha) of riparian forest has been lost from pre-European extent.

In the Burnett Mary region, 0.43% (3797ha) of riparian areas were non-forested with low groundcover potentially leading to lower bank stability and an increased risk of erosion.

Ground cover results

Improved land management helps maintain ground cover during dry periods when erosion risk is highest.

Ground cover and rainfall trends are reported for the grazing lands of the following regions:

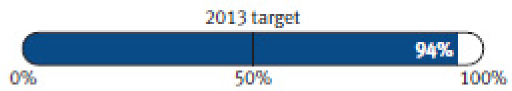
- Herbert catchment (in the Wet Tropics region)
- Burdekin region
- Mackay Whitsunday region
- Fitzroy region
- Burnett Mary region.

Ground cover is not reported for the Cape York region and the Wet Tropics region, with the exception of the Herbert catchment. These areas are generally considered to have low grazing pressure and the tree cover is too high for ground cover monitoring derived from satellite imagery.

Great Barrier Reef

Ground cover

Target: A minimum of 50% late dry season ground cover on dry tropical grazing land by 2013.
Result: Target met



The 2010 mean ground cover was high (94%), well above the Reef Plan target of 50% mostly due to high rainfall over recent years. This was 16% higher than the 23-year mean. The area below the 50% target was only 1% in 2010.

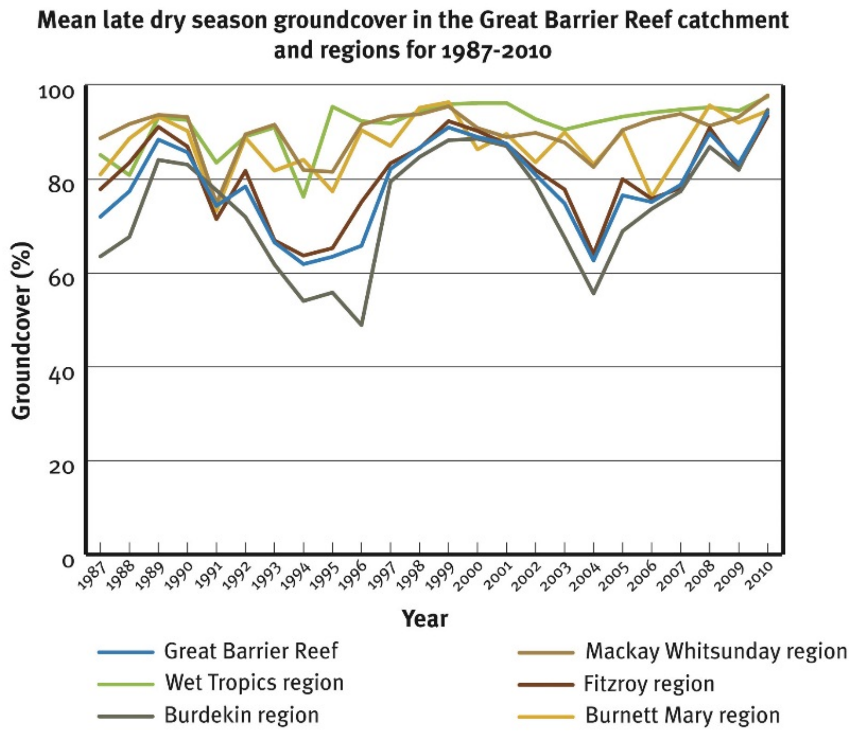
All regions had mean ground cover levels well above the target, ranging from 94% (Fitzroy) to 98% (Mackay Whitsunday and Wet Tropics). The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

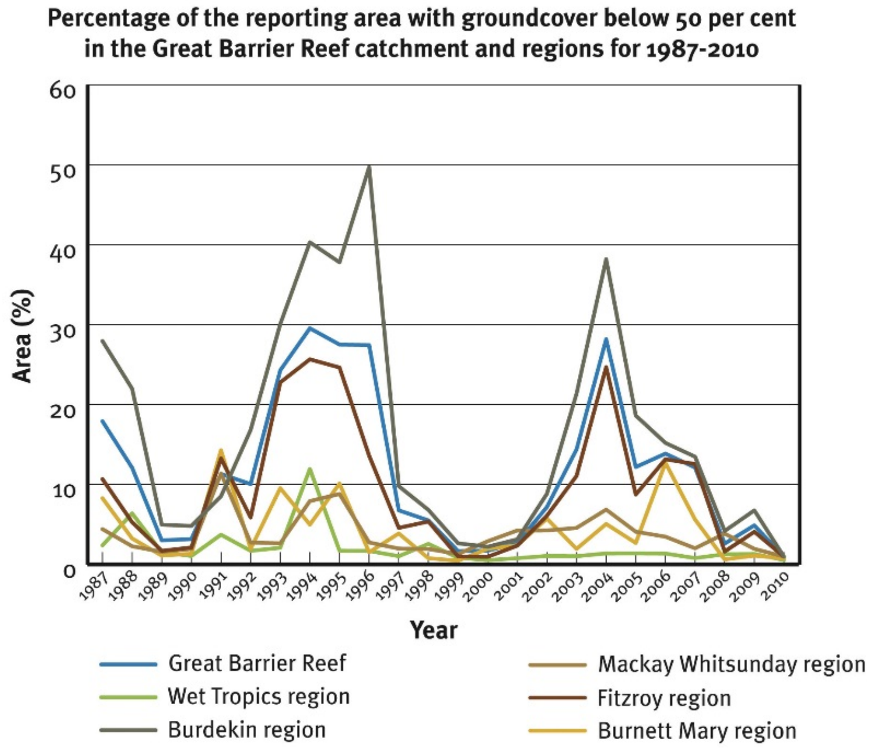
Improved land management helps maintain ground cover during dry periods when erosion risk is highest.

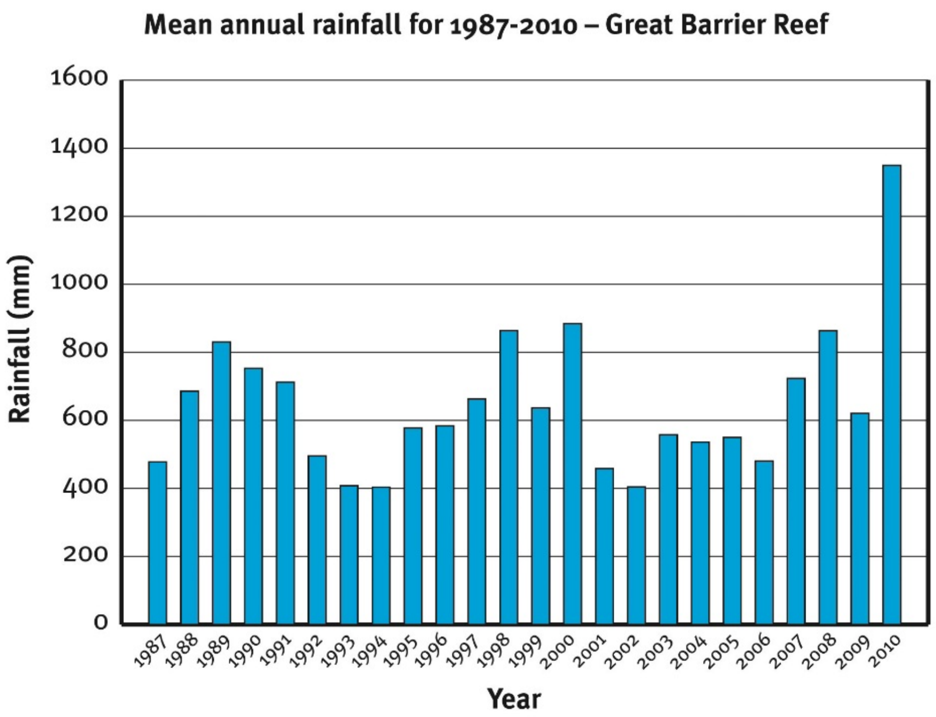
Ground cover results for the Great Barrier Reef catchment and regions

Region	23-year mean ground cover (%)	2010 mean ground cover (%)	Area with less than 50% ground cover averaged over last 23 years (%)	Area with less than 50% groundcover in 2010 (%)
Wet Tropics – Herbert catchment only	91.4	97.6	2.1	0.6
Mackay Whitsunday	90	97.9	3.8	1.0
Burdekin	74.7	94.8	16.5	1.0
Fitzroy	80.1	93.5	9.3	1.0
Burnett Mary	87.3	94.6	4.3	0.8
Total Great Barrier Reef	78.6	94.2	11.7	1.0

Ground cover changes over time





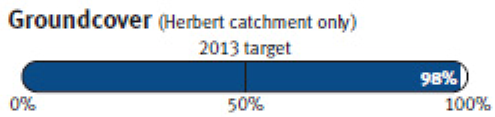


The 2010 mean ground cover across the Great Barrier Reef catchment is the highest of the past 23 years. This has resulted in a very low proportion (1%) of the catchment being below 50% ground cover and corresponds with above average annual rainfall in the past four years. Over the past 23 years there were periods where almost 30% of the area had low ground cover. During periods of low rainfall, mean ground cover has approached 60% and the percentage of area with mean ground cover below 50% reached almost 30%.

Regions with generally high rainfall have consistently high levels of ground cover. For example, the Mackay Whitsunday, Wet Tropics and Burnett Mary regions had mean ground cover greater than 70%. These regions have mean annual rainfall levels of at least 750mm. In comparison, regions with lower, more variable mean annual rainfall (Fitzroy and Burdekin) show greater fluctuations in ground cover. In these regions, mean ground cover falls in drier years and the area which is below 50% ground cover increases.

Wet Tropics

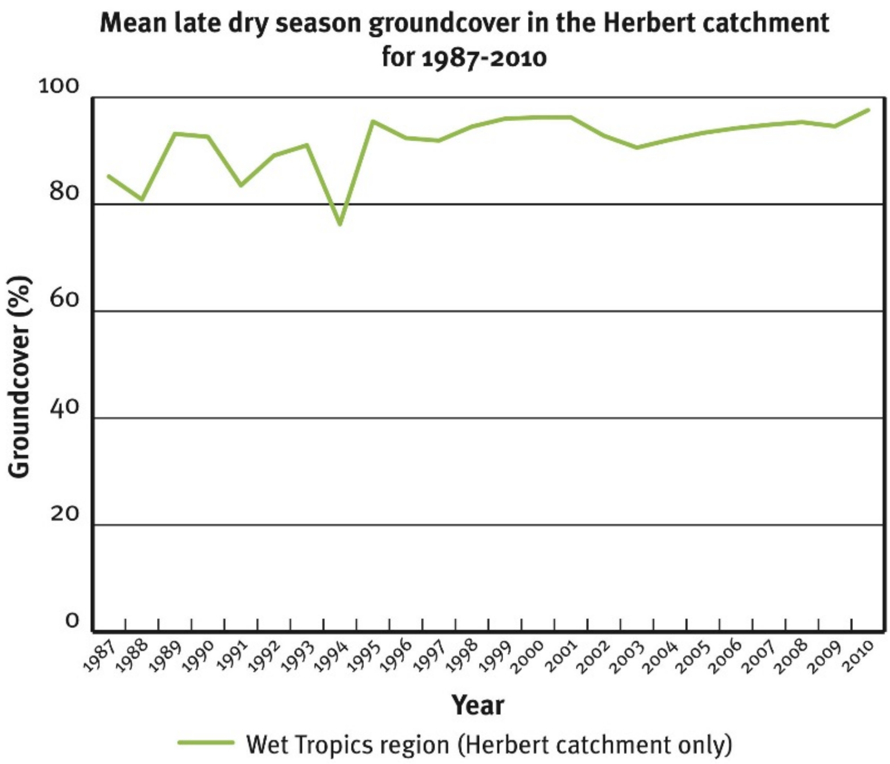
Ground cover (Herbert catchment only)

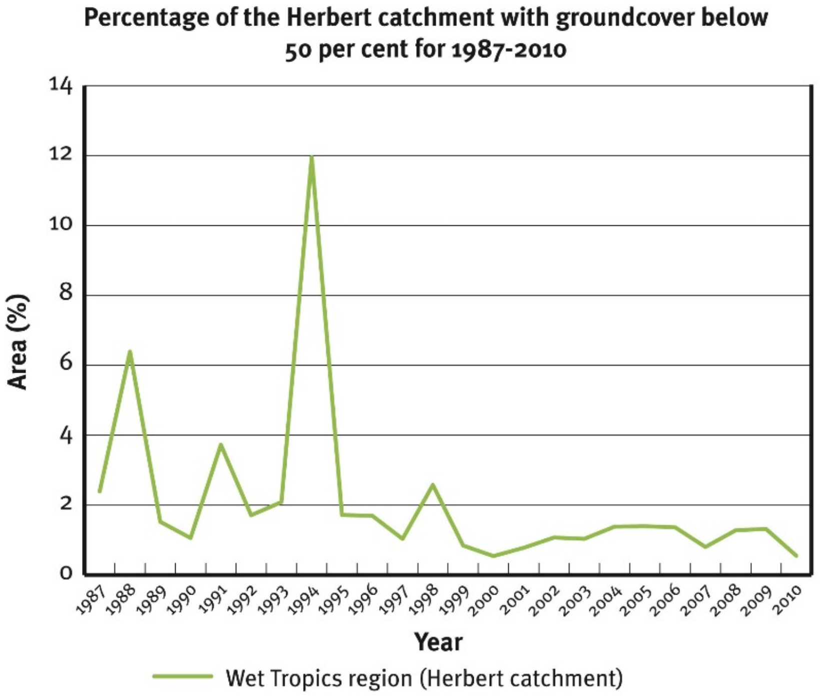


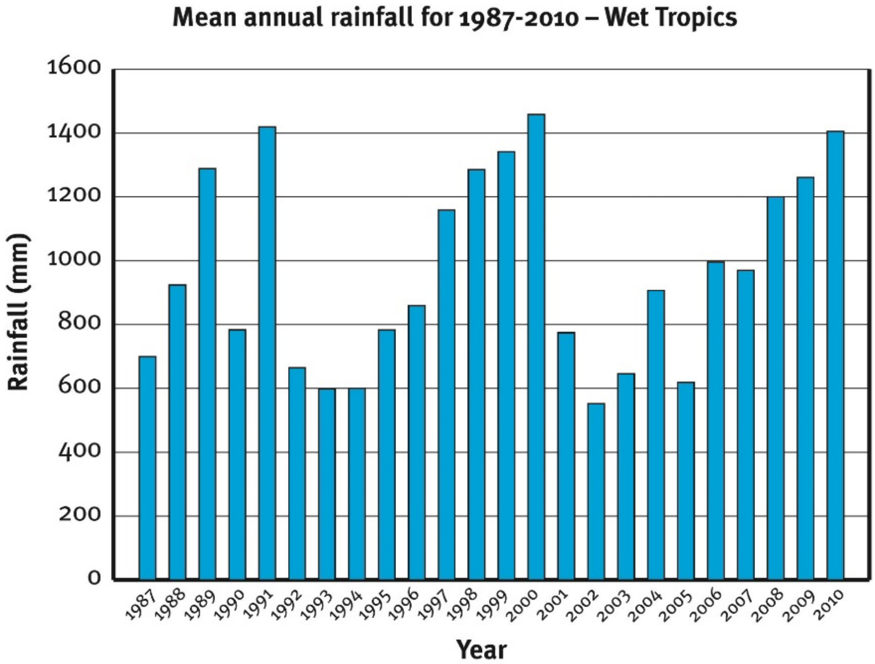
Late dry season ground cover for grazing lands of the Herbert catchment was high (98%). The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

Ground cover results for the Herbert catchment (Wet Tropics region)				
Catchment	**23-year mean ground cover (%)**	**2010 mean ground cover (%)**	**Percentage of regional area with less than 50% ground cover averaged over last 23 years (%)**	**Percentage of regional area with less than 50% ground cover in 2010 (%)**
Herbert (Wet Tropics region)	91.4	97.6	2.1	0.6

Ground cover changes over time



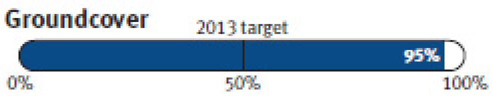




The Herbert catchment had consistently high mean ground cover from 1987 to 2010 with a mean ground cover level of 91.4% and a consistently low proportion of grazing area under the Reef Plan target of 50% ground cover. The minimum mean ground cover for the monitoring period was 76% in 1994. The highest percentage of area with ground cover below 50% was 12%, also in 1994. The Herbert catchment is the second wettest of the areas reported (970mm mean annual rainfall).

Burdekin

Ground cover

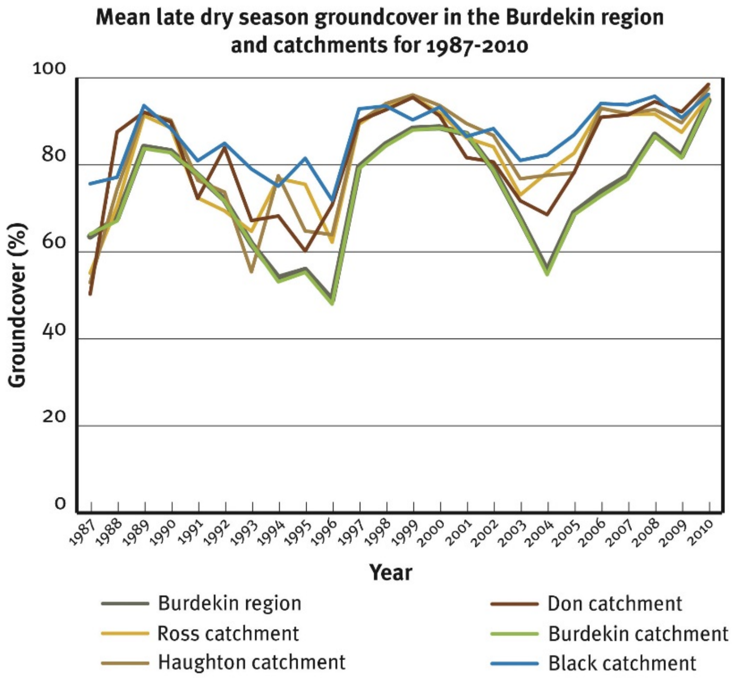


Late dry season ground cover for grazing lands was 95%. This is due to high rainfall over recent years. This is due to high rainfall over recent years.

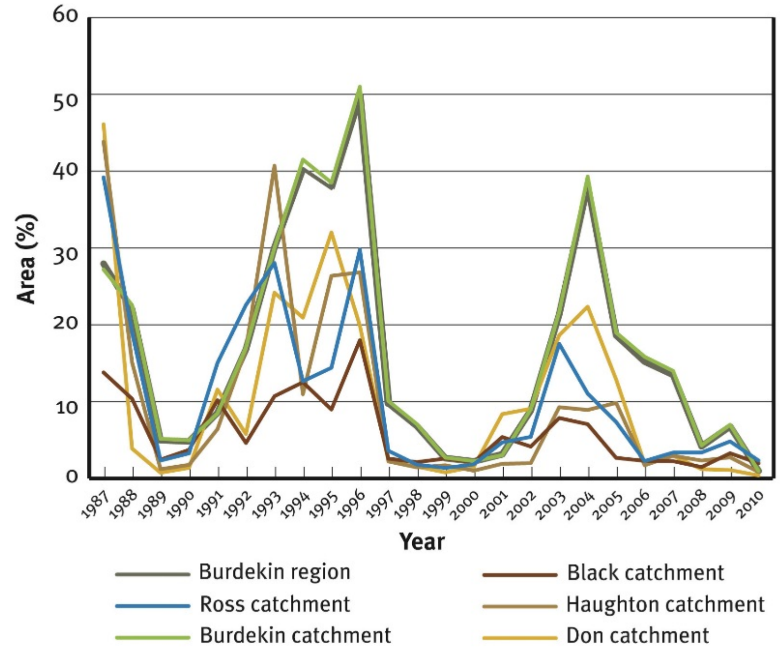
Mean ground cover in the Burdekin region is mainly influenced by the Burdekin catchment, which constitutes 94% of the reporting area. In 2010, extensive cloud cover obscured a large portion of the lower Burdekin catchment. This obscured area has historically been an area of lower ground cover and is not reported on here. The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

Ground cover results for the Burdekin region and catchments				
Catchment/ Region	**23-year mean ground cover (%)**	**2010 mean ground cover (%)**	**Percentage of regional area with less than 50% ground cover averaged over last 23 years (%)**	**Percentage of regional area with less than 50% ground cover in 2010 (%)**
Black	86.4	96.2	6.0	2.0
Burdekin	74.3	94.7	16.8	1.0
Don	81.8	98.5	10.5	0.4
Haughton	81.7	97.6	10.0	0.8
Ross	81.6	95.7	10.7	2.3
Burdekin region	74.7	94.8	16.5	1.0

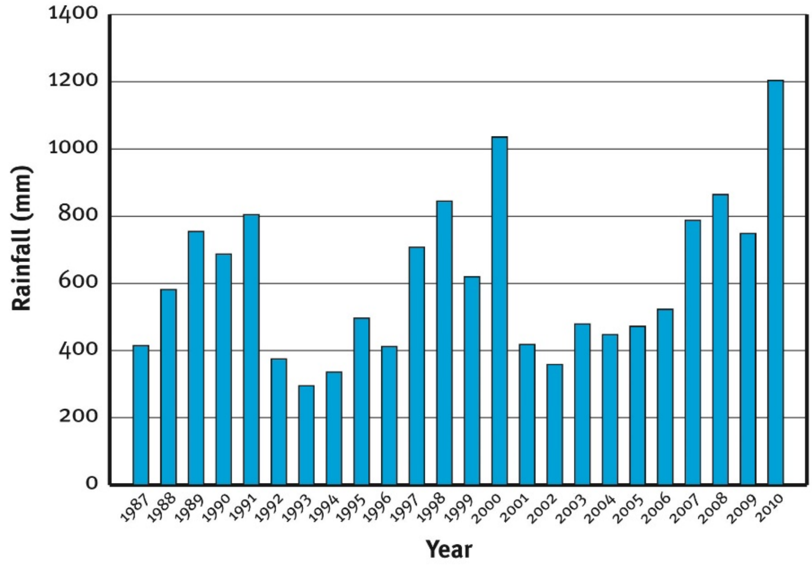
Ground cover changes over time



Percentage of the area with groundcover below 50 per cent in the Burdekin region and catchments for 1987-2010



Mean annual rainfall for 1987-2010 - Burdekin

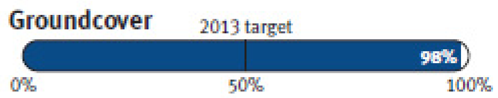


Ground cover in the Burdekin region fluctuates significantly over time. For example, in 1996 the mean late dry season ground cover was 49% while the following year it approached 80%. Increases in the area with less than 50% ground cover correspond to lower mean annual rainfall. For example, in 1996 almost half of the area had ground cover less than 50% and the mean annual rainfall was 412mm, nearly 200mm less than the mean annual rainfall for the 23-year period of 610mm.

The Burdekin catchment had a 2010 mean ground cover level of 95%, exceeding the 23-year mean by 20%. This is the greatest difference between the 2010 mean ground cover and the 23-year mean ground cover of all the catchments in the Great Barrier Reef region.

Mackay Whitsunday

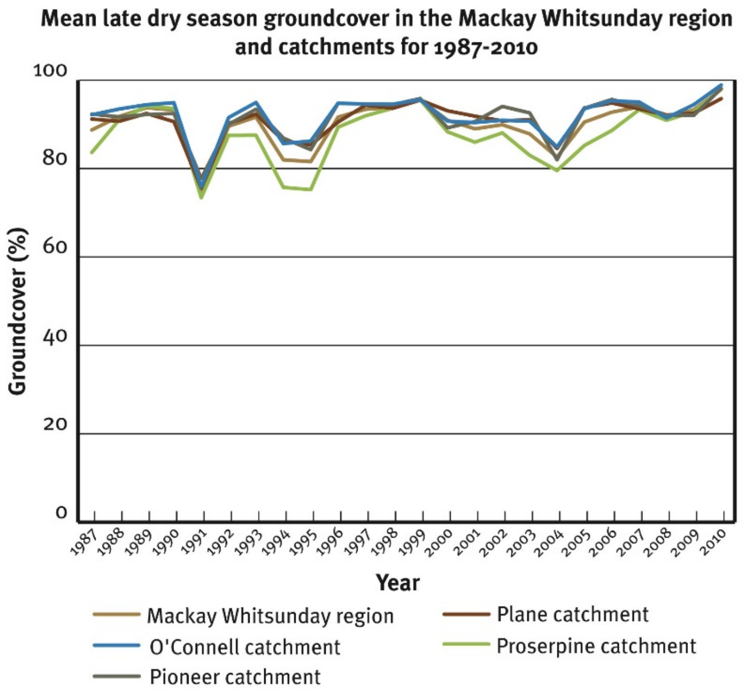
Ground cover

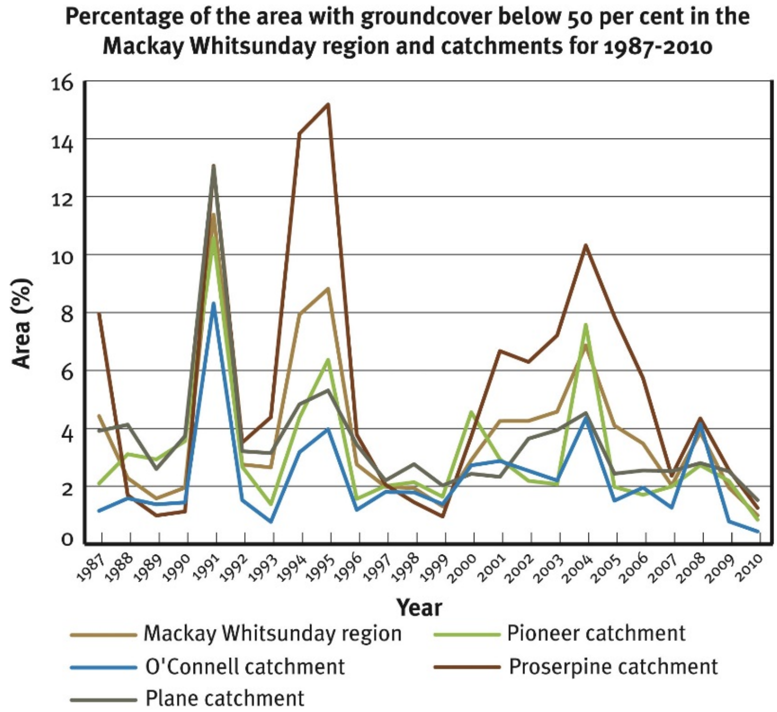


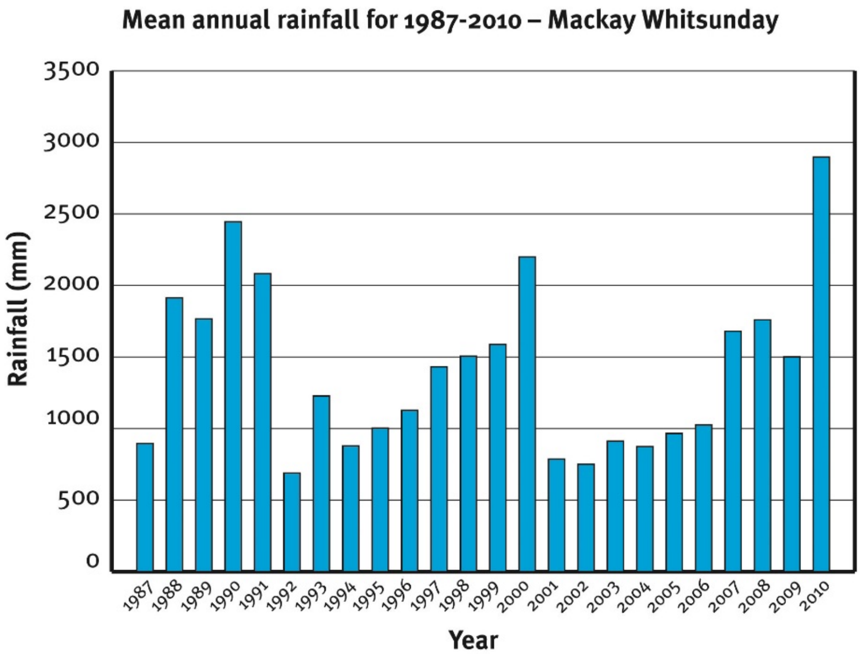
Late dry season ground cover for grazing lands was 98%. The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

Ground cover results for the Mackay Whitsunday region and catchments				
Catchment/ Region	**23-year mean ground cover (%)**	**2010 mean ground cover (%)**	**Percentage of regional area with less than 50% ground cover averaged over last 23 years (%)**	**Percentage of regional area with less than 50% ground cover in 2010 (%)**
O'Connell	91.8	98.9	2.3	0.4
Pioneer	91.6	98.1	3.1	0.8
Plane Creek	90.6	95.8	3.6	1.5
Proserpine	88	97.9	5.4	1.3
Mackay Whitsunday region	90	97.9	3.8	1.0

Ground cover changes over time



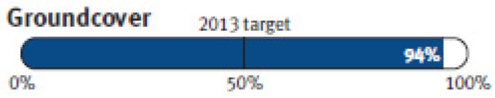




During the past 23 years, the Mackay Whitsunday region has had consistently high mean annual ground cover levels of 90%, with a minimum level of 75% in 1991. The greatest area with ground cover less than 50% was 11%, also in 1991. The Mackay Whitsunday region is the wettest of the regions reported (1410mm mean annual rainfall).

Fitzroy

Ground cover

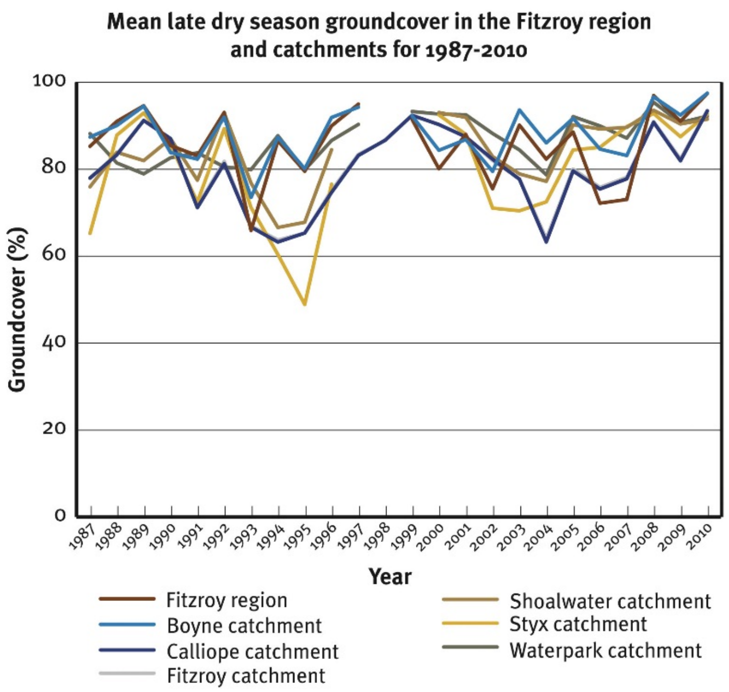


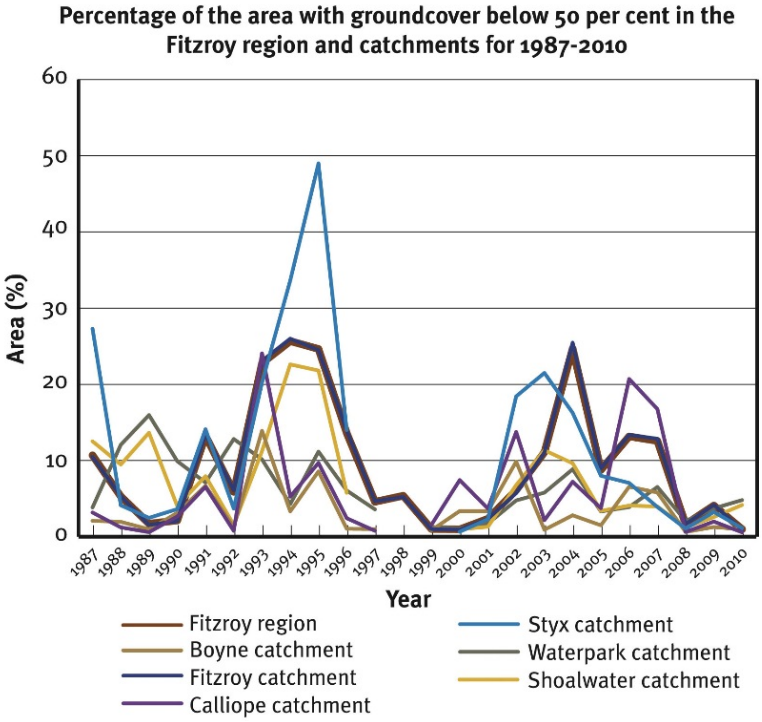
Late dry season ground cover for grazing lands was 94%. This is mostly due to high rainfall during recent years.

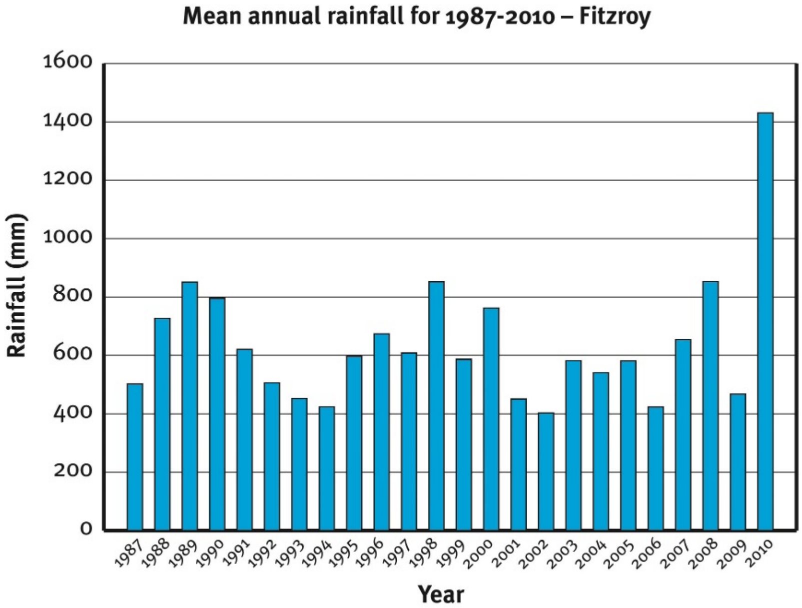
The Fitzroy catchment constitutes 95% of the reporting area for the region. The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

Ground cover results for Fitzroy region and catchments				
Catchment/ Region	**23-year mean ground cover (%)**	**2010 mean ground cover (%)**	**Percentage of regional area with less than 50% ground cover averaged over last 23 years (%)**	**Percentage of regional area with less than 50% ground cover in 2010 (%)**
Boyne (Gladstone)	88.2	97.5	3.4	0.9
Calliope	86.2	97.4	5.7	0.6
Fitzroy	79.9	93.4	9.4	0.9
Shoalwater	84.1	91.5	6.8	4.2
Styx	79.8	92.7	11.2	1.1
Water Park Creek	86.8	92.2	6.0	4.8
Fitzroy region	80.1	93.5	9.3	1.0

Ground cover changes over time





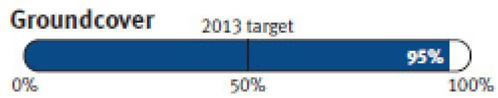


Mean annual late dry season ground cover in the Fitzroy region fluctuates considerably. For example, ground cover was as low as 64% in 1994 and as high as 92% in 1999 – the 23-year mean is 80%. Ground cover was at its highest for the 23 year period in 2010. Declines in ground cover correspond with increases in the area with cover under 50%.

These declines also correspond to below average rainfall in preceding years. For example, in 1994, the area with ground cover below 50% was almost 26% and the mean annual rainfall had been declining since 1989. The annual rainfall was 420mm, more than 200mm lower than the region's mean annual rainfall for 1987 to 2010.

Burnett Mary

Ground cover

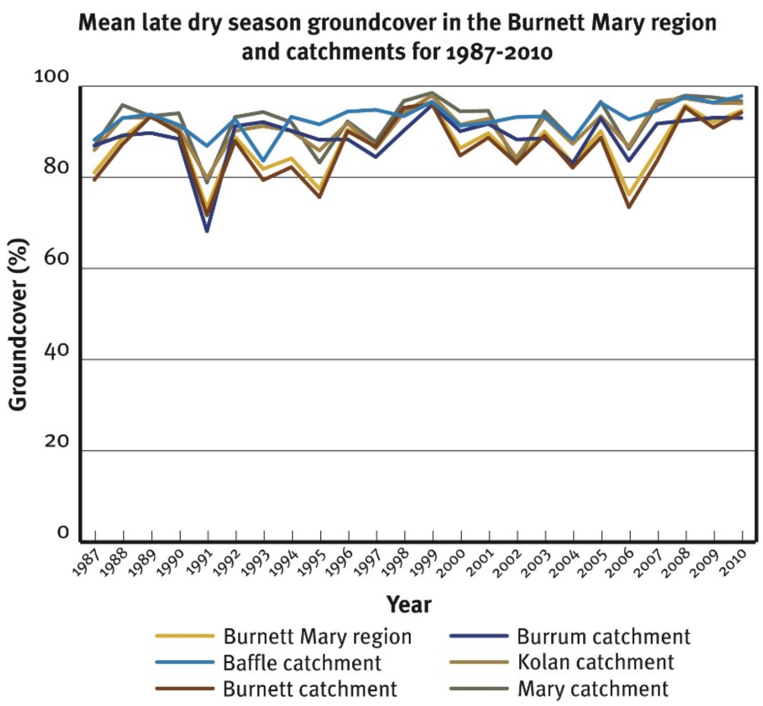


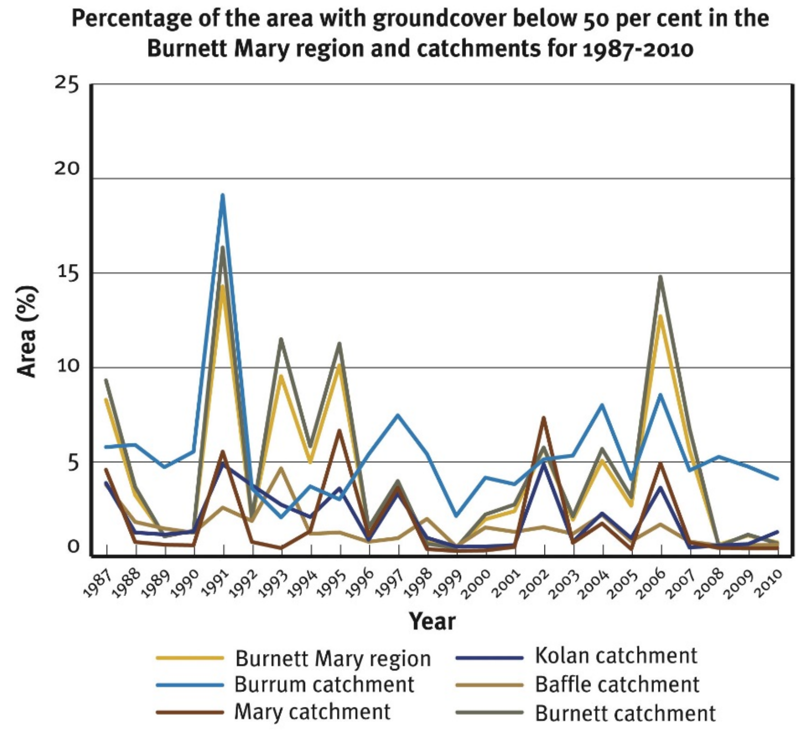
Late dry season ground cover for grazing lands was 95%.

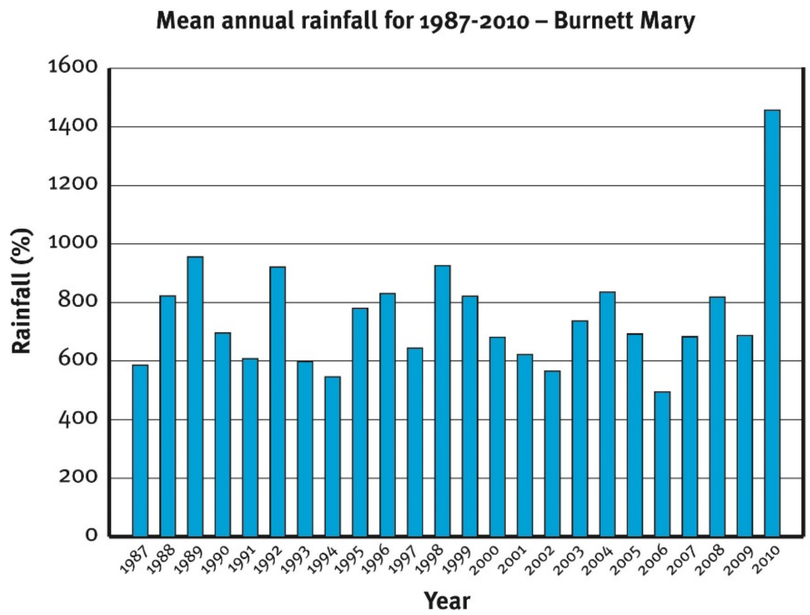
The 23-year mean statistics were calculated for the period 1987 to 2010 inclusive.

Ground cover results for the Burnett Mary region and catchments				
Catchment/ Region	**23-year mean ground cover (%)**	**2010 mean ground cover (%)**	**Percentage of regional area with less than 50% ground cover averaged over last 23 years (%)**	**Percentage of regional area with less than 50% ground cover in 2010 (%)**
Baffle	92.8	97.8	1.6	0.6
Burnett	86.3	94.2	4.8	0.7
Burrum	88.7	93	5.5	4.1
Kolan	91.1	96.2	2.0	1.3
Mary	92.2	96.7	1.9	0.4
Burnett Mary region	87.3	94.6	4.3	0.8

Ground cover changes over time







Over the past 23 years, the Burnett Mary region has had a consistently high mean annual ground cover of 87%, with a minimum of 73% in 1991. The highest level of cover was 96% in 2008. The greatest area with ground cover less than 50% was 14%, also in 1991. Mean annual rainfall for the Burnett Mary region, over the period 1987 to 2010, is approximately 750mm.

Catchment pollutant loads results

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.

The pollutant loads leaving catchments and entering the reef vary significantly from year to year, mainly due to differences in annual rainfall. Catchment modelling has been used to correct the annual pollutant loads for climate variability and estimate the long term annual load reductions due to the adoption of improved management practices. Progress towards load reduction targets is modelled using well documented methods and assumptions, and long term water quality monitoring is used to validate these modelled results. Progress is measured in terms of the reduction in loads due to agriculture (termed 'anthropogenic load' in this context).

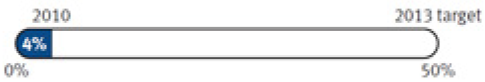
The catchment loads targets are ambitious measures designed to be met in 2013 for nutrients and pesticides and 2020 for sediment. The bar indicators below show the one-year reduction in load as at June 2010. This period covers only the first year of Reef Plan implementation. More progress will be evident in the third and subsequent Report Cards. This result is a very good outcome as it demonstrates the program is arresting and reversing the loads into the reef.

The load reductions do not include all activities undertaken during the reporting period and are, therefore, considered an underestimate of total progress. For example, land management changes in the horticulture and dairy industries and parts of the grains industry have not been modelled at this time. Changes in riparian management also could not be modelled due to the lack of data.

Great Barrier Reef

Nitrogen

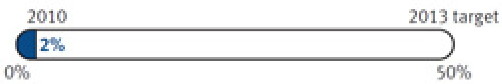
Target: A minimum 50% reduction in nitrogen load at the end-of-catchments by 2013.
Result: Moderate progress



- The estimated annual average total nitrogen load leaving catchments reduced by 4% (641t).
- The greatest per cent load reduction (6%) was in the Burdekin and Burnett Mary regions with 346t and 91t, respectively.
- The total nitrogen load leaving the Great Barrier Reef catchments was an estimated 36,843t per year, double the pre-development load.

Phosphorus

Target: A minimum 50% reduction in phosphorus load at the end-of-catchments by 2013.
Result: Moderate progress



- The estimated annual average total phosphorus load leaving catchments reduced by 2% (83t).
- The greatest per cent load reduction was from the Burdekin region with 3% (35t), the majority being particulate phosphorus.
- The total phosphorus load leaving the Great Barrier Reef catchments was an estimated 6312t per year, which is two and half times greater than the pre-development load.

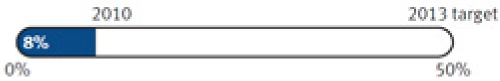
Sediment

Target: A minimum 20% reduction in sediment load at the end-of-catchments by 2020.
Result: Good progress

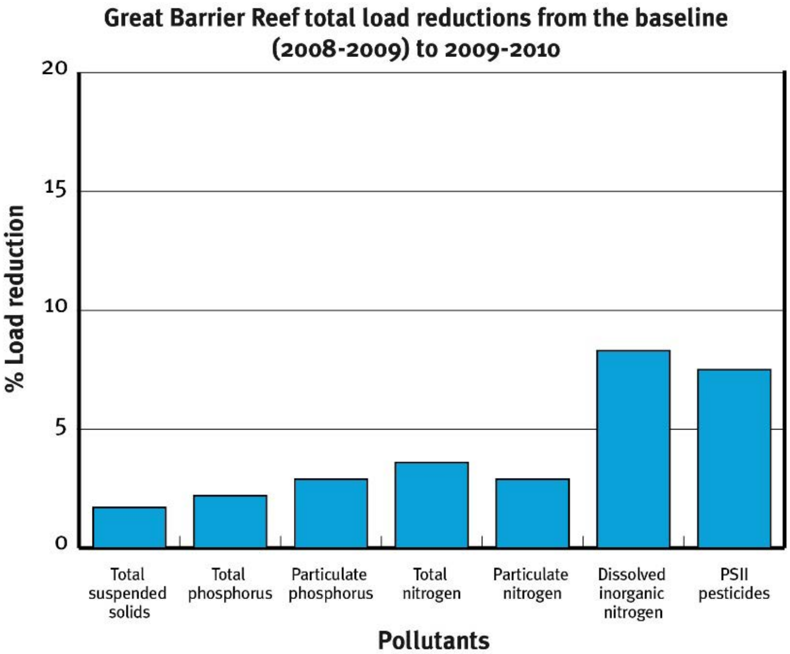
- The estimated annual average suspended sediment load leaving catchments reduced by 2% (105,000t).
- The greatest per cent load reduction was in the Mackay Whitsunday region.
- The average annual total suspended sediment load leaving the Great Barrier Reef catchments was an estimated 8,850,000t per year, a threefold increase on the pre-development load. The regions contributing the highest total suspended sediment loads were the two largest catchments which are dominated by grazing - the Burdekin (4,104,000t per year) and the Fitzroy (2,034,000t per year).

Pesticides

Target: A minimum 50% reduction in pesticide load at the end-of-catchments by 2013
Result: Good progress



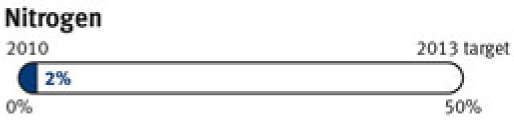
- The estimated annual average pesticide load leaving catchments reduced by 8% (1254kg).
- The greatest per cent load reductions were from the Mackay Whitsunday and Burnett Mary regions with 18% (376kg) and 14% (219kg), respectively.
- Agricultural lands are a key source of pesticide runoff, particularly cane lands. The total load of photosystem II pesticides leaving the Great Barrier Reef catchments was 16,692kg.



Cape York

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.
Changes in riparian management could not be modelled due to the lack of data. Load reductions are estimated for the Normanby catchment only.

Nitrogen

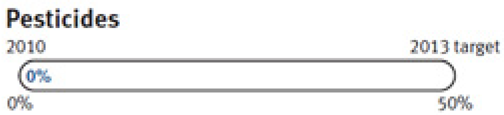


The estimated annual average total nitrogen load leaving the Normanby catchment reduced by 2% (7t).

Phosphorus

The estimated annual average total phosphorus load leaving the Normanby catchment reduced by 2% (3t).

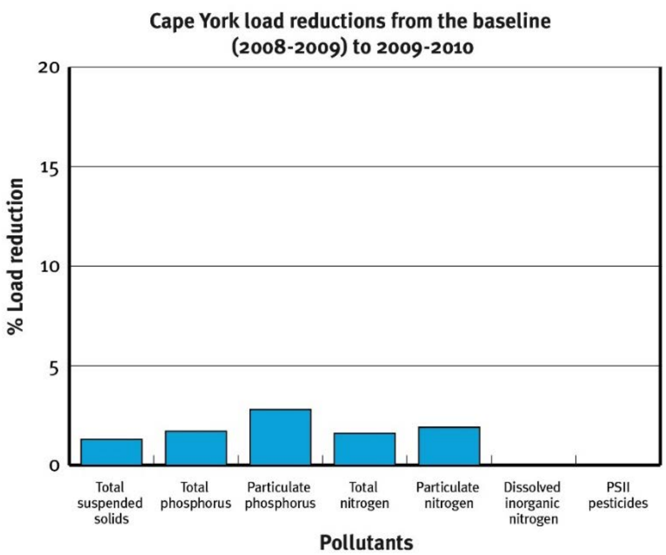
Pesticides



There were no load reductions for pesticides in the Normanby catchment.

Sediment

The estimated annual average suspended sediment load leaving the Normanby catchment reduced by 1% (3000t).



Wet Tropics

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.
Land management changes in the horticulture and dairy industries have not been modelled.
Changes in riparian management also could not be modelled due to the lack of data.

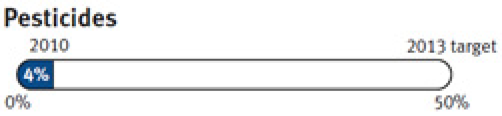
Nitrogen

The estimated annual average total nitrogen load leaving catchments reduced by 2% (111t).

Phosphorus

The estimated annual average total phosphorus load leaving catchments reduced by 2% (20t).

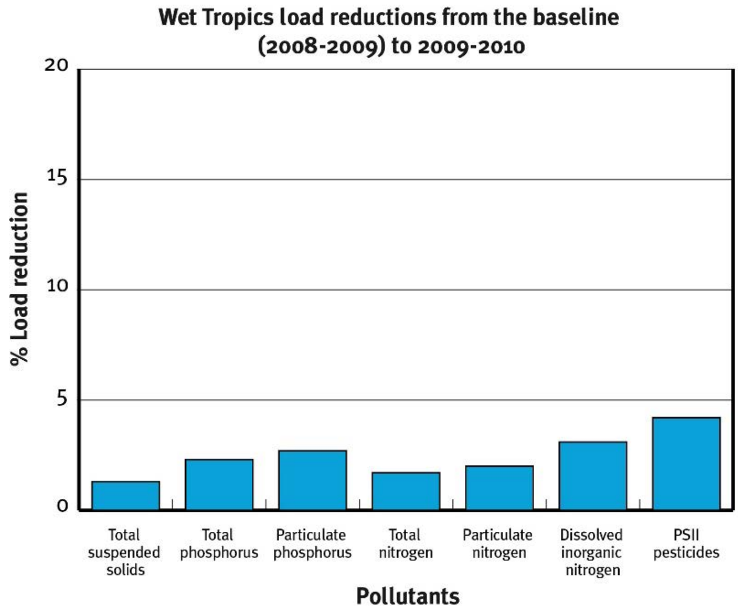
Pesticides



The estimated annual average pesticide load leaving catchments reduced by 4% (434kg).

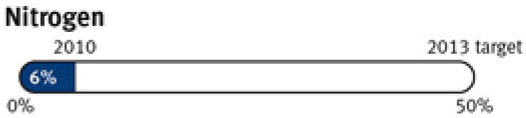
Sediment

The estimated annual average suspended sediment load leaving catchments reduced by 1% (10,000t).



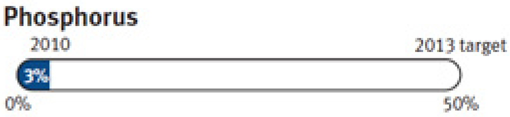
Burdekin
The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.
Land management changes in the horticulture industry have not been modelled. Changes in riparian management also could not be modelled due to the lack of data.

Nitrogen



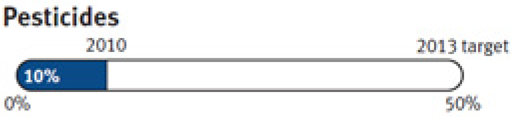
The estimated annual average total nitrogen load leaving catchments reduced by 6% (346t).

Phosphorus



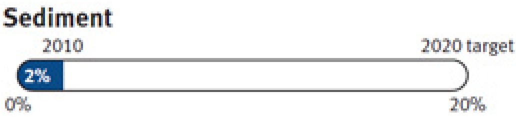
The estimated annual average total phosphorus load leaving catchments reduced by 3% (35t).

Pesticides

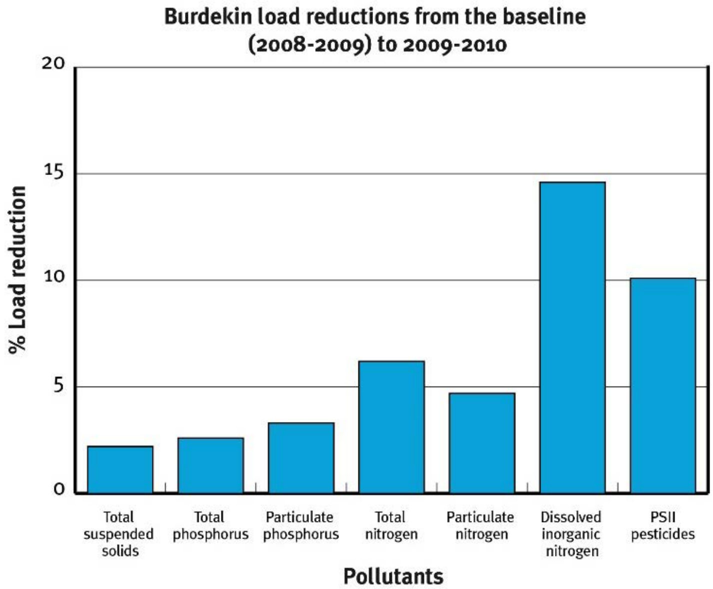


The estimated annual average pesticide load leaving catchments reduced by 10% (225kg).

Sediment



The estimated annual average suspended sediment load leaving catchments reduced by 2% (61,000t).

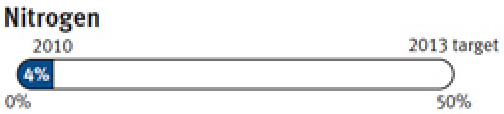


Mackay Whitsunday

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.

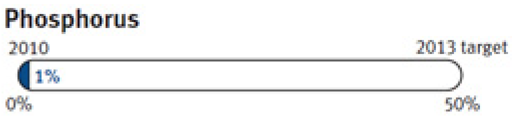
Land management changes in the horticulture industry have not been modelled. Changes in riparian management also could not be modelled due to the lack of data.

Nitrogen



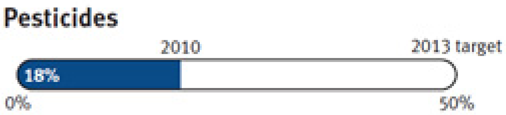
The estimated annual average total nitrogen load leaving catchments reduced by 4% (76t).

Phosphorus



The estimated annual average total phosphorus load leaving catchments reduced by 1% (5t).

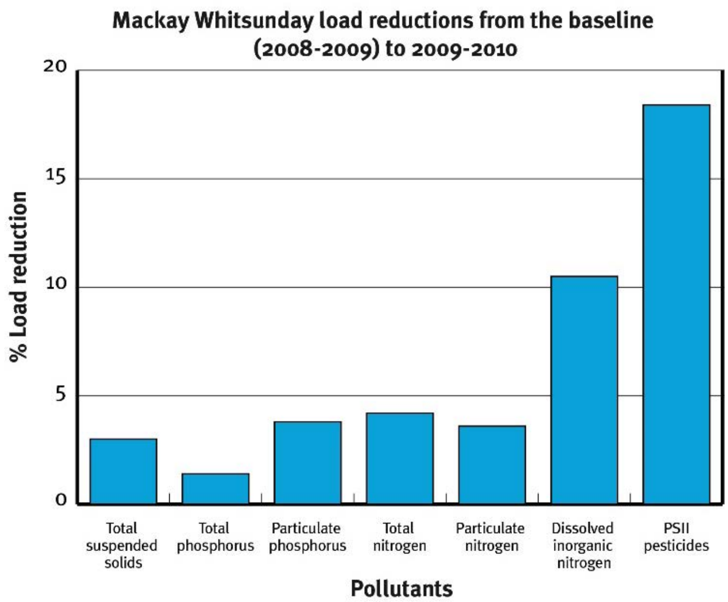
Pesticides



The estimated annual average pesticide load, largely from sugarcane cultivation, leaving catchments reduced by 18% (376kg)

Sediment

The estimated annual average suspended sediment load leaving catchments reduced by 3% (11,000t).

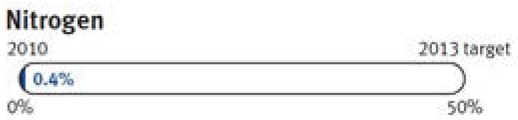


Fitzroy

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.

Land management changes in the horticulture and grains industries have not been modelled. Changes in riparian management also could not be modelled due to the lack of data.

Nitrogen

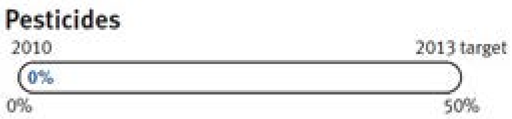


The estimated annual average total nitrogen load leaving catchments reduced by 0.4% (9t). This does not include nitrogen reductions from improved cropping practices.

Phosphorus

The estimated annual average total phosphorus load leaving catchments reduced by 1% (11t).

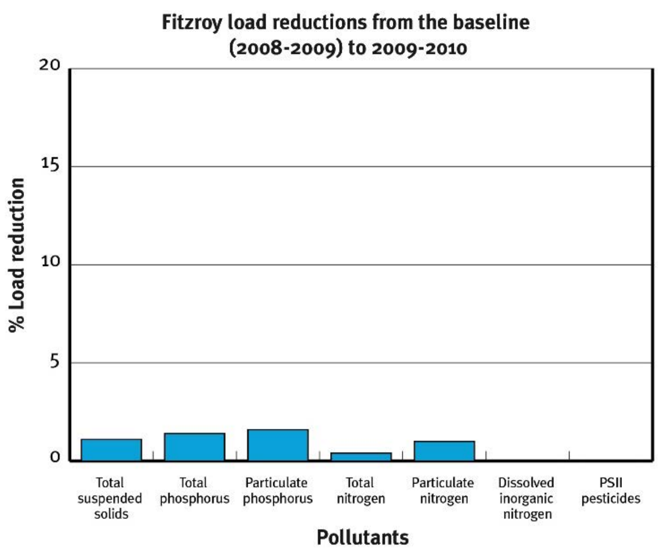
Pesticides



There were no load reductions for pesticides in the Fitzroy region. This does not include pesticide reductions from improved grazing practices.

Sediment

The estimated annual average suspended sediment load leaving catchments reduced by 1% (17,000t).



Burnett Mary

The pollutant loads at the end of the catchment come from modelling, validated by monitoring, to remove the effect of a variable climate from year to year.

Land management changes in the horticulture industry have not been modelled. Changes in riparian management also could not be modelled due to the lack of data.

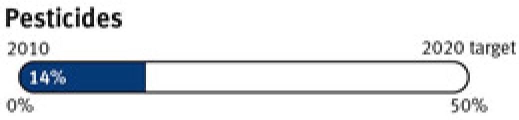
Nitrogen

The estimated annual average total nitrogen load leaving catchments reduced by 6% (91t).

Phosphorus

The estimated annual average total phosphorus load leaving catchments reduced by 3% (9t).

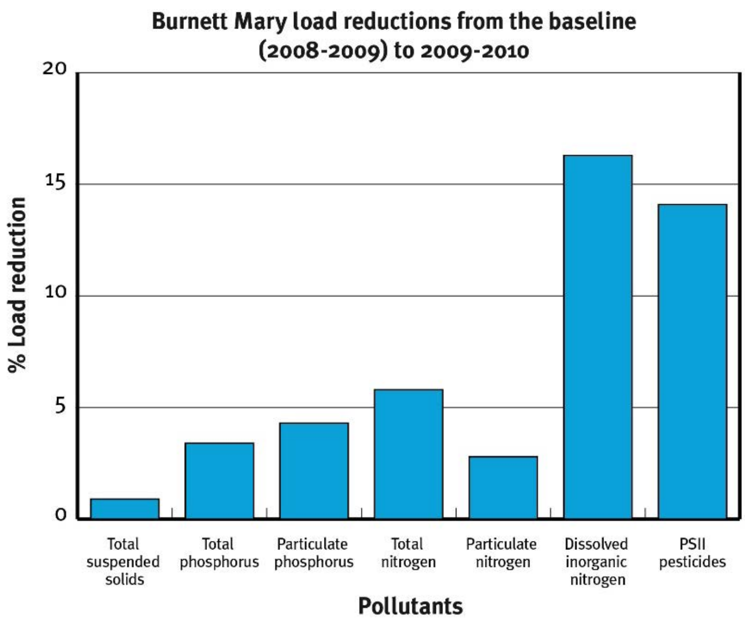
Pesticides



The estimated annual average pesticide load leaving catchments reduced by 14% (219kg).

Sediment

The estimated annual average suspended sediment load leaving catchments reduced by 1% (4000t).



Marine results

Marine results cover water quality, seagrass and coral. The overall marine condition in 2009-2010 was moderate and has remained moderate since 2005-2006. There was some variability between regions, with the Burdekin and Burnett Mary in poor condition overall. Water quality and the condition of seagrass meadows and coral reefs also varied regionally.

Marine results are provided overall for the Great Barrier Reef and for each of the six regions.

There are significant time lags between altering land management practices and seeing results in the marine system. Reef Plan monitors outputs and outcomes at the farm, catchment and marine levels, and focuses on the long-term health of the reef.

The reef was affected by extreme events in 2009-2010. Significant rainfall led to comparatively high levels of fresh water entering the reef. Exposure to large volumes of low salinity flood waters for an extended period contributed to localised coral bleaching on shallow, inshore reefs. Tropical Cyclone Ului passed through the Mackay Whitsunday region in early 2010 causing damage to parts of the reef.

Disturbances affecting the Great Barrier Reef

The health and resilience of the reef is affected by a range of short-term and long-term disturbances, including:

- floods
- cyclones
- elevated sea surface temperatures
- crown-of-thorns starfish outbreaks
- influence of climate change.

The impact of disturbances on the reef depends on their frequency, duration and severity, as well as the state of the ecosystem (Fabricius 2005; Osborne *et al*., 2011). Multiple disturbances may have a combined negative effect on reef resilience that is greater than the effect of each disturbance in isolation. In 2009-2010, floods and cyclones had a considerable impact on the water quality and ecosystem status of the inshore area of the Great Barrier Reef.

Floods

Significant rainfall during 2009-2010 caused greater freshwater discharge across the Great Barrier Reef compared to the long-term annual median flow. This was primarily due to high discharge from the Fitzroy River (4.2 times the annual median flow) and all rivers in the Mackay Whitsunday region (1.0 to 3.1 times the annual median flow). This is the fourth consecutive year where the collective freshwater discharge from all rivers has been at least 1.5 times the long-term annual median.

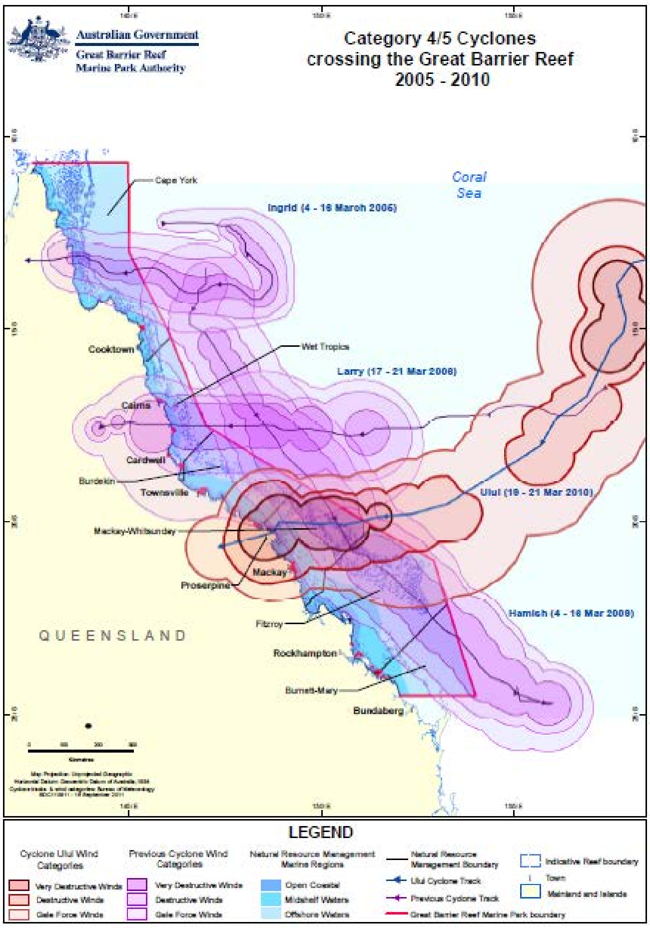
The influence of flood plumes on the marine environment depends on the volume and duration of river flows, the influence of wind direction and velocity, local currents and tidal regimes. Flood plumes had a greater impact in southern inshore areas of the reef compared to northern regions. The southern section of the Marine Park was exposed to large volumes of low salinity flood waters for an extended period, which is likely to have contributed to localised coral bleaching on shallow, inshore reefs in the area.

As well as freshwater, floods also deliver the majority of nutrients, sediments and herbicides to the reef lagoon. In 2009-2010, herbicide concentrations in flood plumes sometimes exceeded those known to have a negative effect on coral and seagrass (Haynes et al., 2000; Jones & Kerswell, 2003).

Cyclones

Tropical Cyclone Ului passed through the Mackay Whitsunday region in March 2010, damaging reef structure and causing short-term spikes in chlorophyll concentration and turbidity at some sites, while pockets of reef were untouched. The most severe damage occurred within 100 kilometres of the eye of the cyclone in the very destructive wind zone. Forty per cent of hard coral cover at Daydream Island was lost and reefs at Double Cone and Hook Islands were also affected.

Cyclones may cause extreme physical damage to reef structure. Since 2005, many areas of the Great Barrier Reef, including the inshore area, have been affected by Category 4 or 5 cyclones. The combined paths of these cyclones have exposed 80 per cent of the Great Barrier Reef Marine Park (3889 reefs) to gale force winds or greater. Of this area, 778 reefs (33 per cent) and 1889 reefs (38 per cent) were exposed to destructive or very destructive wind speeds. Most of the affected reefs were outside the inshore area.



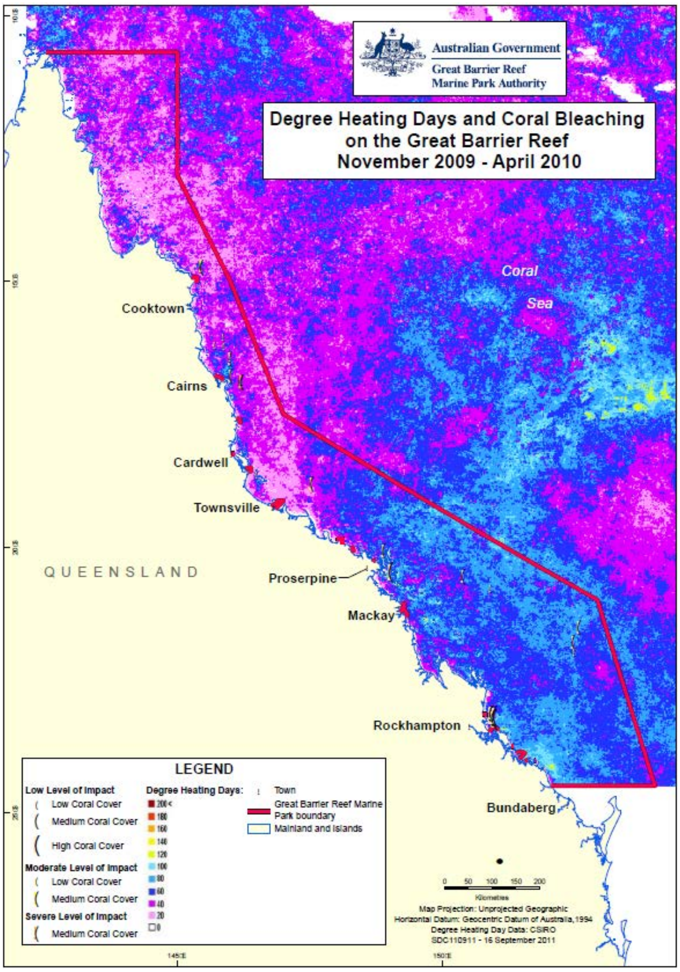
Caption: All category 4/5 cyclones that have affected the reef from 2005 to 2010 with their zones of influence. The path of Cyclone Ului is highlighted.

Elevated sea surface temperatures

Coral bleaching commonly occurs when accumulated temperature stress exceeds a threshold of about 60 -100 degree heating days (Maynard et al., 2009). In the last 50 years, an increase in the long-term average temperature of reef waters has narrowed the gap between a regular summer and one hot enough to trigger coral bleaching. This has caused an increase in mass bleaching events during the last two decades. Even when corals don't bleach, thermal stress from exposure to elevated seawater temperatures may increase their susceptibility to disease (Bruno et al., 2007).

Major coral bleaching events caused by unusually warm water temperatures were recorded in the Great Barrier Reef Marine Park in 1998, 2002 and to a lesser extent in 2006. Coral bleaching may also occur in response to other stressors, such as exposure to low salinity flood waters and/or certain chemicals, and is probably often due to a combination of pressures.

In 2009-2010, coral bleaching across the Great Barrier Reef was low and mainly in shallow areas impacted by solar heating. There were, however, localised areas of moderate to severe bleaching mainly in the northern section of the Marine Park, where monsoonal activity was weaker and reefs were exposed to moderate levels of heat stress in late summer. The southern section of the Marine Park was exposed to large volumes of low salinity flood waters and patterns of bleaching suggest it was caused by exposure during king low tides and salinity stress.



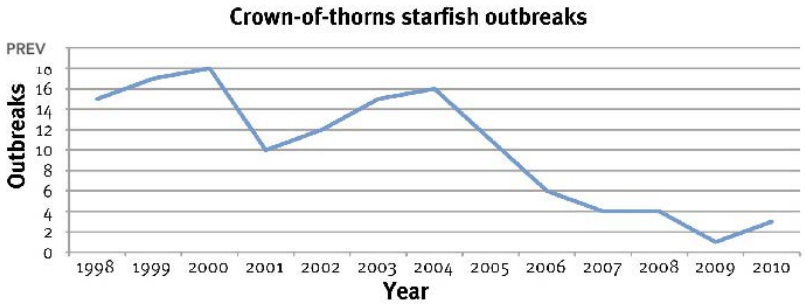
Caption: Water temperature as degree heating days and areas where coral bleaching occurred.

Crown-of-thorns starfish

Most of the crown-of-thorns starfish monitoring in the Great Barrier Reef is conducted by the Australian Institute of Marine Science as part of the Long Term (Reef) Monitoring Program. An active outbreak of crown-of-thorns starfish is when densities are such that the starfish consume coral tissue faster than the corals can grow. This is generally considered to be densities greater than about 30 starfish per hectare (Engelhardt et al., 1997; Sweatman et al., 2008).

Most outbreaks occur on midshelf reefs, beginning in the north and moving south over several years as larvae are transported by the East Australian Current. The Swains Reefs in the Fitzroy region have had low-level chronic infestations throughout most of the last three decades explained by the high density of reefs in this region and the regional oceanography.
Google Earth shows recent crown-of-thorns starfish densities

In 2009-2010, there were few outbreaks of crown-of-thorns starfish. However, they have had a major impact on the Great Barrier Reef since surveys began in the 1960s. In 1988, crown-of-thorns starfish caused widespread destruction on reefs in the central region. The greatest percentage of reefs with active outbreaks was 17 per cent, recorded in 1987, 1999 and 2000. The relatively high levels of starfish before 2006 has been attributed to enhanced survival of larvae from nutrient-rich flood waters and increased availability of phytoplankton as a food source (Brodie et al., 2005; Fabricius 2011). However, a reduction in predator populations has also been suggested, as outbreaks may be less common in zones closed to fishing (Osborne et al., 2011).



Caption: The proportion of reefs with outbreaks of crown-of-thorns starfish 1998 to 2010 (Australian Institute of Marine Science). There were relatively few outbreaks in 2009-2010.

Influence of climate change

The frequency and intensity of disturbances to the reef is set to increase under future climate change scenarios (Hoegh-Gulberg et al., 2007). The average annual seawater temperature on the reef is likely to rise by one to three degrees Celsius by 2100 (Intergovernmental Panel on Climate Change 2007; Garnaut 2008). It is also predicted that reef waters will become more acidic, sea levels will continue to rise, patterns of ocean circulation will change and weather events will become more extreme (Intergovernmental Panel on Climate Change 2007). The Outlook Report (GBRMPA 2009b) assessed the overall outlook for the Great Barrier Reef to be 'poor' and reported that catastrophic damage to the ecosystem may not be averted.

The extent and persistence of damage to the Great Barrier Reef will largely depend on the rate and magnitude of change in the world's climate and on the resilience of the reef ecosystem (GBRMPA 2009b). This has important implications for the future management of the Great Barrier Reef and the importance of improving the quality of water entering the reef lagoon.

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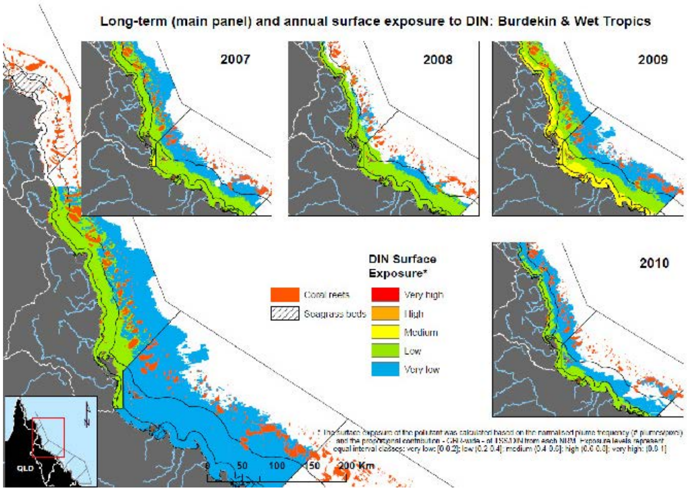
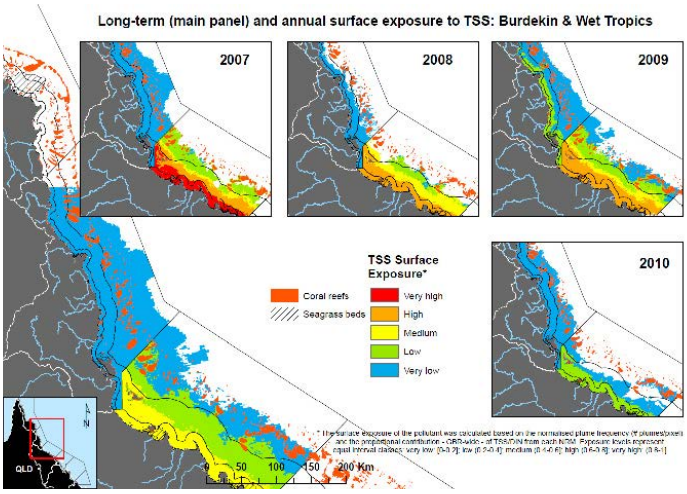
Case-study: Pollutant loads reaching the reef in harmful concentrations

This case-study between the Wet and Dry Tropics links flood plume monitoring data and end-of-catchment load data to estimate areas of the Great Barrier Reef with a high likelihood of being exposed to elevated concentrations of dissolved inorganic nitrogen and suspended solids.





Caption: The long-term average surface exposure (integrated over 2000 to 2010) and annual surface exposure (from 2007 to 2010) of the Burdekin and Wet Tropics to total suspended solids and dissolved inorganic nitrogen. The pollutant loads from each region are expressed as a proportion of the annual pollutant load; hence exposure is relative and not contiguous across regions. The larger map reflects the long-term exposure data from 2000 to 2009 where available.

Key findings are:

- Flood plumes containing relatively high concentrations of pollutants are reaching inshore seagrass meadows and coral reefs.
- In the 2007-2008 wet season, discharge from the Burdekin River was well above the annual median flow, resulting in greater exposure of inshore areas to suspended solids.
- In 2009-2010, the Wet Tropics and Burdekin contributed similar proportions to the total annual load of dissolved inorganic nitrogen.

Exposure for each region is based on the spatial extent of the flood plume and the frequency of exposure to the main pollutants in the plume. Data are collected from remotely sensed images and integrated with end-of-catchment pollutant loads for each region, which are expressed as proportion of the total annual pollutant load to the Great Barrier Reef lagoon. Seagrass and coral reef communities that are frequently exposed to flood waters may be less resilient to other disturbances.

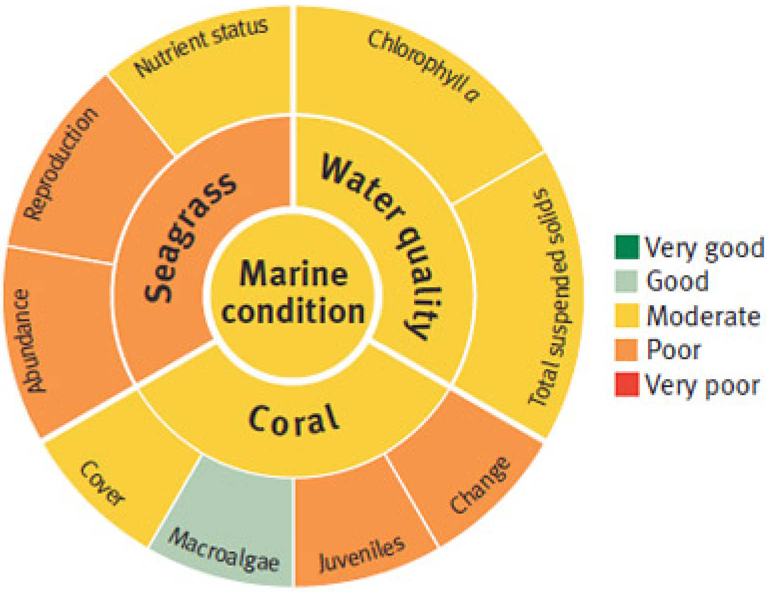
Marine results

Great Barrier Reef

Reef Plan aims to improve the quality of water entering the reef and maintain its health and resilience. Marine results for 2009–2010 are shown for water quality, seagrass and coral.

The overall marine condition has remained moderate since 2005–2006. There was some variability between regions, with the Burdekin and Burnett Mary in poor condition overall. Water quality and the condition of seagrass meadows and coral reefs also varied between regions.

The reef was affected by a range of extreme events in 2009–2010. Significant rainfall events led to comparatively high levels of freshwater entering the reef. Exposure to large volumes of low salinity flood waters for an extended period contributed to localised coral bleaching on shallow, inshore reefs. Tropical Cyclone Ului passed through the Mackay Whitsunday region in early 2010 causing damage to some parts of the reef.



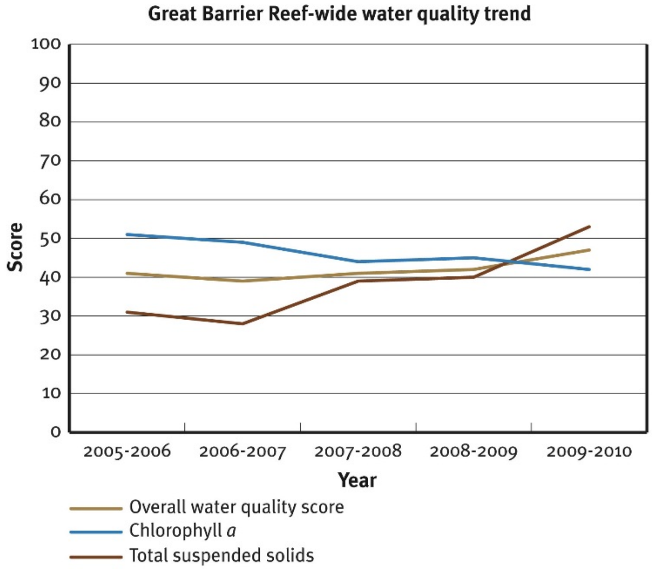
Marine graphic descriptions

- **Chlorophyll a** indicates nutrient availability and productivity.
- **Total suspended solids** measures particulate matter in water.
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.
- **Coral cover** is a measure of the percentage of coral on a reef and indicates the capacity of coral to persist under the current environmental conditions and its potential to recover.
- **Coral change** measures change in coral cover which indicates coral resilience to disturbance.
- **Macroalgal cover** - high abundance indicates poor water quality and negatively affects the resilience of coral communities.
- **Coral juvenile** density measures the abundance of corals less than 10 centimetres in diameter which indicates the recovery potential from disturbances.

Water quality

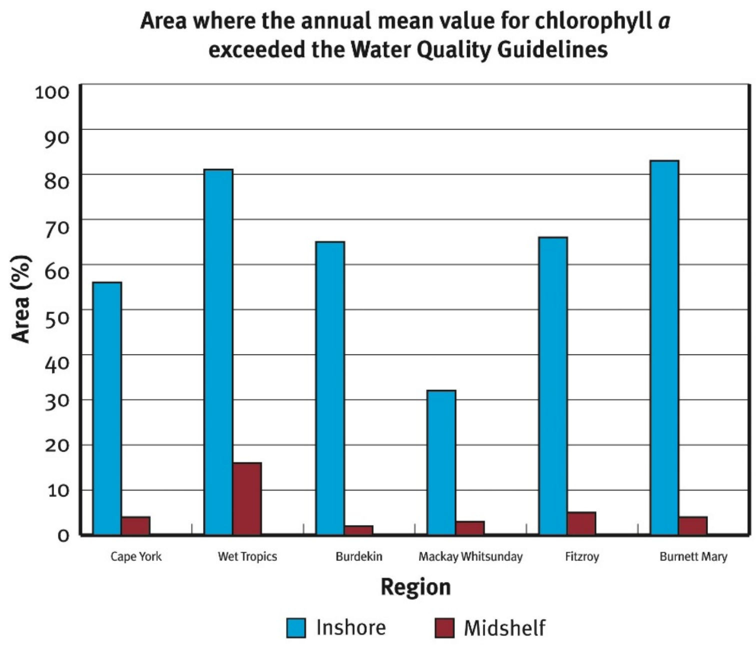
Inshore water quality was moderate overall across all regions in 2009–2010. Concentrations of chlorophyll a and total suspended solids were also moderate overall. Overall inshore water quality has been relatively stable since 2005–2006.

Pesticides were detected at all monitored sites in 2009–2010, except for Cape York, with high variability between regions and seasons. Higher concentrations were generally detected in the wet season when flood plumes transport pesticides from adjacent catchments into the marine environment. Pesticides that inhibit photosynthesis, in particular diuron, were frequently detected in inshore waters of the reef. At times, these herbicides were found up to 15km from the shore at concentrations that when combined have potential to affect marine plants and corals.

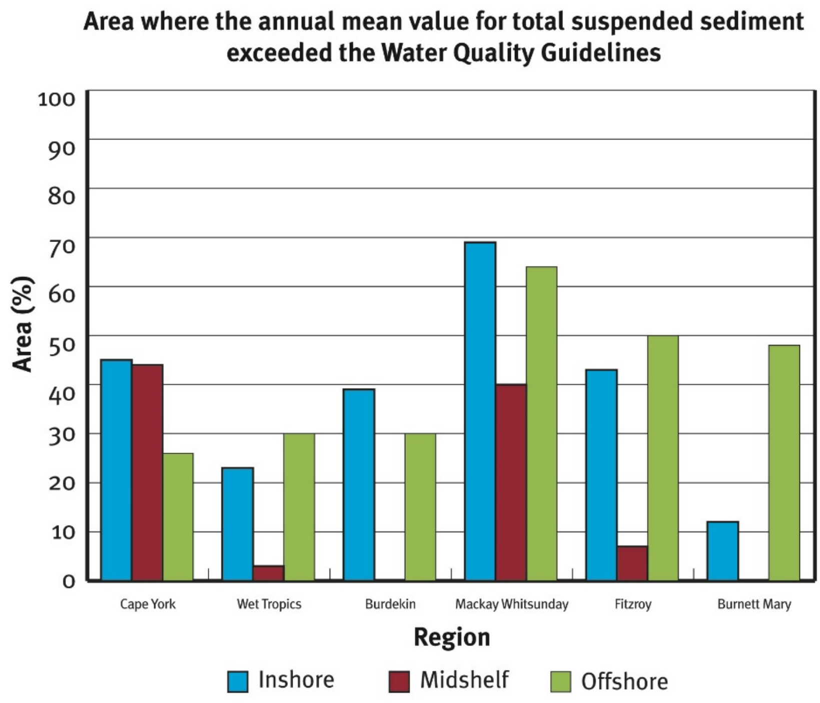


Total suspended solids have improved since 2005-2006 from poor to moderate.

In 2009-2010, remote sensing of water quality declined closer to inshore areas more frequently exposed to flood waters. In all regions except Mackay Whitsunday, more than half of the inshore area had annual mean chlorophyll *a* concentrations that exceeded the Great Barrier Reef Water Quality Guidelines. In Mackay Whitsunday, water quality was influenced by a high annual mean concentration of total suspended sediment that exceeded the Great Barrier Reef Water Quality Guidelines. The relatively high concentrations of total suspended sediment in most areas of Mackay Whitsunday may be a result of higher river discharge since 2007 and continued re-suspension of finer sediment particles by wind and wave action.



Caption: Relative area (%) of the inshore, midshelf and offshore water bodies where the annual mean value for chlorophyll a exceeded the Water Quality Guidelines from 1 May 2009 to 30 April 2010.



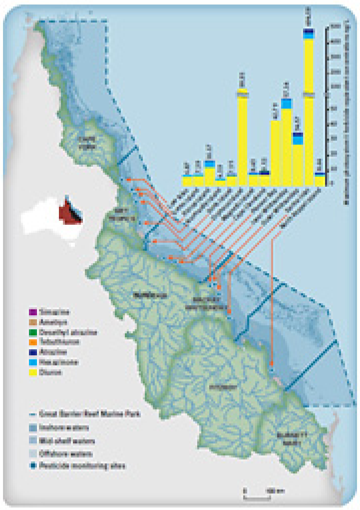
Caption: Relative area (%) of the inshore, midshelf and offshore water bodies where the annual mean value for total suspended sediment exceeded the Water Quality Guidelines from 1 May 2009 to 30 April 2010.

Note - Caution must be applied in interpreting the results for the Cape York and Burnett Mary regions, as well as the offshore water body, because there has been limited field validation for these regions.

Pesticides

Pesticides were detected at all monitored sites in 2009-2010, except for Cape York, with high variability between regions and seasons. Higher concentrations were generally detected in the wet season when flood plumes transport pesticides from adjacent catchments into the marine environment. Pesticides that inhibit photosynthesis, in particular diuron, were frequently detected in inshore waters of the reef. At times, these herbicides were found up to 15 kilometres from the shore at the combined concentration harmful to marine plants. The PSII Herbicide Equivalent Concentration incorporates both the relative potency and relative abundance of individual PSII herbicides compared to a reference PSII herbicide, diuron.

The highest PSII Herbicide Equivalent Concentration detected in 2009-2010 was at Sarina Inlet (Category 2) in the Mackay Whitsunday region, which has large areas of seagrass meadows and nearby coral reefs.

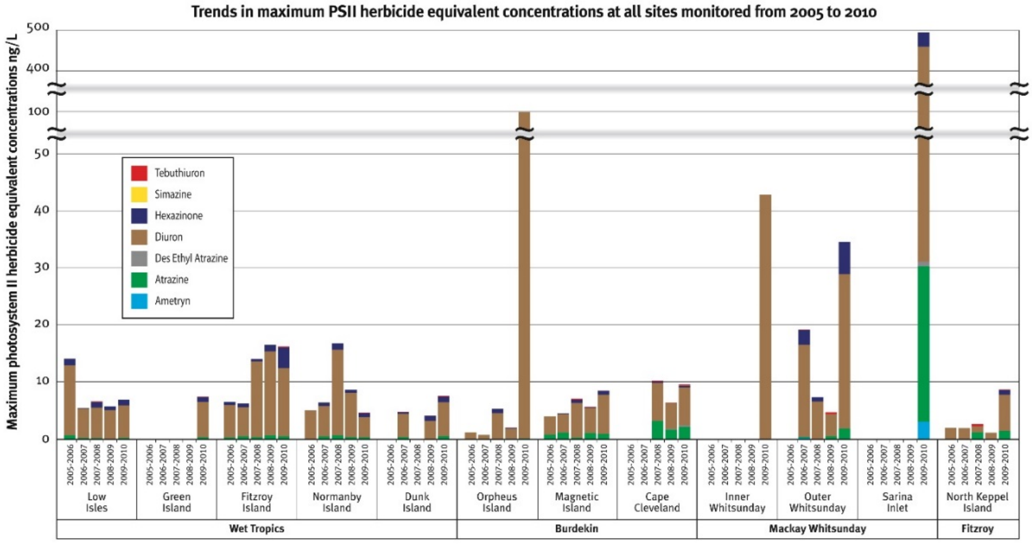


Caption: Pesticides at all sites monitored in the Great Barrier Reef in 2009–2010.

Herbicide Equivalent Concentrations provide a single reporting parameter for PSII herbicides with a similar mode of action; however, they may obscure differences in the abundance of individual herbicides detected in different regions, because herbicide equivalent concentrations also consider the potency of each herbicide. The most prevalent herbicide detected across the Great Barrier Reef was diuron, which dominated the PSII Herbicide Equivalent Index. Hexazinone and atrazine were also detected at relatively high concentrations, with hexazinone contributing a greater relative proportion to the PS-II Herbicide Equivalent Index at sites in the Wet Tropics and Mackay Whitsunday regions, and atrazine contributing a greater relative proportion at sites in the Burdekin and Mackay Whitsunday regions (Kennedy et al., 2011).

The concentrations of individual herbicides detected in 2009-2010 did not exceed the Great Barrier Reef Water Quality Guideline values, however, the insecticide chlorpyrifos exceeded Guideline values at all sites where it was monitored (all sites in the Wet Tropics).

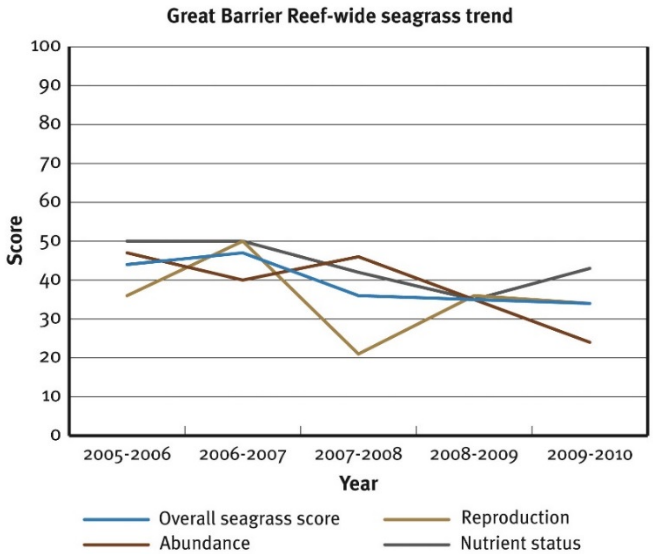
There is evidence of an increasing trend in PSII Herbicide Equivalent Concentrations since monitoring began in 2005 at Fitzroy Island in the Wet Tropics region, Magnetic Island in the Burdekin region and North Keppel Island in the Fitzroy region. Equivalent concentrations of PSII herbicides that may have short-term effects on photosynthetic organisms (Category Four or above) have been detected at most sites at least once.



Caption: Trends in maximum PSII Herbicide Equivalent Concentrations at all sites monitored across the Great Barrier Reef from 2005 to 2010 where data are available.

Seagrass

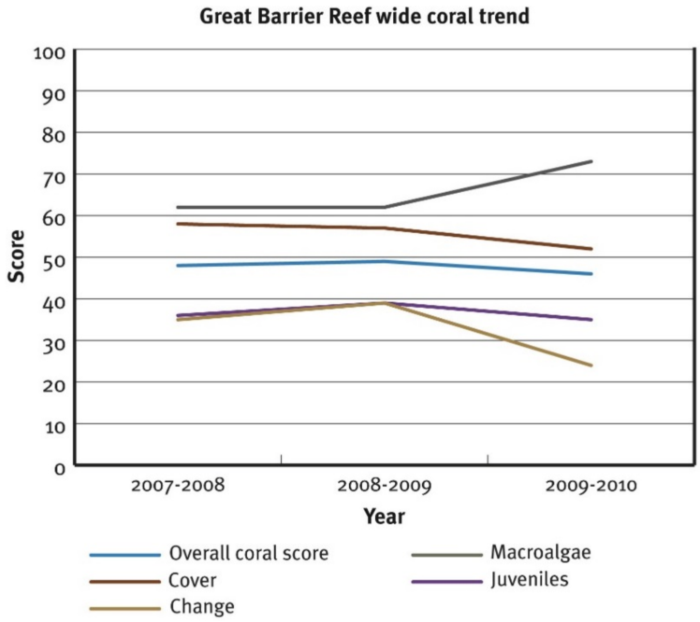
Inshore seagrass was generally in poor condition overall in 2009–2010, and its condition has declined since 2005. The exception was Cape York, where limited monitoring indicated seagrass meadows were in good condition. Seagrass abundance and reproductive effort, although highly variable between regions, were poor overall. The nutrient status of seagrass was moderate in four of the six regions indicating excess nutrients in the water. However, there are differences between habitats and regions over time (refer to regional sections).



In 2009-2010, the abundance of intertidal seagrasses in the Cape York region and the northern section of the Wet tropics region increased or remained stable, respectively. However, at most locations from Cairns to the southern Great Barrier Reef, there was a decline in seagrass abundance. Exceptions within the southern region were Shoalwater Bay and Gladstone Harbour where seagrass abundance increased and locations that had severe losses in 2006 largely recovered by the late monsoon 2010. The regions of greatest concern for seagrass are the Mackay Whitsunday and Burnett Mary where a decline in abundance was accompanied by a poor and very poor reproductive effort, respectively, which may result in reduced capacity of local meadows to recover from environmental disturbances.

Corals

Inshore coral reefs were in moderate condition overall in 2009–2010, with some sites in the Burdekin and Fitzroy in poor condition. The condition of inshore reefs has remained relatively stable during the past three years. Coral cover at most inshore reefs was moderate and competing macroaglae cover was low (good), particularly at sites in the Wet Tropics. At some inshore reefs, the density of juvenile hard coral and the rate of change in coral cover were poor overall, indicating recovery potential from disturbances may be poor. However, there are differences between regions over time.

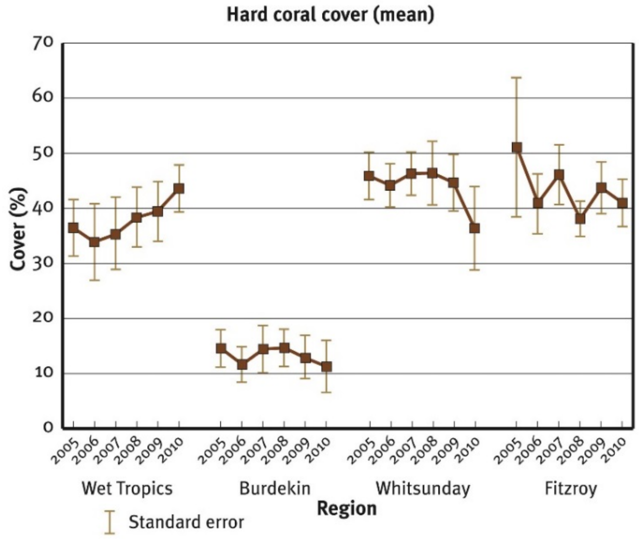


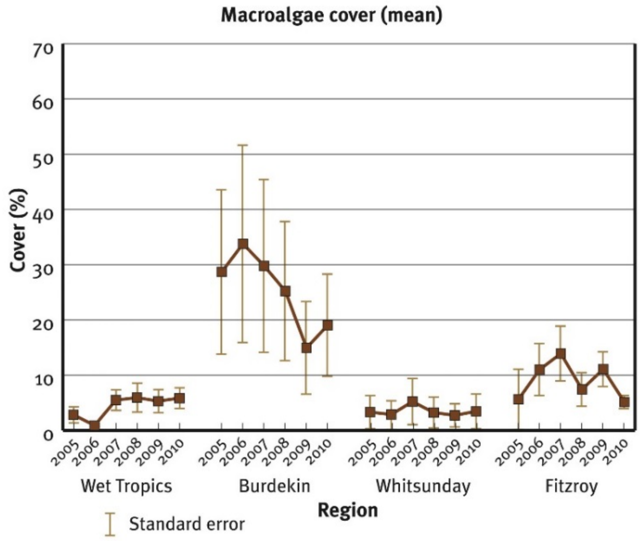
Caption: Although coral data is available since 2005-2006; the trend in coral condition is only able to be calculated from 2007-2008 because the coral change indicator requires the preceding three years of data.

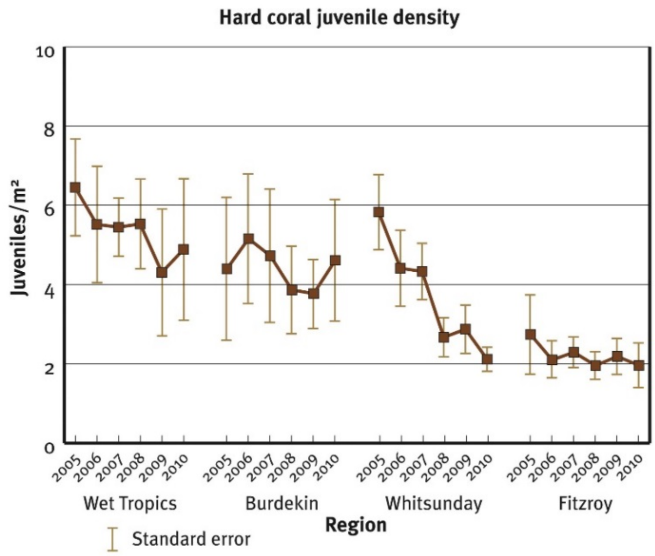
Monitoring of inshore reefs since 2005 has shown that variation in environmental conditions can alter the dynamics of coral communities on inshore reefs.

At inshore reefs in the Wet Tropics, hard coral cover increased as coral communities continued to recover from the impact of past disturbances such as Cyclone Larry in 2006. In contrast, hard coral cover declined in the Burdekin, Mackay Whitsunday and Fitzroy regions, with the greatest decline observed at sites in the Whitsunday Islands due to the impact of Cyclone Ului in 2010. The cover of hard coral has been consistently lower in the Burdekin compared to other regions since surveys began in 2005, even though there have been no major disturbances recorded since the mass coral bleaching event in 2002. This may indicate a lack of resilience of coral communities in the Burdekin region. Coral reefs in the Burdekin also had a relatively high cover of macroalgae with high spatial and temporal variability.

There was a trend of decreasing density of juvenile corals from the Wet Tropics in the north to the Fitzroy region in the south, with high temporal and spatial variability that may be correlated with variation in river flows, disturbance events, and regional connectivity. In the Mackay Whitsunday region, the general decline in the density of juvenile hard coral colonies since 2005 was compounded by the effects of Cyclone Ului and severe flooding in the region. In the Fitzroy, the very low densities of juvenile hard corals may reflect the impact of recurrent environmental disturbances over the past decade such as storms, outbreaks of disease, bleaching events in Keppel Bay and flooding of the Fitzroy River. The low densities of juvenile corals coupled with the low rates of increase in coral cover are a concern for the resilience of coral communities in the region.



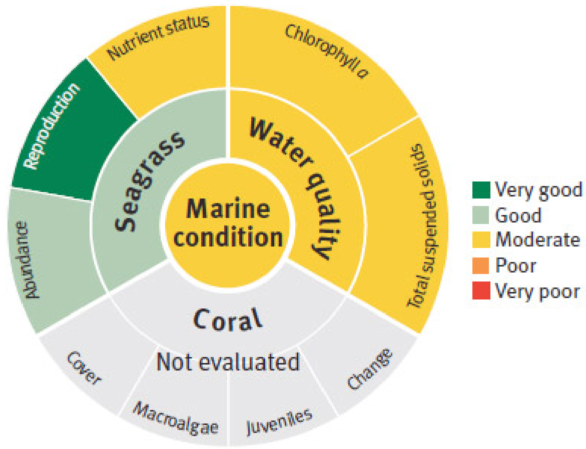




Caption: Average cover of hard corals, cover of macroalgae and density of hard coral juveniles in the Wet Tropics, Burdekin, Mackay Whitsunday and Fitzroy regions from 2005 to 2010.

Cape York

The overall marine condition in 2009–2010 was moderate. Seagrass was in good condition and inshore water quality was moderate. Further validation of remotely sensed water quality data for the Cape York region is required to verify this assessment. Coral monitoring is not conducted in the region through the Paddock to Reef program.



Marine graphic descriptions:

- **Chlorophyll a** indicates nutrient availability and productivity.
- **Total suspended solids** measures particulate matter in water.
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.

Water quality

Inshore water quality improved from poor in the 2009 baseline year to moderate. Annual variations since 2005–2006 reflect increases and decreases in chlorophyll a and suspended solids. Both chlorophyll a and total suspended solids were, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park for inshore waters.

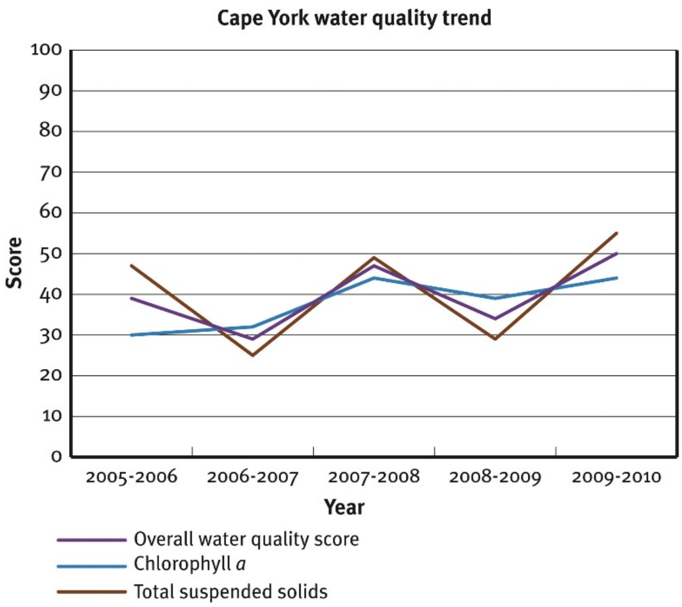
Estimates of chlorophyll a and total suspended solids are derived from remote sensing only, which requires further field validation in this region. Therefore, these estimates have relatively low reliability compared to those for other regions.

Estimates of chlorophyll *a* and total suspended solids are derived from remote sensing only, which requires further field validation in this region. Therefore, these estimates have relatively low reliability compared to those for other regions.

No herbicides were detected in 2009-2010. However, diuron, hexazinone, simazine, atrazine and various breakdown products of atrazine have been detected in previous years, including the 2009 baseline year.

Chlorophyll *a* and total suspended solids have also varied similarly over time and both were moderate in 2009-2010.

Chlorophyll *a* exceeded the Great Barrier Reef Marine Park Water Quality Guidelines in the inshore area in the dry season predominantly. In the wet season exceedances were mainly around river mouths and embayments. Total suspended solids exceeded the Great Barrier Reef Marine Park Water Quality Guidelines in approximately half the inshore area, in the dry and wet seasons.



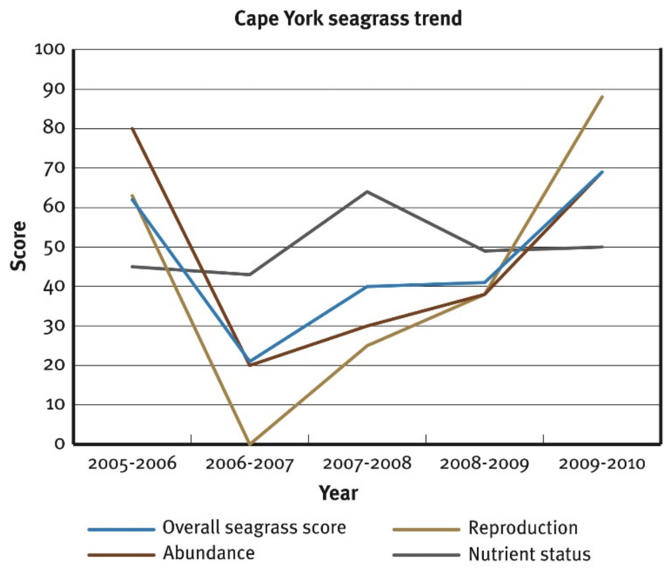
Pesticides

Pesticide monitoring was conducted at only one offshore site in Cape York and monitoring was discontinued in 2010. No herbicides were detected in 2010; however diuron has consistently been the most predominant herbicide since monitoring began in 2006. Other herbicides detected in the region include hexazinone, simazine, and atrazine and its breakdown products. All herbicide concentrations were higher in the wet season.

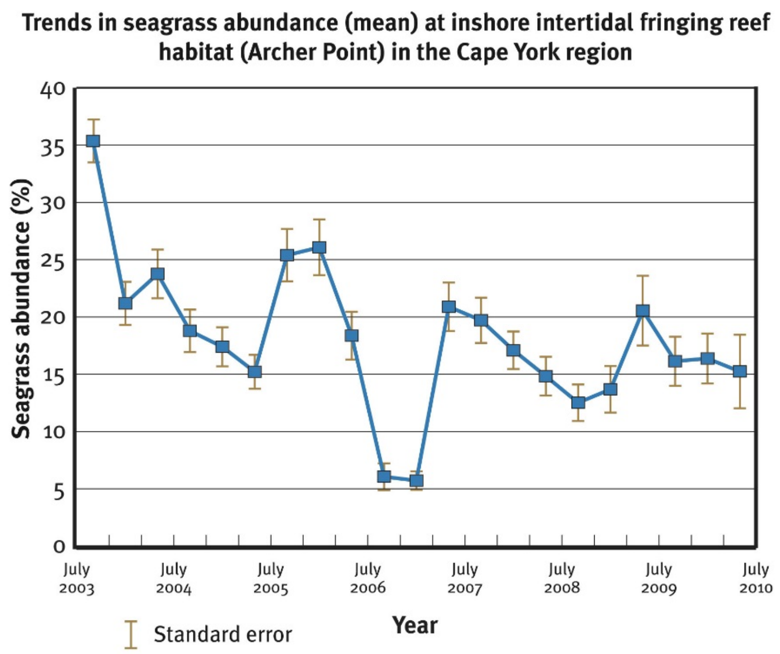
Seagrass

Seagrass is monitored at one site in southern Cape York and meadow condition improved from moderate in the 2009 baseline year to good.

Seagrass abundance was good and reproductive effort was very good, indicating communities have a relatively high potential for recovery from disturbances compared to seagrass in other regions. The data collected at this site is not representative of the spatial variability of the region.



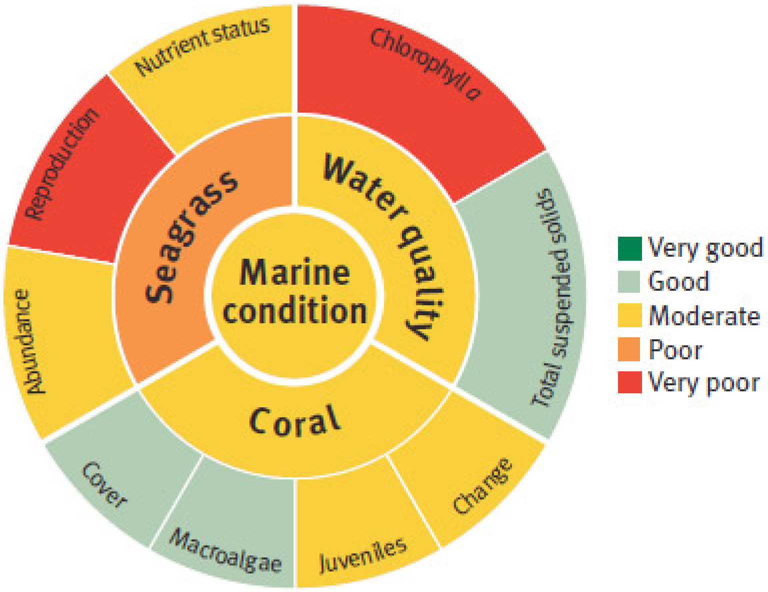
Seagrass is monitored at one fringing reef location in the southern region, Archer Point, which supports a diverse range of species. The environment is characterised by fluctuating temperature and salinity, and the growth of seagrass is primarily influenced by physical disturbance from waves and swell and associated sediment movement. Seagrass abundance in 2009-2010 is good and reproductive effort is very good, indicating communities may have a relatively high potential for recovery from environmental disturbances compared to seagrass in other regions. Nutrient ratios of seagrass tissue are rated as moderate, reflecting local water quality conditions.



Caption: Trend in seagrass abundance (per cent cover) at the inshore intertidal fringing reef habitat at Archer Point.

Wet Tropics

The inshore area of the Wet Tropics was influenced by flood waters for an extended period as a result of above median rainfall. There were localised areas of coral bleaching on shallow, inshore reefs where reefs were exposed to moderate levels of heat stress in late summer.



Marine graphic descriptions:

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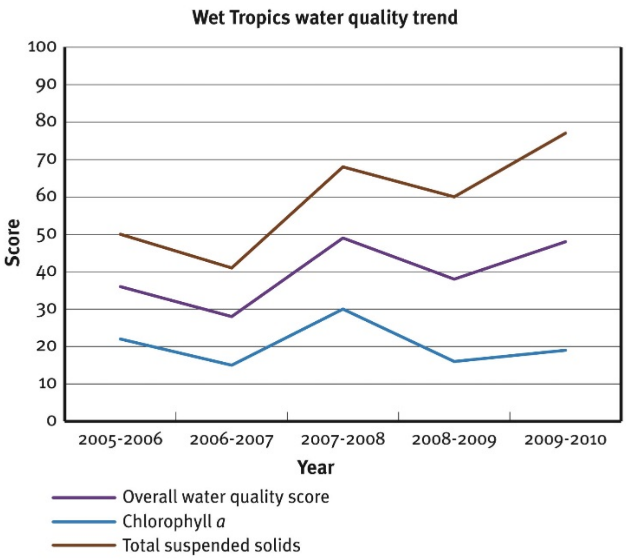
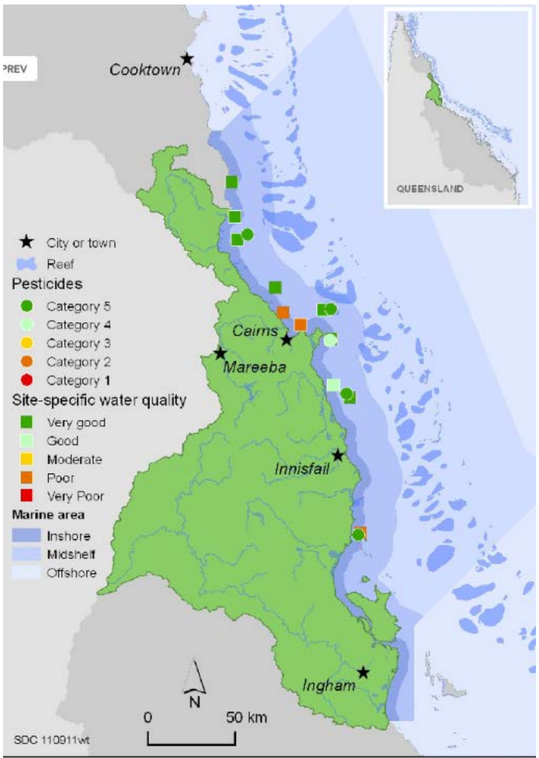
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.
- **Coral cover** is a measure of the percentage of coral on a reef and indicates the capacity of coral to persist under the current environmental conditions and its potential to recover.
- **Coral change** measures change in coral cover which indicates coral resilience to disturbances.
- **Macroalgal cover** - high abundance indicates poor water quality and negatively affects the resilience of coral communities.
- **Coral juvenile** density measures the abundance of corals less than 10 centimetres in diameter which indicates the recovery potential from disturbances.

Water quality

Inshore water quality is moderate, having gradually improved since 2005–2006. The long term improvement in condition has been driven mostly by an overall improvement in suspended solids. Both chlorophyll a and total suspended solids were, at times above Water Quality Guidelines for the Great Barrier Reef Marine Park. Water quality was poorer in inshore areas. A range of pesticides was detected. The insecticide chlorpyrifos was, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park at all five monitored sites.



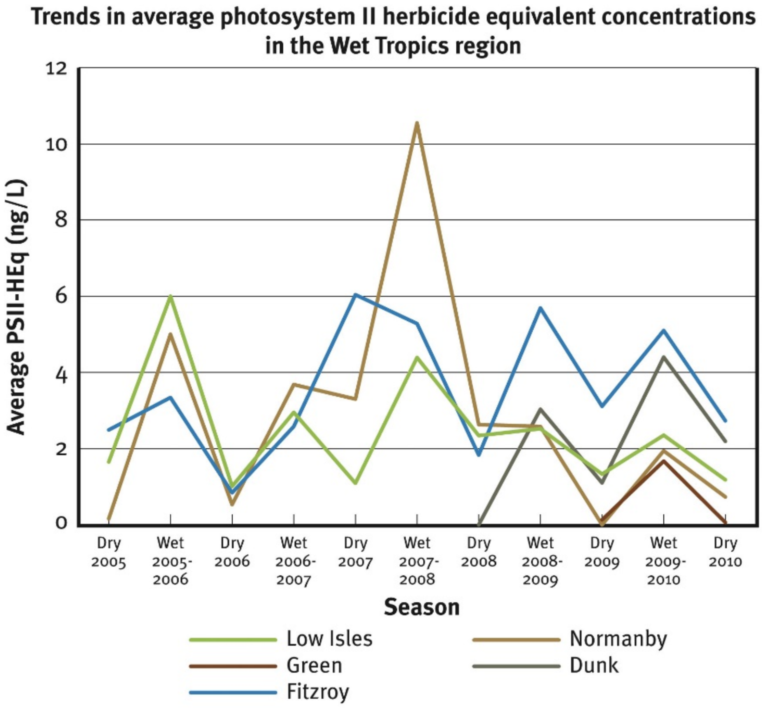
Water quality clearly declined from offshore to inshore areas more frequently exposed to flood waters. Site-specific water quality was rated as either good or very good at eight out of eleven sites in the region. However, water quality at Dunk Island was moderate due to high concentrations of particulate phosphorus and turbidity that exceeded the Great Barrier Reef Marine Park Water Quality Guidelines in 2009-2010. Two sites in the Cairns area also had moderate water quality due to very high levels of chlorophyll *a*, turbidity and particulate phosphorus that well exceeded the Guidelines. Turbidity also exceeded the Great Barrier Reef Marine Park Water Quality Guidelines at Snapper Island in 2009-2010.



Caption: Water quality and pesticide scores for PSII herbicides at fixed monitoring sites in the Wet Tropics.

A range of herbicides was detected in the Wet Tropics region, including diuron, atrazine, hexazinone, simazine and tebuthiuron. Higher concentrations were generally detected in the wet season compared to the dry season. The highest PSII Herbicide Equivalent Concentration in flood waters (Category 2) was detected near the Russell-Mulgrave river mouth several days after the peak of a moderate flow event.

In 2009-2010, concentrations of PSII herbicides were above those known to affect photosynthesis in diatoms at Fitzroy Island. Other pesticides detected in the Wet Tropics include the insecticide chlorpyrifos, the concentrations of which exceeded the Great Barrier Reef Marine Park Water Quality Guidelines at Green, Fitzroy, Normanby and Dunk Islands in the wet season. Chlorpyrifos is not included in the pesticide score, which is based only on PSII herbicides.

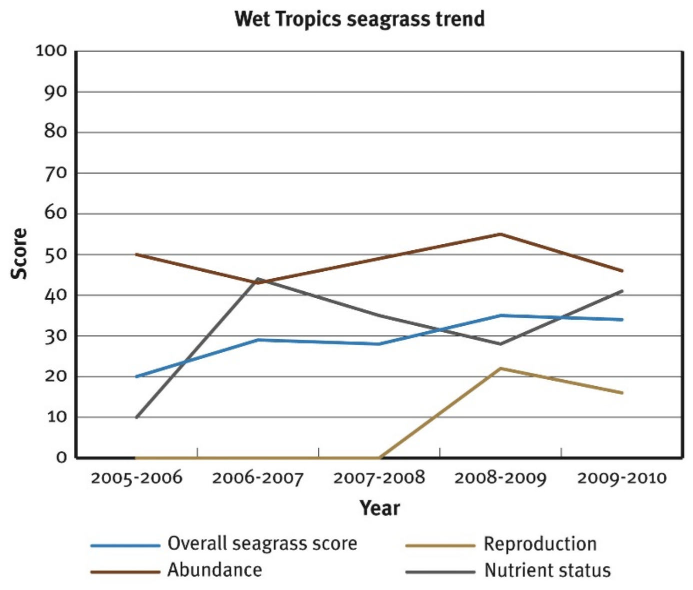


Caption: Trends in average PSII herbicide equivalent concentrations at each sampling site in the Wet Tropics according to season.

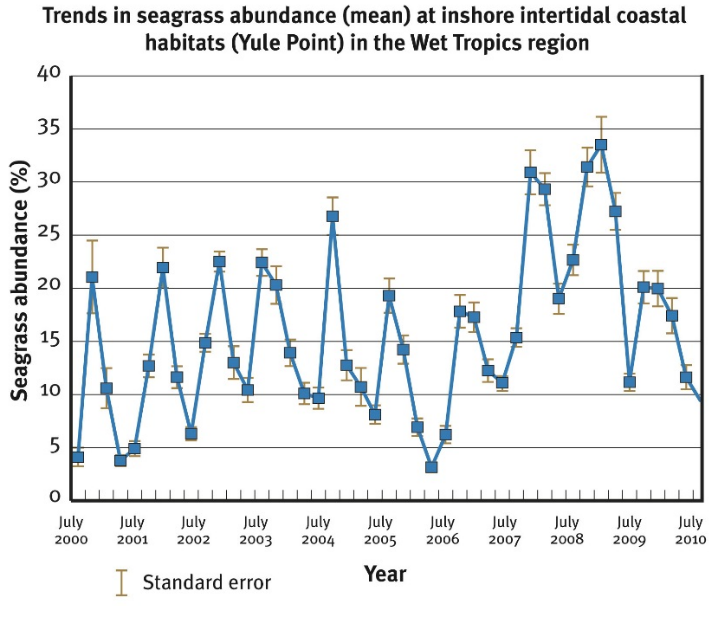
Seagrass

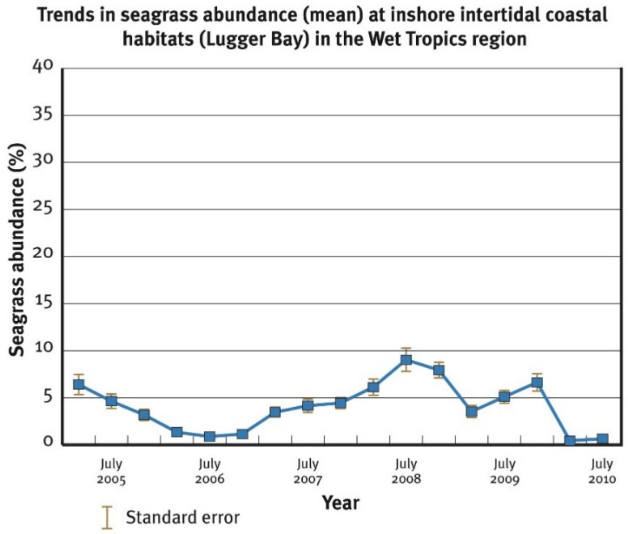
Inshore seagrass meadows remained in poor condition and have been relatively stable since 2005–2006. However, the abundance of seagrass was moderate in the northern part of the region and very poor in southern areas. Reproductive effort was very poor across the region in 4 out of 5 monitoring years, indicating a low capacity to recover from disturbances.

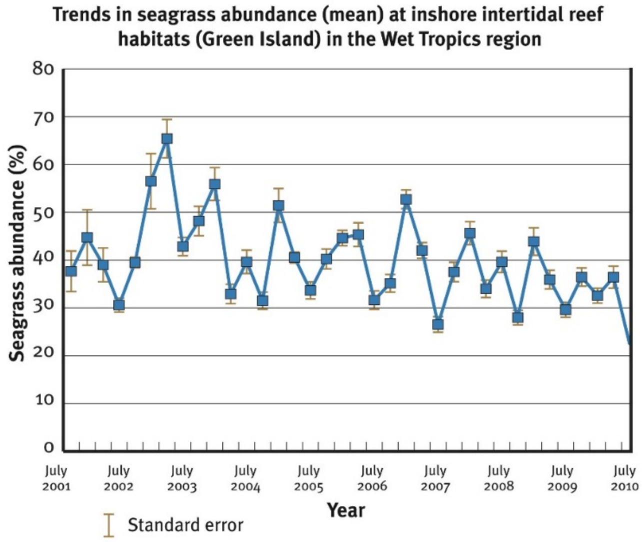
The poor assessment is a product of complex interactions between the three indicators of seagrass condition: abundance, reproductive effort and nutrient status, which are highly variable between years and habitats.

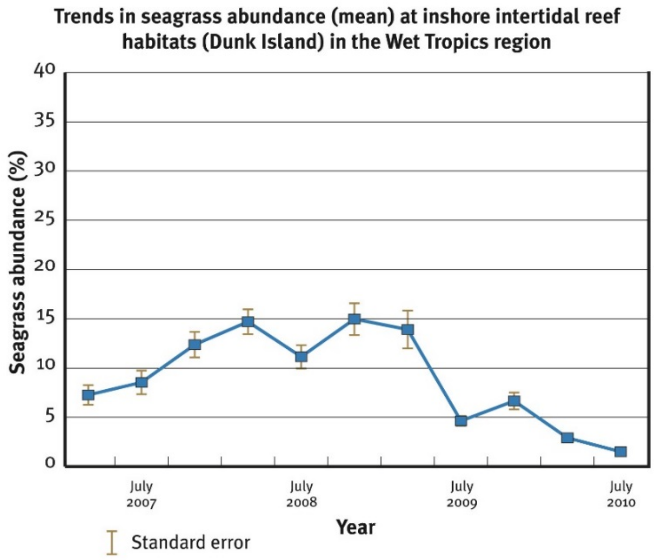


In 2009-2010, seagrass meadows at Yule Point and Green Island in the north remained in moderate condition and either expanded or stabilised over the monitoring period. At Lugger Bay and Dunk Island in the south seagrass abundance declined to a very poor state. The reproductive effort of inshore seagrass in the Wet Tropics was very poor in four of the five monitoring years, which may indicate a low potential of meadows to recover from disturbances. Leaf tissue nutrient ratios were moderate overall; however, seagrass tissue had a high concentration of nitrogen at both coastal locations and Dunk Island, which are a likely reflection of local water quality.







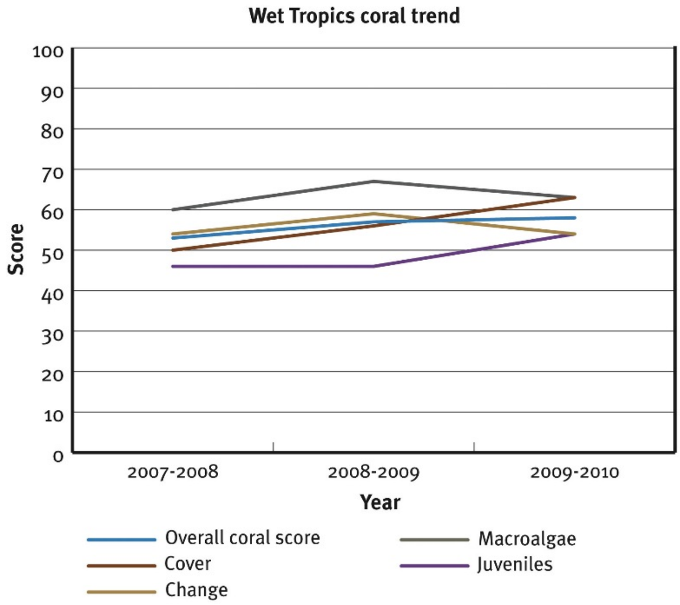


Caption: Trend in seagrass abundance (per cent cover) at inshore intertidal coastal habitats (Yule Point and Lugger Bay) and inshore intertidal reef habitats (Green and Dunk Islands) in the Wet Tropics.

Coral

Inshore coral reefs remained in moderate condition and have been relatively stable since 2005–2006. However, reefs in the northern part of the region were in good condition compared to inshore coral reefs in southern areas which were in poor condition. The density of juvenile corals was good, indicating recovery from previous disturbances (for example Cyclone Larry) is underway.

Coral reef communities in the Barron Daintree and Johnstone Russell-Mulgrave areas in the northern Wet Tropics were in good condition, while those in the more southerly Herbert Tully areas were in poor condition.

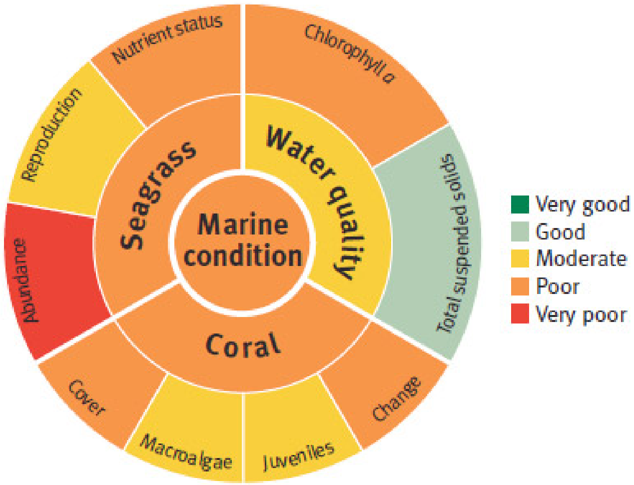


Coral cover at sites in the Barron Daintree and Johnstone Russell-Mulgrave areas was very good and has increased rapidly in the absence of disturbances. The largest increases in cover in 2009-2010 were at Snapper Island South and Fitzroy Island West, where the cover of coral continued to recover from the acute disturbances of flooding in 2004 and an outbreak of crown-of-thorns starfish in 2000, respectively. The cover of macroalgae was low on most reefs in the northern region.

In contrast, coral cover increased moderately but was still very poor in the Herbert-Tully area, reflecting the severity of the impact of Cyclone Larry in 2006. Relatively high densities of a diverse range of juvenile colonies and moderate increase in coral cover show that recovery is underway.

Burdekin

The inshore area of the Burdekin region was influenced by flood waters and there were localised areas of coral bleaching where reefs were exposed to moderate levels of heat stress in late summer.



Marine graphic descriptions:

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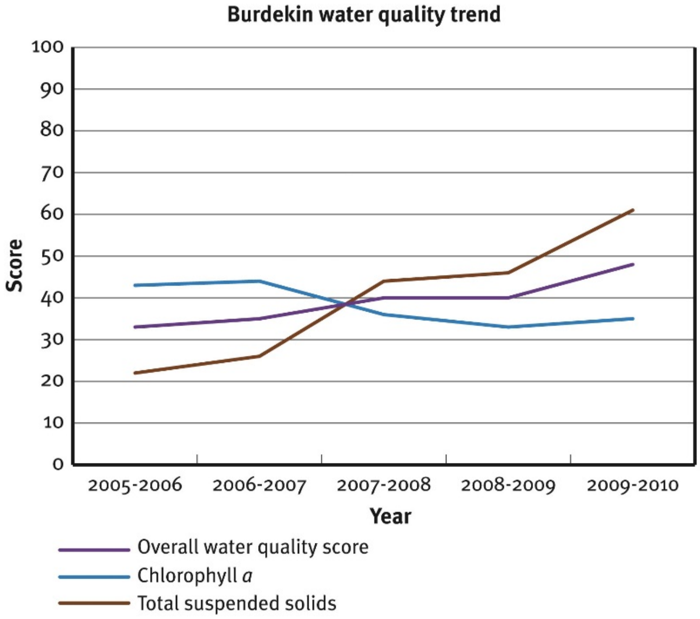
- **Total suspended solids** measures particulate matter in water.
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.
- **Coral cover** is a measure of the percentage of coral on a reef and indicates the capacity of coral to persist under the current environmental conditions and its potential to recover.
- **Coral change** measures change in coral cover which indicates coral resilience to disturbances.
- **Macroalgal cover** - high abundance indicates poor water quality and negatively affects the resilience of coral communities.
- **Coral juvenile** density measures the abundance of corals less than 10 centimetres in diameter which indicates the recovery potential from disturbances.

Water quality

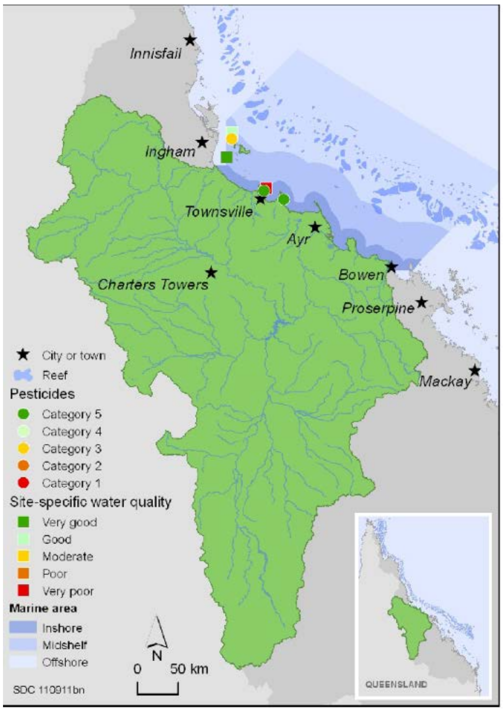
In shore water quality was moderate, having gradually improved from poor since 2005–2006. This improvement has been driven by an improvement in suspended solids compared to a decline in chlorophyll a. However, both chlorophyll a and total suspended solids were, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park for inshore waters. Water quality was poorer in the inshore areas.

A range of pesticides was detected including diuron, atrazine, tebuthiuron and metolachlor. At the Orpheus Island site, herbicides at times exceeded the combined concentration harmful to marine plants.

In 2009-2010, chlorophyll *a* was again rated as very poor, with concentrations exceeding the Great Barrier Reef Marine Park Water Quality Guidelines in inshore areas, particularly in the dry season. Total suspended solids were rated as good; however, concentrations exceeded the Guidelines for approximately half of the area in the dry and wet seasons.

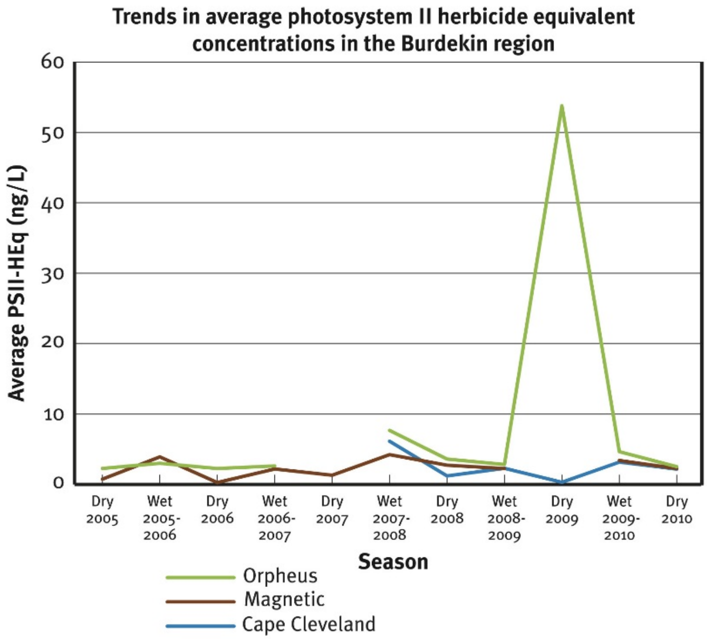


Water quality across the region showed a clear gradient of decline from offshore to inshore areas more frequently exposed to flood waters. Site-specific water quality was good at the two mid-shelf sites and very poor at Magnetic Island in the inshore region. The Great Barrier Reef Marine Park Water Quality Guideline values for turbidity and concentrations of particulate phosphorus were exceeded at Magnetic Island in 2009-2010.



Caption: Water quality and pesticide scores for PSII herbicides at fixed monitoring sites in the Burdekin.

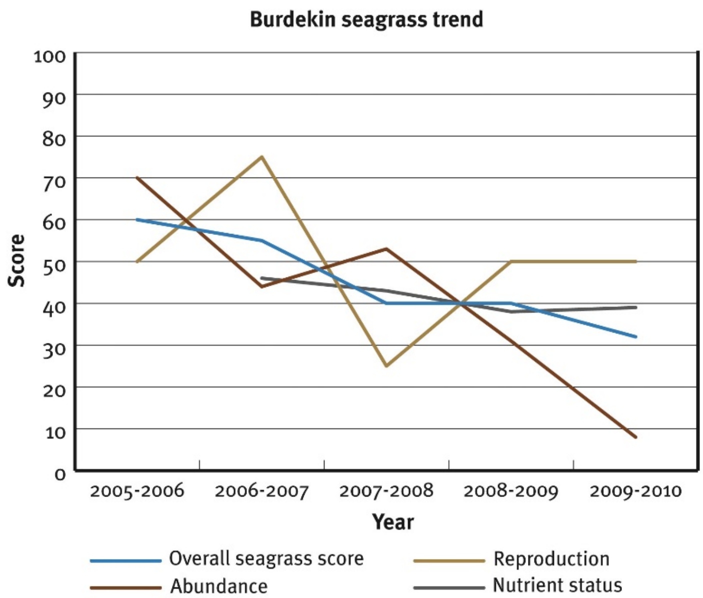
Atrazine and diuron were the most frequently detected herbicides throughout the year. Higher concentrations were generally detected in the wet season compared to the dry season, with the exception of Orpheus Island where the highest concentrations were detected in the 2009 dry season. The PSII Herbicide Equivalent Index, which considers the relative potency and abundance of each PSII herbicide, showed that maximum herbicide equivalent concentrations at Orpheus Island were above those known to affect photosynthesis in seagrass and diatoms. The Burdekin River had a moderate flood event in the 2009-2010 wet season and tebuthiuron was the only herbicide detected near the mouth of the river during peak flow. Other pesticides detected in the Burdekin region in 2009-2010 include metolachlor at Cape Cleveland. Long-term monitoring of pesticides shows evidence of an increasing trend in the detection of herbicides at some sites in the Wet Tropics.



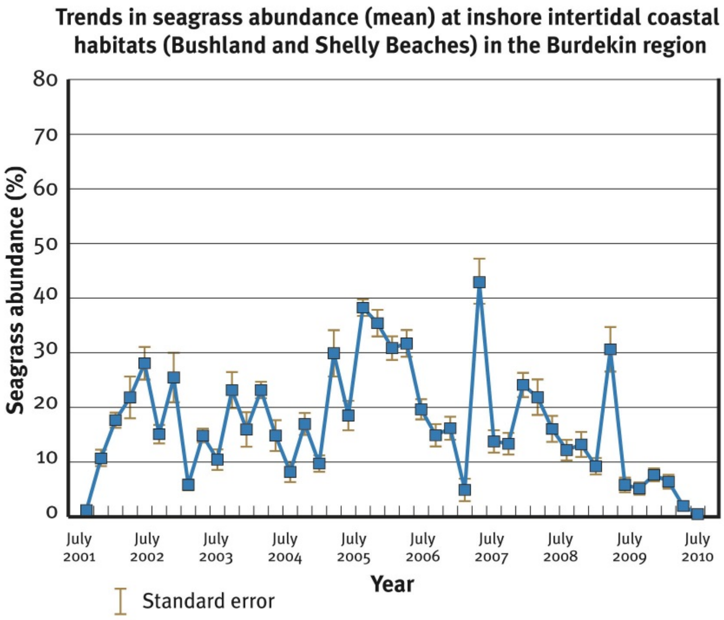
Caption: Trends in average PSII herbicide equivalent concentrations at each sampling site in the Burdekin according to season.

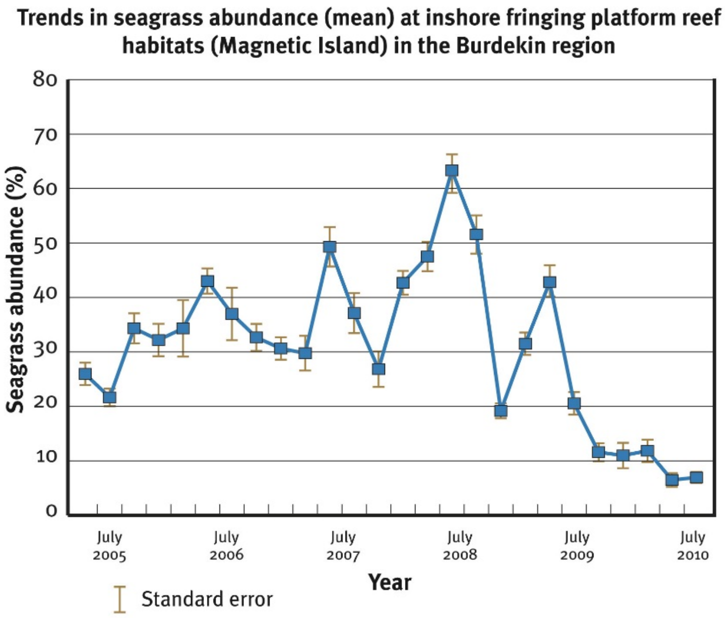
Seagrass

Inshore seagrass meadows have progressively declined since 2005–2006. This is driven by a relatively large decline in abundance to very poor at all sites. Reproductive effort remained moderate and the nutrient content of seagrass tissue indicated high concentrations of phosphorus in coastal habitats and nitrogen in reef habitats.



Seagrass monitoring was conducted on coastal and reef habitats primarily influenced by wind-driven turbidity and pulsed delivery of nutrients and sediment. Seagrass abundance declined to a very poor state at both coastal (Bushland Beach and Shelly Bay) and reef (Picnic Bay and Cockle Bay) locations. Reproductive effort, although moderate overall, was poor at reef habitats, which may result in reduced capacity of local meadows to recover from environmental disturbances. The nutrient content of seagrass tissue indicated phosphorus enrichment in coastal habitats and nitrogen enrichment in reef habitats, due to local water quality conditions.

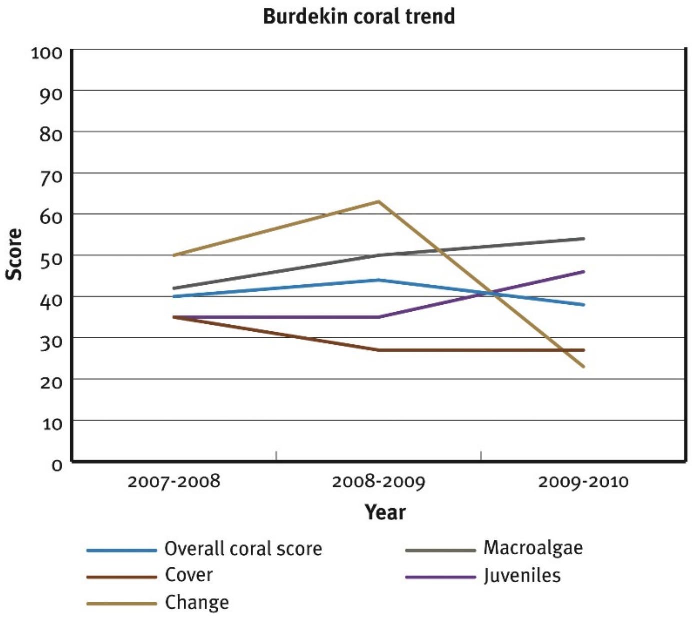




Caption: Trend in seagrass abundance (per cent cover) at inshore intertidal coastal habitats (Bushland and Shelly Beaches) and inshore fringing platform reef habitats (Magnetic Island) in the Burdekin.

Coral

Inshore coral reefs were in poor condition, reflecting poor coral cover and moderate densities of juvenile colonies and macroalgae cover. Coral cover across the region has not recovered from impacts of bleaching in 1998 and 2002. The sustained moderate cover of macroalgae at some locations may be suppressing the recovery of coral communities following the impact of disturbances.

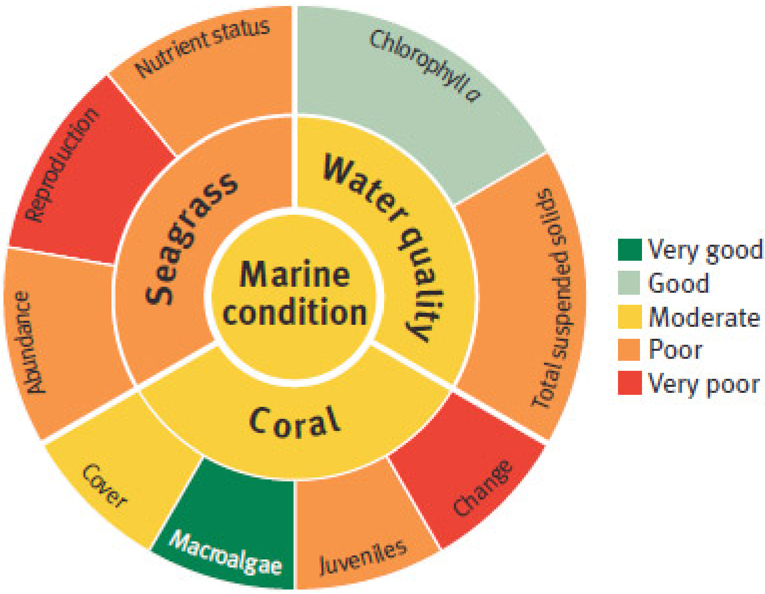


Caption: Coral data are available since 2005-2006; however, the trend in coral condition is only able to be calculated from 2007-2008, because the coral change indicator requires the preceding three years of data.

Coral cover across the Burdekin region has not recovered from the impact of coral bleaching in 1998 and 2002, and the rate of cover increase was poor despite an apparent lack of disturbances. The settlement of coral larvae was very poor and the density of juvenile colonies moderate and macroalgae cover at some reefs was high, which all contributed to the poor condition assessment and suggest a lack of resilience of these reef communities. The sustained high cover of macroalgae at some locations, for example Havannah Island, may be suppressing recovery of coral communities.

Mackay Whitsunday

The inshore area of the Mackay Whitsunday region was influenced by multiple high flow events as a result of above median rainfall. There were localised areas of coral bleaching where reefs were exposed to moderate levels of heat stress in late summer. Cyclone Ului also caused a substantial reduction in coral cover at localised sites in the region.



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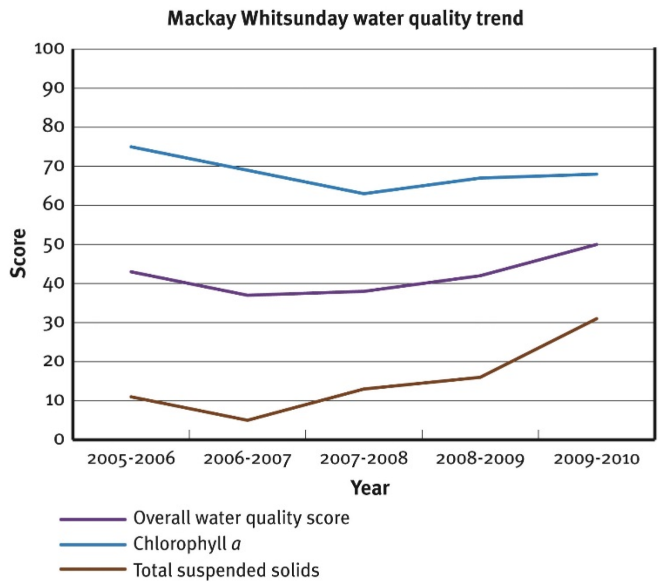
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.
- **Coral cover** is a measure of the percentage of coral on a reef and indicates the capacity of coral to persist under the current environmental conditions and its potential to recover.
- **Coral change** measures change in coral cover which indicates coral resilience to disturbances.
- **Macroalgal cover** - high abundance indicates poor water quality and negatively affects the resilience of coral communities.
- **Coral juvenile** density measures the abundance of corals less than 10 centimetres in diameter which indicates the recovery potential from disturbances.

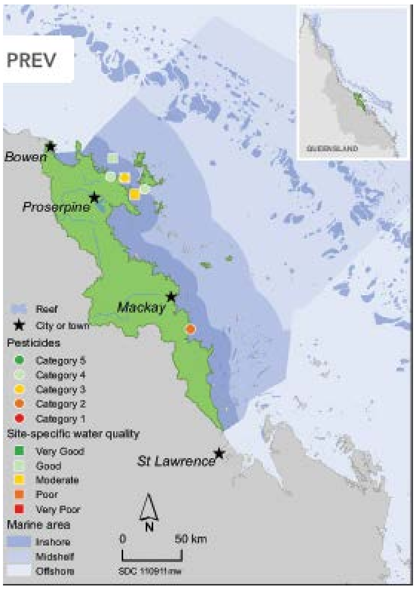
Water quality

Inshore water quality was moderate, having varied from poor to moderate since 2005–2006. Both chlorophyll a and total suspended solids were, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park for inshore waters. Water quality was poorer in inshore areas.

A range of pesticides was detected including diuron, atrazine and hexazinone. Herbicides at all monitored sites at times exceeded the combined concentration harmful to marine plants. Sarina Inlet had the highest concentrations of herbicides compared to all other sites in the Great Barrier Reef.

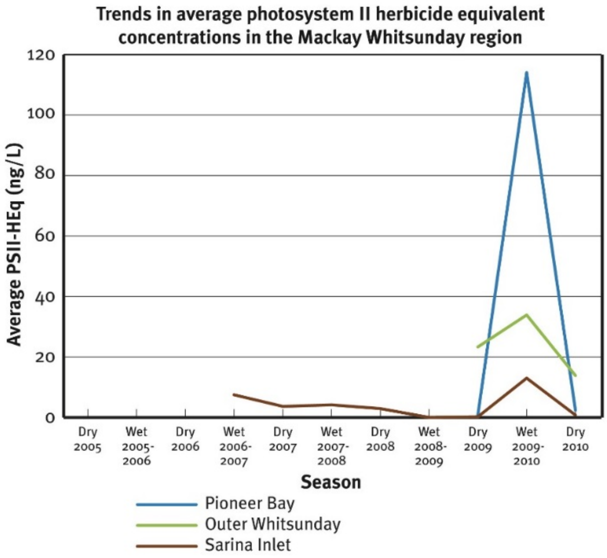


Water quality showed a clear declining gradient from offshore to inshore areas more frequently exposed to flood waters .Site-specific water quality was moderate at Daydream and Pine Islands, and good at Double Cone Island. Annual mean turbidity levels at Pine and Daydream Islands exceeded the Great Barrier Reef Marine Park Water Quality Guidelines in 2009-2010.



Caption: Water quality and pesticide scores for PSII herbicides at fixed monitoring sites in Mackay Whitsunday.

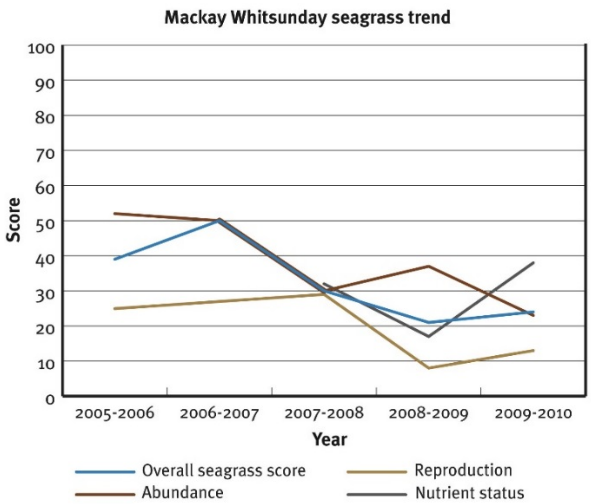
There were multiple, high flow events in all rivers of the Mackay Whitsunday catchment in the 2009-2010 wet season. A range of herbicides were detected in flood waters in the region several days after peak flows, including diuron, atrazine and hexazinone. Herbicide Equivalent Concentrations at the mouth of the O'Connell River were above those known to affect photosynthesis in seagrass and diatoms, and were relatively high across the region in 2009-2010, compared to other regions. Pesticide monitoring was discontinued at the Daydream Island site, and new sites were established in Pioneer Bay and Sarina Inlet. Sarina Inlet had the highest concentrations of most PSII herbicides compared to all other sites in the Great Barrier Reef, which reflected the proximity of the site to direct output from Plane Creek (Rhode et al., 2008).



Caption: Trends in average PSII herbicide equivalent concentrations at each sampling site in Mackay Whitsunday according to season.

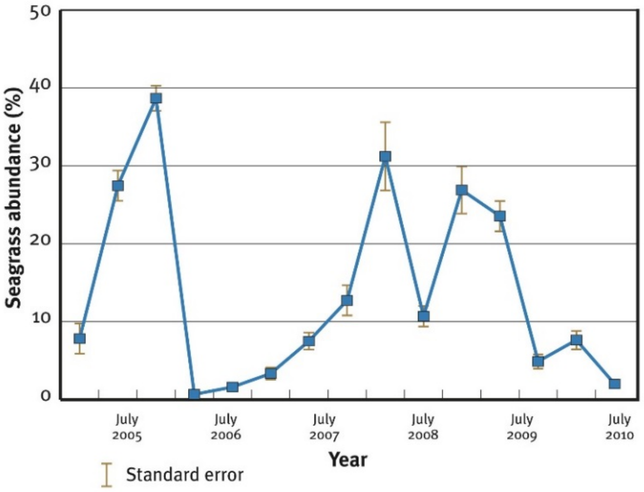
Seagrass

Inshore seagrass meadows remained in poor condition, having progressively declined since 2005–2006. This reflects long-term declines in abundance and reproductive effort, which is a concern in terms of capacity of local seagrass meadows to recover from disturbances. The nutrient status of seagrass tissue was rated as poor and reflected local water quality, particularly high concentrations of nitrogen.

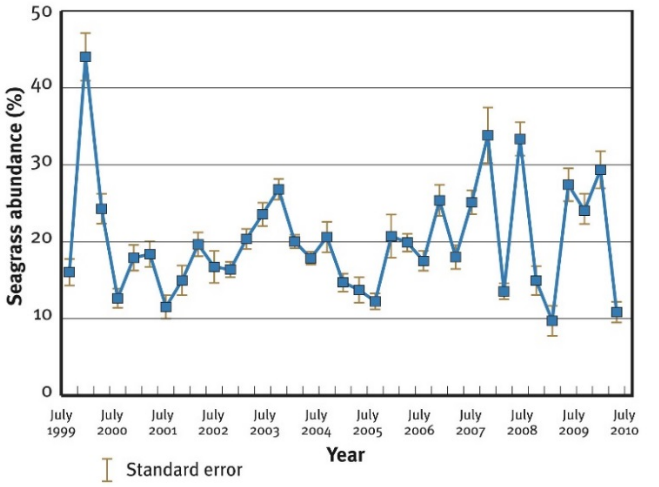


Seagrass meadows were monitored at coastal, estuarine and fringing reef locations in the Mackay Whitsunday region (Pioneer Bay, Sarina Inlet and Hamilton Island, respectively). Key environmental drivers of seagrass communities in this region include exposure at low tides and catchment run-off. Seagrass abundance declined significantly at all habitats throughout the region over the monitoring period; by late monsoon 2010, all but one site in the region was in poor condition. Reproductive effort declined at both reef and coastal sites, raising concerns about the ability of local seagrass meadows to recover from environmental disturbances. The nutrient status of seagrass tissue was poor and reflected the poor water quality of surrounding habitats, in particular the high concentrations of nitrogen.

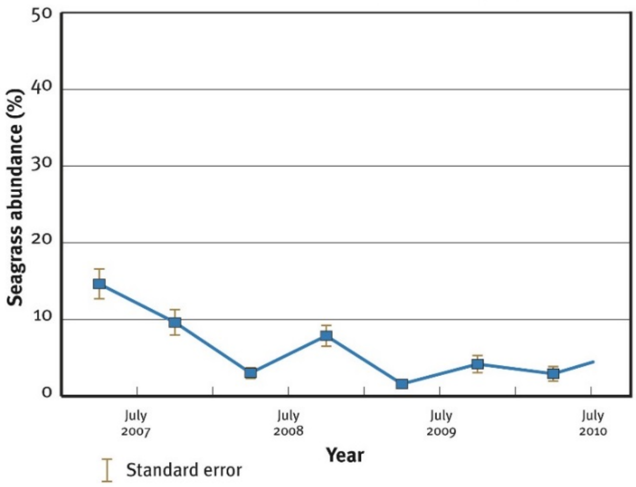
Trends in seagrass abundance (mean) at inshore intertidal estuarine habitats (Sarina Inlet) in the Mackay Whitsunday region



Trends in seagrass abundance (mean) at inshore intertidal coastal habitats (Pioneer Bay) in the Mackay Whitsunday region



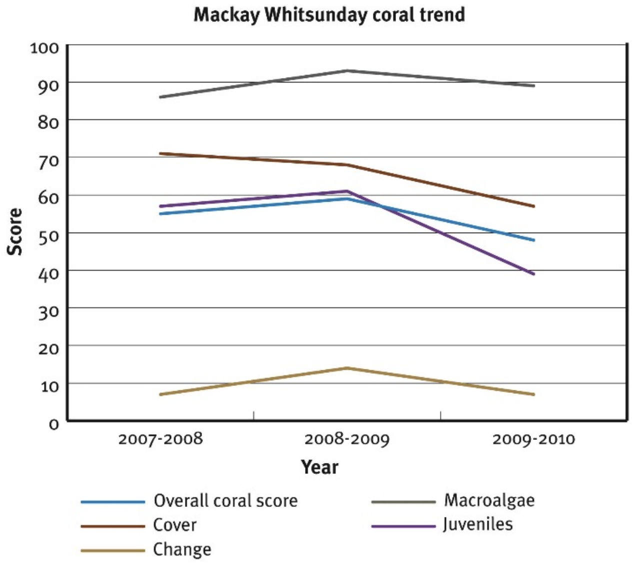
Trends in seagrass abundance (mean) at inshore fringing reef habitats (Hamilton Island) in the Mackay Whitsunday region



Caption: Trend in seagrass abundance (per cent cover) at inshore intertidal estuarine habitats (Sarina Inlet), inshore intertidal coastal habitats (Pioneer Bay) and inshore fringing reef habitats (Hamilton Island) in Mackay Whitsunday.

Coral

Inshore coral reefs remained in moderate condition. However, coral cover showed very poor recovery from past disturbances. Cyclone Ului caused a substantial reduction in coral cover at Daydream Island. Damage to other reefs in the region was minor. When considered in combination with poor densities of juvenile colonies, decreases in cover may have implications for the long-term resilience of coral communities.

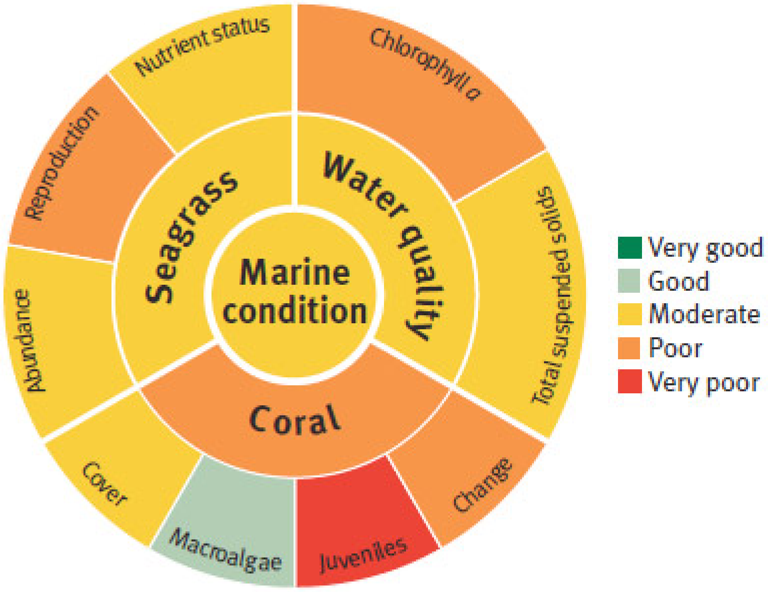


Coral data are available since 2005-2006; however, the trend in coral condition is only able to be calculated from 2007-2008, because the coral change indicator requires the preceding three years of data.

Cyclone Ului passed almost directly over the monitoring sites at Daydream Island in early 2010, causing a substantial reduction in coral cover. Damage to other reefs in the region was minor. The rate of increase in coral cover was very poor across the region, and hard coral cover showed limited recovery from widespread disturbances (acute and chronic) that included coral bleaching in 1998 and 2002 and repeated flooding events over the past four years. The general decline in the density of juvenile colonies from moderate to poor and the poor settlement of coral larvae may have implications for the long-term resilience of local coral communities in the region. The very good macroalgae score offset the poor or very poor ranking of most of the coral community attributes, resulting in the overall condition assessment of moderate.

Fitzroy

The inshore area of the region was influenced by the high flow event from the Fitzroy River in 2009–2010 and there were localised areas of coral bleaching where reefs were exposed to low salinity flood waters.



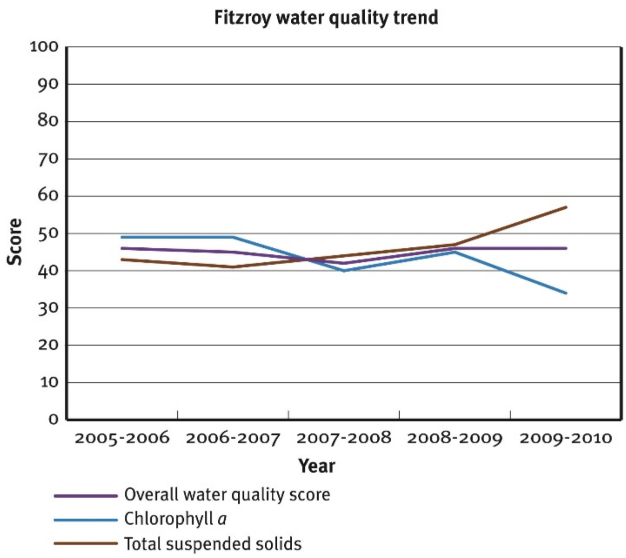
Marine graphic descriptions:

- **Chlorophyll a** indicates nutrient availability and productivity.
- **Total suspended solids** measures particulate matter in water.
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.
- **Coral cover** is a measure of the percentage of coral on a reef and indicates the capacity of coral to persist under the current environmental conditions and its potential to recover.
- **Coral change** measures change in coral cover which indicates coral resilience to disturbances.
- **Macroalgal cover** - high abundance indicates poor water quality and negatively affects the resilience of coral communities.
- **Coral juvenile** density measures the abundance of corals less than 10 centimetres in diameter which indicates the recovery potential from disturbances.

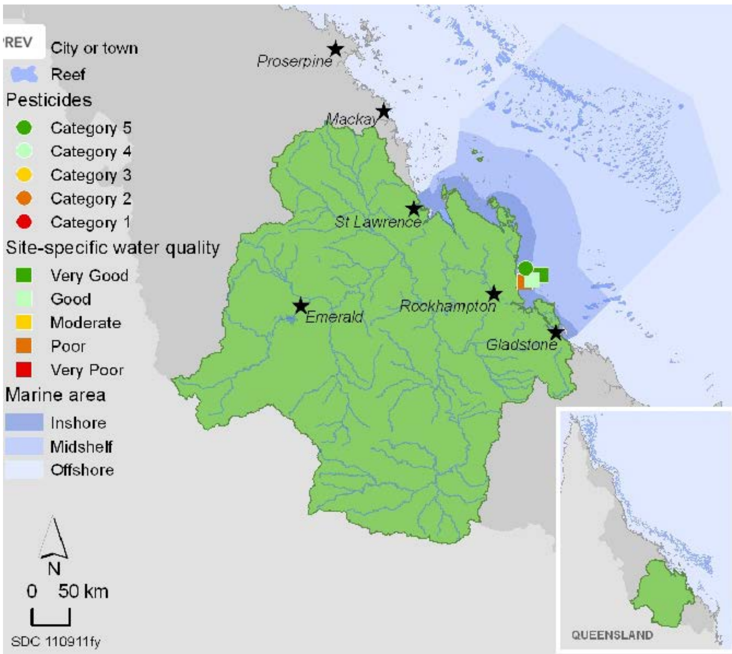
Water quality

Inshore water quality for the region remained moderate as it was for the 2009 baseline year. Concentrations of chlorophyll a and suspended solids were poor and moderate, respectively, and both were, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park for inshore waters.

Water quality was poorer in inshore areas. A range of pesticides was detected including diuron, atrazine, tebuthiuron and hexazinone.

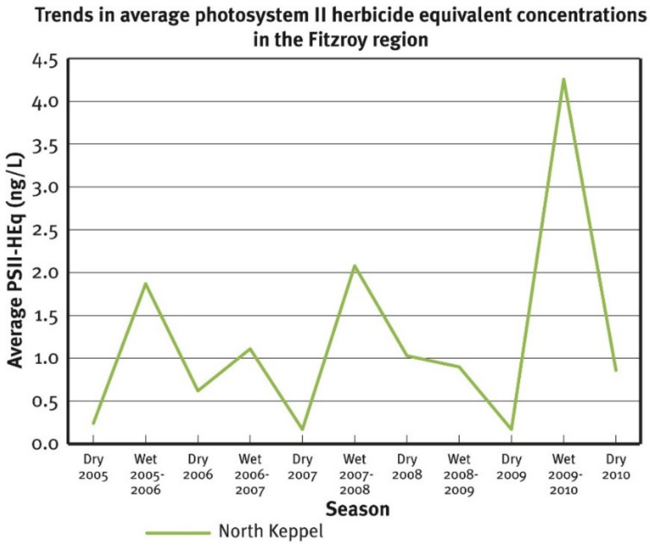


Water quality showed a clear gradient of decline from offshore to inshore areas more frequently exposed to flood waters .Site-specific water quality was poor at Pelican Island, good at Humpy Island and very good at Barren Island. At Pelican Island, the Great Barrier Reef Marine Park Water Quality Guidelines were exceeded for chlorophyll *a*, turbidity and concentrations of particulate phosphorus in 2009-2010.



Caption: Water quality and pesticide scores for PSII herbicides at fixed monitoring sites in the Fitzroy.

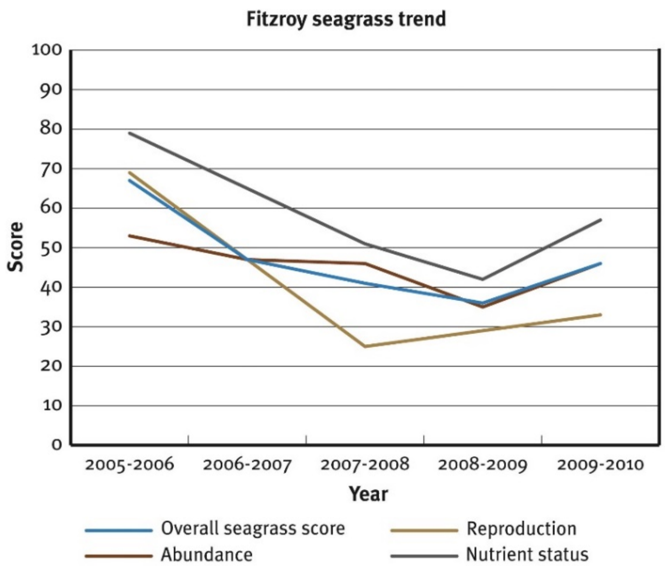
The Fitzroy River had a high flow event in the 2009-2010 wet season, and concentrations of pesticides were generally higher in the wet season compared to the dry season. Pesticides were monitored at one site at North Keppel Island where there was an increase in the PSII Herbicide Equivalent Index in 2009-2010 (Figure X) due to the highest concentrations of diuron detected to date at this site. Concentrations of atrazine and tebuthiuron were relatively high, and hexazinone was detected for the first time since monitoring commenced in 2005.



Caption: Trends in average PSII herbicide equivalent concentrations at the sampling site in the Fitzroy according to season.

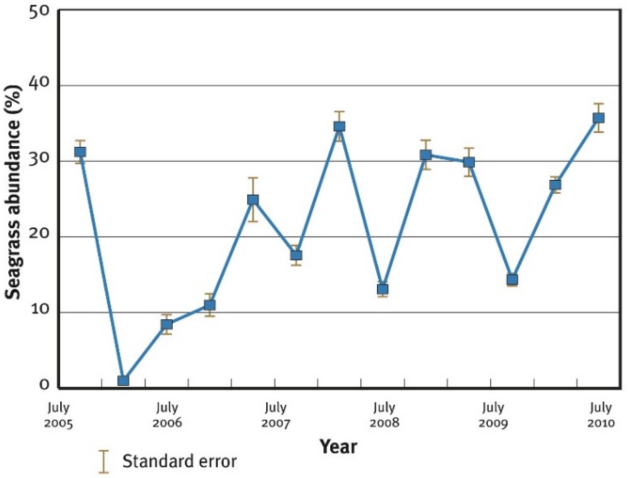
Seagrass

Inshore seagrass meadows improved from poor to moderate condition from the 2009 baseline year, which reflected stable and increasing cover at estuarine and coastal sites, respectively. The improvement in condition reflects a reversal in the trend of decreasing condition since 2005–2006. Reproductive effort and tissue nutrient content differed according to habitat type, but were poor and moderate overall, respectively.

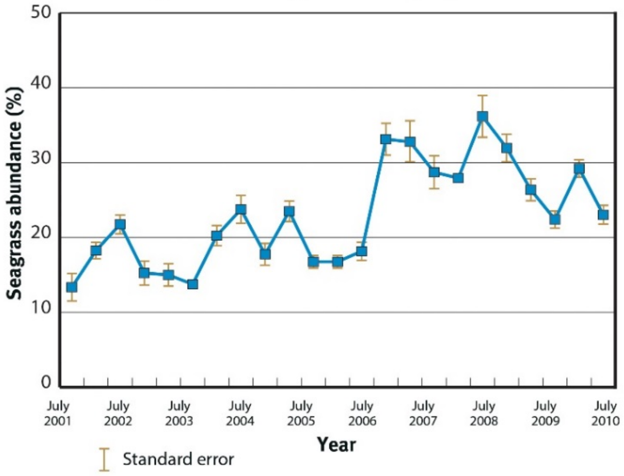


Seagrass meadows were monitored at coastal, estuarine and fringing reef locations in the Fitzroy region. Key environmental drivers in the region include exposure at low tide and high turbidity. Seagrass abundance at the coastal Shoalwater Bay and estuarine Gladstone Harbour sites continued to increase during the 2009-2010 monitoring period, to very good and moderate, respectively. However, the condition of seagrass at the Great Keppel reef site declined to very poor condition. Relatively high reproductive effort at the reef site indicates these seagrass meadows may have a higher capacity to recover from disturbances compared to seagrass in other habitats. The nutrient status of seagrass tissue was moderate overall, reflecting high concentrations of nitrogen and phosphorous at the reef site, and high concentrations of nitrogen at the coastal and estuarine sites. High concentrations of nutrients in seagrass tissue are indicative of poor water quality.

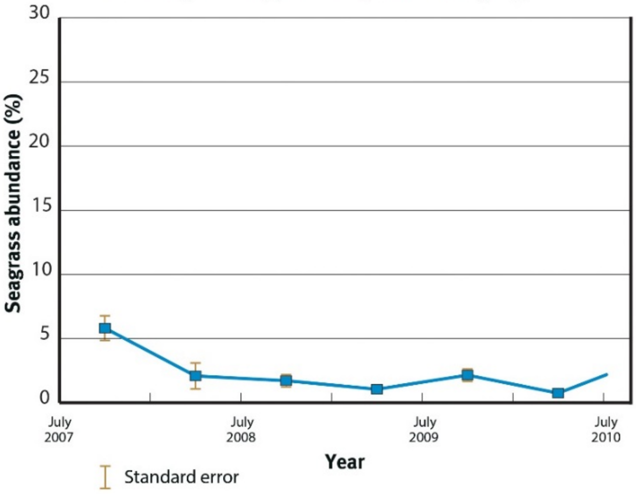
Trends in seagrass abundance (mean) at inshore intertidal estuarine habitats (Gladstone Harbour) in the Fitzroy region



Trends in seagrass abundance (mean) at inshore fringing reef habitats (Shoalwater Bay) in the Fitzroy region



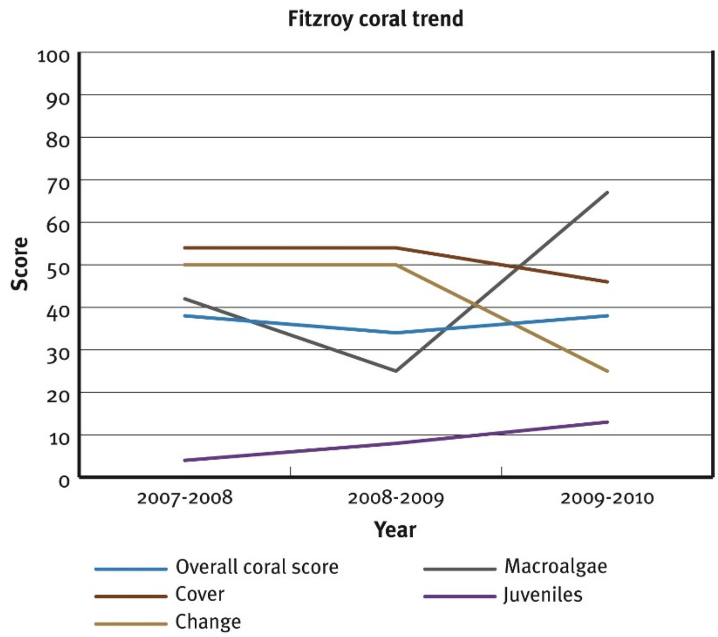
Trends in seagrass abundance (mean) at inshore intertidal coastal habitats (Great Keppel Island) in the Fitzroy region



Caption: Trend in seagrass abundance (per cent cover) at inshore intertidal estuarine habitats (Gladstone Harbour), inshore intertidal coastal habitats (Shoalwater Bay) and inshore fringing reef habitats (Great Keppel Island) in the Fitzroy.

Coral

Inshore coral reefs have remained in poor condition since 2005–2006. The rate of increase in coral cover from 2008–2010 was poor and the density of juvenile hard coral colonies was very poor. There was an increase in prevalence of coral disease in the region that may be a consequence of chronic environmental stress following flooding of the Fitzroy River in 2008 and 2010. The low scores for many of the community attributes may have implications for the resilience of coral communities.

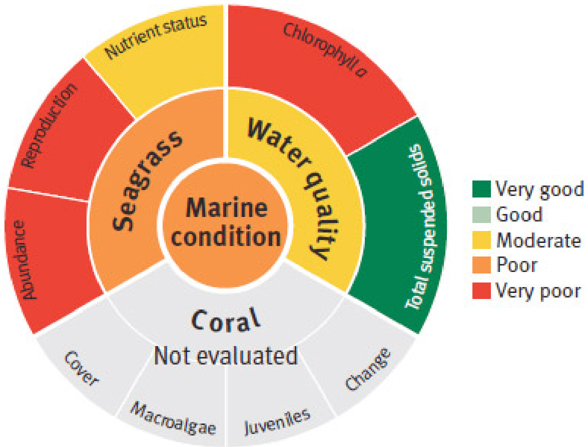


Caption: Coral data are available since 2005-2006; however, the trend in coral condition is only able to be calculated from 2007-2008, because the coral change indicator requires the preceding three years of data.

Coral cover maintained moderate levels across the Fitzroy region; however the rate of increase in coral cover from 2008 to 2010 was poor and may reflect the impact of minor storms and mortality caused by disease. Several reefs in the Fitzroy that predominantly consist of branching coral have previously shown rapid recovery following disturbances. The macroalgae score has improved since 2008-2009 as coral communities recover from bleaching-induced mortality. The increase in the prevalence of coral disease in the region may be a consequence of chronic environmental stress following flooding of the Fitzroy River in 2008 and 2010.

Burnett Mary

The inshore area of the Burnett Mary region was influenced by flood waters as a result of above median rainfall.



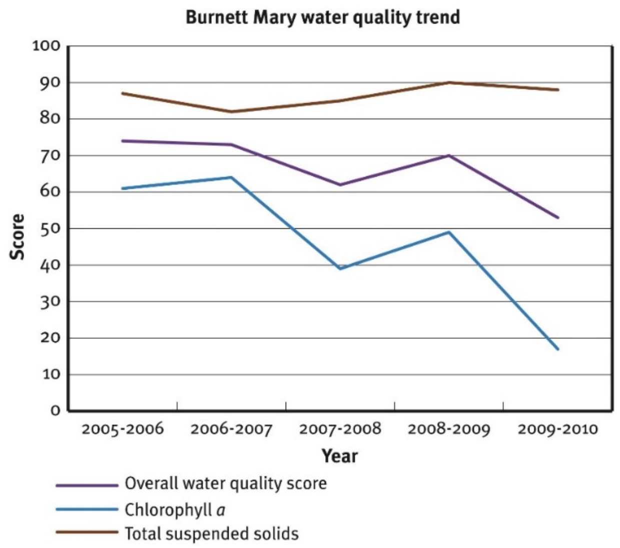
Marine graphic descriptions:

- **Chlorophyll a** indicates nutrient availability and productivity.
- **Total suspended solids** measures particulate matter in water.
- **Seagrass abundance** includes the cover and change in cover.
- **Reproduction** indicates the potential of seagrass meadows to recover from disturbances.
- **Nutrient status** measures the response of seagrass to nutrient conditions in surrounding waters.

Water quality

Inshore water quality declined from good to moderate from the 2009 baseline year. There has been a general decline in water quality since 2005–2006, driven by an overall increase in chlorophyll a. Both chlorophyll a and total suspended solids were, at times, above Water Quality Guidelines for the Great Barrier Reef Marine Park for inshore waters.

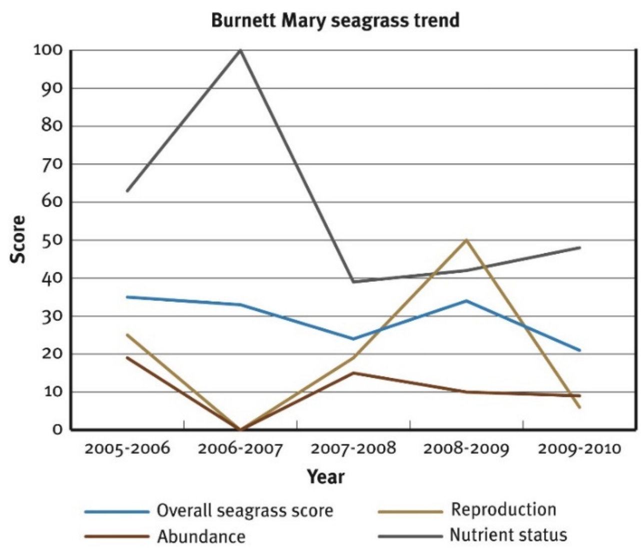
Estimates of chlorophyll a and total suspended solids are derived from remote sensing only, which requires further field validation in this region. Therefore, the estimates have relatively low reliability compared to those for other regions.



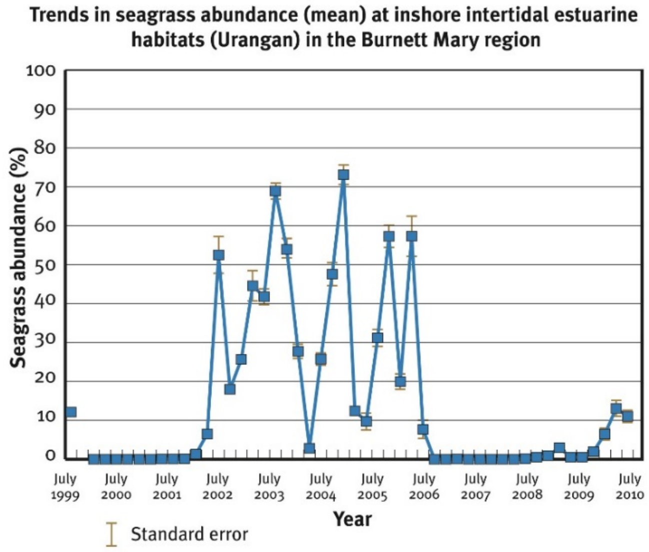
Seagrass

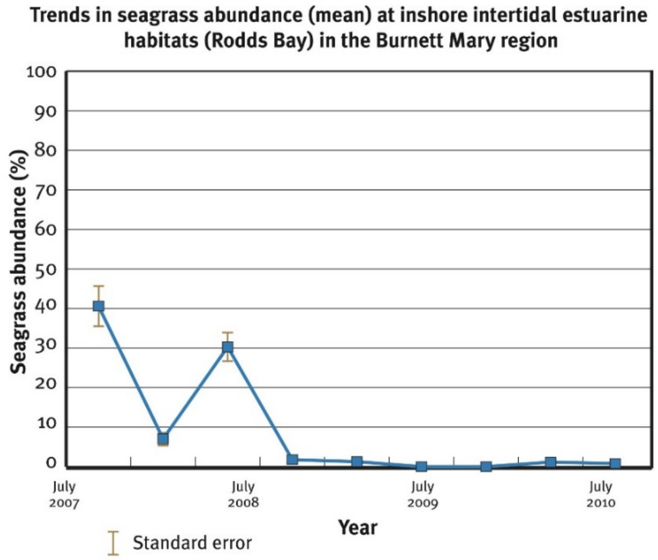
Inshore seagrass meadows remained in poor condition for the fifth consecutive year. Seagrass abundance and reproductive effort were very poor throughout the region, indicating meadows may have a low capacity to recover from disturbances. The nutrient status of seagrass is moderate, reflecting consistently high concentrations of nitrogen in the surrounding environment.

The area of seagrass monitored is within the Marine Park, which reflects only a small proportion of the whole region.



Seagrass is monitored at estuarine sites at Rodds Bay and Urangan, in the north and south of the Burnett Mary region, respectively. The primary environmental drivers of community composition at these sites are fluctuating temperatures, catchment run-off and high turbidity. Seagrass abundance was very poor throughout the region; however, seagrass in the south recovered from aggregated patches to continuous meadows. In the north the meadows declined and were lost by late monsoon 2010. Reproductive effort declined across the region to a very poor state, which may result in reduced capacity of local meadows to recover from environmental disturbances. The nutrient concentrations of seagrass tissue indicated that nitrogen in the surrounding environment remained high at Urangan and increased at Rodds Bay, which is indicative of poor water quality.





Caption: Trend in seagrass abundance (per cent cover) at inshore intertidal estuarine habitats (Urangan and Rodds Bay) in the Burnett Mary.

Coral

Coral monitoring is not conducted in the region under the Paddock to Reef program.

References

Kennedy, K., Schroeder, T., Shaw, M., Haynes, D., Lewis, S., Bentley, C., Paxman, C., Carter, S., Brando, V.E., Bartkow, M., Hearn, L. & Mueller, J.F. 2011, "Long-term monitoring of photosystem II herbicides - Correlation with remotely sensed freshwater extent to monitor changes in the quality of water entering the Great Barrier Reef Australia", *Marine Pollution Bulletin,* vol. in press.